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THE RAILWAYS OF THE WORLD.

WE have prepared, from the latest returns, the following statement of the length and cost of railways in all the countries of the world.

GREAT BRITAIN AND IRELAND.

On the 31st December, 1860, the length of railways open and in use in the United Kingdom was 10,433 miles. The total amount of capital raised for their construction, and including that raised for lines then in progress, was £348,130,327. During the past year upwards of 300 miles of new line have been opened; so that the total present length of British railways cannot be far from 10,750 miles, nor their cost less than £355,000,000. The total traffic receipts for 1860 amounted to £27,766,622, and working expenses to £13,187,368, or to 47 per cent. of the receipts. 163,435,678 passengers were carried, besides 60,386,780 tons of minerals, and 29,470,931 tons of general merchandise. The train mileage for the year was 102,243,692 miles run. The working stock consisted of 5,801 locomotives, 15,076 passenger carriages, and 180,574 wagons. Of the 10,433 miles of railway open, there were 7,583 miles in England and Wales, 1,486 miles in Scotland, and 1,364 miles in Ireland.

INDIA.

According to the reports of Mr. Juland Danvers, 842 miles of railway were open in India at the end of 1860, and of 2,932½ miles then in progress, 1,353½ miles were expected to be opened in 1861. The total railway guarantees had been for £56,000,000, but the construction of certain lines and portions of lines having been postponed, the amount to be expended under guarantee was £49,000,000, of which sum £34,396,445 had been raised up to April 30th last, the end of the Indian official year.

Nothing like the amount of line expected to be opened this year has been completed. The East Indian Railway Company had 458 miles open at the date of their last report, viz., 248 miles in Bengal and 210 miles in the North-west Provinces. Mr. Turnbull, the Company's Engineer in Bengal, and who has, from the first, been most punctual in keeping his engagements with the shareholders, had promised to open 50 miles, to Colgong, and 24 miles further to Bhaugulpore, in the course of the year just expired, besides 33 miles to Monghyr in the course of the present month, and 106 miles more to Patna in June next.

The Great Indian Peninsula Railway Company have 437¾ miles of line open, and it is understood that 13 miles of the Bhore Ghaut incline are to be opened this month. The opening of the 16 miles of this incline will be equal in importance to that of any 300 miles of the rest of the line.

The Madras Railway Company, at the date of their last report, had 252 miles of line open, viz., 224 miles westward from Madras, and 28 miles eastward from Beypoor, on the Malabar coast.

The Bombay, Baroda, and Central India Railway was open, at the date of the last report, for a length of 132¼ miles, from Doolia to Bulsar. The line for 23 miles northward to Neriad was expected to be open by the first of this month. The whole line of 313 miles will, it is expected, be opened for £3,130,000, or £10,000 per mile. This line, it will be recollected, was pronounced impracticable by Robert Stephenson. The East Indian Railway, of the practicability of which there has never been any doubt, is now estimated to cost £16,000 per mile.

The Scinde Railway, 114 miles long, is open throughout.

The Great Southern of India is open for a length of 14 miles.

It appears, therefore, that, up to the date of the last advices, 1,408 miles of railway were open in India, and we have reason for supposing that at least 110 miles more are now open.

The Eastern Bengal line is expected to be open early this year.

About one-half of the Calcutta and South Eastern, a line about 30 miles long, was expected to be opened by the beginning of this year, and the whole line would, it was thought, be opened in the course of the spring. The Indian railways are of 5ft. 6in. gauge.

CANADA.

The extent of the Canadian railways has been somewhat over-rated by including with them a considerable length of line leased by the Grand Trunk Railway Company, in the States of Maine and Michigan, U.S. Thus, a year ago, in an address delivered at the Institution of Civil Engineers, the length of Canadian railways was set down as 2,093 miles, which is considerably in excess of the length of line now open.

The Grand Trunk Railway is, by the last report, 885 miles in length in Canada, besides the 149 miles of the Atlantic and St. Lawrence Railroad, in Maine, U.S., leased to the Grand Trunk for 999 years, and 59 miles of the Detroit and Port Huron Railway, also leased by the Company in Michigan, U.S. Thus the whole length now worked by the Company is 1,093 miles, although, as the Riviere du Loup branch, 110 miles long, has been "farmed out" at a loss, the mileage given in the weekly traffic returns is 970. Of the whole capital account of £11,888,454, £429,772 stood at the last report to the credit of the account, and nearly £350,000 had been expended on the Atlantic and St. Lawrence leased line. The cost of the Grand Trunk, in Canada, may be set down therefore at £11,000,000, or £12,430 per mile, including the Victoria bridge, the cost of which, up to June 30th last, had been £1,356,021.

The Great Western of Canada is 229 miles long, from Suspension bridge, near Niagara Falls, to Windsor, opposite Detroit. The Sarnia branch, from Komoka, beyond London, to Sarnia, is 51 miles long; the Toronto branch (from Hamilton) measures 39 miles, while the Guelph and other short branches make up the total length to 357 miles, the capital account, by a late report, being £4,976,049.

The Buffalo and Lake Huron line is 161 miles long; the Northern of Canada, with a short branch to Bell Ewart, is 96 miles long; the Montreal and Champlain line, with the Caughnawaga branch, is 81 miles long; the Ottawa and Prescott, 54 miles; Brockville and Ottawa, 48 miles; London and Port Stanley, 24 miles; Welland, 25 miles; Coburg and Peterboro', 28 miles; Erie and Ontario, 17 miles; and Port Hope, Lindsay, and Beaverton Railway, with Peterboro' branch, 50 miles.

Thus the total length of Canadian lines now open is 1,826 miles, and, if we take the cost of the lines other than the Grand Trunk and Great Western at £8,000 per mile, we shall have (584 miles, £4,672,000) £20,648,049 as the total railway investment in Canada. The earnings on this sum are not much more than enough to cover working expenses.

In 1859 an official return showed that 1,573 miles of railway were open in Canada, the locomotives in use being 366 in number. The Grand Trunk had, at the date of a recent report, 212 engines, besides 41 on the Atlantic and St. Lawrence division, and 5 on the Detroit and Port Huron line. Of the 366 locomotives in Canada, on the 1st of January, 1859, 47 had been made in the province, while 209 had been made in the United States and 110 in England, both those made in the United States and here paying an *ad valorem* duty of 12½ per cent. on their importation into the province. Nine-tenths of the length of the Canadian railways are of 5ft. 6in. gauge, the rest being 4ft. 8½in.

NEW BRUNSWICK.

The European and North American Railway is open for 110 miles from St. John's to Shediac, and the cost may be put down at £700,000. The New Brunswick and Canada Company had 65 miles of line open at the date of a recent report, the cost having been £350,000. Additional sections were about to be opened.

NOVA SCOTIA.

The Nova Scotia Railway, from Halifax to Truro, is 61 miles long, and the Windsor branch 38 miles long, making 99 miles in all, costing, say, £1,000,000, and worked by 20 locomotives, mostly by Neilson, of Glasgow.

VICTORIA.

Eight short lines of railway now radiate from Melbourne, viz., to St. Kilda and Brighton, 8 miles; to Sandridge, 2½ miles; Melbourne and Williamstown, 9 miles; Melbourne and Geelong, 47 miles; Melbourne and Sunbury, 46 miles; Melbourne and Essenden, 4½ miles, and two short suburban branches of 7 miles. The Sunbury line has, we believe, been extended to Woodend, a distance of 28 miles from Sunbury, and it was some time since promised that the Geelong and Ballarat line, 53 miles long, would be opened in 1861. In this case, 205 miles are now open. The expenditures of the Victorian Government, on account of railways, had been £7,828,233 up to the 1st of January last, and it was estimated that £2,050,000 would be expended during the year 1861. In the mean time the works on the Melbourne and Mount Alexander line, 152 miles long, of which 50 miles, *viâ* Sunbury and Woodend, are already open, are in active progress, and the estimated cost is no less than £34,000 per mile. The Victorian lines are of a gauge of 5ft. 3in. (Irish gauge.)

NEW SOUTH WALES.

From Sydney three important lines of railway will radiate in the directions expressed by their names, viz., Great Southern, Great Western, and Great Northern. The Southern line, ultimately to be extended to the Murray river, to join the Victorian railways, is completed *viâ* Paramatta and Campbelltown to Picton, a distance of 54 miles. From Sydney to Paramatta, 13½ miles, the cost had been £40,000 per mile, for a double line, and thence, with a single line to Picton, the cost has averaged £10,000 per mile. The works are in progress (under a contract with Sir S. M. Peto and Co.), on the extension to Goulburn, but the cost will be very great. The Western line, leaving the Southern near Paramatta, is open, we believe, to Penrith, a distance of 20 miles. Hence, it is to be extended across the Blue Mountains to Bathurst, on the River Lachlan, one of the principal tributaries of the Murray, which flows many hundred miles westward, finally emptying itself in Encounter Bay. The Northern Railway commences at Newcastle, 60 miles north of Sydney, and has been opened, we believe, to Singleton, a distance of 51 miles. This line is to be extended up the River Hunter to Muswellbrook, a distance of 70 miles. Sir S. M. Peto's contracts for the Goulburn, Bathurst, and Muswellbrook extensions, 218 miles in length, cover work to the value of £4,000,000. The lines completed measure 125 miles, and their cost has been about £1,750,000. The New South Wales lines have a gauge of 4ft. 8½in.

SOUTH AUSTRALIA.

Railways are open from Port Adelaide to Adelaide, a distance of 3½ miles, and from Gawler to Kapunda, 16 miles. The cost has probably been about £400,000.

CAPE OF GOOD HOPE.

Of the Cape Town Railway, which will extend for 56 miles to Wellington, the first 28 miles from Cape Town to Stellenbosch were to have been opened by the end of 1861. The capital of the company, upon which a 6 per cent. guarantee is given, is £500,000. A line of 8 miles, to cost £100,000, has since been projected from Cape Town to Wynburg.

NEW ZEALAND.

The Christchurch and Lyttleton Railway, to be 6 miles long, and estimated to cost £240,000, has been commenced. A long and difficult tunnel is to be driven, which accounts for the great comparative expense. A line of railway is in progress, also, out of Nelson.

CEYLON.

A line is in progress.

DEMERARA.

A short line has been open and in use for some time.

CONTINENTAL RAILWAYS.

FRANCE.

At the end of 1860 the Minister of Agriculture, Commerce, and Public Works, reported the length of railways open as 5,778 miles, their cost having been £184,440,000, of which £32,440,000 had been contributed by the State and £152,000,000 by companies. The gross receipts for 1860 were £16,328,549. 430 miles were set down 1860 were £16,328,549. 430 miles were set down for completion in 1861. At the end of September last the whole length of line opened was 6,147 miles, of which 4,347 miles belonged to the old, and 1,800 miles to the new *reseau*. The receipts for nine months had been £13,348,462, or at the rate of £17,797,949 per annum. The new *reseau*, now in course of execution, is to include 5,318 miles, at an estimated cost of £123,400,000, or £23,200 per mile. An expenditure of £14,000,000 was authorised last year. The lines of the Bourbonnais, 420 miles in extent, are reported to be nearly complete. The lines open in France on the 1st of January, 1858, were worked by 2,624 locomotives, and at the present time the number in use, doubtless, exceeds 3,000.

PRUSSIA.

By an official report, made up to the end of 1859, there were 3,162 miles of railway open and in use, the cost of which had been £44,080,000, equal to £13,940 per mile. The gross receipts for 1859 were £5,399,440, and of this the working expenses absorbed 46 per cent. The average dividend paid was 5·36 per cent. 19,279,668 passengers were carried, exclusive of soldiers, and 11,904,761 tons of merchandise were also carried. The Berlin and Breslau, Eastern and Westphalian lines, have been constructed by the State. The Eastern line, from Frankfort-on-the-Oder to the Russian frontier, is 450 miles long, or, including the Danzig branch, 469½ miles. It is now under the consideration of the Government to construct a coast line from Danzig, *via* Stettin, to Hamburgh. There is not, we believe, a railway tunnel in all Prussia.

AUSTRIA.

The principal railway undertaking in Austria is that of the South Austrian, Lombardo-Venetian, and Central Italy Railway Company, whose lines, it is true, extend somewhat beyond Austria. The whole length of this company's line now open is 1,294 miles, including the Vienna and Trieste line and short branches, altogether 380 miles long. At a recent date, when 1,248½ miles had been opened, there were the Trieste line, just given, the line from Pragerhof to Ofen, opposite Pesth, 205 miles long, besides the branch of 50 miles from Stuhlweissenburg to Comorn; 136½ miles in the Tyrol; 230 miles in Venetia; 156 miles in Lombardy, and 91 miles in Central Italy. At the end of 1860 the company's capital expenditure had been £16,621,802, or £13,311 per mile. At the same time, 648½ miles of the company's concessions remained to be completed.

The Emperor Ferdinand's Nordbahn and the Eastern State Railway extend north-easterly from Vienna, skirting the Silesian-Prussian and Russian frontiers, and reaching 121½ miles east of Cracow, far into Galicia. The whole main line is 380 miles long, and, with the Bohm-Trubau and Troppau branches, is 464 miles long. Its cost has probably exceeded £8,000,000.

The Austrian State Railways, sold some years since to a French company, comprise three lines, one from a station on the Emperor's Nordbahn, 51 miles from Vienna *viâ* Prague to the Saxon frontier; another line (from another station on the Nordbahn), *via* Pesth to the Danube at Basiasch, and a third line from Vienna to Raab and Comorn. These three lines are 828 miles in length. The capital expenditure by the last report was £16,121,658.

The Thiess (Hungarian) lines are open from Czegled, 178 miles, to Miskolez, with branches to Arad and Grosswardein, 93 miles and 42 miles, respectively, in length, or 313 miles in all. The cost may be estimated at £3,000,000.

The line towards Munich, *via* Linz to Salzberg, is 195 miles long, the Passau branch being 51 miles more. The cost of these lines may be set down at £4,000,000.

Besides the main lines named there are 320 miles of short railways, and branches other than those already enumerated. The cost of these may be put at £2,000,000, upwards of 120 miles being horse railways, one (of which, the Linz and Budweis, 80 miles long, was opened as early as 1828.

Thus we have for Austria, and including that portion of the South Austrian Company's line beyond the empire, 3,465 miles of railways, at a cost of £49,743,460.

OTHER GERMAN STATES.

It difficult to separate the railways of the various German States from each other. Indeed, several of those already included in the mileage set down for Prussia are partly in Mecklenburg, Hanover, &c., the states and principalities in the German Confederation being intermingled, so to speak, like many of our counties, as, for example, East Barnet, on a peninsula (if we may employ the term) of Hertfordshire extending into Middlesex; Dudley, belonging to Worcester, but forming a sort of island by itself in Staffordshire; Hale's Owen, really in Staffordshire, and miles away from Shropshire, to which it legally belongs; Craike, in Yorkshire, and Holy Island, off the Northumberland coast, both belonging to Durham, &c. &c. Early in 1859, Mr. J. Ward, her Majesty's consul at Leipzig, reported that 7,360 miles of railway were open for traffic in Germany, including Prussia and Austria. We have already seen that there are now at least 6,627 miles of railway in Austria and Prussia alone, but Mr. Ward reported but 4,144 miles three years ago, and exclusive of Hungary and Galicia. Allowing for these provinces, the remaining mileage of railways in the German States would not have fallen short of 2,700 miles. Taking *Bradshaw's Continental Railway Guide* (and excluding from the enumeration the Luxemburg railways, and also taking care that no portion of any line shall be included but once, although given in connection with two or more routes) we can make up 3,239 miles now open in the German States, exclusive of Austria and Prussia, and this, possibly, does not cover the whole. This, too, although including Mecklenburg, is, of

course, exclusive of Holstein and Schleswig, the railways of which are to be included with those of Denmark.

The Wurtemburg and Bavarian lines, it is hardly necessary to say, are numerous, long, and important, and these and the Saxon railways have been costly in construction. The line from Frankfort-on-the-Maine, *via* Bamberg, Nuremberg, and Augsburg, to Munich, is 328½ miles long; the south-eastern extensions to the Tyrolese and Austrian frontiers are of considerable length; the line from Munich *via* Landshut and Ratisbon to Nuremberg, with the branch to Passau, on the Austrian frontier, is 240 miles long; the line from Augsburg to Lindau, on Lake Constance, is 121 miles long, and that from Augsburg to Ulm 53 miles; the Wurtemberg line from Bruchsal, near Carlsruhe, to Friedrichshafen, on Lake Constance, and including the Heilbroun branch, is 201 miles long, and the Grand Duke of Baden's line, from Mannheim, up the Rhine, to Waldshut, near Zurich, is 215 miles long, including branches.

Estimating the 3,239 miles in question at £18,000 per mile, which cannot be far from the real cost, we shall have £58,302,000 as the total investment in railways in Germany; and exclusive of Austria and Prussia. Mr. Ward estimated the investment at £120,000,000 for the 7,360 miles already referred to. Our present information goes to show that the mileage cannot now be less than 9,866, and the capital expenditure £152,125,460, equal to £15,420 per mile.

Spain.

The Madrid and Alicante line, 282 miles long, increased by the Toledo and Cuidad Real branches to 370 miles, has been open for a considerable length of time. The line from Madrid to Jadraque is 65 miles long; that from Barcelona *vid* Saragossa to Pamplona is 337 miles long, and 93½ miles of other railway line also extend from Barcelona. A railway of 80½ miles is open between Cordova and Seville, a line extending 94¾ miles from the latter point to Cadiz. A line 73 miles long reaches from Valencia to Almansa, 60 miles north of Alicante, on the railway connecting that port with Madrid. In the north, about 255 miles of railway are open from Santander and Barcena inland, and extending (with the exception of an interruption at the Sierra de Guadarama or Cantabrian Mountains), southward *vid* Valladolid with a branch to Burgos.

We have thus enumerated 1,375 miles of Spanish railways, but it is believed that about 1,450 are now open in Spain, while upwards of 1,000 miles more are in course of construction, the contemplated "system" covering the whole kingdom from Bayonne to Cadiz, and from Corunna to Alicante, and thence along the Mediterranean to the French frontier. The actual cost of Spanish railways already executed may be set down at £26,000,000.

Italy.

We have already, improperly perhaps, included the Lombard lines with the great Austrian system to which it belongs. Thus, besides the line entering Milan from Venice, the South Austrian Company work the line from Piacenza to Bologna, and from Plaisance to Bologna, the Piacenza line being 105, and the Plaisance line 91 miles long. Of the whole "system" of 1,294 miles, upwards of 300 are in that part of Italy now subject to the rule of Victor Emmanuel. Including this portion, the whole mileage of railways in the kingdom of Italy was, a few months ago, 1,115. Of this, 524 miles were at work, besides 66 miles about to be opened within the Sardinian territory, 212 in the Emilia, 222½ in Tuscany, besides 121 miles in construction, and 125 miles nearly completed in the Neapolitan territory. The Bologna and Ancona, 126 miles long, has since been opened, and, altogether, the present length may be taken at 1,350 miles. In our concluding summary we shall deduct from the mileage already given for Austria the 300 miles of Italian line worked in connection with the South Austrian system, and shall thus give full credit to Italy in respect of railway enterprise.

The Roman States.

The line towards Naples is reported to have so far progressed that it was expected to run locomotives to Ceprano, by the present new year. The line to Frascati already open is 11½ miles long, besides a short branch.

Russia.

The St. Petersburg and Moscow line, 400 miles long, is owned by the Russian Government, and its cost has never, we believe, been stated officially. Bayard Taylor, an intelligent traveller, who spent some time in Russia and paid much attention to this railway, states that its cost was £18,000,000, or £45,000 per mile.

The Grand Russian Railway Company had 501 miles of line at work at the date of their last report, and expected to open 568 miles more early in the ensuing season. As the company has been authorised to abandon its Southern line to the Crimea, the complete *reseau* will include 1,069 miles only, instead of nearly 2,600, as originally intended. The company's capital has been fixed at £20,000,000, most of which probably has been expended.

The St. Petersburg and Peterhof line, owned by Baron Stieglitz, is 18½ miles long, and is about to be extended to Narva.

The Riga and Dunaburg line, owned by an English company, is 135 miles long, and we may estimate its cost at £1,500,000.

The Warsaw South Western line, extending to the Austrian frontier, and including branches, is 235 miles long. Taking its cost at £3,500,000, we shall have 1,289½ miles, and £43,185,000 capital expenditure, represented in part by extensive works in progress.

Denmark.

The following enumeration includes the railways in Schleswig and Holstein.

Altona and Kiel, 65 miles; and branches to Itzehoe and Rendsburg, 42 miles. Flensburg to Tonning, with branch to Rendsburg, 70 miles; and Copenhagen to Corsoer, 56 miles. The Lubeck branch of the Berlin and Hamburg line, 29 miles long, is in Holstein.

We thus have 262 miles of railway in Denmark, the cost of which may be taken at £3,000,000.

Norway.

The Norwegian Trunk Railway, from Christiania to Eidsvold, is 42 miles long. The Stor Hammer line, of 21 miles, has been opened from the Trunk line to Elverum, and the Kongsvinger line, which is above 60 miles long, is expected to be opened in the spring.

Sweden.

From Gottenburg, the Government railway is open for 113 miles to Toreboda, in the direction of Stockholm. About 50 miles of railway are open also from Malmö, nearly opposite Copenhagen. Of the Royal Swedish Railway, extending towards Lake Wener, 45 miles are open. A line of 80 miles is completed also from Gefle inland to Falum. There are thus 288 miles of railway open in Sweden, which have probably cost about £5,000,000, the Government having contracted a debt of £2,200,000 for railway purposes.

Belgium.

The railway system of Belgium is the most complicated, for its extent, of any on the globe. Its extent is now 955 miles, divided in at least 24 lines, most of which are worked by the State. The mileage given includes the Sambre and Meuse line, and that portion of the Great Luxemburg within Belgium, the remainder properly belonging to Holland. The capital expenditure on the Belgian lines has probably reached £18,000,000.

Holland.

The Dutch lines may be set down as 308 miles, including 37 miles of the Great Luxemburg, and portions of other lines which, although not absolutely in Holland, are part of its own railways, and are not included with those of other countries. The Dutch lines have probably cost about £6,000,000 all told. The Government of the Netherlands have resolved to carry out an extensive system of railways, embracing, in addition to those already noted, 668 miles of "first class," and 171 miles of "second class" railway. These lines will involve the construction of extensive bridges, some of which will require to have spans of unusual width.

Switzerland.

The Swiss lines are already upwards of 600 miles in extent, and a large sum has been voted to their extension, *vid* the Splugen pass, into Italy.

Portugal.

The two lines, one from Lisbon to Porte d'Asseca, and the other from Barreiro to Vendas Novas, and measuring together rather more than 80 miles, are all that are yet in operation. During the past year, however, upwards of 22,000 men have been employed on the new lines.

Turkey.

In European Turkey the Kustendje and Black Sea line, 40 miles long, and costing £300,000, is open. In Asiatic Turkey, 40 miles of the Smyrna and Aidin line are at work. The whole length of this line will be 80 miles, and its cost is estimated at £1,200,000.

Algeria.

The Algiers and Blidah line has been commenced, and also the Constantine and Philippeville line.

Egypt.

The Alexandria, Cairo, and Suez line, 204 miles long, has cost, probably, about £4,000,000.

NORTH AMERICA.

Returning now to America, the length and cost of British American railways being already given, we come to the United and Confederate States. These countries have, together, by far the most extensive railway system in the world. The railway companies do not report to the national Governments, and only in a few States is any report made to the local Governments. The length and cost, however, of all the lines in the States have been carefully collected, for many years, by trustworthy statisticians, among whom the most authoritative is Mr. Henry V. Poor, of New York, for many years editor of the *American Railroad Journal*. These statistics gave the following results on the 1st of January, 1861, or one year ago:—

United States.

	Miles of Railway open.	Cost.
Six New England States, including 149 miles leased to Grand Trunk of Canada	3,715½	£30,249,842
New York, New Jersey, Pennsylvania, Delaware, Maryland and District of Columbia	6,922	72,332,200
Ohio, Michigan, Indiana, Illinois, Wisconsin and Iowa	10,333	79,579,612
California	70	740,741
Missouri and Kentucky	1,344	10,689,237
Total in the "Loyal" States	22,384½	£193,591,632

Confederate States.

Railways in the 11 Seceded States	8,784	48,793,300
Total, United and Confederate States	31,168½	£242,384,932

The railways in the "loyal" States have cost on the average £8,648 10s. per mile. Those in the Confederate States have averaged £5,555 per mile. The average cost of all the lines in the United and Confederate States has been £7,777 per mile.

Of the whole cost of £242,384,932, it is estimated, by the best authorities, that £60,000,000 are held in debentures and shares (chiefly the former), in Great Britain, and probably £40,000,000 on the continent. The gross earnings of all the 31,169 miles was estimated for 1860 at £28,806,584, or 12 per cent. on the whole cost, the net earnings being similarly estimated at £12,345,678, or 5 per cent. As, however, more than one half of the whole cost of American railways is represented by debentures, bearing from 6 to 10 per cent. interest, the actual average dividends on shares could hardly have averaged as much as 3 per cent., and the whole share capital of American railways did not, previous to the breaking out of the present war, average much more than 50 per cent. of its par value in the share market.

On the 1st of January, 1861, there were, in the 34 States, and in addition to the 31,169 miles of railways then open, 17,080 miles, on which more or less work had been done, making the total of lines constructed, and in course of construction, 48,101 miles. Thus, in the State of Texas, which had but 294½ miles of railway open, there were 2,572½ miles in progress. Minnesota, which had no railways open, had 1,167 miles in progress.

The progressive increase of railways in the States is shown in the following statement of the miles open and in use at the end of quintennial periods:

1831	54 miles.
1836	1,102 „
1841	3,319 „
1846	4,870 „
1851	8,856 „
1856	21,440 „
1861	31,169 „

This increase is strikingly illustrated in certain of the principal States, North and South, as follows:—

	Miles in 1861.	Miles in 1851.	Increase.
Ohio	3,057	497	2,560
Pennsylvania	2,943		
Illinois	2,924½	148	2,777
New York	2,809	1,304	1,505
Indiana	2,055	215	1,843
Virginia	1,805	413	1,392
Georgia	1,401½	665	737
Massachusetts	1,314	1,150	164

In Mexico a short line is open from the city of Mexico towards Vera Cruz.

West Indies.

In Cuba upwards of 500 miles of railway are open and in use, the average cost of which may be taken at £11,000 per mile, equal to, in all, £5,500,000.

SOUTH AMERICA.

New Granada.

The Panama Railway across the Isthmus of Panama (Darien) is 49½ miles long, and cost £1,600,000, or say £32,000 per mile. The net receipts have averaged about £400,000, or 25 per cent. on the cost.

Venezuela. Two or three lines have been commenced—one from Puerto Coabello to San Felipa, a distance of 53 miles, and another running from La Guayra towards Caraccas.

Brazil.

In Brazil 37 miles of the Bahia line are open, and up to the 30th of June last £1,236,405 had been expended on the whole line, open and in progress.

There are also open 36½ miles of the Pernambuco line, the cost of which, thus far, has been £1,409,000.

The Dom Pedro II. Railway is open for 38 miles from Rio de Janeiro to Belem, and 220 miles are in course of construction.

On 88 miles of the San Paulo line £314,000 had been expended up to the date of the last report.

Chili.

In Chili the Copiapo Railway extends from the Pacific coast at Caldera, 74 miles inland, *vid* Copiapo to Pabellon, whence the Copiapo Extension Railway, 26 miles long, extends to Chanaxillo, 100 miles from the sea. A branch of 53½ miles is in course of construction by the Copiapo Extension Railway Company.

From Valparaiso a line of railway has been opened for nearly one half the distance of 110 miles to Santiago, the Capital of the Republic. Another line is in progress from Santiago southward to Talca, a distance of 162 miles, upwards of 60 miles being open.

Peru.

Three lines are open in Peru—the Arica and Tacna, 38½ miles long, and one of 8¾ miles from Callao to Lima, and one from Chorillas to Lima. These three lines, nearly 50 miles in extent, may be set down at, in all, £500,000.

RECAPITULATION.

Great Britain and Ireland:	Miles open.	Cost.
England and Wales	7,583	
Scotland	1,486	
Ireland	1,364	
	10,433	£348,130,327
India	1,408	34,396,445*
Canada	1,826	20,648,049
New Brunswick	175	1,050,000
Nova Scotia	99	1,000,000
Victoria	183	2,878,233*
New South Wales	125	1,750,000
Cape of Good Hope	28	500,000*
Total, Great Britain and Colonies	14,277	£417,353,054*

Continental Railways.

France	6,147	£184,440,000
Prussia	3,162	44,080,000
Austria, deducting 300 miles in Lombardy and Central Italy, but worked as part of the South Austrian "system"	3,165	£45,243,460
Other German States	3,239	58,302,000
Spain	1,450	26,000,000
Italy	1,350	25,000,000
Rome	50	1,000,000
Russia	1,289½	43,185,000*
Denmark	262	3,000,000
Norway	63	700,000
Sweden	288	5,000,000
Belgium	955	18,000,000
Holland	308	6,000,000
Switzerland	600	10,000,000
Portugal	80	1,600,000
Turkey	80	1,000,000
Egypt	204	4,000,000
Total	22,692½	£476,550,460

North and South America,

Exclusive of British America, the railways of which are included with Great Britain and Colonies.

United States	22,384½	£193,591,632
Confederate States	8,784	48,793,300
Mexico	20	200,000
Cuba	500	5,500,000
New Granada	49½	1,600,000
Brazil	111½	5,000,000†
Paraguay	8	80,000
Chili	195	2,000,000
Peru	50	500,000
	32,102½	£257,264,932
Grand total of all the railways in the world	69,072	£1,151,168,446

Inasmuch as the particulars given for the various countries are in some cases derived from returns a year, and

* Including sums raised for works in progress.
† Including sums raised for extensive works in progress.

in a very few cases, two years old, it is probable that the actual extent of railway now open in the whole world is about 70,000 miles, and that the capital expenditure to date has been nearly £1,170,000,000. This vast sum has been almost wholly raised and expended within the last quarter of a century. No longer ago than 1834, M. Thiers, while a minister of France, declared his opinion, founded upon an examination of the Liverpool and Manchester line, that railways were hardly more than toys for the curious, being useful in certain exceptional cases only! Now they are rightly regarded as hardly less than prime necessities, and in any case as indispensable agents of civilisation.

MANCHESTER GEOLOGICAL SOCIETY.

November 26th, 1861.

JOSEPH DICKINSON, F.G.S., President, in the chair.

ON PLEISTOCENE DEPOSITS ON THE STOCKPORT AND WOODLEY RAILWAY.

By Mr. JOHN TAYLOR, Jun.

DURING the cutting of this railway I have paid several visits in order to work out the position of the drift beds. In the present state of this department of Geology every fact, duly authenticated, is valuable, and, as I have studied the beds in question with great care, this is my only excuse for bringing the subject before you.

The extent of the above railway is about two miles and a half; and the cuttings are taken through the tops of the higher grounds; the *débris* being used for filling up the valleys. In the length of the railway several distinct sections of the drift beds have been laid open. As yet the Stockport end of the line has been carried only to a spot a little below St. Paul's Church, Portwood, on the grounds of Mr. Howard. It is here that the first section is exposed. The lower beds of the new red sandstone, at Stockport, may be seen dipping in a north-westerly direction, and, in turning off the Portwood-road to the section above-named, they are again seen cropping out, and are capped below by gravel and clay. These drift beds cover the underlying rocks along the whole course of the line, and hide the junction of the new red sandstone and the coal measures. For, about a mile beyond Woodley may be seen several grit-stone quarries in the upper coal-measures, abounding in *Sigillaria*, *Calamites*, *Lepidodendra*, and their associated fossils. The stone used for building the bridges along the line is obtained from these quarries. These few remarks on the position of the underlying rocks lead us to consider the drift beds which cover them.

In the first cutting the depth of the gullet is about 25ft., and the beds here lie in the following order:—

1st and uppermost, An irregular layer of gravel and thin layers of sand; the pebbles composing the gravel consisting of rounded fragments of granite, syenite, porphyry, and trap, but more especially of sandstone, apparently of carboniferous age; this bed is about 12ft. in thickness, and just caps the summit of the first mound.

2nd, A layer of very stiff and dark-coloured clay, charged with fragments of coal and black shale. Boulders of a tolerable size are found in it, obtained from various rocks, but more especially from the *ganister*; and lying in heaps by the side of the railway are rounded boulders of rock, similar to the Permian at Collyhurst, and containing fossils such as *Bakevellia*. One large boulder of black limestone, which I dug out of the clay myself, furnished me with tolerable fine specimens of *Goniatites reticulatus*, *G. Listeri*, and *G. Leylandi*. This clay bed is from 8ft. to 10ft. thick, and nearly all the boulders are polished and striated; some of them so polished as to give the appearance, when first dug out, of having been black-leaded.

3rd, A bed of very fine red and yellow sand, similar to that found near Stockport station. This bed contains in some places layers of dark carbonaceous matter, which soils the fingers upon touching it. It extends to an unknown depth.

These beds are found lying in the first cutting in the order in which I have named them. The cutting is about 250 yards long. At the end may be seen, imbedded in the gravel, a huge boulder of coarse-grained syenite. Since going over the grounds, in company with Messrs. Binney and Barr, when this boulder was lying *in situ*, its upper surface quite smooth, I found that it had been disinterred, and turned over, so that it has now its under side exposed, and shows most evident traces of the scratchings to which it has been subjected by grating on the old sea bottom. In this first cutting we find the lower beds of gravel of a coarser texture than the upper, owing to the water not being able to percolate through the clay, filtering through them, and carrying away with it the finer particles of sand and gravel. These lower beds are quite moist owing to the above cause.

At the next cutting, some 200 yards further on—and which is about 400 yards long—the clay is seen lying undermost, and is of a very great thickness. It is just capped in the beginning of the section by layers of gravel and sand. In some places the sand is quite black, and so hard as to be only broken with a hammer. This blackness has been evidently caused by the decomposition of vegetable matter—old drift-wood, or huge masses of sea-weed which were buried in the sediment of the glacial seas. In these beds there lies another large boulder of fine-grained red granite, not so large as the one first mentioned, but still of a tolerable size. The underlying clay is very fine and adhesive, as I, and the gentlemen I have named, found out one moist Saturday afternoon. What seems to me the most singular fact connected with it is the presence of numerous branches and roots of trees, apparently of coniferous wood. Some of them appear to have been chopped and sawn, and are found lying at a depth of fifteen feet from the surface. The specimens upon the table are fragments which I obtained during a recent visit * From this place we take leave of the gravel beds and clay beds—into which layers of sand are found often feathering out and losing themselves, only to appear again in a short distance—predominate. A little further on brings us to a place where the clay is capped by about 6ft. or 8ft. of coarse sand, charged with carbonaceous matter. This series is succeeded in the next cutting by alternating layers of clay and sand; the clay, however, greatly preponderating, and often presenting the appearance of having been felted together. It lies in thick layers, and, apparently, only wants consolidation to convert it into shale. Polished and scratched boulders are still common in it. The depth of the gullet here is about 30ft. About a quarter of a mile further on this series alters, and the underlying sand comes up. Here the sand, which is capped by about 20ft. of till, is found to contain numerous fragments of marine shells belonging to the genera *Mactra*, *Tellina*, *Venus*, *Cardium edule*, and *Turritella terebra*. Most of these fragments give evidence of having been exposed to a rolling action among the grains of sand in which they are imbedded. Although these fragments are numerous entire shells are rather rare, still there is sufficient evidence that these beds need only careful examination to prove them anything but unfossiliferous.† The sand beds, in which they lie, are also mottled with carbonaceous matter, the relics of the ancient algae which composed it. This series continues to the end of the railway cuttings—sand below, and clay above. At Woodley this clay is dug into for brickmaking, and for the manufacture of tiles.

Few and simple as are the facts which I have recorded, still I cannot help regarding them with a great degree of interest. In studying them more minutely we find in these later deposits that the same phenomena of denudation and deposition which characterised the older strata are exhibited even in Pleistocene times. The dark-doloured beds of clay, charged with fragments of coal and shale, in which also lie boulders of sandstone and limestone, clearly point to their derivation, and tell how the numerous escarpments and ravines—which, prior to glacial times, must have intersected the neighbourhood of a coal country from the faults and dislocations caused by upheaval of the solid rocks—have been slowly worn down to their present appearance. The numerous fragments of *gannister*, with their enclosed fossil rootlets of *stigmaria*, as well as the fragments from the Permian, tell of the extensive denudations which some parts of our Lancashire coal-field have suffered. Then the huge boulders of granite, along with the smaller and more rounded fragments of porphyry and trap, tell of the time when, drifted by icebergs from their ancient deposits, they were strewn along the old sea bottom. And the red sand below—which only requires re-consolidation to convert it again into *new* red sandstone—evidences by what agency, and at what time, the basin in which the lower part of Stockport now stands was scooped out of the solid rock. We learn, from the recently published work of Dr. Maury, that the bottom of the Atlantic is an inclined plane, formed from the accumulating materials dropt by icebergs as they float southerly, until, as they come upon the Gulf-stream, they suddenly melt, and so finally drop all that they have remaining, thus forming a tolerably steep escarpment in a line with the places where the Gulf-stream crosses the Atlantic. Such circumstances, however, do not seem to have prevailed during the time of the northern drift. Then the order of things was reversed, and the thicker deposits were more northerly, and thinned out in the southerly direction. It is probable that, during this later period, the neighbourhood of the above deposits was covered by a shallow sea, in which icebergs became stranded, and thus pounded and crushed the solid rock into gravel and sand. It is further probable that at this time what is now the chain of hills commonly known as the "back-bone of England," were low lands covered by a wintry growth of coniferous trees. The whole of these deposits, in short, in their varying characters, plainly tell of the littoral conditions under which they were accumulated.

Recent as the above deposits are, geologically speaking, yet the time taken up in their formation must have been immense, in the gradual wearing and denuding of the carboniferous rocks, to form the clays, and in the breaking up of the old igneous deposits to form the gravels. This extent of time, however, may have been equalled by that which has elapsed since they were formed. These high grounds—some 150ft. above the river—have since then been slowly upheaved from the bottom of the sea. During this slow uprising, the river on the left hand cut its way through the superficial deposits, and even through some 20ft. or 30ft of solid rock besides, as may be seen in several places about Stockport. That the river was considerably broader then than now is plainly indicated by the terraces which it has left all the way down the valley; whilst the shifting of its bed, now on this side and now on that, has deposited the sand and mud which lie below.

Great as the period of time must have been during which these changes took place, the whole of them have been effected in the lifetime of existing species of shells! The old drift streams, in bringing together and commingling the ingredients of the various rocks, have served the same purposes as those which man attempts when he adds mineral manure to his lands; and, doubtless, had it not been for this finishing stroke of the Creator, had not the temperate zones been covered by such a subsoil of gravel and sands, a scant and meagre vegetation would everywhere have greeted the eye. And thus, like the fabled philosopher's stone, which turned the baser metals into gold, time can make the most common things venerable, and a patch of gravel or clay, viewed in the light of geologic science, furnishes to us the history of our planet just before, or contemporaneously with, the epoch when man was called to take possession.

* I may just say that the clay in which these branches occur is capped by a layer of coarse sand three or four feet thick.

† The shells, which are chiefly found whole, are those belonging to *Turritella terebra*.

CARBURETTING GAS.

AT a special meeting, on Tuesday, of the City Commission of Sewers, a report from the Committee on General Purposes, on the proposal of the Carburetting Gas Company to apply their process to the whole of the public lamps throughout the City, was received and considered. The process consists of an apparatus, containing naphtha, complete in itself, which can be adapted to all existing gas lamps and burners, whether for public or private lighting. It tends to economy in consumption of gas, without diminishing the brilliancy of the light, and has been tried by this commission for a month, in the public lighting of Moorgate-street, with satisfactory results. The General Purposes Committee, to whom the subject had been referred, reported that the Carburetting Gas Company had proposed to carburate the gas supplied to the public lamps in the City, according to certain conditions contained in a specification, at 17s. 6d. per burner per annum, provided a contract were entered into for not less than 500 burners, or at 16s. per burner if the process be applied to about 1,700 of the public lamps. That being so the committee recommended the court to accept the proposal, and also to adopt the process for the whole of the public lamps in the district henceforward to be lighted by the City of London Gas Company, on the understanding, to which the Carburating Company had consented, that this commission might at any time terminate the contract, if they thought fit, after fourteen days' notice. It should be stated that the court, at its last meeting, accepted a tender from the City Gas Company, for the ensuing year, to supply gas to the public lamps, within a certain large district, at £5 11s. per annum for each burner consuming 5ft. of gas in the hour. To that offer the court, however, appended a condition that they (the court) were to be at liberty, at their own cost and risk, to apply the carburating process to the public lamps, if they should think it desirable, at any time during the contract. Mr. Millar, the secretary to the City Gas Company, on their part adhered to the tender with that condition; but yesterday Mr. Gray, the chairman of the company, attended before the court, and disavowed, on their part, so much of the arrangement as related to the carburating process, averse as they were to being placed under the control of another company, and to the adoption of the process itself. For those reasons they were disinclined to take upon themselves the fulfilment of the contract. This announcement, taking the court by surprise, led to a discussion, on the motion of the chairman for adopting the report, in which observations upon the merits of the process in question and the desirability of applying it to the public lighting were mixed up with remarks on the withdrawal of the City Gas Company from their contract. Dr. Abraham regarded the act of that company as an attempt to dictate to the court that they were not to have recourse to the carburating process, though it might result, as he contended it would, in a saving to the ratepayers in the public lighting of about £1,700 a year. It was, in fact, another phase of the confederacy which had recently been entered into between the three city gas companies in their own interests, as opposed to those of the public. The whole secret of the opposition of those companies to the process in question was that it would result in about half the present consumption of gas, without diminishing the amount of light, and so lessen their profits. That process, he added, had been applied in lighting the front of Lord Palmerston's house and the *Times* office. It was being brought generally into public use, and he held it to be a duty incumbent on the court to avail themselves of it in lighting the streets of London, having regard to the pockets of the ratepayers. Deputy Jones regarded the act of the City Gas Company in withdrawing from the contract as a breach of faith. He trusted they would yet see the propriety of abiding by the engagement. Mr. Matthews complained of the revengeful spirit shown towards the Great Central Gas Company by several members of the court, in excluding them from the contract to supply gas for the public lighting of the City. Mr. Brass spoke in favour of the Great Central sharing in the contract for the public lighting, and contended, amid remarks of dissent, that a saving would thereby be effected of upwards of £1,300 in the event of the carburating process not being successful. Mr. Saunders bore testimony to the process coming extensively into use, and remarked that the gas companies, whose profits it would diminish, had taken fright at it in consequence. Dr. Harrison refused to be a party to reopening the contract between the court and the City Gas Company, holding that it was binding on both. He also argued in favour of carburating the gas on the ground of economy. The remainder of the discussion was conducted with closed doors, and eventually the court adopted, all but unanimously, the report of the committee, and the result was communicated by the chairman to Mr. Shepard, one of the directors of the Carburating Company.

A DOCKYARD IN THE MERSEY.

MR. JOHN LAIRD has addressed the following letter to the *Times*:—"I observe in the naval intelligence from the various dockyards that the want of suitable dock accommodation is being felt more strongly now that the large class of ships is increasing and likely to increase. Some decided steps must soon be taken by the Government to remedy this want, but, before fixing where the accommodation should be provided, it appears to me that it would be desirable that the various ports in the country suitable for the reception of vessels of great draught of water should be surveyed and reported upon, so that Parliament might have an opportunity of judging where the accommodation so much required could be obtained at the least cost, and, at the same time, affording the greatest facilities for the public service. Matters of this importance should not be left, as the inquiry into the extension of Chatham Dockyard was, until the end of the session. About two years ago I addressed a letter to your paper, pointing out what I conceived to be the advantages possessed by this locality for the establishment of a dockyard and arsenal. The commission appointed 'to consider the defences of the United Kingdom,' in their report of 1860, agreed with me that the Mersey possessed very great advantages for the establishment of a naval arsenal and depot. Some objections were raised by parties in this locality to the plan I then proposed of having the entrance to the dockyard and arsenal through the Birkenhead Commercial Docks, now being constructed by the Mersey Docks and Harbour Board. This objection can be obviated, and the two classes of establishments be entirely separate, by placing the naval dockyard in Tranmere Bay, between the most southern point of Birkenhead and Rock Ferry and constructing wet basins and graving docks there. The decision also having been come to to place the new arsenal on Cannock Chase, so large an amount of land as I previously anticipated will not be required for a dockyard used solely for the purpose of building and repairing ships and machinery. Tranmere Bay is a position, therefore, well calculated for a dockyard establishment, being sheltered from the prevailing winds by high land, and having a depth of water in the river at that point sufficient to allow of dock sills being laid so low as to admit the largest class of vessels on almost every day of the year. The best anchorage in the Mersey is also opposite the proposed site. The nature of the foundation is rock, and from the experience I have had of the great economy in constructing graving docks in the immediate neighbourhood, I have no doubt that a wet basin suitable to receive iron-cased frigates of the largest class, with graving docks attached for repairing them, can be constructed at a lower cost than similar works in almost any other part of the United Kingdom. The material excavated in forming the foundations of the proposed works being principally sandstone, it could be used most advantageously in constructing the works, and any deficiency in the quantity required could easily be made up from the extensive quarries in the immediate vicinity. There is a large population of artisans of various classes resident in the neighbourhood—an important point in case of heavy repairs to any of her Majesty's ships being unexpectedly required. The Birkenhead Railway, communicating with all parts of the country, adjoins the proposed site, so that iron, coal, and all other materials required for use in a dockyard could be brought at the lowest cost direct into the establishment. Southampton, Portsmouth, and other places in the south of England are claiming for their respective localities the best site for establishing new or increasing old dockyard establishments, but as a dockyard for docking and prompt repair of her Majesty's ships will be found absolutely necessary on the western coast, I am induced to lay before you the advantages which this port possesses. I hope other parties at the various western ports will do the same, in order that the question may come under the notice of Government and Parliament, and that locality be adopted which is likely to prove most advantageous to the general interests of the country."

RAILWAYS IN HOLLAND.

THE following communication has been received from M. J. W. De Campo, of Holland:—

"Railways may now be regarded as necessaries of life, and, however high were the expectations of the invention of Stephenson, we have not been disappointed; on the contrary, wherever the steam locomotive has appeared, prosperity has increased, isolation and ignorance have given way, traffic and civilisation have advanced. It is astonishing, therefore, that this valuable means of communication is not more generally used in some countries, so as to increase still more considerably their commerce and industry.

"How was it that a country like Holland, generally known and highly esteemed for its trade and industry, did not avail itself of railways, so as to keep pace with the general progress in other countries? Its most flourishing provinces, where the cultivation of the soil and the breeding of cattle have made great progress, are completely separated from the general means of communication; their products are sent to the nearest harbour to be embarked for the great metropolis of the world, while persons travel by stage coaches, like those used half a century ago in England.

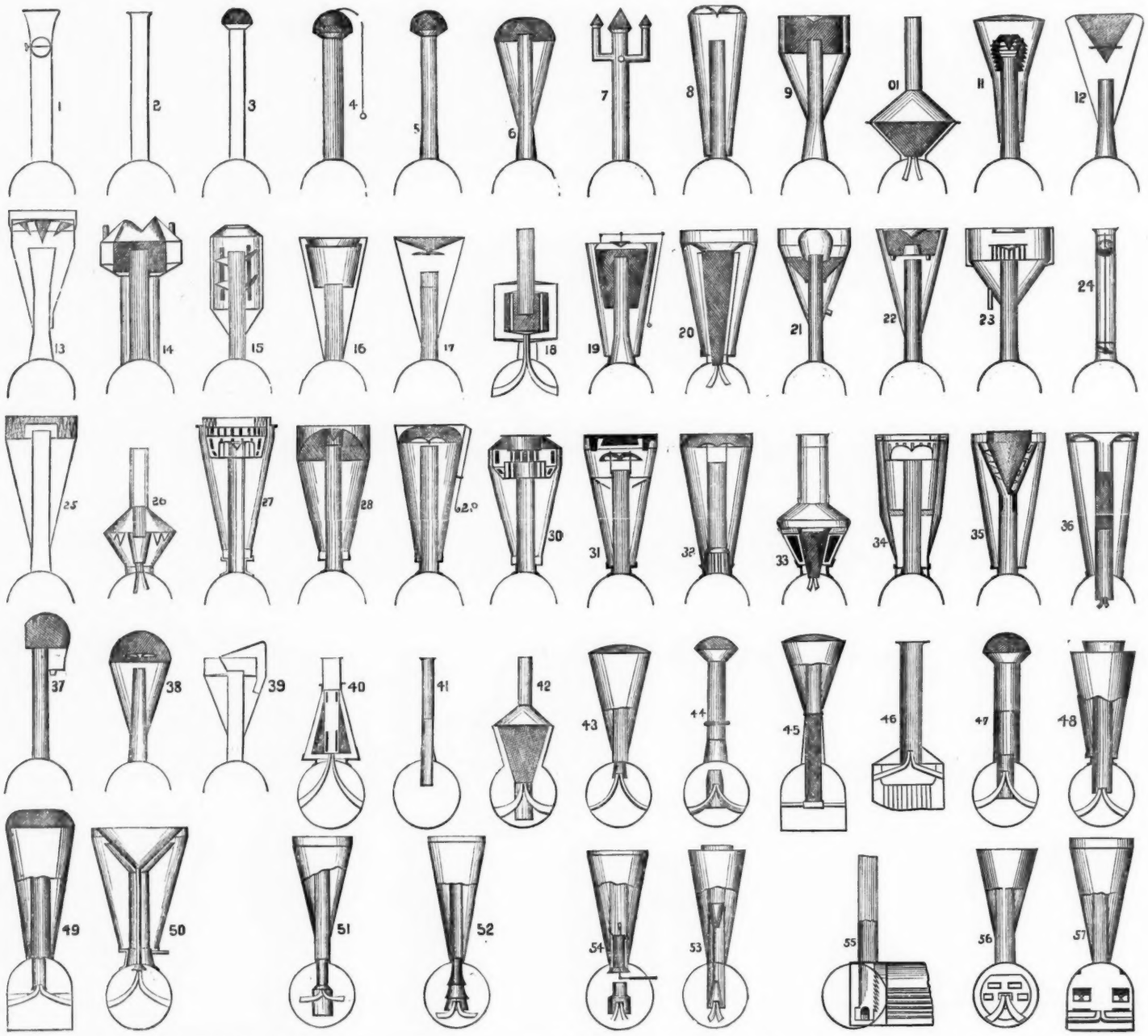
"The great inclination of the people for water communication, the great difficulties of constructing railways over rivers and arms of the sea, which penetrate the country and form many islands; the fact that their construction could not be a profitable enterprise for any private company, and the hesitation on the part of Government to undertake their construction itself against the rules of a sound policy, may account in some way for this. However, these are not to be considered as valid reasons for being deprived of railways, and, if they are now considered advantageous, why were they not so ten years ago? When the nature of the country made private companies hesitate to construct them, why should not the Government have done it? There are, indeed, very few railways which have been profitable to the companies, but who can tell how many millions they have increased the wealth of the people, or how much they have contributed to their civilisation and welfare?

"I am glad, however, to be able to say that railways are now being constructed in Holland. The Government is making use of its able civil and military engineers to overcome the difficulties of crossing the rivers, and has in view the carrying out of a complete railway system within ten years. There will be constructed about 900 miles of railway, at an expense estimated at £7,000,000, of which a third part is to be expended on railway bridges only. These railways will unite the following towns:—Amsterdam, Hague, Rotterdam, Breda, Maastricht, Utrecht, Arnhem, Zutphen, Assen, Harlingen, Nieuw Diep, and others.

"Besides the railway, a canal will be made to unite the capital, Amsterdam, immediately with the ocean.

"This railway system will be beneficial to the country, the production of the soil and of industry increasing in proportion as the means of communication improve, and will be, at the same time, of much importance to Great Britain. The commercial towns of Holland will thus be brought nearer to England's sea ports, and the intercourse will be greater. It must be beneficial to both countries, whose histories are so connected with each other. In the great battle for liberty they have both marched in the same course; in the promotion of commerce they both have shown themselves energetic and successful".—*Society of Arts' Journal.*

CHIMNEYS FOR WOOD-BURNING LOCOMOTIVES.



In America, including all the Canadian lines, wood is the principal fuel employed for locomotives. In burning, however, this fuel produces such a shower of sparks as to endanger everything combustible in the neighbourhood. To arrest and detain these sparks a vast variety of contrivances have been devised and brought into use. We have collected a number of these, dating from 1831 to the present time.

No. 1 is the original straight chimney, with a circular damper near the top. No. 2 the straight chimney, open throughout. No. 3 the same with a wire netting cowl. No. 4 the same as No. 3, with the exception that the top of the cowl could be opened at will. In No. 5 the sparks were shot up against a flat plate and deflected downward, through and beneath an internal cowl, escaping afterwards through the outer one. No. 6 the same as No. 5, with the exception that a large outer casing is supplied to retain the sparks. This was worked in 1834. No. 7 a curious affair hardly worth explanation. No. 8 shows the inverted deflecting cone over the inner chimney, the sparks being thrown down while the smoke filters through a wire cloth screen, and rises in an annular space around it. No. 9 the same in principle as No. 8. No. 10: here the blast pipes are carried up through the wire cloth, the steam being discharged above. No. 12: the sparks are projected against a cone of wire cloth. No. 15: here a spiral motion is given to the sparks, the centrifugal force thus generated carrying them outwards.

In No. 23 this principle is further carried by guides much like those of a Fourneyron turbine, used in 1841. In No. 25 a great extension of the wire-cloth surface is obtained by arranging it in sections as shown. No. 27, introduced in 1842, combines this principle with that of the centrifugal discharge of the sparks. This chimney has been much used on railways carrying cotton, as it discharges the fewest sparks. It interferes, however, to greater extent than many of the others, with the draught, requiring smaller blast orifices, and thus causing greater back pressure. No. 29 is a section of the chimney in perhaps the most general use on American wood-burning locomotives. The sparks are thrown down on striking against the underside of a deflector, conical at first, but spreading out in a broad rolling flange which strikes down the sparks in the huge outer casing, characteristic of American locomotives. The smoke rises through a wire cloth cowl. No. 32 shows the same thing with a feed-water heater in the throat of the chimney. No. 33 shows a "telescopic chimney," something like Mr. Toplin's, of Woolwich Dockyard. No. 33 was first used in 1854. No. 36 shows a plan in much favour on the Grand Trunk Railway, the blast pipes discharge within a pipe, into which the smoke can pass only through the wire cloth sides, the sparks dropping as in the others. Nos. 41 to 57 show various arrangements of lifting pipes or "petticoat pipes" as they are called. No. 41 was used in 1839, on an English engine, the "John Bull." No. 42 was used in 1836, No. 43 in 1839, and No. 44 in 1840. Nos. 51 and 52 show the plans most used at the present time.

Clothing of the Police.—Dr. Borlase Childs, the surgeon to the City police force, has just issued a report, addressed to the Police Committee, upon the subject of the clothing of that body, which contains some very interesting details. After a few introductory remarks Dr. Childs says:—The hat now worn by the police force fulfils no indication which the covering for the head of men so exposed requires. It affords no protection in a struggle, for it either immediately falls or is struck off; and the man, becoming conscious that his head is exposed to great danger, hesitates, and begins to think only of self-defence. It is moreover heavy, weighing 14 ounces, even when dry; offers no protection to the eyes, face, ears, or neck; causes headaches, &c.; not being arched, it does not sufficiently, even if it kept on, protect the head from a blow, no matter what may be its strength; while, as to appearance, it presents the additional absurdity of superadding a civilian's hat (the worst covering for the head ever invented) to a semi-military dress. "The coatee worn at present by the force is the relic of a past age; it affords no protection from wet or cold to the vital organs contained within the cavities of the abdomen or pelvis, nor does it afford covering or warmth to the haunches and limbs. In its place ought to be substituted a tunic, full, handsome, and provided with ventilation in the armpits, and sufficiently warm to protect the wearer in our cold, damp, variable climate. The modern trousers, when made of good material, and sufficiently elastic, have been proved the best; but the trousers as generally made do not give full protection to the joints. Cold and damp aid in the production of rheumatism and other diseases in these parts; to remedy which it might be advisable to strengthen the trousers on the inside over the knee, in those especially who may be liable to rheumatism, and to afford the shins and ankles additional protection from wet by the use of waterproof leggings, worn over the trousers. But, whatever plan may be adopted, care must be taken so as not to interfere with the circulation in the superficial veins of the limbs."

Chatham Dockyard.—At no former period, not even during the busiest portion of the Russian war, has more activity been observable in all the departments at Chatham Dockyard than at present; every mechanic and workman connected with the establishment, numbering in the aggregate close upon 4,000 hands, being fully employed, and the resources of the several departments taxed to the utmost. The chief object of the officials is to get those vessels out of hand which are required for immediate active service, including the Defence, 22, iron steamer; the Galatea, 26, 800-horse power; the Rattlesnake, 22, 400-horse power; the Pylades, 22, 400-horse power; and the screw gun-vessels intended to be sent to the principal ports of the kingdom. Every exertion is devoted to the completion of the Defence, the interior of which presents a most animated scene from the number of hands employed about her. It does not, however, seem at all probable that she will be got to sea till towards the end of next month. The intention of having four masts on board has been abandoned, and it has been decided to rig her for three masts, the mistake in that respect made with the Warrior being about to be repeated with the Defence, which will have to trust more to her sailing powers than either the Warrior or Black Prince. The Galatea is now completely rigged. This fine frigate, the tonnage of which is greater than that of many of our line-of-battle ships, has been fitted entirely by the seamen, marines, and riggers belonging to the Defence. It is not yet known whether she will be commissioned, the Admiralty awaiting the news from America, but, whatever the result, she will be placed in the first-class steam reserve, and as she is fully equipped, and the greater portion of her stores are on board, she will be ready to proceed to sea within a few hours after hoisting the pennant. The Galatea will leave Chatham Harbour for Folly Point on Tuesday next. The Rattlesnake is to be ready for sea by the 16th of January, and from the progress already made in her there is little doubt she will be completed by the date named. Her recent trial trip, which, so far as her speed was concerned, was exceedingly satisfactory, again demonstrated the fault observable in most of our 21-gun corvettes, such as the Orpheus, the Orestes, and others, of being down so much at the head, which renders them so uncomfortable to those forward. To remedy this as much as possible all her shot and shell will be stored, as far as practicable, aft. She will present the novel appearance of having four catheads, rendered necessary to admit of the working of her Armstrong guns on the upper deck. The Royal Oak, 51-gun iron-plated screw frigate, constructing at Chatham Dockyard, is making very satisfactory progress, and the enormous teak planking on which the iron slabs will be fixed is nearly half completed. The slabs of iron which will form her covering are all of an uniform thickness of 4½in., each plate being about 12ft. in length by 3ft. in width, and of the average weight of four tons. In order to do away with the necessity of fastening the armour-plates to the vessel's sides by means of iron bolts bolts driven into the planking, by which it is calculated the timbers and planking will be very considerably weakened, a plan has been submitted to the Admiralty of fastening each plate on an entirely new principle, by which, although not a single bolt will be required, the plates will be held together more securely and solidly than under the old process. From the superiority of the plan proposed it will be adopted on the Royal Oak and the other vessels of her class building at the several royal dockyards. Each of the armour-plates, before being fixed in its place, will be required to be bent to the shape of the portion of the frigate's side to which it will be attached. To obviate the necessity of bending the huge plates hot, by which enormous furnaces would require to be erected adjoining the slip on which the Royal Oak is building, it is intended to bend each plate cold. To accomplish this, however, the most powerful hydraulic machines will be required, and some idea of the tremendous force necessary for this operation may be formed when it is stated that the machinery to be erected for this purpose is calculated to exert a pressure of something like 2,000 tons to the square inch.

COST OF BUILDING LOCOMOTIVES IN AMERICA.

THE following letter, respecting the cost of constructing and working locomotives in the United States, has lately been printed and circulated. Under present circumstances the American locomotive builders are hardly likely to receive any accession to their foreign trade, which object might have been to some extent attained by the letter in question had the conduct of the Americans been such as to insure that their ports should remain open, and their commerce continue in its usual course.

"15, Tavistock-street, Bedford-square, London, W.C.,
"December 10th, 1861.

"——— ———, Esq.,

"Engineer to the ——— Railway Company.

"DEAR SIR,—Your favour of the 26th ult.* has remained unanswered until now, owing to the pressure of duties which have left me but little time to collect and arrange the information which you require. Much of this information I should on no account disclose were I not certain that it could not be used to the disadvantage of the American houses from whose business it has been derived. As it is, however, I am disposed to believe that, in making known here how cheaply locomotives are made in the States, I may be rendering a service to some of my former employers; and, although I have not waited to obtain their consent to anything I may say, I feel no anxiety as to their approval, when copies of this letter shall have reached them.

"I was for some time engaged in the engineering works of Mr. Souther, of Boston, Massachusetts, U.S. Between July 28th, 1848, and the spring of 1851, we turned out—in addition to a considerable amount of other work—forty-one locomotive engines, ranging in weight from 20 tons to 24 tons. All of these engines had four coupled driving-wheels and a bogie, and a tender holding from 900 to 1,200 gallons, and mounted on either six or eight wheels, according to the weight. The smallest diameter of cylinder was 14in., the largest 16in. The plan and workmanship of these engines was, I should say, quite up to the standard prevailing at the time in the States. Thirty-seven of the engines had inside cylinders and four outside. For these engines Mr. Souther received 299,400 dols.—equal to an average of 7,302 dols., or £1,502 for each engine, with tender, the rate of exchange being taken at 4 dols. 86 c. per £. The prices received were variable, and it was by no means the case that the heaviest engine brought the most money. Thus, but one engine sold for as much as 8,000 dols., or £1,646. This was a 15-in. inside cylinder, 20-in. stroke engine, with four coupled 5½-ft. wheels and a bogie, 43-in. boiler, 135 copper tubes, 10ft. 6in. long and 1¾in. in diameter, separate expansion valve, and short-throw pumps. Three engines brought 7,800 dols. each, or £1,605 (the tender being, in all cases, included with the engine). Seven engines sold for 7,600 dols., or £1,564. Nine were delivered for 7,500 dols. each, or £1,543, and among these were the largest and best-made engines we turned out. Five sold for 7,300 dols., or £1,502; four for 7,200 dols., or £1,481; six for 7,000 dols., or £1,440; four for 6,800 dols., or £1,399; and two outside 14-in. cylinder engines for 6,400 dols., or £1,317. Few of these engines were paid for on delivery, most of the payments being made in notes, at from three to eighteen months, with from 6 to 7 per cent. interest added. These were discounted by the Boston banks. Railway bonds, also, had to be taken, now and then, and worked off according to the state of the stock market.

"These engines had ⅜-in. English iron in all parts of the boiler, except the tube-plate in the fire-box, which was of ⅜-in. copper, and the smoke-box tube-plate, which was of 7/16-in. iron. The boilers of the 15-in. cylinder engines were 43-in. in diameter outside, and contained 135 tubes of No. 14 copper, 10ft. 6in. long and 1¾in. in diameter. The fire-grate was 3ft. 1¾in. square. Cast iron main steam pipe, and copper branch steam pipes and blast pipes. Cast iron driving wheels, with 2½in. Bowling tyres. Truck and tender wheels 30-in. in diameter, of cast iron, with chilled wearing surfaces, and costing 14 dols., or £2 17s. 7d. each before being bored. Crank axle of hammered scrap 7in. in diameter in the journals. Heavy steel springs over the driving-axles and in truck-frame, and india-rubber springs under the tender. The valve gear and working parts of the engine were somewhat complicated, and thoroughly finished. There were many extras—an engineer's house, or 'cab,' with glazed windows, being always erected over the foot-plate, a sand-box with sand-valves, worked from the foot-plate, a 'cow-catcher,' a spark arrester, an 80 lb. bell to be rung at stations, tools, buckets, &c., being supplied also. The following gives the cost of making these engines, almost the whole of the labour being performed at piece-work by 'job hands,' employing from one to thirty men each. The prices of materials are those which prevailed in Boston, U.S., in 1851, a considerable rise having taken place in the price of iron, &c., in 1852.

IRON CASTINGS.

"Loam castings supplied by the South Boston Iron Company, at 4 cents per pound, equal to £18 8s. 8½d. per ton.

2	15-in. cylinders	1,354 lb.
2	Slide valve-box casings	156
Total	13 cwt. 1 qr. 26 lb., or	1,510 lb. £12 8s. 6½d.

"The remaining castings, as follows, were cast in green sand, and supplied by the same founders at 3 cts. per pound, equal to £13 8s. 6½d. per ton.

		lb.
2	15-in pistons	168
2	Covers, or "followers" for do.	96
2	Inside rings for do.	72
2	Front cylinder heads	241
2	Back do. do.	306
2	Slide valve boxes	295
2	Seats for expansion-valves	82
2	Slide-valve box covers	166
2	Stuffing-box glands for piston-rods	47
2	Cross heads	197
2	Rock arms for expansion-valve	60
2	Stands for do.	82
2	Slide-valves	50
2	Expansion-valves	40
4	Driving-wheels	5,680
1	"Draw iron" under foot plate	415
2	7-in. axle-boxes	273
2	6-in. do. for back axle	269
4	Oil cellars for do.	44
1	Smoke-box front and door	325
1	Set of fire-bars in six castings	246
2	Pump barrels	140
2	Air vessels for pumps	88
1	Pintle for truck frame	125
4	Castings for truck spring-sockets	78
2	Stands for safety-valves	144
1	Buffer casting	165
1	Cone for spark-arrester	61
1	Base or saddle for do.	145
2	Base mouldings for safety valve or escape-pipes	56
1	Base for dome-casing	130
1	Dome case	189
1	Ring moulding and 1 cap for dome-case	182
1	Dome-cover for inner, or steam-dome	123
1	Ring, forming seat for do.	139
1	Main steam pipe	120
1	Upright branch for do. and regulating-valve	96
4	Caps on bottom of truck axle-boxes	48
2	Upright or branch barrels for pumps	76
2	Check or clack-cases	80
2	Pivot-stands for compensating levers	30
1	Stuffing-box for regulator-rod	10
1	Ring and flange for truck-frame	70
2	Chilled guide-boxes for pump-plungers	35
4	Castings for branch steam pipe joints	40
6	Eccentrics, 2¾-in. throw	270
6	Distance-pieces for main jaws (the "jaws" corresponding to horn-plates)	151
8	Jaws for tender	616
8	Sets (24 pieces) Lightner's boxes for do.	330
4	Stands for side-bearings on tender	116
4	Rockers for do.	48
8	Stands to hold brake-beams	56
16	Caps for india-rubber tender-springs	72
2	Pintles for tender-truck frames	96
2	Bushings for do.	56
1	Buffer casting at back end of tender	66
1	do. do. „ front „	66
4	Castings for india-rubber draw-spring	241
2	Water-cocks in tender	34
2	Strainers for do.	20
2	Posts and 1 yoke for bell (on boiler)	114

Total green sand castings 13,759 lb. or 6 tons 2 cwt. 3 qr. 11 lb., at £13 8s. 6½d. per ton £84 18s. 7½d.

"BOILER AND TENDER TANK.

		£ s. d.		£ s. d.
1 ton 3 cwt. 1 qr. 15 lb.	plates, at	16 2 7½	per ton	18 17 10½
7 „ 3 „ 21¼	„ „	20 14 10	„	8 4 8½
6 „ 1 „	„ „	21 17 10½	„	6 16 10
5 „ 1 „ 19	„ „	23 0 11	„	6 4 10
Extra quality for flanging	„ „			
1 ton 0 cwt. 1 qr. 3 lb.	of tank plates, at	13 8 6½	„	14 0 4½
2 cwt. 2 qr. 20 lb.	copper tube plate	115 4 6	„	15 8 8
1 ton 2 cwt. 3 qr. 2 lb.	copper tubes at	6 18 3	per cwt.	157 8 1½
Bar iron and rivets for boiler, and rivets and angle iron for tank				10 10 0
Total, boiler and tender tank				£237 11 4

FORGINGS, BAR IRON TYRES, &c.

	£ s. d.
1 ton 6 cwt. 3 qr. 21 lb. of bars and shapes for frame, at £25 7s. per ton	34 2 10½
3 cwt. 1 qr. 12 lb. shapes for same	5 3 4½
1 Crank axle, weighing, in rough, 13 cwt. 3 qr. 10 lb., at £3 9s. 1½d. per cwt.	47 16 9½
1 Trailing, 2 truck, and 4 tender axles, 19 cwt. 3 qr. 26 lb., at £23 0s. 11d. per ton	23 0 6
Shapes, angle iron, &c., 6 cwt. 0 qr. 13½ lb., at £23 0s. 11d. per ton	7 1 0½
Boiler braces, piston-rods, guide-bars, and crank-pins, 7 cwt. 26½ lb., at £21 12s. 3d. per cwt.	11 13 5½
2 Connecting-rods, 3 cwt. 1 qr. 14 lb., at £21 16s. 10½d. per cwt.	6 4 5
4 Bowling tyres, 1 ton 5 cwt. 3 qr. 16 lb., at £2 8s. 4½d. do.	62 13 1
6 Springs (4 driving and 2 truck), 6 cwt. 19 lb., at £2 13s. do.	16 7 0
1 ton 15 cwt. 2 qr. 24 lb. bar iron, at £10 18s. 11d. per ton	19 10 11½
Total	£233 13 6

All the heavy forgings were purchased from a steam forge in the neighbourhood, at the prices quoted. Some of these forgings afterwards came under the hammers of the blacksmiths engaged at our works, and whose labour was supplied by a "job blacksmith" at 2¾ cents. a pound, we finding iron, coal, and shop room.

BRASS CASTINGS.

		lb.
1	Bell, 2 qrs. 24 lb. at £6 9s. 0½d. per cwt. £4 12s. 2d.	
4	Main 7-in. brasses (lined with soft metal) for connecting rods	60
4	3-in. do. do. for crossheads	21½
8	Lined 2¼-in. do. do. coupling rods	30
4	15-in. lined packing rings for pistons	76
6	Lined brasses and caps for rocker shafts	91
8	Lined gibs for crossheads	46
8	Lined brasses for tender axles	42
4	do. do. engine truck	53
Total, 419½ lb., or 3 cwt. 2 qr. 27½ lb. of soft metal lined brasses at £26 18s. 3d. per cwt. £225 7s. 11d.		
12	Pieces eccentric hoops	245
2	Pump plungers	47
4	Plates for crossheads	23
4	Stands and caps for lifter shafts	22
4	Skeleton linings for main axle-boxes	18½
8	Brasses for pump-rods	12
10	Rings for pump-joints	12½
8	Valve spindle brasses	10½
2	Safety-valves	5½
2	Chambers for lower valves of pumps	26
18	Pieces of pump-valves or clacks	35
4	Water-hose nuts and thimbles	23
4	Stuffing-box glands for valve-spindles	53½
4	Plates for bosses of driving-wheels	16
2	Oil cups complete, for slide-valve boxes	15½
18	Balls for railing stanchions	19
2	Pet-cocks, 3 gauge do. 4 cylinder do.	14½
1	Blow-off cock, 1 waste steam-cock	17½
10	Pieces of brass casting for frost-cock	10
1	Gland for stuffing-box of regulator	9½
4	Oil cups and covers for crossheads	5½
4	Mud-hole plugs	6½
2	Maker's name plates	14½
1	Stand for whistle	9½
1	Stand for signal-flag	4½
2	Water-plugs for tender, with fittings	17½
2	Water nozzles for bottom of tender	16
2	Thimbles for bell-cord and whistle-cord, 2 spring balance nuts, &c.	5½
Total, 714 lb., or 6 cwt. 1 qr. 14 lb. of ordinary un-lined brass castings, at 26 cents. per lb., or £5 19s. 10d. per cwt. £38 3s. 11½d.		

All brass castings were purchased at the prices quoted, none being made on the premises. The total weight of brass castings, of all kinds, is 10 cwt. 3 qrs. 9½ lb., exclusive of brass in name-plates, given farther on.

	£ s. d.
1 5-in. steam-whistle, purchased ready made	2 17 7½
2 Salter's spring balances, at £1 15s.	3 10 0
Total brass castings, whistle, spring balances, &c.	75 1 8

MISCELLANEOUS.

12 Bush and Lobdell's chilled 30-in. wheels, at £2 17s. 7½d.	£34 11 6
1 Tender frame, oak timber and making, by contract, 45 dols.	9 5 2
16 India-rubber springs for tender, 2 for each journal, 5in. diam. 4in. high, 66 lb., at 75 cents per lb.	10 3 8½
1 India-rubber draw spring, 5½in. diameter, 14in. long, 151b., at 75 cents	2 6 3½
27 lb. bands and coiled wires for springs, at 12½ cents	0 13 11
For making india-rubber water hose	1 11 6
Total miscellaneous	£58 12 1

TIMBER.

635 superficial, or 50¾ cubic feet of pine and oak timber, deals, &c.	4 2 1

LABOUR.

The following abstracts of prices, paid under contracts with job hands, are given so as to show the amount paid to each contractor:—

Paid Michael Lally for making boiler, by contract, 275 dols. .. £56 11 8

Putting on boiler braces, safety-valve stands, and smoke box, 25 dols. 5 2 10½

Making tender tank, 90 dols. 18 10 4½

Total in boiler shop £80 5 0

Paid Thomas Wise for forging 7,200 lb. smithwork at, by contract, 2¾ cents per lb. £43 14 6

Charles E. Whittemore.

For boring, facing-up, and drilling cylinders, slide valve boxes and covers, and cylinder heads, 75 dols.			£15 8 7½
Fitting-up 2 pistons, packing, and rods, 20 dols.			4 2 3½
„ 2 main connecting rods,	40	„	8 4 7½
„ 2 coupling rods	34	„	6 19 11
Total paid Charles E. Whittemore			£34 15 5½

Oscar F. Lucas.

For fitting-up driving and trailing wheels, crank axle, trailing axle, and crank pins, and setting and turning tyres, by contract, 107 dols.	£22 0 4½
Fitting-up 6 truck and tender axles, and boring and seating 12 wheels, 18 dols.	3 14 1
Fitting-up 6 eccentrics and hoops, 42 dols.	8 12 10
Total paid Oscar F. Lucas	£34 7 3

Wesley Burnham.

	dols. cts.
For planing frame bars	20 00
„ „ cylinder brace	3 00
„ drilling holes in frame	16 00
„ „ cylinder brace	2 50
„ turning and cutting frame bolts	16 00
„ fitting draw-iron casting	2 50
„ „ springs	8 00
„ fitting and fastening cylinders to frame	18 00
„ erecting frame	30 00
„ various other jobs	7 00
Total paid Wesley Burnham, 125 dols.	£25 14s. 5d.

Bowles and Buel,

For fitting-up the following work:—

	dols. cts.
4 Valve spindles complete (2 main, 2 expansion)	25 00
2 Pump rods, with boxes, cotters, and bolts	12 00
2 Inclined braces for smoke box	3 00
2 Pumps, air vessels, and plungers	35 00
2 Check or clack chambers	6 00
2 Guides for pump plungers	6 00
Railing around engine	28 00
1 Main valve reversing lever, and one ditto for expansion valve	9 00
1 Lifting shaft for expansion gear, stands, &c.	15 00
1 Regulator lever, joint and stem	3 50
Finishing and fitting bell	3 00
1 Bell frame	8 00
1 Bell yoke and arm	5 00
4 Guide bars	12 00
Case hardening and straightening do.	3 00
2 Safety valves	12 00
3 Braces to cross girt	5 00
2 Cross heads	32 00
2 Slide valves	3 00
1 Dome-head and cover	4 25
1 centre pintle and flange for truck	6 00
Drilling 135 holes in each of two tube plates	10 00
1 Lifting shaft for main valve gear	17 00
Fitting pistons to cross heads	5 00
1 Regulator valve and steam pipe	12 00
Planing jaws (axle guards) boxes and wedges	20 00
Work on tender	3 00
Total paid Bowles and Buel, 308 dols. 75 cents	£63 10s. 7d.

Richard Hewins.

For fitting-up the following brass-work:—

	dols. cts.
4 Glands for valve spindles	4 00
3 Gauge cocks at 50 cents each	1 50
4 Cylinder cocks „ 50 „	2 00
6 Pump clacks or valves	2 40
4 Cross head oil cups	1 60
2 Spring balance nuts	40
Cutting screws on water nozzles to go under bottom of tender	40
18 Railing balls, or ornaments for stanchions	4 50
1 Stand for signal flag	40
4 Wheel plates	40
1 Frost cock or heater cock	3 00
2 Oil cups and bases for slide valve chests	3 00
4 Mud-hole plugs (cutting screws)	24
2 Maker's name-plates, drilling and polishing	50
2 Pet cocks for pumps	75
2 Thimbles or eyelets for bell and whistle ropes	34
1 Blow-off cock	62
1 Condensing or waste-steam cock	1 50
4 Water hose nuts and thimbles	2 00
Cutting screw on whistle base	25
1 Stuffing box gland for regulator	30
2 Chambers for lower clacks of pumps	3 50
2 Brass plugs	16
Total paid Richard Hewins, 33 dols. 96 cents.	£6 19s. 9d.

Seneca P. Morse.

	dols.
For fitting "yoke"	70
„ stands and rocker arms for expansion gear	40
„ main-valve gabs, and works connected with them	58
„ 2 cranks for working pumps	8
„ 2 gabs, for expansion gear	24
Total paid Seneca P. Morse, 200 dols.	£41 3s. 0½d.

Allen and Butterfield.

	£ s. d.
For erecting engine 296 dols.	60 18 1
„ fitting-up truck frame 14 „	2 17 7½
„ setting 135 tubes 24 „	4 18 9
Total paid Allen and Butterfield, 334 dols.	£68 14s. 5½d.

Simon F. Marshall.

For making timber truck frames for tender, brake beams and blocks, and mounting tender frame on trucks	8 4 7½
„ making "cab" and lagging boiler	8 4 7½
Total paid Simon F. Marshall	£16 9s. 3d.

Joseph A. Arnold.

Mr. Arnold was a coppersmith, and supplied his own materials, conducting his work in his own shop. The following is a transcript of his account for materials and labour on one engine:—

	dols. cts.
175 lb. of Russian iron for lagging boiler, say 15 sheets of 11½ lb. each, measuring 38in. by 50in. No. 21 wire gauge thick, 175 lb. at 12 cts.	21 00
Putting same around boiler	6 00
7 Brass bands for same, 40 lb. at 23 cts.	9 20
Finishing bands	4 0
34 lb. copper blast pipes, including making	17 0
35 lb. do., branch steam pipes, do.	18 00
35 lb. feed pipes for pumps	17 50
21-ft. ¾-in. frost pipe, at 37 cts.	7 77
12-ft. 1¾in. waste steam pipe, at 45 cts.	5 40
Bending and making joints on same	2 75
Copper trough under gauge cocks	2 75
Soldering small jobs	0 50
Two brass escape pipes, over safety valves, 3ft. 4in. high, 9in. in diameter at bottom	36 00
One spark arrester, with wire netting cap 480 lb. at 16 cts. per lb.	76 80
Total paid to Joseph A. Arnold, 224 dols. 67 cts.	£46 4s. 7d.

Eugene Kelly.

Painting engine, including paints and oils	27 00
Do. tender	12 00
Do. inside of tender tank	2 00
Total paid Eugene Kelly, 41 dols., or	£8 8s. 8½d.

James Manning.

Paid him for erecting tender, 45 dols. £9 5s. 3d.

EXTRAS.

Cost of a pair of names of 9 letters each, 25 lb. brass cast letters and borders, finishing, wood work, and painting	£3 3 0
Cost of sand box, 8½ lb. brass, 125 lb. cast iron, 25 lb. smith's work, fitting, painting, &c.	5 16 8
Cost of "cow-catcher," 8 cubic feet timber, 111 lb. smith's work, carpenters' and fitters' work, and painting	5 4 0
Cost of 3 oil and tallow cans, pair of jack screws, set of wrenches and screw wrench, 2 lb. hammer, pinch-bar, 3 chisels, and 3 files	5 8 0
Total extra charges	£19 11 8

Paid to Benjamin Thurston, carter, for trucking engine from works to alongside of any vessel at South Boston wharves, 50 dols.; if taken over any of the bridges to the city of Boston, for delivery at either of the seven railway stations there, 100 dols., say, on an average, 75 dols., or £15 8 7½

RECAPITULATION.

Iron castings, in loam	£12 8 6½
do. do., in green sand	84 18 7½
Boiler iron, tubes, tube plate, and tank iron	237 11 4

(* Copy)
"London, November 26th, 1861.

"Zerah Colburn, Esq.

"DEAR SIR,—I am informed that locomotive engines cost hardly more than two-thirds as much in the United States as here. I am at a loss to understand how such can be the case—labour and most materials being necessarily dearer with you than with us. Your long acquaintance with the engineering and commercial details of American locomotive construction induces me to ask if you are disposed to favour me with particulars of the cost of making locomotives in America, specifying what kind of engines are made for given prices, and, if you feel at liberty to do so, giving the cost, in detail, of executing the various portions of the work. I shall be obliged, also, for any facts you may be able to give me as to the performance of American locomotives, and the cost of upholding or repairing them. "Yours, faithfully, "———."

Forgings, bar iron, tyres, &c.	233	13	6
Brass castings, &c.	75	1	8
"Miscellaneous"	58	12	1
Timber, deals, &c.	4	2	1
Boiler maker's labour, Michael Lally	80	5	0
Smith's Labour, Thomas Wise	43	14	6
Turners' and fitters' labour, Chas. E. Whittemore	34	15	5½
do. do. Oscar F. Lucas	54	7	3
do. do. Wesley Burnham	25	14	5
do. do. Seneca P. Morse	41	3	0½
do. do. Bowles and Buel	63	10	7
do. do. Richard Hewins	6	19	9
Erecters' labour, Allen and Butterfield	68	14	5½
do. do. James Manning	9	5	2
Carpenters' do., Simon F. Marshall	16	9	3
Coppersmith's do., and materials, Joseph A. Arnold	45	4	7
Painters' labour and do., Eugene Kelly	8	8	8½
Extras	19	11	8
Trucking engine away from works	15	8	7½
	£1,221	0	3½

GENERAL EXPENSES.

473 tons of coal per annum, for steam engine, and for smith's and boiler shop, at £1 1s. 7½d.	£511	8	7½
Engine-man at 37s. per week	96	4	0
Watchman at 28s. 5d.	75	2	1
Job blacksmith, for mending tools, 41s. 2d. per week	106	4	2½
Joiner, for shopwork, 24s. 8d. per week	64	2	8
Carting (in addition to Thurston's charges)	102	10	0
Insurance	102	10	0
Oil	102	10	0
Taxes	107	5	0
Water	25	8	0
Lamps, brooms, pails, belting, hardware, &c.	102	10	0
Superintendent	307	10	0
Draughtsman	128	12	0
	£1,831	16	7

At this scale of general expenditure, and supposing no other work were turned out, thirty engines could be made yearly, giving say £61 of general expenses to each, and making their total cost £1,281 each, exclusive of money paid in discounts and interest. Allowing for these the actual profit per engine must have been nearly, or quite, £200, equal to 50 per cent. profit on the £12,000 capital, which was about that upon which the business was then carried on. This sum may appear ridiculously small, as, indeed, it was; but the land and buildings were not worth more than £3,000, the plant hardly over £4,000, and with the system of credit everywhere prevailing, the stock of materials and working capital never exceeded £5,000.

As regards the labour, it amounts, in the case in question, to about £450 per engine. The cost of the tender is included with that of the engine. Separated therefrom its total cost, including labour and materials, was £146 12s.

The "job hands," who contracted for the work, worked themselves, and employed each from one to thirty workmen, we "finding everything," shop-room, tools, power, oil, steel, &c.; except files, emery, emery cloth, &c., for bench work, which were found by the job hands themselves. But, which may appear surprising, the men employed by the job hands were mostly engaged by the day. The ordinary wages of a good journeyman were from 40s. to 50s. a week, ordinary hands being paid from 30s. to 40s., and apprentices 14s The hours were ten a day, viz., from 7 a.m. till noon, and from 1 to 6 p.m. Of course, under a system whereby fixed prices were paid for the several parts of all engines, the small locomotives cost hardly less than the largest—the cost of labour being the same for both.

In 1852 a considerable rise took place in the prices of iron and copper, and they were, last year, probably 20 per cent. dearer than in 1851.

In the spring of 1854 I became engineer to the New Jersey Locomotive and Machine Company. We built engines chiefly for the 6-ft. gauge, although we built some for nearly all of the seven different widths of gauge existing on the railways of the United States and Canada. Our work was heavier and of a more expensive character than that turned out in Boston, and iron and copper were then 25 to 40 per cent. dearer than in 1851. We made our own castings, however, and did much of our heavy forging, and these parts of our work did not, therefore, stand us in much dearer than like items at Boston, three years before. Our work was all done "by the day," and we could not, therefore, arrive at the cost of an engine with the same degree of certainty as at Boston. For first-class express engines, with 16-in. outside cylinders, 20-in. stroke, 5½-ft. wheels, and weighing 25 tons, we had 9,500 dols., or £1,955, and this is now about the price of such engines by the very best American builders. We built some 33-ton engines, on six coupled 4-ft. wheels, 18-in. outside cylinders, 24-in. stroke, cast iron chilled tyres and iron tubes; but, with these exceptions, of expensive materials and workmanship, for an actual cost for labour and materials of under £1,700 each. Among the most expensive engines ever made in the States were those made upon plans furnished by the New York and Erie Railroad Company, for their line, of 6ft. gauge. These were 18-in. inside cylinder engines, 20-in. stroke, four coupled 5-ft. 2-in. wheels, and a truck, with separate tenders, holding 2,000 New York, or 1,600 imperial gallons. The 48-in. boilers contained 197 copper tubes, 2in. in diameter and 10ft. 9in. long. These engines had, however, like the majority of American locomotives, iron fireboxes, cast iron driving-wheels, with Bowling tyres, and solid cast iron truck and tender wheels. They were delivered at 10,500 dols. each, or £2,160 10s. each. At Paterson we allowed £600 for labour on engines of the ordinary class, although that on the Erie engines cost nearly £700. A tender, the price of which is included in that of the engine, cost, separately, and including everything, only about £200.

As a rule, in American locomotive factories, 100 men nearly are employed for each engine turned out per month. Thus, in the first eight months of the year 1853, Messrs. Richard Norris and Son, of Philadelphia, made exactly 100 locomotives, or 12½ per month. The number of men employed averaged between 1,100 and 1,200 during the same period. In the year 1860, Messrs. M. W. Baldwin and Co., of Philadelphia, completed 86 locomotives, or rather more than 7 per month; and during the whole year they employed, on an average, 710 men. The Rogers Locomotive Works turned out, during 1859 and 1860, from 8 to 9 engines a month, and employed, during the same time, between 700 and 800 men on locomotive work, in addition to others on cotton and other machinery. At a time when the Amoskeag Machine Shop was turning out 5 locomotives per month on the average, about 500 men were employed, in addition to those engaged on millwork, cotton machinery, and engineers' tools. The Schenectady Locomotive Works, of a capacity to work 500 men, are capable of producing 5 engines per month. The Taunton Locomotive Manufacturing Company, when employing rather more than 300 men, were delivering from 3 to 4 engines per month. Messrs. Danforth, Cooke, and Co., of Paterson, New Jersey, turned out regularly 5 engines in two months when employing 250 men. The Boston Locomotive Works completed 80 locomotives in the year 1853, or 6⅔ per month, and the number of men employed seldom rose to 500. When the late Mr. Robert Stephenson visited the Portland Locomotive Works, at Portland, Maine, in 1853, they were understood to be equal to the employment of 500 men, and the production of 5 engines per month. At Mr. Souther's and at the New Jersey Locomotive and Machine Company's Works, where I was successively engaged, less than 100 men sufficed to turn out one engine per month. I am not warranted in drawing comparisons between the working of the American and English locomotive factories; but I may, perhaps, be allowed to record my belief that more work, of a given quality, is had from a given number of men in the American workshops than here—almost, if not quite enough more, I apprehend, to compensate for the higher wages paid in the States. Here, I am told the production of six engines monthly requires the constant employment of from 950 to 1,000 men.

That there may be no uncertainty as to the cost of American locomotives, I may further quote that of other engines actually delivered, as well as the "list" prices quoted by certain makers.

Four engines, on the Fitchburg Railroad, weighing 18 tons each, and having 13½-in. outside cylinders, 20-in. stroke, four coupled 5-ft. driving-wheels and a bogie, 569 square feet of heating surface (copper tubes), and a separate tender, were delivered by the makers for 6,800 dols., or £1,400 each. Two engines of like plan and construction, on the same line, but having 15-in. cylinders, 620 square feet of heating surface, and weighing 20 tons, were delivered by the same makers at 7,450 dols., or £1,533. One 19-ton engine, with 14-in. inside cylinders, 18-in. stroke, and in other respects like the above, was delivered to the same line for 7,500 dols., or £1,543, and this was the price, also, of a 16-in. inside cylinder passenger engine, 20-in. stroke, 698 square feet of heating surface, and weighing 22 tons. An eight-wheeled 20-ton goods engine, with 15-in. outside cylinder and 20-in. stroke, was delivered also to the Fitchburg Railroad Company for 7,800 dols., or £1,605. The engines made by Mr. Ross Winans for the Baltimore and Ohio Railroad, weighing 25 tons, and having 19-in. outside cylinders, 22-in. stroke, eight coupled wheels 3ft. 7in. in diameter, with chilled cast iron tyres, and with iron fire-box and tubes, were paid for at the rate of 9,750 dols., or £2,006 each, of which 750 dols., or £154, is charged as royalty for certain patents, the ostensible price of the engines being 9,000 dols., or £1,852. As a locomotive engineer, familiar with the construction of these engines, I should say that nearly cent. per cent. profit was made upon them, even without the royalties charged. The Baltimore and Ohio and the Reading Railroads have, together, nearly 250 of these engines, in none of which is there as much as 5 cwt. of brass and copper, none but the cheapest forging, and less bright work than would be put upon an English contractor's locomotive. Mr. Winans' bid for 10-wheel goods engines for the Baltimore and Ohio Railroad, to weigh 27 tons (60,000 lb.), and to have 18-in. cylinders and 24-in. stroke, was (October 4th, 1856) 10,000 dols., or £2,057, 12s. 6d. each. In 1855 the New York and Erie Railroad Company received 14 locomotives, of 30 tons' weight, four having 17-in. outside cylinders and 24-in. stroke, made by the New Jersey Locomotive and Machine Company, and ten having 18-in. inside cylinders and 24-in. stroke, made by Messrs. Danforth, Cooke, and Co.—all the engines having four coupled 5-ft. drivers and a bogie, and a tender holding 1,600 imperial gallons, the materials and workmanship throughout being the best used in American engines. These engines were all paid for at the rate of 11,000 dols., or £2,263 each.

In 1860 Messrs. M. W. Baldwin and Co.'s price for a 24-ton passenger engine, with 15-in. cylinders and 24-in. stroke, made in the best manner known in the States, was 9,750 dols., or £2,006; a 25-ton passenger engine with 16-in cylinders, 22-in. stroke, and four coupled 5½-ft. wheels, being 10,000 dols., or £2,057 12s. One of their 27-ton goods engines, delivered two years ago to the Mine Hill and Schuylkill Haven Railroad, and having 19-in. outside cylinders, 22-in. stroke, and eight coupled 3-ft. 7-in. driving wheels, with Bowling tyres, brought 11,331 dols., or £2,331 10s.

In the year 1855 the price list of the Lawrence Machine Shop was as follows, for engines with four coupled driving wheels and bogie, and a tender on either six or eight wheels, the materials and workmanship being equal to those of any locomotives made in New England.

12-in. outside cylinders,	20-in.	stroke,	36,000 lb.	7,000 dols.	£1,440
13 "	20 "	"	40,000 "	7,500 "	1,543
14 "	22 "	"	44,000 "	7,750 "	1,595
14 "	22 "	"	46,000 "	8,300 "	1,708
15 "	22 "	"	48,000 "	8,750 "	1,800
15 "	22 "	"	50,000 "	8,825 "	1,816
14 "	22 "	"	47,000 "	8,500 "	1,749
16 "	22 "	"		9,000 "	1,852

These "list" prices, I am disposed to believe, were higher than those generally obtained.

It will be understood that every engine of which I have yet given the price had a separate tender, the price of which is invariably included in that of the engine.

The reports of the various American railway companies afford abundant *data* as to the average cost of locomotives made in the States, nearly all of these reports giving the number of engines owned and their aggregate cost.

The New York and Erie Railroad Company owned 203 locomotives on the 30th of September, 1855, their aggregate cost having been 2,013,528 dols., or an average of 9,919 dols., or £2,041 each. This line, of 6-ft. gauge, employs the heaviest and most costly engines, as a class, of any in the States.

The Pennsylvania Central Railroad Company owned, on the 31st December, 1857, 216 locomotives. Of these 69 had been purchased together with the Philadelphia and Columbia Railroad, the cost of the remaining 147 having been 1,355,051 dols., or an average of 9,218 dols., or £1,896 14s.

The New York Central Railroad has 225 locomotives, and the Baltimore and Ohio, at the beginning of the war now going on, had 234. The average cost of these was not far from that of the Pennsylvania Central engines.

The Galena and Chicago Union Railroad Company owned, on the 1st of January, 1858, 60 locomotives, of which the cost had been 538,230 dols., or an average of 8,970½ dols., or £1,845 10s. each. This, too, includes the cost of delivery at a distance averaging 800 miles from the factories where the engines were made.

The Pittsburgh, Fort Wayne, and Chicago Railroad Company, owning nearly 100 locomotives, purchased 25 engines in the year 1857, at a cost of 260,438 dols., or 10,417½ dols., or £2,143 10s. These engines were considered as in every way first-class.

The Cincinnati, Wilmington, and Zanesville Railroad Company owned, in 1857, 16 locomotives, the cost of which had been 136,997 dols., or 8,562 dols., or £1,762 each, which includes cost of delivering 10 of them at a distance of 1,000 miles (mostly by rail) from the maker's works.

The Dubuque and Pacific Railroad Company owned, in January, 1857, 8 locomotives, which had cost 86,301 dols., or 10,788 dols. each, or £2,219 10s., which includes cost of delivering the whole at a distance of 1,200 miles from the maker's works. This line is one now in progress.

In the report for 1855 of the State Engineer of New York, he gave the quotients, obtained by dividing the aggregate cost of the locomotives of various New York railway companies (as such cost stood on their books) by the number of engines then owned by the respective companies. I have given the results below; but, I may remark here, that in most cases they probably show more than the real cost of the engines, it being, I suspect, the fact that the "total cost" of all the locomotives of many of the roads included that of all engines purchased from the beginning, whereas the "number of engines," by which this total cost was divided, was, I suspect, only the number owned in 1855, and irrespective of engines which had been broken up and sold, the inclusion of which would have diminished the "average cost."

Name of Railway.	Average cost of Engines.
New York and Erie, 6ft. guage	9,919 dols. £2,041
New York Central, 4ft. 8½in.	10,740 " 2,210
Hudson River, do.	9,163 " 1,885
New York and Harlem, do.	11,691 " 2,387
New York and New Haven, do.	8,661 " 1,782
Buffalo and New York City, 6ft. guage	11,014 " 2,266
Buffalo, Corning and New York, do.	9,293 " 1,912
Canandaigua and Elmira, do.	10,314 " 2,122
Canandaigua and Niagara Falls, do.	8,569 " 1,763
Cayuga and Susquehanna, do.	6,928 " 1,425
Buffalo and State line, 4ft. 10in. gauge	8,179 " 1,683
Syracuse and Binghampton, 6ft. gauge	8,952 " 1,838
Black River and Utica, 4ft. 8½in.	7,495 " 1,542
Watertown and Rome, do.	6,634 " 1,365
Pottsdam and Watertown, do.	7,373 " 1,517
Oswego and Syracuse, do.	7,606 " 1,565
Troy and Boston, do.	8,833 " 1,817
Rensselaer and Saratoga, do.	9,713 " 1,999
Ogdensburgh, do.	8,423 " 1,734
Long Island, do.	7,623 " 1,558

I have already explained how I believe these averages to have been obtained, and I may remark, in support of my belief, that there is not one engine on the New York and Harlem Railroad that has cost £2,387: few on the Buffalo and New York City that have cost as much as £2,266; and few, if any, on the Rensselaer and Saratoga that have cost £1,999 each.

As to the cost of maintenance of American locomotives, it must be borne in mind that all iron employed in repairs costs about 50 per cent. more in the States than here, pig iron worth £3 here, being £4 10s. there, and bars worth £10 here bringing £15 there. Mechanics' wages are also 50 per cent. dearer in the States than in England, the range of wages in repair shops being from 27s. to 55s. 6d. per week, and averaging about 42s. For nearly one half of the year, also, many of the lines—imperfectly ballasted and drained as many of them are—are frozen almost to the hardness of rock. On most American lines the winter repairs are considered to be from one half as heavy again to twice as heavy as those in summer, not a winter passing in which the cold is not, at some time, from 5 to 20 deg. below zero, or from 37 to 52 deg. of frost. In one winter—that of 1855-56—nearly 200 breakages of driving-wheel tyres were reported at the Syracuse workshops of the New York Central Railroad, 85 engines being employed on the two divisions of the line for which repairs were made at Syracuse. In the winter of 1856-57, there were, on the Michigan Central Railroad, then working 92 engines, 20 broken crank axles, 48 broken driving-wheels, and 70 broken driving-wheel tyres.

Another fact, which is to be considered in connection with the repairs of American locomotives, is that they are heavier worked than English engines, taking heavier trains over more difficult lines, although at a rather slower speed than the average in England. Thus the repairs, *per train mile*, which is the standard to which engine repairs are commonly referred, show higher, in comparison with the same items on English lines, than would the repairs, if referred to the actual amount of work done—say to horse-power exerted for any given unit of time. In other words, American engines, being urged under a sharper blast and worked to a rather higher average pressure of steam, evaporate more water per hour, and exert a greater horse-power than English engines, although running a less number of miles per hour. Thus an English engine might run 30,000 miles per annum, at a cost of 3d. per mile, or £375 in all; whereas an American engine, running 22,500 miles, might really perform the same work, both dynamically and commercially, and, although costing 4d. per mile for repairs, cost only the same sum in the course of a year.

With these observations I may quote the cost of repairing American locomotives, from the reports of various American railway companies, viz.:—

By the reports of the New York and Erie Railroad Company, it appears that their locomotives ran, in the sixteen years, from September 23rd, 1841, to October 1st, 1857, 21,225,240 miles, at a cost for repairs of 9·42 cents, or 4·7d. per train mile.

The average cost of repairing 735 locomotives on all the railways of the State of New York, was in the year 1855, 9·8 cents, or 4·9d. per mile run.

The New York Central Railroad, which may be considered as the London and North-Western of the United States, ran 218 engines in the year 1858, at a cost of 7·2 cents, or 3·6d. per train mile, the whole number of train miles run being 3,942,547.

On eight of the principal railways of Massachusetts, including the seven lines running out of Boston, 13,755,550 miles were run during the five years from 1846 to 1851 inclusive. The repairs of engines, *and carriages of all kinds*, averaged for this period 13·66 cents, or 6·83d. per mile; and as the repairs of carriages generally average more than two-thirds as much as those of engines, the cost for repairing the latter probably averaged 8 cents, or 4d. per mile.

On the Baltimore and Ohio Railroad, the engines of which draw exceedingly heavy trains at slow speeds, 109 of the standard class of burden engines had run, from the time they were placed on the road up to October 1st, 1856, 7,437,896 miles, at a cost for repairs of 9·93 cents., or nearly 5d. per train mile.

The following table will give a general idea of the cost of upholding American locomotives, having been prepared from various reports by different companies:—

WORKING AND REPAIRS OF LOCOMOTIVES.

Name of railway.	For the year ending	Number of Locomotives.	Miles run.	Cost of repairs per mile run. cts.	pence.
Baltimore and Ohio	Oct. 1, 1857	223	4,026,037	12.66	6.33
New York and Erie	Sept. 30, 1857	210	3,092,581	13.67	6.83
New York Central	Sept. 30, 1858	218	3,942,547	7.2	3.6
Pennsylvania Central	Feb. 1, 1858	216	2,542,213	8.26	4.13
Reading	Dec. 1, 1857	142		10.07	5.03
Pittsburgh and Chicago	Dec. 31, 1857	94	1,829,118	7.95	3.98
Galena and Chicago	" "	69		4.9	2.45
Western (Massachusetts)	For 1857.	68		10.34	5.17
Cleveland and Columbus	" "	42	678,757	9.78	4.89
Little Miami	" "	41	666,546	9.81	4.90
Central Ohio	" "	38	589,574	9.13	4.56
Boston and Maine	" "	34	537,770	5.8	2.9
Boston and Worcester	" "	30	534,882	9.02	4.51
Fitchburg	" "	30	351,657	7.2	3.6
Philadelphia and Baltimore	" "	26	429,035	5.4	2.7
Cincinnati and Dayton	" 1856.	23	312,176	5.99	3.
Indianapolis and Cincinnati	" 1857.	23	353,648	5.48	2.74
Boston and Providence	" "	21	286,374	7.35	3.67
Cincinnati and Zanesville	" "	16	304,169	7.34	3.67
Kentucky Central	" "	14	240,940	8.75	4.37

Taking into account the higher cost of labour and materials chargeable to repairs in the States, and considering the heavier work performed under a more severe climate by American engines, I think the actual repairs made upon them, for a given service, are no greater than those upon English engines; and, I further believe, that the "life" of the former is quite as long as that of the latter.

As to the peformance of American locomotives, I presume you are aware that the gradients of American lines are heavier and the curves sharper than on English railways. You may not be so well aware that the average weight of trains drawn on American railways is considerably more than here, although the speed is about one-fifth, or between that and one-fourth less.

At the end of the year 1855 there were, by official reports, 2,616½ miles of railways open in the State of New York. Although this extent of line hardly represented one-tenth of the reported length of railways then open in all the States, the New York lines may be fairly taken as representative of American railroads generally. On these New York lines there were, according to the report of the State Engineer, 14,707ft. of rise from tide water and 17,588ft. fall towards tide water. This was, however, exclusive of the New York Central—the principal railway in the State—and as the rise and fall on its main line is 2,625½ft., and on both the main and side lines, about 4,590ft., the total rise and fall on the New York State Railways would be equal to 36,885ft., or to an average gradient of 1 in 375 over all the railways in the State. One of these railways, the New York and Erie, has 8,056ft. of rise and fall in a length of 445 miles, equal to an average gradient of 1 in 293 over the whole distance. Of the whole length of this line, 34 miles are on a gradient of 1 in 88, or 60ft. per mile.

Going out of the State of New York, the main line of the Pennsylvania Central Railroad, 250 miles long, has 4,639ft. of rise and fall, 10 miles rising continuously at the rate of 1 in 56. (This length of 250 miles is exclusive of 105 miles from Harrisburg to Philadelphia). The Baltimore and Ohio Railroad, 378 miles long, has 3,131ft. of rise and fall in the first 178 miles, and 9,505ft. in the whole distance, equal to an average gradient of about 1 in 200 all the way. On this line there are, on one division of 60 miles, 32 miles of gradients ranging from 1 in 50 to 1 in 45½.

Going into the State of Massachusetts, the Boston and Worcester and Western Railroads, 200 miles long, collectively, have 4,481ft. of rise and fall between Boston and Albany, 12 continuous miles ranging from 1 in 71 to 1 in 64.

I need not amplify these particulars. They apply to the five prin-

cipal lines of the States, from tide-water to the "West," and they indicate what American lines are like. In the year 1855, the reported average weight of passenger trains on the railways of the State of New York was, including engine and tender, 87½ tons, the average number of passengers carried being 73 for each train mile run. This, it will be found by comparison with the data furnished in Captain Galton's reports, is about one-fourth greater than the average on English lines. The goods trains weighed, including engine and tender, an average of 239 tons. The speeds were somewhat less than in England; I should say, on an average, from one-fifth to one-fourth less.

I cannot give you a broader average than that contained in the working of the New York railways. I might give you an almost endless list of performances of individual engines on various lines, but these would hardly assist you in determining the average of every day work. As an engineer of some experience I can, however, give you my unreserved opinion that locomotives are worked considerably harder on American than on English lines.

Yours faithfully,

ZERAH COLBURN.

RAILWAY TRAFFIC RECEIPTS.

THE gradual decline in the traffic receipts of railways in the United Kingdom has caused some uneasiness respecting the dividends of the current half-year, just completed, that they will not be so good as those of the corresponding period of 1860. The decline in the traffic receipts is attributable to the depression of trade, arising chiefly from the war in America, and other proceedings there injurious to commerce. The receipts on the railways for the week ending the 21st instant showed a decrease of £16,760 as compared with the receipts of the corresponding week of 1860; and for the preceding week, ending the 14th instant, the receipts showed a decrease of £5,975. The falling off in the expected receipts of the preceding nine months has been chiefly shown by a decline in the increase over the corresponding period of 1860, the amount of it becoming smaller and smaller until the last two weeks above-mentioned, when the receipts fell below the receipts of the corresponding period of last year. This serious decline has been attributed to the expectation of war, and a consequent cessation of speculative operations. It should be mentioned that the gradual increase of traffic on railways in the United Kingdom during the seven years preceding 1861 averaged £1,418,000 a-year, or £27,270 per week, so that a decrease in the receipts of £16,760 below the preceding year practically represents a decrease of £44,030, or about 9 per cent. of the total receipts.

The traffic receipts on railways in the United Kingdom for the first quarter of 1861 showed an increase of £253,000 over those of the corresponding period of 1860; for the second quarter they showed an increase of £119,300 over the second quarter of 1860; for the third quarter they showed an increase of only £76,800 over the same quarter of 1860, and for the fourth quarter an increase of about £52,800, which might be reduced when the returns for the week ending the 28th inst. are made up. This decline in the receipts will be better understood when it is stated that the increase of traffic in the first quarter of 1860 over the same period of 1859 amounted to £439,700; for the second quarter to £592,600; for the third quarter to £483,421; and for the fourth quarter to £404,000, making together £1,919,721 over the preceding year 1859, while the total increase in the receipts in the year 1861 will probably not exceed £500,000, showing a decrease of something like £1,420,000. If this had been realised a great portion of it would have gone towards meeting the interest on additional expenditure, and increasing the dividends on the ordinary shares. Going further back, the increase of traffic in the first quarter of 1859 over the same quarter of 1858 amounted to £434,500; in the second quarter to £450,400; in the third quarter to £435,300; and in the fourth quarter to £464,900 over the same period of 1858, making together an increase in 1859 of £1,785,100 over the year 1858. The traffic receipts of 1858, owing to a commercial crisis and great depression of trade, were £400,000 less than for the preceding year 1857. The year 1858 was the first year since 1842 in which the aggregate receipts of railways were less than in the preceding year. The following will show how the traffic on the principal railways in the United Kingdom was affected during the past year as compared with that of 1860, and will show that the falling off in the traffic has chiefly taken place in the manufacturing districts:—The increase in the traffic on the following railways in 1860 over the preceding year amounted in the aggregate to £1,553,800, against £251,720 in 1861 over 1860. The increase in the traffic on the London and North-western Railway in 1860 over the preceding year amounted to £244,881, against a decrease in 1861 of about £17,200; in the traffic on the Midland an increase of £209,289 in 1860, against a decrease in 1861 of £3,220; in the traffic on the Lancashire and Yorkshire an increase of £199,728 in 1860, against a decrease of £16,350 in 1861; in the traffic on the North Eastern an increase of £128,946 in 1860, against an increase of £24,980 in 1861; in the traffic on the Great Western and West Midland an increase of £128,251 in 1860, against £53,220 in 1861; on the London and South Western an increase of £78,592 in 1860, against £56,920 in 1861; on the South-Eastern an increase of £58,190 in 1860, against a decrease of £19,900 in 1861; on the Great-Northern an increase of £56,277 in 1860, against £39,450 in 1861; on the London Brighton, and South Coast an increase of £53,230 in 1860, against £54,130 in 1861; on the Manchester, Sheffield, and Lincolnshire, an increase of £52,790 in 1860, against £6,823 in 1860; on the Great Southern and Western of Ireland an increase of £52,317, against £15,590 in 1861; on the Caledonian an increase of £49,880 in 1860, against £22,870 in 1861; on the West Hartlepool an increase of £47,960 in 1860, against £13,016 in 1861; on the Taff Vale an increase of £37,246, against £478 in 1861; on the Glasgow and South Western an increase of £34,990 in 1860, against £5,230 in 1861; on the South Wales an increase of £27,086 in 1860, against a decrease of £6,660 in 1861; on the North Staffordshire an increase of £27,300 in 1860, against a decrease of £36,100 in 1861; on the Eastern Counties an increase of £20,420 in 1860, against £22,721 in 1861; on the Stockton and Darlington an increase of £18,810 in 1860, against £20,620 in 1861; on the Newcastle and Carlisle an increase of £16,860 in 1860, against £670 in 1861; and on the Midland Great Western of Ireland an increase of £10,850 in 1860, against £14,480 in 1861. The year 1860 in the foregoing refers to the increase of traffic in 52 weeks, while 1861 refers to the increase and decrease of traffic during 51 weeks, the last week's traffic not having yet been made up.

THE DOVER MAIL PACKETS.—Some interesting trials of speed have taken place between the Dover and Calais mail packets and the Admiralty and Belgian steam packets, specially sent to this port for the conveyance of distinguished personages. On Thursday, last week, the celebrated mail packet John Penn brought over to Dover from Boulogne her Serene Highness the Princess Hohenlohe. Although blowing a fresh gale, with a heavy sea, she made the passage in 1 hour and 50 minutes. On Saturday the Belgian Government packet Topaze, just come out with new boilers and lengthened dimension, with the Duke of SAXE-Coburg and the Belgian Princes on board, left Calais at the same time as the mail packet Vivid, with his Excellency Lord Cowley and 126 passengers and their luggage on board, but in the run she beat the Belgian by nearly a quarter of an hour. On Monday night again the Admiralty yacht Vivid, formerly the crack mail packet on this station, started from Dover neck-and-neck with the John Penn, the former with the Prince of Prussia, and the mail vessel with a large number of mails, passengers, and luggage; but the Admiralty yacht had no chance, for the John Penn beat her by eight minutes, in a strong wind and heavy sea, with the tide against them. Several rapid passages have recently been made between Dover and Calais by the mail packet Empress, just brought out with improved new boilers, new wheels, &c., constructed at the factory of this port. On Thursday last, with a sack tide, she made the run to Dover in less than 85 minutes.

NOTES FROM NEW SOUTH WALES.

In referring, last week, to the progress of various public undertakings in course of development in the colony of New South Wales, we found ourselves unable to clear off the mass of details available, and we, therefore, now recur to the subject. It appears that, when our advices left in October, the works upon the three railway extensions contracted for by Sir M. Peto and Co. were all in a forward state, and in some portions rapidly approaching completion. On the Northern line the excavations through the most difficult of the rock cuttings are nearly finished, and only a small portion of the earth-work remains to be executed. A large quantity of ballast has been laid upon the line between Black Creek and Lochinvar, and the permanent way is being laid from Lochinvar station towards Black Creek, extending at present as far as Harper's Hill. Most of the culverts and principal bridges are completed, but a few flood openings remain to be made. The line as far as Black Creek was expected to be finished last month, and the remainder of the extension before the end of this year.

Upon the Western line all the earth work is completed, excepting a portion of one cutting, which has to be taken over the South Creek viaduct when ready for it. The only bridges not yet finished were those over South and Rope's creeks. Considerable difficulty has been experienced in obtaining ballast for this line; the contractors have to cart stone from the Parramatta Domain to the side of the railway between Parramatta and Blacktown, and again to transport it on to the new line by their locomotive engine. A large quantity of ballast is being procured from the Nepean River near Penrith, for that portion of the line. The ballasting and permanent way are finished between Blacktown and Eastern Creek, and a large number of men are employed in carrying on the work towards Penrith. It is anticipated that the Western extension will be ready for opening early this year. On the Southern line most of the cuttings are out, and the culverts are finished. There are yet two or three timber viaducts to construct which will occupy some time. The works for the Menangle viaduct (described in detail in THE ENGINEER a few months since) are progressing, but still a great deal remains to be done in preparing for the foundations of the piers. The masonry, which is obtained from the side of the river at a short distance from the site, is being carried up for the first pier on the Menangle side of the river, and the foundations of the second pier are ready to receive the masonry. The timber approaches on the Menangle side are also in course of construction. The line is being ballasted in a great number of places between Campbelltown and Picton, and the permanent way is being laid between Campbelltown and Menangle. From the present aspect of the works it is expected that the line will be completed considerably before the time stated in the new contracts—the 1st of January, 1863.—At a public dinner given to the Governor at Windsor, Mr. Cowper announced that, the evening before he left Sydney, the Government had agreed to place a sum of money on the estimates for a railway or a tramway to Windsor. The distance of Windsor from the Blacktown station, on the Western line, would be about thirteen miles, and a select committee of the Assembly appointed three years since to inquire into the desirability of the extension reported in its favour, the evidence taken showing that the traffic on the branch line would give a paying return upon the cost of construction. Since this announcement was made the estimates have been submitted to the Assembly, and from these it appears that the line to Windsor and Richmond is to be a horse railway, and to cost £60,000. A short line between Maitland and Morpeth, connecting the Great Northern Railway with the head of the navigation of the Hunter River, was proposed last year to be carried out by the Government, but the estimate for its construction was refused by the Assembly, chiefly on the ground that, as the railway started from the mouth of the river, the new line would injure the port of Newcastle. Subsequently a private company was got up for carrying out the undertaking, and the necessary capital having been subscribed an Incorporation Bill was brought into the Assembly. The measure was supported by a large majority of the members, but met with persistent opposition from two or three who urged that the proposed line would take away the traffic from the Government railway; and, owing partly to their opposition and partly to the lateness of the session when the bill was brought in, it was not passed. The bill has been again introduced into the Assembly, and has been referred to a select committee. A petition has been drawn up by some of the residents in the Hunter River district and presented to the Assembly against the passing of the bill; it alleges that the two steam companies engaged in the carrying trade upon the Hunter River are in collusion in keeping up the freights, which, in some cases, amount to three-fourths of the value of the agricultural produce conveyed; and that this is likely to be perpetuated should the proposed railway between Maitland and Morpeth be constructed; the petition further mentions that the shareholders being, to a great extent, the same as those of the steam companies, their interest in monopolising the trade of the district would be identical. Notwithstanding the defeat sustained by the Government last session upon their proposal for constructing the Morpeth Railway as a Government line the sum of £20,000 has again been placed on the estimates for that purpose. The project of constructing a railway between Botany and Sydney has been energetically supported by a number of gentlemen, most of whom have property about Botany, the value of which would be considerably enhanced by the formation of such a line. A committee appointed at a preliminary meeting having reported favourably of the project a second meeting was held, at which it was resolved to form a company, to be called the "Botany Railway Company," the capital to consist of £15,000, in 3,000 shares of £5 each. Several proposals were made as to the route which the line should take, and to other details, but these it was decided not to enter upon until the company had been formed. The opinion of the promoters of the line appeared to be in favour of a tramway which could be laid along the existing thoroughfares without interfering with the traffic.

For the two premiums—£600 and £300—offered by the Government of the colony for the best designs for the new Houses of Parliament, and Government buildings, which it is proposed to erect, twenty-one designs were tendered in competition; and, after these had been publicly exhibited, the commissioners appointed to decide selected six as being the most eligible, and directed the Colonial Architect to report upon them. As the instructions received by that officer included an estimate of the entire cost of carrying out each design, a very great amount of labour was involved. The work is, however, at length completed, and the report of the Colonial Architect sent in. The commissioners have since had one meeting, and there can be no doubt that the next mail for England will carry home the names of the successful competitors. The following are the mottoes attached to the six designs which were selected by the commissioners as the most eligible:—"Palladio," "Hora e Sempre," "I bide," "Fide et Virtute," "Follower of Wren," and "Sic fortis Etruri crevit."

We read in the *Sydney Mail* with regard to the strike among the Newcastle coal miners, noticed once or twice in previous numbers of THE ENGINEER:—"The strike among the coal miners at Newcastle has terminated at last, after having endured for about eight weeks. The men at all the mines have gone to work again. The wages remain very nearly the same as before the strike. A concession of 3d. a ton has been made by the miners, but then the employers undertake the wheeling of the coal, so that there is a compensation. The masters have failed in enforcing the reduction of 20 per cent.; and have failed also in their attempt to break up the dominating control of the union. The victory, therefore, rests with the men, and this may compensate them for the loss of two months' wages. The masters have gained nothing to compensate them for the loss of two months' profits. The only result which may be said to be adverse to the men and favourable to the employers is one that will operate indirectly. The effect of the discussion that has taken place has been to show that the Newcastle coal miners earn far more than the average wages of the labouring class. It has been published far and wide that in a short day's work a coal miner can earn 11s. 4d. with ease. This is considerably above the average net earnings of gold diggers, and is above the pay of artizans in Sydney. As there is nothing very mysterious in the art of coal getting—nothing that any man of moderate intelligence cannot easily learn, especially if he has been accustomed to handle the pick at the gold-fields, it is natural to suppose that many of the less fortunate members of the working classes will view the coal-getters' wages with an envious eye. Profits and wages in all occupations tend to equalise themselves, and the display that has been made of the large earnings that a coal-getter in full work can secure may gradually induce many persons to gravitate towards that employment. The foreign trade in coal has been to some extent injured, but the local consumers will probably gain. The new mines that have been opened, and the increased stimulus that has been given to the existing mines, will have the effect, when taken in combination with the resumed operations where work had been suspended, of increasing the production and reducing the price. The co-operative company has made good its footing, and this is one very definite result of the strike. The company has hitherto had all fair weather, but now, of course, it will have to contend with the severer competition which its members have helped to call forth. It is to be hoped, however, that the scheme will be successful, as its development is sure to teach useful lessons in political economy alike to employers and employed. A little intermixture of experience by different classes is about the best cure for class prejudices."

THE GUNBOATS.

FROM the notices published of late respecting the extraordinary activity displayed in the outfit, commission, and despatch of the first-class reserve gun-boats to the Mersey and elsewhere it might naturally be presumed that an equal degree of activity existed at the head-quarter depot of the gunboats at Haslar. This is not the case, however. With the exception of thirty hands specially employed to complete the Tyrian, begun, but delivered in an unfinished state by a private builder, there is nothing doing in the yard and shipway. It would take a considerable number of hands some length of time to render the boats stored under Haslar sheds fit for commission. Many of them now lying on the blocks with their copper off and an air-strake out of their planking on each side have lain thus for eighteen months, and some still longer, since they were partially examined and passed as sound boats. If a judgment may be formed of the probable state of the whole of these, from a recent examination of one of their number, it may be concluded that many of them now are exceedingly faulty. There can be but little doubt that many of these vessels, which at the time of the official examination may have had but a rotten timber or piece of planking at wide intervals, are now very defective. The line of blocks on which the boats are stowed are divided by brick partitions into six equal parts, and the whole covered by zinc ridge and furrow roofing. The mortar boats stand on the opposite side of the yard, with their decks merely covered with penthouse roofing. In the first division of the gunboat sheds are stowed the Caroline, Pet, Pert, Tiny, Wolf, Crocus, Camel, Skylark, Garland, and Gannet. The seven last-named have each their copper off, with which exception they are supposed to be complete and sound in their hulls. But it is well known that they are not. The Pet and the Pert have portions of the planking stripped from their bottom. One is in a good state of preservation; the other is not. One was built in a public and the other in a private yard. The remaining boat in the shed is the Caroline, still doing penance for her faults of construction. In the second divisional shed stands the Mackerel, fixed like the Caroline. Both vessels should be pulled to pieces and their places occupied by craft that may be some day of use. In addition to the Mackerel is the Flirt, with fore part of keel and some of her timbers crumbling to dust from dry rot. Her after body has not yet been sufficiently opened to give a correct idea of its state. The Cherokee is bare yet to her timbers, which are being completed slowly for planking. The Brave is rather more forward, and will soon commence planking. The Beaver and the Badger have been hauled up, and still retain their old copper, with an air-strake of planking out, but no one can say what condition they are in until they have been fairly opened. The remaining boats here are the Primrose, the Prompt, and the Pickle, belonging to the uncoppered class. In the third shed are the Fervent, the Albacore, the Gnat, the Swan, and the Redbreast, of the uncoppered class; the Grinder and the Brazen, with their old copper on; the Beacon, stripped of planking, and making good her timbers; and the notorious Whiting, at length nearly complete in her new planking. In the fourth shed stands the Snapper, partially opened, and faulty, as also may be termed the Pincher; the Peacock is stripped of planking, and making good her timbers; the Gadfly, the Rocket, the Midge, the Charger, the Parthian, the Blossom, and the Confounder, belong to the supposed sound but uncoppered class. In the fifth division the Thrush and Ready are partially stripped of their planking, and in the adjoining and last division of the sheds are the new class of gunboats now building by the Government, comprising the Minstrel, Netley, Orwell, Bruiser, and Cherub, with the majority of their timbers and framing in position, and the Tyrian, completing, after having been received in an unfinished state from the hands of the contractor, as already stated. The mortar boats in the yard consist of twelve built of wood and nine of iron. Of the condition of the former, at present, no one can speak with confidence until they have been further opened and examined. Twelve months since they were said to be in good condition. Three-fourths of the gunboats are of 60-horse power. Of those afloat in the port are the advanced flotilla, comprising the Rose, Raven, Blazer, and Highlander. From this class have been recently detached the Amelia and Escort for service in the Mersey. To supply the places of the advanced flotilla in the first-class reserve the following boats are being hurried forward in the ship and steam basins of the dockyard from the second-class reserve:—The Jasper, 80-horse power, and the Earnest, Savage, Cracker, Foam, Swinger, and Pheasant, of 60-horse power each. The remainder of the gunboats in the port reserve consist of the Fenella and Hunter, of 40-horse power each, and the Chub, Decoy, Ant, Rambler, Daisy, Angler, and Cheerful, each of 20-horse power. The gun-boat yard at Haslar at present is a solitude compared with the chief yard at Portsmouth. In the latter it is one continuous scene of energy and bustle. The efforts of the departments are at present chiefly concentrated upon the gunboats being brought forward for first class, and the vessels in the ship and steam basins and contiguous docks, comprising the Black Prince, 40, screw, ordered for completion by the 30th of April next; the Geyser, 6, paddle, Commander Jackson, bound for Vancouver, ordered for the 15th inst.; the Sutlej, 51, screw, for the 10th inst.; the Tribune, 32, screw, for the 1st of February; the Duncan, 101, screw, for the 28th of February; the Glasgow, 51, screw, and the Frederick William, 86, screw, for the same date; the Octavia for the 1st of March, and the Esk for the 9th of May. In addition to these the Coquette, 5, screw, is masted; and the Dart, 5, screw, has commenced receiving her masts; and both will be completed for commission as rapidly as possible, and very probably will be commissioned before they are out of the hands of the departmental officers of the dockyard. The Black Prince was yesterday placed in No. 10 dock, and, after having her bilge pieces, &c., fitted to her bottom, will be payed over with the composition prepared by Mr. Hay, the dockyard chemist, in a like manner to the Warrior.

WHERE OUR TIMBER COMES FROM.—Great Britain and Ireland import annually some 27,000,000 cubic feet, or 540,000 loads, of Canadian pine timber, the greater part of which is manufactured on the Ottawa river and its tributaries. The operations of this manufacture extend over upwards of 11,000 square miles, and give employment to more than 40,000 men; but there are, perhaps, but few in England who have more than the most misty conception of the way in which the giants of the forest are subjected to the dominion of man.—*Once a Week.*

CLAY'S CULTIVATORS.

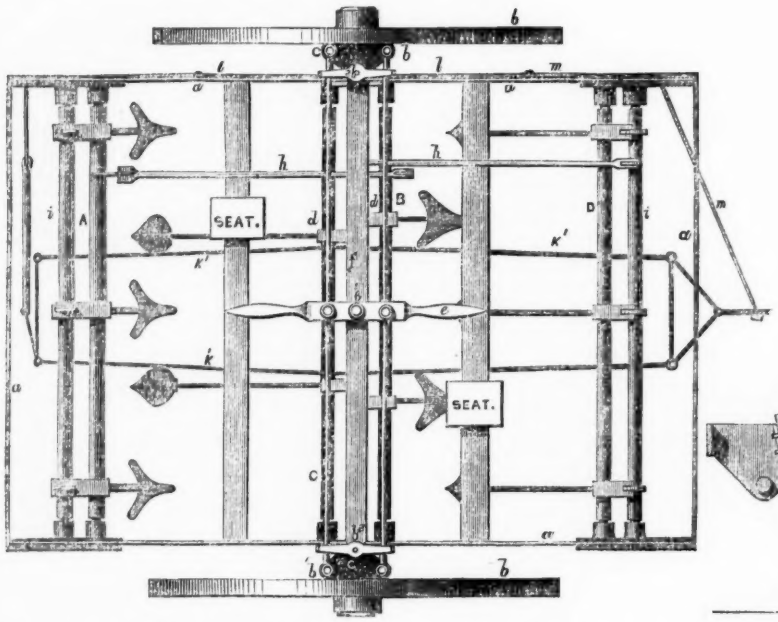
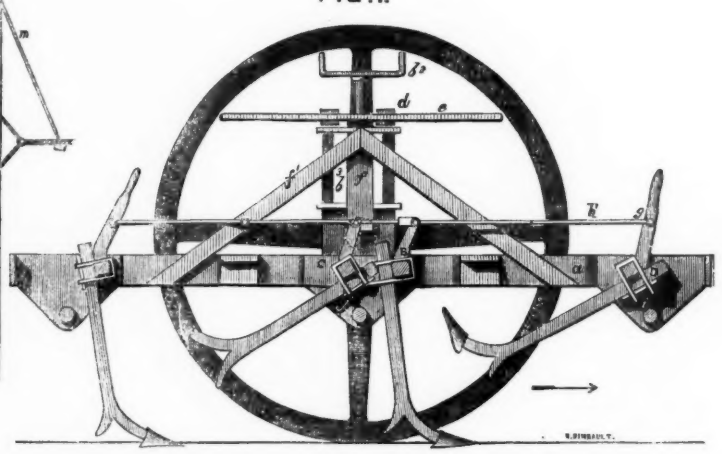


FIG. 1.



This invention, by Charles Clay, of Wakefield, has for its object improvements in implements for cultivating land suitable to be worked by steam or other power. In the specification of a former patent granted to Mr. Clay, and dated Nov. 4th, 1857, No. 2803, a cultivating implement is described in which a series of tines or tilling tools are employed. These tines or tilling tools are mounted on bars or axes so carried by the frame of the implement as to be capable of turning, and the partial rotation of these bars or axes causes the tines or tilling tools to descend into the land, or to rise out of it as required.

Fig. 1 is a longitudinal section of an improved cultivator; and Fig. 2 is a plan. *a*, *a*, is the framing of the machine, which, it is preferred, should be carried by a pair of wheels *b*, *b*, so arranged that they may be used to steer the machine by reason of the axles of the wheels being arranged to perform a locking motion. For this purpose the axles of the wheels are fixed to blocks b^1, b^1, which are capable of being raised or lowered by screws b^2, b^2, on the bars or uprights b^3, b^3, the plates to which such bars or uprights b^3 are fixed being arranged to move up and down the two bars or axes *c*, *c*, one on each side of the machine, and it is on these upright bars or axes *c*, *c*, that the blocks carrying the axles of the wheels move or perform their locking motion, and they are caused to lock by means of the two connecting rods *d*, *d*, which connect the two frames of bars up and down which the blocks b^1, b^1, are capable of being raised and lowered. The two connecting rods *d*, *d*, are connected by the lever handles *e*, which turn on an axis e^1 on the transverse bar or framing *f*, which is connected to the side framing *a*, *a*, by the uprights f^3, f^3; hence it will be seen that, by pressing the lever handles in either direction, the axes of the wheels will be caused to move so as to cause the wheels to lock to a greater or less extent, or the steering may be by other convenient means. A and B are two bars or axes to carry one of two sets of tines or cultivating instruments to act when the machine is being moved in one direction, and C, D, are two other bars or axes to carry another set of tines or cultivating instruments to act when the machine is moved in the opposite direction. Each of these bars or axes is provided with an arm or projection *g*, *g*, so that they may be connected in pairs by a connecting rod *h*, *h*, and these connecting rods may be so connected together as to cause one set of tines or cultivating instruments to go out of the land when the other set is entering, and as the two sets of tines or cultivating instruments are pointed in opposite directions, the simple act of drawing the machine first in one direction and then in the other, will alternately bring the two sets of instruments into and out of action without having to turn the machine at the headlands. *i*, *i*, are transverse bars which act as stops, against which the stems which carry the tines or cultivating instruments rest when they are acting in the land, and these transverse bars also give stiffness and strength to the framing. *j*, *j*, are feet, the stems of which are adjustable, and are used to prevent the framing descending too far towards the surface of the land; *k*, *k*, are two draught hooks, which are attached by chains or rods k^1, k^1, to the central bar *j*. These draught hooks are respectively attached to the two ends of the wire rope used to move the machine, first in one direction and then in the other, by the use of suitable machinery, as is well understood, and these draught hooks are also connected to each other by means of the rod *l* and chains or cords *m*, *m*, so that when one draught hook is being acted on by one end of the wire rope, and power to move the machine, this bar *l* and chains or cords *m* will be drawn in that direction, whilst the other draught hook will go out of action, though still connected to the other end of the wire rope. In order that both sets of tines or cultivating instruments may be off a road when being moved from place to place, the connecting rods are arranged to be shortened.

BARKER'S SIGNALLING.

These improvements in signalling, by Delabere Barker, of Clapham, are principally intended for the purpose of communicating signals in foggy and other weather from the land to vessels at sea, but are also applicable for use in signalling on board vessels, and in signalling on railways, and to and from railway trains, and for other purposes.

The apparatus for signalling from the land to vessels at sea, and for other purposes where a stationary apparatus is used, consists of a steam boiler or superheating apparatus suitable for generating steam to a very high pressure; that which has been found most suitable for the purpose is a small vertical tubular boiler surmounted by a high steam chest, into which some of the fire-tubes from the furnace are carried for the purpose of superheating the steam therein to a pressure of about 150 lb. on the square inch. Connected with a steam pipe from the said boiler is a powerful steam whistle or whistles for signalling, and the said whistle is furnished with a sound reflector and conducting tube or tubes for concentrating and directing the sound of the whistle in any required direction. The whistle is operated upon by means of a suitable automatic apparatus connected to the boiler, which opens the valves for sounding the same at regulated periods; the apparatus to be wound up every hour, and furnished with a movement to enable it to work while it is being wound up. The boiler is fitted up with a pump and the necessary apparatus for supplying it with water. By using more than one whistle, sounding different notes on the same apparatus, an identity may be given to the locality in which the apparatus is placed, for example, a 6-in., 5½-in., and a 5-in. whistle, each sounding alternately and forming a chord, may be gone over exactly in a minute of time, and forms a suitable arrangement with a distinct musical cadence for signalling from the land to vessels out at sea; the name of the place at which the apparatus is fixed thus efficiently serving the purpose of a lighthouse in the densest fog, or by means of a properly arranged code of signals telegraphic communications of much greater length may be sent, not only in signalling out to sea, but in signalling between vessels at sea, or from one fixed station to another, as may be desired. In using the apparatus on board a vessel the most suitable position to place it is on the forecastle with a sound reflector or reflectors behind the whistle to reflect the sound with a tube or tubes to direct the sound in advance, and in a measure shield the passengers from the annoyance hitherto experienced when steam whistles have been used. The reflector and tube may be united, if deemed desirable.

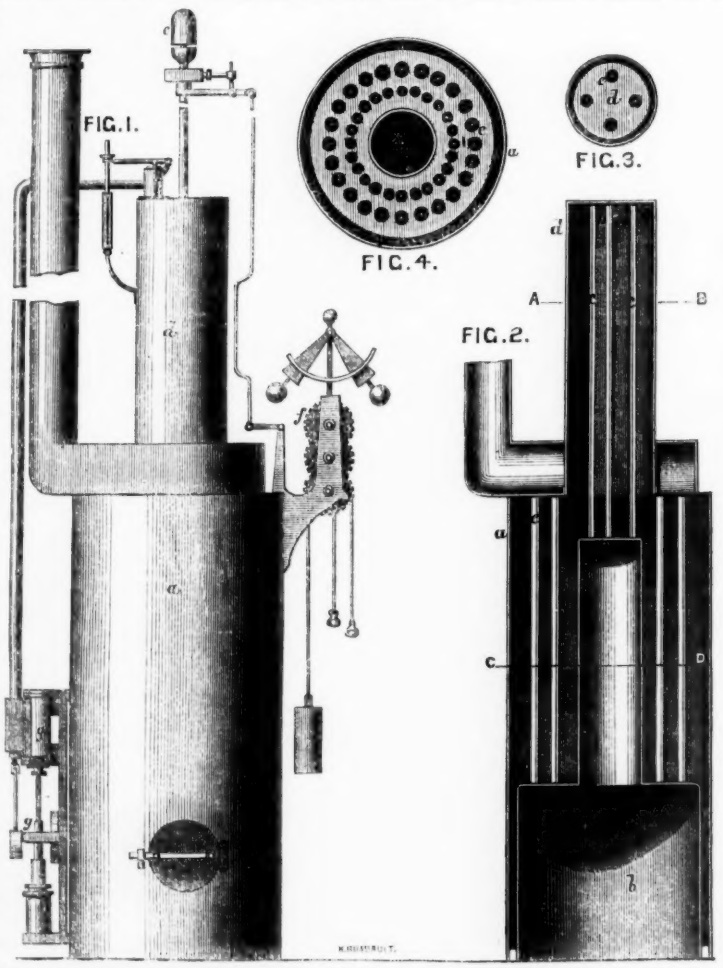


FIG. 1.

FIG. 4.

FIG. 3.

FIG. 2.

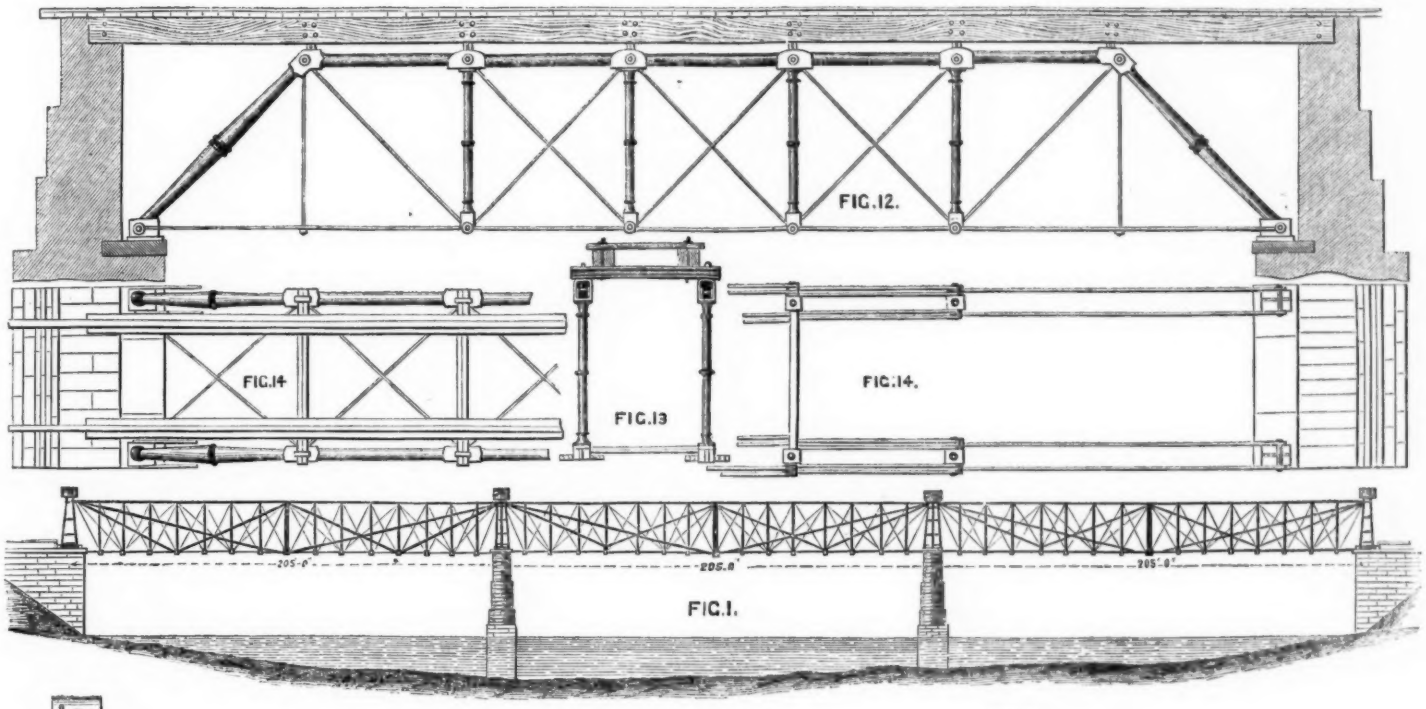
In the illustrations Fig. 1 is an elevation of a superheating boiler fitted with apparatus according to the invention; Fig. 2 is a vertical section of the boiler; Fig. 3 is a section in plan on the line A, B; and Fig 4 section on the line C, D.

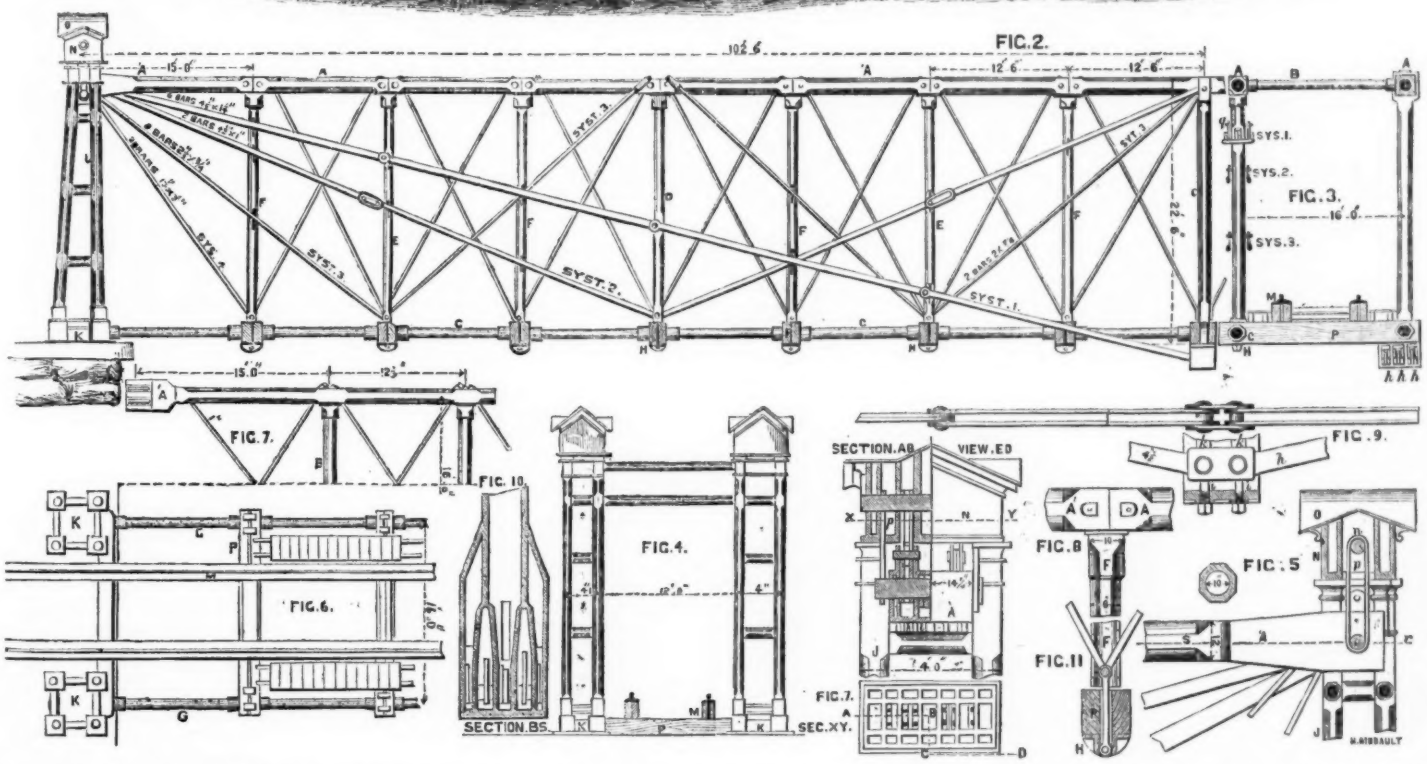
a is the boiler shell, *b* is the furnace; *c* are the fire-tube; *d* is the steam-chest; *e* is the whistle (the reflector and conducting tubes not being shown); *f* is the automatic apparatus operating on the valves for sounding the whistle; and *g* is the feed-pump apparatus.

The Peninsular and Oriental Company's Steamers.—Her Majesty's Government have determined, it appears, to arm the steamers of the Peninsular and Oriental Company, and other mail contract packets, so as to render them fully capable of defence against the attacks of privateers in the event of war with America. The Peninsular and Oriental Company have sent in consequence a requisition for a considerable amount of ordnance stores. This company possess about fifty vessels, and most of them can carry an armament of six heavy guns, including two 40-pounder Armstrongs, with rifles, revolvers, cutlasses, and boarding pikes for crews of about 150 men and officers for each ship. With armaments and crews to this extent, not taking into account the number of naval and military passengers usually carried, and who would doubtless be willing to give their assistance, these vessels would not only take good care of themselves, but, if opportunity offered, would be ready to act upon the offensive. The same company are having their officers and men drilled both in gunnery and rifle practice.

The Smoke Nuisance.—In the Thames Police-court, on Tuesday, Mr. H. Charles Butts, the manager of the Portland Cement Works, Millwall, Poplar, appeared to answer a summons taken out by Mr. Daniel Howie, superintendent of the K division, which charged him with using furnaces so constructed as not to burn or consume their own smoke. Mr. William Sandison, civil engineer, said he had examined the defendant's premises, and saw two furnaces to steam boilers, connected with two steam engines. Both were smoking badly on the 14th of last November. A slight alteration was made after an inspection three years ago. It was not effectual. There were also four furnaces for heating cement ovens, on which no attempt had been made to apply an apparatus for the consumption of smoke, and three coke ovens, from all of which emanated dense black smoke in large volumes. Mr. John Hampton Hall, one of the firm to whom the cement works belonged, stated that no fewer than fifty-four plans had been tried for the purpose of consuming the smoke. The place had been pulled to pieces in making the attempt. All the experiments had failed. The engineer of the firm had at last adopted a scheme of his own. The firm did intend to do all that was possible to carry out the intentions of the Legislature. It was impossible to fire a furnace without causing smoke to some extent. Mr. Sandison said it was practicable to apply an apparatus to each furnace on Hall and Co.'s premises for the consumption of smoke. He was forbidden by the Secretary of State to recommend any particular apparatus for adoption. There were fifty-four inventions which were unsuccessful in operation. Cory and Co. were the largest coke burners in the kingdom, and they had altered their furnaces for the consumption of smoke in a very successful manner. Messrs. Truman, Hanbury, and Co., the great brewers, had also fitted their furnaces for the consumption of smoke with most decided success. He would advise Mr. Hall to see these furnaces, and also the apparatus at the Royal Mint. The expense of the apparatus at Messrs. Truman and Hanbury's brewery was in the first instance very considerable, but it was proved by Mr. Hanbury, in a return made to the House of Commons, that the saving effected in one year by its adoption was £2,640. After a protracted discussion Mr. Woolrych imposed a penalty of £5 on the defendant, and agreed to suspend his decision for six weeks on Mr. Hall undertaking to make the necessary alterations, and to apply a smoke-consuming apparatus to each of his furnaces within that period.

AMERICAN IRON BRIDGES.





We give illustrations of two kinds of iron bridges in extensive use on the American railways. Figs. 1 to 11 inclusive represent what is known as Fink's Bridge, and figs. 12 and 13 that known as the "Murphy-Whipple" Bridge. Our illustration of the latter shows a short span with the roadway on the top chord; and we take from an American publication the following description of another and larger bridge on the same general plan, and in which the roadway is supported on the lower chords:—

The spans consist each of a central and two outside trusses, 125ft. from centre to centre of bearing on the masonry, and giving 120ft. of clear opening. The two spans have no connection over the central pier, each being a separate and distinct bridge. The two outer trusses are each 14ft. (from centre to centre) from the middle truss. The top and bottom chords are horizontal, and 23ft. from centre to centre, the roadway being laid on the lower chord. The top, or compression chord, is formed, in each truss, of a line of ten cast iron cylindrical pipes, 8in. outside diameter, abutting end to end. The top chord is 20ft. 10in. shorter than the bottom chord, the load being carried down to the masonry through an inclined cast iron column at each end. These columns are 8in. in diameter at the ends, 9in. at the centre (where there are also large mouldings) and $\frac{3}{4}$in. thick. In the middle truss three of the pipes, on each end of the chord, are $\frac{3}{4}$in. thick, the four central pipes being $1\frac{1}{4}$in. thick. In the outside trusses all the pipes in the top chord are $\frac{3}{4}$in. thick, with the exception of the two at the centre of the span, which are 1in. thick each. The lower ends of the leaning columns, or, in other words, the lower ends of the truss, are connected together by a bottom chord, formed of a series of wrought iron bars. The truss is divided into twelve panels, and the bottom chord is formed of eye bars jointed under each upright post, the length from centre to centre being 10ft. 5in. In the outer trusses the ends of each lower chord are formed by two bars $1\frac{7}{8}$in. square, and the middle of the chord by four bars, scant $2\frac{1}{4}$in. square. In the middle truss the ends of the lower chord are formed by two bars $2\frac{1}{4}$in. square, while at the centre there are four bars $2\frac{7}{8}$in. square. Square iron is preferred, as it is more easily rolled than round iron, in considerable lengths. The eyes at the ends of the bars are formed by bending the full size of the bar around a pin (the bent end, before welding, having nearly the form of a fish hook), and then making a long weld between the end thus bent around and the body of the bar. The full section of the bar is thus preserved all around the eye, which is thus, theoretically, twice as strong as the bar itself. The bars are connected by $3\frac{1}{4}$in. wrought iron pins, and the lower chord may be considered, therefore, as a chain. At each joint, with the exception of one next to each end of the bottom chord, a hollow cast iron post is erected, or really a two-storey post, one length upon the other. These posts are all 6in. in diameter and $\frac{3}{4}$in. thick. Where the upper section or storey of the post bears on the top of the lower one a spider, or cast iron ring, with four radial arms, is made to encircle the joint. Four truss rods, of $1\frac{1}{2}$in. round iron, extend from top to bottom of each post (each post of two sections), in the manner of the two truss rods commonly applied to steamboat connecting rods. These posts bear each at the bottom, on one of the $3\frac{1}{2}$in. pins connecting the separate bars or links of the lower chord, and, at the top, against the under side of a $2\frac{1}{2}$in. pin, which pin passes horizontally through the joint where one of the pipes of the top chord bears against the end of the next.

The nine upright posts, with the two vertical suspension rods descending from the upper ends of the leaning columns, thus divide the span into twelve panels, each 10ft. 5in. long, and 23ft. high. To bring, therefore, the diagonals as nearly as may be to an angle of 45 deg. (the most economical in trussing), each diagonal crosses two panels, the end diagonals only excepted. The latter are twice as steep as the others, crossing one panel only. In the middle truss the diagonals at each end consist of two bars, each 2in. square. The diagonals next to these, for the first pair which are inclined 45 deg., are two in number and $2\frac{1}{2}$in. square. At the centre of the middle truss the diagonals, two in number, are each $1\frac{1}{4}$in. square. In the outer trusses the pair of end diagonals are each $1\frac{3}{4}$in. square; the next pair (the first of 45 deg. inclination) are each $1\frac{3}{4}$in. square, and the two at the centre are each $1\frac{1}{4}$in. square. The diagonals are formed each from a single bar, with eyes turned, as already described, and having no weld, except the long weld at each end, where the end lapped over to form the eye is welded to the body of the bar. The light counter diagonals have eyes also, but so formed that their lengths may be adjusted, at will, by means of keys. The diagonals embrace, at each end, the $2\frac{1}{2}$-in. and $3\frac{1}{2}$-in. pins at the tops and bottoms, respectively of the posts. The ends of the top chords have a $3\frac{1}{2}$-in. pin each, at their bearings on the tops of the leaning end columns, and to each of these pins a vertical suspension rod, an end or steep diagonal, and a diagonal tension rod inclined at 45 deg. are all attached.

The trusses are braced apart, at the top and bottom, and the timbers supporting the track are laid upon iron cross girders, rolled by the Trenton Iron Company.

The estimated weight of the three trusses of each span is:—Cast iron, 96,000 lb.; wrought iron, 68,000 lb.; total, 164,000 lb., exclusive of beams and roadway; equal to two-thirds of a ton per running foot. The bridge is proportioned to carry, in addition to its own weight, 3,000 lb. to the foot on each track, and, with this load on each track, at the same time not to strain the wrought iron in the outer trusses to more than 8,000 lb. per square inch of section, or, in the middle truss, to more than 12,000 lb. per square inch; the cast iron, at the same time, sustaining a compressive strain of 10,000 lb. per square inch in the outer trusses, and 15,000 lb. in the middle truss. As two trains would very seldom be upon the bridge at the same time, the middle truss is amply strong.

As there are two systems of diagonals throughout, each diagonal crossing two panels, forming what is called a double cancelled truss, it follows that any one pair of diagonals may break, or any one upright post snap in two, without causing the downfall of the bridge. The proportions of the parts are such, however, that the failure of any one member, under ordinary circumstances, would be extremely improbable, while as a whole their arrangement appears to present the greatest simplicity and strength with the least quantity of material.

Iron bridges, upon the plan patented by Albert Fink, Esq., are being adopted to a considerable extent on railroads in the South-western States. As an illustration of these bridges we may describe one span of the Barren River Bridge on the line of the Louisville and Nashville Railroad. This span has a clear opening of 201ft., the roadway being carried at the bottom. The top chord is level and about 205ft. long, its ends having each a rolling bearing on the top of a column or tower of masonry, through which the weight of the bridge and its load are taken down to the abutments. With the exception of horizontal cast iron braces to steady the floor, there is no bottom chord, all the tensile strains being transferred through inclined suspension bars to the abutments. The top chord is formed by a series of hollow cast-iron pipes, abutting end to end. They are octagonal outside, with a circular hole through them. The outside diameter (between parallel faces of the octagon) is 12in., the inside diameter being 10in. Midway of the length of the top chord a vertical post descends for about 20ft. This is also hollow and octagonal in its outer form. Its outside diameter is 12in.; inside diameter, 10in. The bottom of this post is tied, by inclined suspension bars, to both ends of the top chord. These inclined bars are in quadruple pairs, eight bars, each 5in. by $\frac{7}{8}$in. each truss, extending from the

foot of the centre post to each end of the top chord. For a single track bridge of two trusses there are, therefore, 35 square inches of section in the principal tension bars in each truss, these bars, for each half span, being connected together, in four lengths, so as to form a great diagonal of about 105ft. length. Each half span is again divided by an upright post of the same height as the centre post, and from the bottom of these secondary posts inclined bars proceed, on the one hand to the end of the top chord, and, on the other, to the centre of the same chord; or, speaking more properly, to the top of the centre post. In Bollman's bridge,* which Fink's in some respects resembles, the diagonals from the foot of each upright post proceed directly to both ends of the top chord. Fink's secondary diagonals in the Barren River Bridge are 4¼in. by ⅝in., and are arranged in double pairs of four, giving 11½ square inches of section in each truss. Each quarter span is again subdivided by an upright post of the same height as the others, and two bars, each 3in. by ⅝in. proceed from the bottom of each of the third system of posts to the tops of the next posts on either side, the diagonals from the posts next to the ends of the span extending to and taking hold of the ends of the top chord. The tertiary diagonals are inclined about 45 deg., and have four square inches of section throughout in each truss. We must beg the reader not to be weary when we tell him that each eighth span is finally subdivided by a light post, only half as high as the others, and that a pair of diagonals, each 3in. by ⅜in., and having, therefore, three square inches of section throughout in each truss, extends from the bottoms of these short posts up to the tops of those on either side, the end diagonals (in the fourth system) taking hold with those of the first, second, and third systems of the end of the top chord. There are thus four systems of trusses, each truss forming an isosceles triangle, the long side of each triangle being the whole or some portion of the top chord. The lower ends of each converging pair of suspension bars are connected to the upper end of a short link, the bottom of which carries the cross beams for the floor. By means of these links the effect of unequal expansion and contraction in the suspension bars is counteracted.

Fink's bridge holds a position intermediate between Bollman's and a single cancelled Whipple truss. In Bollman's bridge the load is everywhere suspended from the tops of the end towers, and if back chains were employed no top chord would be required. In Fink's only a load at the centre is suspended directly from the tops of the end towers, a load at any other part being partly transmitted (to one or both towers) through upright posts, and with the consequent exertion of local compressive strain upon some intermediate part of the top chord. Fink's bridge has decided advantages over Bollman's. In the former no suspension rod is longer than the diagonal of the half span. In the latter one-half or more of the bars may be of greater length, and the length of two pairs of bars in each truss may be from three-fourths to eleven-twelfths of the entire span. In Bollman's bridge the load at every point, except the centre, is suspended by a pair of suspension bars of unequal lengths—by a short bar running up to one end of the top chord, and by a long bar to the other end. The evils of unequal expansion and contraction, even with the compensating links at the lower ends of the suspension bars, are likely to be felt to a greater extent in the Bollman than in the Fink bridge. In Fink's bridge the upright posts are compressed by the load; in Bollman's no upright posts are required, except to steady the structure.

In all bridges an angle of 45 deg. is the most economical for trussing. The tendency to buckling, however, of long compression members, whether of cast or wrought iron, requires that they be as short as possible, and, therefore, vertical. In the Murphy-Whipple bridge all the tension rods are inclined at nearly 45 deg.; in the Fink bridge the departure from 45 deg. is considerable; in the Bollman bridge but one or two pairs of rods are inclined at any angle approaching 45 deg. If the parts of a bridge could be safely proportioned to the exact strength required for the transmission of direct strains, and irrespective of the tendency to buckling in the compression members, the load at the middle of a bridge could be transferred to the abutments with but about two-thirds the quantity of iron, when disposed in diagonals of 45 deg. and upright posts, as when dispo-ed, as in Bollman's bridge, in a pair of long suspension bars. A weight of 7 tons produces a strain of about 10 tons on a tension rod inclined at 45 deg., while it causes a strain of nearly 29 tons upon a rod inclined at 4 horizontal to 1 vertical. The sections, and consequent weight per foot, being in proportion to the strains, the lengths, with the rods of 45 deg. and uprights, would be 100 for every 47½ of length of direct suspension rod, inclined at 4 to 1. Hence the product of 10 tons into 100ft. is 1,000, while 29 tons into 47½ft. are 1,377½, being a loss in this case of nearly 40 per cent. against direct suspension. As, however, the compression members in a Murphy-Whipple bridge cannot be fined down to the calculated strain—the allowance to prevent buckling, and the necessary thickness to prevent the core from floating too high in making the casting—involving an excess of metal, the comparison in practice is not so much against the Bollman bridge, and still less against that of Fink.

* An illustration and description of the Bollman bridge appeared in The Engineer, Vol. III., March 6th, 1857, page 182.

Steam Shipbuilding on the Clyde.—Messrs. J. and G. Thomson, of Govan, have launched a fine screw named the Cortes, intended to run between Cadiz and Havannah, being the first of a fleet of steamers destined for that line by the Spanish Steam Navigation Company of Cadiz. The Cortes is 2,200 tons burden, and 500-horse power; she has a lifting screw propeller, and all recent improvements, and will be fitted for the accommodation of 170 first-class and 70 second-class passengers. Messrs. Charles Connel and Co. have launched, at Overnewton, a screw of 500 tons, built for Messrs. Handysides and Henderson, and intended for the Mediterranean trade. The vessel has been named the Livorno, and is now being engined by Messrs. A. and J. Inglis, Whitehall Foundry. Messrs. Connel and Co. have now on the stocks a fine iron ship of 1,000 tons, building for Messrs. G. Smith and Sons, and intended for the Calcutta trade. The fine steamer Peru, built by Messrs. J. Reid and Co., of Port-Glasgow, for the Pacific Steam Navigation Company, has made a successful run from the Clyde to the Mersey, having accomplished the distance in 14 hours, exclusive of stoppage for water to cross the bar. During the run she attained a speed of 15 knots with 33 lb. pressure of steam to the square inch, the engines making 23½ revolutions per minute, and the consumption of coal being at the rate of 30 cwt. per hour. The engines of the Peru were constructed by Messrs. Randolph, Elder, and Co., of Glasgow, and are the tenth pair supplied by that firm to the Pacific Steam Navigation Company.

The Clyde.—Of the Clyde it is impossible to speak in other language than that of admiration. It is but the fourth river in Scotland in volume of fresh water, and the third in length; inferior to the Forth or Tay in Highland scenery, and to the Tweed in pastoral beauty: but it is superior to all of them in utility, in artificial improvement, in manufactures, in commerce, and in the triumphs of mechanical genius. The improvements on this river have, we must say, been conducted on a scale of unusual magnificence. About a century ago its depth at the point where the Kelvin discharges into its channel was only 18in. at low water, and 44in. at high water. Its course, far below Dumbarton, abounded in shallow lagoons, interspersed with low islets and marshy ground. By judicious engineering operations, spread over a series of years, accompanied with an enormous expenditure of capital, it is now as navigable as the Thames. In fact, by dint of dredging, cutting, excavating, and embanking, to the tune of about a million and a half sterling, the navigable depth of the river has been increased within the last 50 or 60 years, from 3ft. to 20ft., and the revenue from £3,000 to £9,000 per annum. The Broomielaw harbour is at this moment practically nothing less than half-a-mile of excellent docks—we need not say how crowded; and the contrast is indeed great between the small fishing sloops and Virginia traders which once unloaded their treasures on the same spot, and the gigantic iron steamer and the merchantman of 2,000 tons, which now constitute the honour and glory of the Clyde.—*Builder.*

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

ROYAL NAVAL ENGINEERS.

Sir,—Permit me to claim your assistance in the matter of a most invaluable body of scientific men now suffering great wrong in the navy. You have before, with great kindness, advocated the cause of the engineers of the navy, and, judging from the reforms following your endeavours, not without success.

The pay, rank, and widows' pensions of the engineers-in-chief, and the pay and rank of assistant-engineers, have been improved, and upon paper all looks well; but, unfortunately, it is not as it looks.

You have, no doubt, visited that great triumph of engineering and naval architectural skill, the Warrior, and can probably bear me out in saying that the accommodation, so-called, provided for the engineer and assistant-engineers is truly disgraceful to the Admiralty. Under the new Admiralty regulations the engineers and first class assistant-engineers are described as commissioned officers, the one ranking with lieutenants in the army, the other with ensigns, the second class assistants being of the same grade with midshipmen.

But in the Warrior those officers are stowed away right forward, and are obliged, in order to reach the place allotted for their messing, to jostle their way among the crew. Their sleeping berth is just over the condensing tanks for distilling water, and when they are at work the compartment is full of steam!

Aware of these evils the Admiralty, when arranging the internal accommodation of the Black Prince, had the engineers' berth fitted in the after part of the ship, opposite to the gun room. It cost some money to make the arrangement, but it seemed so desirable that the Admiralty consented at once to pay the difference.

On the passage round of the Black Prince from Greenock to Portsmouth the engineer and one of the assistants, temporarily appointed, misbehaved themselves, and were dismissed the service, and that circumstance is supposed to have induced the Admiralty to consent to the proposition of the captain of the Portsmouth Steam Reserve, and order the engineers' berth of the Black Prince to be shifted forward, as in the Warrior. Thus, in the two largest steam ships in the navy, will the engineering staff be degraded by being put forward among the men, and stigmatised as being unfit to live in the vicinity of young gentlemen! The same officer has, I understand, induced the Admiralty to make an alteration in the engineers' berth of the Duncan, 101 gun ship, which was arranged as part of the gun room, his reason being that it was inexpedient for the engineers to be intimate with the officers!

I am sure you will agree with me that the more respectable and comfortable the young engineers are made in the navy the better will be the class of talent that will be found in that service; and that while respectable, clever young men, who, by education and training, cannot fail to be valuable in any service, are treated thus scornfully, only an inferior body, the very refuse of our factories, will be found willing to submit to it.

Rank, uniform, and pay will not make up for contemptuous treatment. Admiral Smart, the Commander-in-chief of the Channel Fleet, has set a noble example to his brother officers by making no distinction in the invitations to dine at his table between engineers and other officers; yet, in spite of this, we find the Admiralty subjecting these fine young men to the greatest indignities, making them hang their hammocks in "a vapour bath," and isolating them from all the officers, to say nothing of the inconvenience of having to traverse two hundred feet of deck among the men's mess tables, or hammocks at night, shut out from every rational enjoyment.

I trust that your valuable paper, which is found in every mechanic's institute, and every factory in Great Britain, will be the medium of showing the rising class of engineers what they have to expect if they should elect to enter the navy as assistant engineers. Better far they should remain in the humblest position on shore, with the hope of rising, than that they should go on board a man-of-war to be treated as if they were no better than dirt.

London, December 31st, 1861. Late R. N.

THE RODMAN GUNS.

Sir,—Captain Rodman, of the United States Navy, casts cannon ready bored by the act of casting, in the same manner as my patented plan. He, moreover, casts his cannon from within. This is an improvement on my patent. The *Scientific American* describes the construction of the Ericsson, a steel-clad floating battery for the defence of the harbour of New York. The sides of this battery could not be pierced by shot fired from any cannon in our service; but a shot fired from the 15-in. bore gun cast on the Rodman principle would crush in the side of our steel-clad Warrior, when fired at the distance that Nelson loved to pour in his broadsides. How would Brighton, with its princely buildings, look after a few rounds of Rodman's shells were thrown into it from a distance of five miles? Dublin is in the same danger, as well as many towns on the coasts of England, Ireland, and Scotland. Shells can now be charged with liquid fire (phosphorus dissolved in bisulphide of carbon) the most "naufrageous" fire-stuff ever invented by the ingenuity of man. Captain Halsted, R.N., one of our very best authorities on naval armaments, has clearly stated that one shell charged with liquid fire is sufficient to destroy the largest line-of-battle ship.

J. Norton,
(Late Captain 34th Regiment.)

PORTABLE ENGINES.

Respected Friend,—Referring to the article in your publication of the 13th December, page 353, headed "The Smithfield Club Show," we observe that mention is made of the generally-adopted plan of passing the exhaust pipe (of portable engines) through the boiler. We beg to remark that we have, for more than one reason, endeavoured to avoid this since 1855, and during the last four years we have made all our engines with the exhaust outside.

Another fault complained of in the same article is that of not counterbalancing the crank, &c. This we have always done since February, 1854.

Remarking also upon the defects mentioned in your article on the Royal Agricultural Society's meeting held at Leeds (publication of July 19th, page 29), we further beg to add—

That we have used stays on our engines, between cylinder and crank shaft brackets, since the year 1856.

That our fire-boxes have been made with flanged plates (without angle iron), and our tubes without ferrules in the smoke-box end since 1852.

And that we have made lock-up safety valves with either springs or weights since 1855, whenever they were asked for and our customers did not object to the extra expense.

We have always had a favourable opinion of the use of high pressure steam and rather quick speeds, and have found, from ten years' experience, no reason to abandon it.

Ransomes and Sims.

Orwell Works, Ipswich,
January 1st, 1861.

COUNTERWEIGHTING PORTABLE ENGINES.

Sir,—Your remarks on the counterweighting of portable engines have aroused the attention of manufacturers to this important object. In the three communications you have already published the necessity of the counterweight is not questioned, but only the method of applying it; and I am rather surprised that on such a simple matter such a diversity of opinion should exist. I say simple because I cannot see any complication in it, notwithstanding the views of "J. D." to the contrary. "J. D." supposes the "to-and-fro motion to be due to the event of a counterweight in the crank and appendages in part." By this I suppose "J. D." to mean the gravitation of the crank and connecting-rod end in horizontal engines. But as gravity acts perpendicularly this can only affect the pressure of the engine and boiler upon its carriages, increasing and diminishing it alternately, and will not produce a "to-and-fro motion," that being due entirely to the reciprocating action of the engine. The weight should be, as Messrs. Brown and May advise, equal to the weight of piston and rod, crosshead, connecting-rod, and crank, and placed the same distance from the centre of the shaft as the crank itself.

"J. D." objects to the counterweight being placed in the fly-wheel, as by that means "an oblique oscillation is produced." His description of the manner in which the "oblique oscillation is produced" I cannot understand. My own opinion is that it is produced by the impulse of the counterweight being upon one bracket in one direction, whilst that of the crank, &c., is upon the other bracket in the opposite direction (the crank being generally close to the bracket furthest from the fly-wheel). "J. D." must have abandoned the single-cylindered engine as hopelessly rocky, or he would not have ventured to design his double-cylindered engine requiring either an extremely inconvenient length of boiler or a terrible complication of parts to get connecting-rods of a proper length. This engine appears to have been designed for the express purpose of increasing the expense, which "J. D." wisely supposes the generality of purchasers would not submit to.

Now, sir, I think the "oblique oscillation" of the single-cylindered engine can be prevented by simply dividing the counterweight into two parts, placing one in the fly-wheel, the other in a pulley on the other end of the crank-shaft, the weights being in the inverse proportion of their distances (longitudinally) from the crank. This, of course, only applies to engines with a cranked shaft, those with a side or over-neck crank can have the counterweight cast in one piece with the crank, either by having a projecting arm opposite the crank, or by putting the crank-pin in a hollow disc having a weight on the opposite side of it. If "J. D." is anxious to improve the portable engine I should advise him to abandon the idea of a rotary engine, and direct his attention to a means of supplying pure water to the boilers, for the water generally used by these engines contains such an amount of animal, vegetable, and earthy matters, that there is not only a great deal of deposit, but it frequently occasions priming, to a fearful extent, deranging the engines, thus adding materially to the wear, and very often the tear of the boilers.

31st December, 1861. Portable.

PREVENTION OF STEAM BOILER EXPLOSIONS.

For some years past an association for the prevention of steam boiler explosions, and for effecting economy in the raising and use of steam, has been in existence in Manchester, and from the reports of the chief engineer, which have been regularly published in the *Mining Journal*, our readers must be well aware that the success which has attended the operations of the society has been complete. Not only have many valuable lives been saved, but the members have derived great pecuniary advantage by availing themselves of the information afforded them by the officers of the association. During the six years of its existence nearly 50,000 boilers* have been inspected and reported upon, and dangerous defects have been discovered by the inspectors, in time to prevent accident in 500 cases. But a more striking proof is afforded in the fact that only three explosions have occurred to boilers inspected by this association since its commencement, one of which was caused by over-pressure, persisted in after advice to the contrary from the association's engineer; another by neglect during the absence through illness of the regular qualified engine attendant; and the third from shortness of water, which the attendant failed to observe, although his boiler was fitted with a glass water-gauge, the deficiency arising from a breakdown of the feed-valve, which was of a construction now generally discarded, and whenever met with by the association's chief engineer or inspectors is pointed out as dangerous; while, on the other hand, it has been found, from limited inquiry only, that during that period no less than 155 fatal explosions have occurred to boilers not under the inspection of this association, which have been attended with the loss of 341 lives, in addition to serious injury to nearly 400 persons, and considerable damage to property.

After such results it is not surprising to find that "The London Association for the Prevention of Steam Boiler Explosions, and for Effecting Economy in the Raising and Use of Steam" should be established, nor that such an association should receive the warm support of the *élite* of the engineering profession. The constitution of the London association is precisely similar to that of its prototype at Manchester, but to compensate for the boiler power being less concentrated elsewhere than in Manchester, the subscriptions have necessarily been fixed somewhat higher, that the self-supporting character of the society may not be endangered, for it must be observed that the association is simply for mutual protection, that the whole of the subscriptions are applied to render it effective, and that there are no shareholders to receive dividends from the application of the members' subscriptions. That every effort will be made to attain the objects in view cannot be doubted, when we see that the council is presided over by William Fairbairn, and composed of such men as William Adams, J. F. Bateman, Frederick Braithwaite, Lionel Brough, H.M. Inspector of Mines; Robert Galloway, the Steam Inspector of the Board of Trade; A. Lamb, of the Peninsular and Oriental Company; Thomas Wicksteed, Prof. Williamson, and many others of equal celebrity; and as the society's operations are to embrace the entire district on the south of a line drawn from Yarmouth to Aberystwith, including Rugby and Warwick, there is an ample field for the association to produce an immense amount of good.

The duty of inspecting the boilers and steam engines of the members, and all apparatus pertaining thereto, is discharged by one or more competent engineers, aided by a sufficient number of local inspectors, and we opine that if the system which the association is established to carry out were generally introduced solely into the mining districts, within the limits of its operation, almost incalculable benefit would accrue. That inspection is necessary is gradually becoming more fully recognised, and the association in question is entitled to especial patronage, since its success will afford the strongest argument that Government interference is not required. A small annual payment for each boiler ensures one examination by the engineer of the association in each year, and to three other examinations by an inspector—one of the inspections being a thorough internal and external examination of each boiler and its flues. An entrance fee is payable, but the fund thus raised will, as far as possible, be reserved by the council for the purpose of promoting such experiments and investigations as may tend to throw light upon the probable causes of boiler explosions, or may otherwise promote the objects of the association. We trust that the London society will succeed as completely as the parent association at Manchester, and certainly know no reason to anticipate any less favourable result: the association is established for an excellent object, and should receive every possible aid to enable it to attain it. —*Mining Journal.*

* We presume that it is meant that 50,000 inspections have been made, for the Association has never had 50,000 boilers altogether under its care. —Ed. E.

Exports of Coal.—By the monthly circular of Messrs. Laird we learn that the quantities of coal exported during November was 484,782 tons, against 519,841 tons in the corresponding month of 1860, showing a decrease of 45,059 tons. The particulars are:—From the northern ports, 225,333 tons; Yorkshire, 18,183 tons; Liverpool, 46,655 tons; Severn ports, 152,853 tons; and Scotch, 41,758 tons. The total exports from January to November were 6,783,584 tons, against 6,588,354 tons in the same period of 1860, being an increase of 395,230 tons during the present year. There was a decrease in the month's shipments at the northern ports of 33,452 tons; Yorkshire, 10,615 tons; Severn, 16,176 tons; and the Scotch, 2,954 tons; while there was an increase at Liverpool of 16,140 tons.

AMERICAN IRON-CLAD VESSELS.

THE following catalogue contains the various specifications recently submitted to the Board of Inquiry appointed by the Federal Congress in August last:—

"We have made a synopsis of the propositions and specifications submitted, which we annex, and now proceed to state in brief the result of our decisions upon the offers presented to us.

"J. Ericsson, New York.—This plan of a floating battery is novel, but seems to be based on a plan which will render the battery shot and shell proof. We are somewhat apprehensive that her properties for sea are not such as a sea-going vessel should possess. But she may be moved from one place to another on the coast in smooth water. We recommend that an experiment be made with one battery of this description, on the terms proposed, with a guarantee and forfeiture in case of failure in any of the properties and points of the vessel, as proposed. Price, 275,000 dols.; length of vessel, 172ft.; breadth of beam, 41ft.; depth of hold, 11½ft.; time, 100 days; draught of water, 10ft.; displacement, 1,255 tons; speed per hour, nine statute miles.

"John W. Nystrom, Philadelphia, 1,216, Chesnut-streeet.—The plan of (quadruple) guns is not known, and cannot be considered. The dimensions would not float the vessel without the guards, which we are not satisfied would repel shot. We do not recommend the plan. Price, about 175,000 dols.; length of vessel, 175ft.; breadth of beam, 27ft.; depth of hold, 13ft.; time, four months; draught of water, 10ft.; displacement, 875 tons; speed per hour, 12 knots.

"William Perine, New York, 2,777, P. O. Box, presents three plans. The specifications and drawings are not full. The last proposal for the heavy plating is the only one we have considered, but there is neither drawing nor model, and the capacity of the vessel, we think, will not bear the armour and armament proposed. Price, 621,000 dols.; length of vessel, 225ft.; breadth of beam, 45½ft.; depth of hold, 15½ ft.; time, nine months; draught of water, 13ft; displacement, 2,454 tons; speed, per hour, 10 knots.

"John C. Le Terre, Boston—Description deficient; not recommended; sent a model, but neither price, time, nor dimensions stated.

"E. S. Renwick, 335, Broadway, New York, presents drawings, specification, and model of an iron-clad vessel of large capacity and powerful engines, with great speed, capable of carrying a heavy battery, and stated to be shot-proof and a good sea boat. The form and manner of construction and proportions of this vessel are novel, and will attract the attention of scientific and practical men. She is of very light draught of water, and on the question whether she will prove to be a safe and comfortable sea boat we do not express a decided opinion. Vessels of somewhat similar form in that part of the vessel which is immersed, of light draught of water, on our western lakes, have, we believe, proved entirely satisfactory in all weathers. To counteract the effect of the waves when disturbed by the wind, by producing a jerk or sudden rolling motion of flat shoal vessels, it is proposed to carry a sufficient weight above the centre of gravity to counterpoise the heavy weight below, which is done in this ship by the immense iron armour. If, after a full discussion and examination by exports on this plan, it should be decided that she is a safe vessel for sea service, we would recommend the construction upon it of one ship at one of our dockyards. The estimated cost of this ship, 1,500,000 dols., precludes action upon the plan until further appropriations shall be made by Congress for such object. Time not stated. Length of vessel, 400ft.; breadth of beam, 60ft.; depth of hold, 33ft.; draught of water, 16ft.; displacement, 6,530 tons; speed per hour, at least 18 miles.

"Whitney and Rowland, Brooklyn, Greenpoint, propose an iron gunboat, armour of bars of iron and thin plate over it; no price stated. Dimensions of vessel, we think, will not bear the weight of and possess stability. Time, five months. Not recommended. Length of vessel, 140ft.; breadth of beam, 28ft.; depth of hold, 13½ft.; draught of water, 8ft.

"Donald M'Kay, Boston.—Vessel in general dimensions and armour approved. The speed estimated slow. The cost precludes the consideration of construction by the board. Price 1,000,000 dols.; length of vessel, 227ft.; breadth of beam, 50ft.; depth of hold, 26½ft.; time, 9 to 10 months; draught of water, 14ft.; displacement, 3,100 tons; speed per hour, 6 to 7 knots. Dimensions will not float the guns high enough; not recommended.

"William H. Wood, Jersey City, N. J.—Price 255,000 dols.; length of vessel, 160ft.; breadth of beam, 34ft.; depth of hold, 22ft.; time, four months; draught of water, 13ft.; displacement, 1,215 tons; speed not stated.

"Merrick and Sons, Philadelphia.—Vessel of wood and iron combined. This proposition we consider the most practicable for heavy armour. We recommend that a contract be made with that party under a guarantee with forfeiture in case of failure to comply with the specifications, and that the contract require the plates to be 15ft. long and 36in. wide, with a reservation of some modification which may occur, as the work progresses, not to affect the cost. Price, 780,000 dols.; length of vessel, 220ft.; breadth of beam, 60ft.; depth of hold, 23ft.; time, nine months; draught of water, 13ft.; displacement, 3,296 tons; speed per hour, 9½ knots.

"Benjamin Rathburn.—We do not recommend the plan for adoption. Price not stated; length of vessel not stated; breadth of beam, 80ft.; depth of hold, 74ft.; time not stated; draught of water, 25ft.; displacement, 15,000 tons; speed not stated; specification incomplete.

"Herry R. Dunham, New York.--Vessel too costly for the appropriation; no drawings or specifications; not recommended. Price, 1,200,000 dols.; length of vessel, 325ft.; breadth of beam, 60ft.; depth of hold not stated; time, 15 to 18 months; draught of water, 16ft.; displacement not stated; speed per hour, 12 miles.

"C. S. Bushnell and Co., New Haven, Connecticut, propose a vessel to be iron-clad on the rail and plate principle, and to obtain high speed. The objection to this vessel is the fear that she will not float her armour and load sufficiently high, and have stability enough, for a sea vessel. With a guarantee that she shall do these we recommend on that basis a contract. Price, 235,250 dols.; length of vessel, 180ft.; breadth of beam, — ft.; depth of hold, 12½ft.; time, four months; draught of water, 10ft.; displacement, — tons; speed per hour, 12 knots.

"John Westwood, Cincinnati, Ohio.—Vessel of wood, with iron armour; plan good enough, but the breadth not enough to bear the armour. No detailed specification. No price or time stated, only a general drawing. Not recommended.

"Neafie and Levy, Philadelphia.—No plans or drawings, therefore not considered; neither price nor time stated. Length of vessel, 200ft.; breadth of beam, 40ft.; depth of hold, 15ft.; draught of water, 13ft.; displacement, 1,748 tons; speed per hour, 10 knots.

"William Norris, 26, Cedar-street, New York.—Iron boat, without armour. Too small, and not recommended. Price, 32,000 dols.; length of vessel, 83ft.; breadth of beam, 25ft.; depth of hold, 14ft.; time, 60 to 75 days; draught of water, 3ft.; displacement, 90 tons; speed not stated.

"William Kingsley, Washington, D.C., proposes a rubber-clad vessel, which we cannot recommend. No price or dimensions stated.

"A. Beebe, 82, Broadway, New York—Specification and sketch defective; plan not approved. Price, 50,000 dols.; length of vessel, 120ft.; breadth of beam, 55ft.; depth not stated; time, 100 days; draught of water, 6ft.; displacement, 1,000 tons; speed per hour, 8 knots.

"These three propositions recommended—viz., Bushnell and Co., Newhaven, Connecticut; Merrick and Son, Philadelphia; and J. Ericsson, New York,—will absorb 1,290,250 dols. of the appropriation of 1,500,000 dols., leaving 209,750 dols. yet unexpended.

"The board recommends that armour with heavy guns be placed on one of our river craft, or, if none will bear it, to construct a scow which will answer to plate and shield the guns for the river service on the Potomac, to be constructed or prepared by the Government at the navy yard here for immediate use.

"We would further recommend that the department ask of Congress at its next session an appropriation, for experimenting on iron plates of different kinds, of 10,000 dols.

"All of which is respectfully submitted.

"J. SMITH.
"H. PAULDING.
"C. H. DAVIS.

"Hon. Gideon Welles, Secretary of the Navy, present."

RAILWAY ENGINE-DRIVERS' SHORT TIME MOVEMENT.

ON Wednesday, 25th December, the engine-drivers and firemen connected with the various railways in the kingdom, to the number of about 200, assembled at dinner at the Belle Vue Gardens, Manchester, with a view of conferring together on the subject of the movement recently established amongst them for regulating their hours of labour. The subject has been mooted for some time, and an effort is about to be made to enlist public sympathy and legislative interference, the argument being that the welfare and convenience of the men, as well as the safety of the public, is concerned. An engineer belonging to the Lancashire and Yorkshire Company presided, and all the principal railways in the country, it was stated, were represented.

The chairman proposed the usual loyal and patriotic toasts, and a delegate from the Great Northern proposed "The Houses of Parliament." He said it was gratifying to find that a bond of union had sprung up amongst engine-drivers and firemen, arising out of the ten hours movement, which had been unknown before. In Leeds they had not been idle. They had there, at all events, the sympathy of the public, having obtained signatures to a petition to Parliament in favour of the scheme—very influential signatures, including the judge of the County Court, the borough coroner, 5 magistrates, 35 of the corporation, 16 poor-law guardians, 5 barristers-at-law, 21 surgeons, 25 solicitors, upwards of 200 manufacturers and the first firms in the borough, and 60 clergymen, the total number being upwards of 1,600; and not one operative amongst them all. It had been stated in Leeds that with shorter hours they would have to put up with less payment. Some of them were paid for over hours others were not; but they did not desire the payment for extra labour so much as the recreation and rest to which they considered themselves entitled. He hoped that if their case came before the Legislature that the members of both Houses of Parliament would see the justice of their demand both as respected themselves and the public. In proposing "Success to the Ten Hours Movement" he said that he was gratified to meet so large a number of his fellow-workmen from all parts of the country, and to congratulate them that the agitation of the ten hours movement had made them better acquainted with each other, more united in their efforts to seek the welfare of the whole body, and more hearty in the cause which they were met to promote. It had been asked whether the ten hours movement was general throughout the country. He held in his hand letters from all parts of the kingdom, which would prove that such was the case. These letters were from Bristol, Exeter, Nottingham, Doncaster, Rugby, London, and, in fact, all the principal stations throughout the kingdom, all of them expressing their interest in the cause. They were only asking for what other workmen enjoyed, and for what they considered themselves, in their own rights, and in the interests of the public, entitled to. Was it tolerable that a man should not see his own family from Monday morning to Saturday night! that he should enjoy no social privileges and enjoyments, and that the public should be subject to the delays and accidents consequent on men being overtaxed in their labour? They had recently had interviews with, and had communications from, the members for Manchester, Mr. J. A. Turner and Mr. Bazley, both of whom had expressed their sympathy with the position of the men, and had stated their wish to aid them in obtaining an amelioration of their condition. They had also seen the Hon. Algernon Egerton, one of the members for South Lancashire, who had also encouraged them to ventilate their grievances. Mr. Cobbett, the member for Oldham, and a well-known friend of the working classes, had also received a deputation, and had entered with a deep interest into their cause. Mr. Cobbett so far sympathised with them that he had mentioned the matter to a meeting of his constituents, and he (the chairman) believed Mr. Cobbett would, if consistent with other arrangements, introduce the subject to the notice of the House of Commons. An engineman ought to be a man with full physical energy, with a clear head, and a steady eye; and with the momentous interests at stake, with the hundreds of lives dependent upon his steadiness and vigilance when he was conducting his train, he ought not to be so far overwrought as to be unable to perform his duty. Mr. Cobbett had mentioned to them the case of an accident where a railway guard, an engineman, and a fireman, were proved to have been asleep when a serious accident occurred. These men were convicted and punished; but Mr. Cobbett admitted that the question had never been asked how many hours they had been at work, and whether, therefore, the real guilt was not attachable to their employers rather than to themselves. He (the chairman) believed that railway directors would find it cheaper in the end to employ more hands, rather than by overworking a small staff to involve the companies in extra risk. They had the authority of a man of keen observation and high position, and a man perhaps better acquainted with railway management than any other in the country, who had moreover ridden more miles on a railway engine than any other man, excepting enginemen themselves—Mr. George Wilson—in attestation of the vigilance necessary for such men, and the general efficiency of those with whom he had met, he hoped that all would strive to deserve that credit, and that they should eventually obtain an amelioration of their condition.

In proposing "The Directors of Railways," a delegate from Crewe said that he believed that many of the gentlemen forming the boards of directors were not aware of the position of their servants, and also that the shareholders would find that the £20,000 or £30,000 that were often required to provide for accidents might be obviated. If these circumstances were well known the interference of the Legislature would not be necessary.

The vice-chairman, an engineman belonging to the London and North-Western Company, in an amusing speech, showed that the human frame was not capable of so much endurance as a locomotive engine, but, like the engine, it required lubrication, which, in the case of the human subject, meant rest. He contended that, socially and morally, men who were compelled to work undue hours—such as railway enginemen were subject to—were placed in a wrong position.

The health of the chairman and of the treasurer, Mr. James Turner, and other toasts, were proposed.

THE METROPOLITAN RAILWAY LOCOMOTIVE.—The original design for the locomotive to be used on the Metropolitan Subterranean Railway emanates from Mr. Edmund Edwards, of Beaufort-buildings, the original drawings having been prepared by him, and merely trifling modifications in details having since been made. The steam is so perfectly condensed that the locomotive can be run five miles without blowing off, and as the longest tunnel on the Metropolitan line is two miles, the machine cannot fail to prove effective. Although there is a mixed gauge laid the engines will at present be exclusively broad gauge, and, as the line is to be worked by the Great Western Company, are likely to continue so.—A locomotive engine is in course of construction at the engine works of Mr. Horsley, at Seaton Sluice, intended to be used underground at the Bedside Colliery, Northumberland. The means proposed to be used for the condensation of the steam, and the consumption of smoke, have not transpired, but should the engine prove a success it will be of immense advantage and a great improvement in the means of coal hauling underground. The construction of a locomotive engine for the purpose of hauling underground has long been a desideratum, and it is to be hoped that this attempt will prove successful. We have not heard the name of the inventor.—*Mining Journal.*

MISCELLANEA.

THE great 300-pounder Armstrong has been completed at Elswick and sent off to Woolwich.

THE Adelaide Gas Company, of South Australia, are advertising for tenders for pipes and other plant.

THE Commissioners for the International Exhibition have authoritatively denied that the Queen will open the Exhibition in person.

THE "Watch Committee" of the corporation of Manchester are advertising for a superintendent of their fire brigade. Salary £200, with house, coals, and gas.

IT is stated that Messrs. Glass, Elliot, and Co. have tendered to the English Government to lay a cable from Milford Haven to Halifax by July, 1862, for £700,000, guaranteeing its efficiency for one year.

THE commissioners under the Airedale Drainage Act have announced their desire to borrow £25,000 under its provisions. Messrs. Martin and Fenwick, of Leeds, are the engineers to the commissioners.

A MEETING, presided over by Mr. John Laird, has been held at Birkenhead, to promote a railway from that place into the salt, iron, and pottery districts of West Cheshire.

THE 200 miles of submarine cable for the new Telegraph to India Company has been manufactured and shipped by Messrs. Glass, Elliot, and Co. within the month stipulated, and the Sir James Duke has sailed for Aden.

THE shareholders of the Chester and Holyhead Railway have agreed to the creation of £200,000 additional guaranteed capital to pay for certain works, and to enable the arrangement of the accounts between this company and the London and North-Western.

A LETTER dated Calcutta, November 22nd, observes that "three months hence the railway will be open all the way between Allahabad and Agra. Twelve months later we may hope to see the iron horse traversing the entire road between Delhi and this, the commercial capital of India."

A LAD of thirteen fell, on Thursday week, between the platform of the New Cross railway station and a train which, although stopping there, was still in motion. He was almost instantly killed, and his brother, in attempting to save him, had two of his toes crushed under the wheels of the train.

THE *Mining Journal* states that Tinsley Main Colliery is about to be lighted with gas. It is added that "the pits are now in excellent state of working, the discipline is good, the ventilation as near as may be perfect, 35,000 cubic feet of air passing into the pits every minute, and safety-lamps are exclusively used."

THE chains, &c., of Hungerford Bridge, which have been purchased for completing Clifton Suspension Bridge, will be delivered in Clifton in June next, when the operation of suspending them between the piers erected on the Gloucester and Somerset sides of the Avon will be immediately commenced. It is hoped the work may be completed within the year 1862.

THE Trent, Ancholme, and Grimsby Railway shareholders, whose work crosses the well be-bridged Trent, at Keadby, have had their first meeting. The work on the bridge is progressing at Messrs. Fairbairn and Co's., Manchester (there are now two firms there bearing the name of Fairbairn, to wit:—Messrs. William Fairbairn and Sons, and Messrs. Fairbairn and Co.,) and both the bridge and the permanent way are expected to be completed by April next.

SPECIAL meetings of the proprietors of the Great Western and South Wales Railway Companies are to be held on the 16th inst., for the purpose of considering and determining with reference to certain heads of agreement which have been provisionally made between the directors of both companies for a lease of the South Wales Railway to the Great Western Railway Company, and for the ultimate amalgamation of these companies and the West Midland Railway Company.

"A TRADER" writes to the *Times* to say that "the cost of sending to Paris 2 lb. weight of goods paying an *ad valorem* duty is legally at this moment 5s. 8d., independent of the duty they may happen to pay. A certificate of origin from our Custom-house costs 1s., a French consular signature appended to the certificate costs 1s., and a French consular signature for the invoice (which should always be sent with goods paying *ad valorem*) costs 2s.; so that voracious animal, the red-tape serpent, swallows 4s." Larger parcels pay no more, but they are generally eight or ten days on the route.

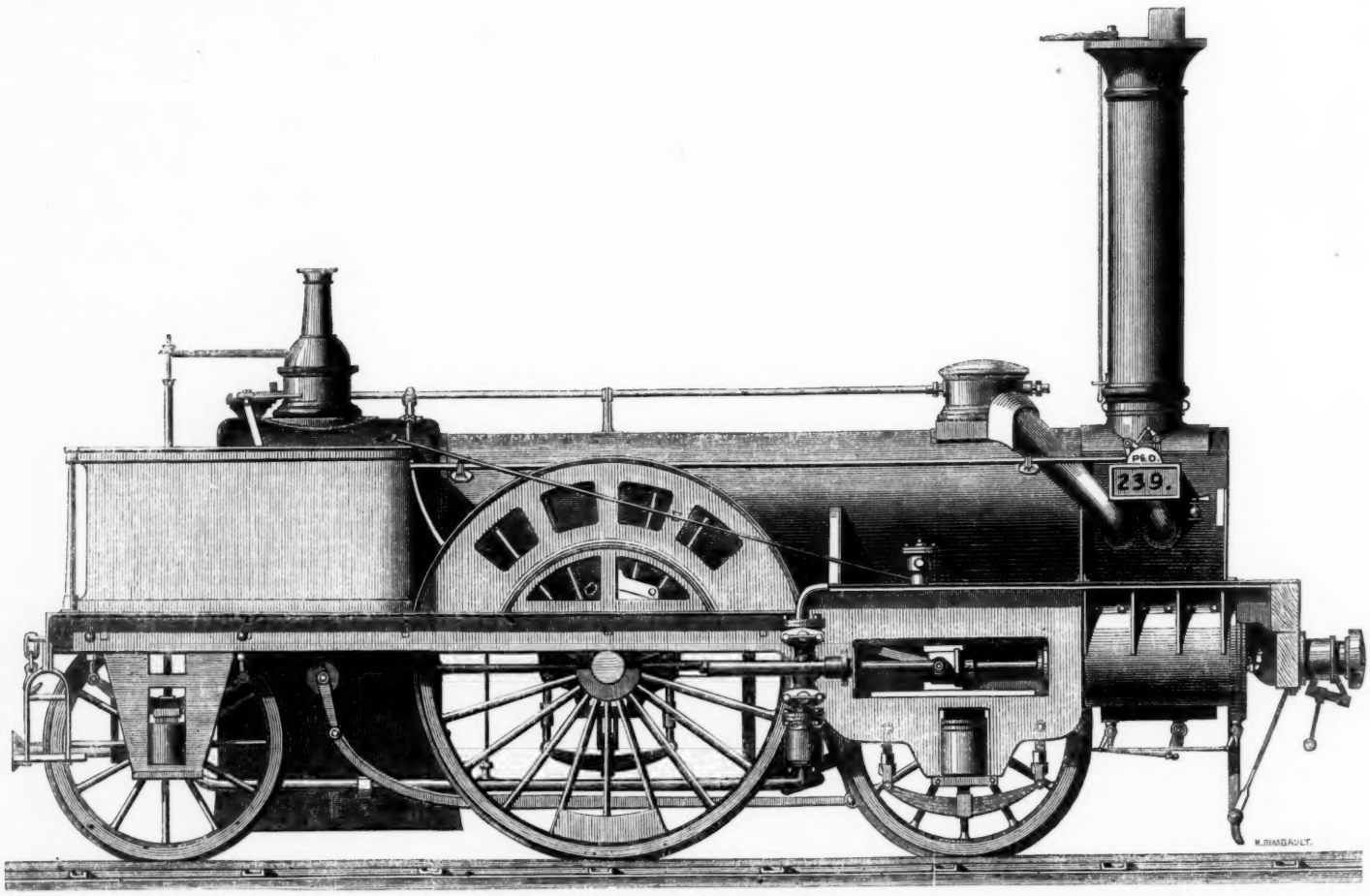
THE iron bowsprit for the Defence, 22, iron steamer, has been received at Chatham from the Thames Iron Company, and successfully fixed in its place in that vessel. Its weight is rather less than five tons. The iron masts have also arrived at the dockyard from the Thames, but these cannot be fixed until the vessel has been undocked. Every day sees the steamer approaching nearer completion, and from the progress already made it is believed she will be ready to proceed to sea in about three weeks. The following officers have taken up their commissions and joined her:—Capt. R. A. Powell, C.B., Commander; P. Saumarez, Lieut. F. T. Thompson, Lieut. J. G. Meade, Lieut. W. Lowther, Lieut. E. P. Pocock, Master W. Mayes, Surg. C. F. A. Courtenay, Assist.-Surg. J. Paterson, M.D., Paymaster G. H. Wise, Assist. Paymaster R. R. A. Richards; J. Cox, clerk; J. M. Ollis, chief engineer; W. Collier, engineer; T. Hartley, S. T. Wallis, and T. Green, first-class assist.-engineers; W. Williams and T. Stewart, acting second-class assist.-engineers.

THE whole of the resources of the smitheries at Chatham Dockyard are being taxed to their utmost to provide the necessary ironwork, and to keep pace with the progress of the several ships fitting for commission at that port. In addition to the ordinary work of the department the workmen have commenced forging the after-portion of the keel of the iron screw frigate Achilles, 50, in consequence of the delay experienced in obtaining the portions of the heavy forgings for the vessels from the several ironworks contracting to supply them. The portion of the keel now being forged at Chatham is 25ft. in length, and weighs upwards of eight tons. A letter from Toulon of the 22nd inst. states that the iron-cased frigate Gloire had just returned to port after a cruise, in which her sailing powers were tested in a heavy sea and during a severe gale of wind. The Magicienne is not to be plated with iron, as was mentioned in the newspapers. She is a magnificent screw steam frigate of 600-horse power, and will carry twenty-eight of the heaviest rifled guns.

THE following appointments of naval engineers have been made since our last:—John Snell, engineer, to the Indus, for the Royalist; William Farquharson, engineer, to the Revenge; J. C. Weeks, first-class assistant-engineer, to the Cornwallis; Hervey Benbow, first-class assistant-engineer, to the Cornwallis, for the Fly; A. Borthwich, first-class assistant-engineer, confirmed, in the Asia, for the Highlander; H. Vatcher, second-class assistant-engineer, confirmed in the Surprise; G. F. Gossage, second-class assistant-engineer, confirmed in the Miranda; C. F. Gregory, second-class assistant-engineer, to the Indus (lent to the Avon); and T. Stewart, second-class assistant-engineer, confirmed, in the Defence; J. R. Abbott and John Hall (B), acting second-class assistant-engineers, to the Cumberland, as supernumeraries; W. P. Davis, acting second-class assistant-engineer, to the Indus, as supernumerary; W. T. Ray and T. S. Blyth, acting second-class assistant-engineers, to the Fisgard, as supernumeraries; W. M'Ewing and R. S. Lee, acting second-class assistant-engineers, to the Asia, as supernumeraries.

THE traffic receipts of railways in the kingdom for the week ending the 21st of December amounted to £533,520, and for the corresponding week of last year to £550,280, showing a decrease of £16,760. The gross receipts of the eight railways having their termini in the metropolis amounted to £250,294, and for the corresponding week of 1860 to £258,224, showing a decrease of £7,930. The decrease on the Eastern Counties Railway amounted to £322; on the Great Northern to £3,041; on the Great Western to £1,669; on the London and North-Western to £2,308; on the London and Blackwall to £21; and on the South-Eastern to £1,822—total, £9,183. But from this must be deducted £164, the increase on the London, Brighton, and South Coast, and £1,089 on the London and South-Western—together, £1,253; leaving the decrease, as above, £7,930. The receipts on the other lines in the United Kingdom amounted to £288,226, and for the corresponding period of last year to £292,056, showing a decrease of £8,830, which, added to the decrease on the metropolitan lines, makes the total decrease £16,760, as compared with the corresponding week of 1860.

FRENCH PASSENGER LOCOMOTIVE.



The illustration represents one of the last class of passenger locomotives constructed by the late M. Camille Polonceau, at the Ivry workshops of the Paris and Orleans Railway (4ft. 8½in. gauge). The peculiarities in the arrangement of the regulator, variable blast pipe, the ribs upon the smoke-box to assist the fastening of the cylinders and the air vessel around the lower clack of the pump are about the only peculiarities to distinguish the French engine from its English progenitor. Most of M. Polonceau's engines have boilers of an oval section, the vertical diameter being 3in. or 4in. greater than that measured horizontally. The present engine has 15½in. cylinders, 23⅝in. stroke, the connecting rod being three times the length of the stroke. The driving wheels are 6ft. 8in. in diameter, the leading and trailing wheels being 4ft. ¾in. The boiler is 3ft. 9½in. in internal diameter, and contains 182 tubes, 11ft. ½in. long and 1¾in. in diameter. The length of the grate is 3ft. 7½in., width, 3ft. 3⅝in. The heating surface of tubes is 838½ square feet. The weight of the engine, in working trim, is 25 tons.

THE NAVY.

The annual official return of the condition and situation of every vessel in the navy was published yesterday, under the authority of the Admiralty. From this return it is satisfactory to know that, so far as the navy is concerned, England was never in a prouder position. The number of vessels on the 1st of January was 856 of all rates and classes. There were, besides, 150 line-of-battle and other sailing ships stationed at the various ports in England and the colonies for harbour duty, thus swelling the total to upwards of 1,000 vessels of all descriptions. Of the 856 vessels actually in commission, or building or preparing for service, only 154 are sailing ships, the whole of the remainder being propelled by steam power. The list of vessels is made up of 81 line-of-battle ships, each mounting from 74 to 131 guns; 22 vessels, each with an armament of from 60 to 70 guns; 44 51-gun frigates, the whole, with the exception of about 10 of that number, being screw steamers; 57 ships, each mounting from 22 to 50 guns, and the majority of which have a tonnage as large as ships of the line; 29 screw corvettes, or frigates, each mounting 22 guns; 317 screw and paddle-wheel steamers, each carrying less than 22 guns; and 185 screw gunboats, each provided with two Armstrong guns. The following screw ships of the line, and other steamers, composed the squadron on the coast of North America, under the orders of Vice-Admiral Sir Alexander Milne, K.C.B., on the 1st of January, exclusive of the vessels of war now on their passage to that station:—The Conqueror, 101, 800-horse power; the Donegal, 99, 800-horse power; the Nile, 91, 500-horse power; the Hero, 91, 500-horse power; the Agamemnon, 90, 600-horse power; the St. George, 90, 500-horse power; the Aboukir, 86, 400-horse power; the Sanspareil, 70, 400-horse power; the Immortalité, 51, 600-horse power; the Liffey 51, 600-horse power; the Phaeton, 51, 400-horse power; the Melpomene, 51, 600-horse power; the Orlando, 51, 1,000-horse power; the Mersey, 40, 1,000-horse power; the Diadem, 32, 800-horse power; the Ariadne, 26, 800-horse power; the Challenger, 22, 400-horse power; the Cadmus, 21, 400-horse power; the Jason, 21, 400-horse power; the Orpheus, 21, 400-horse power; the Greyhound, 17, 200-horse power; the Rinaldo, 17, 200-horse power; the Racer, 11, 150-horse power; the Desperate, 7, 400-horse power; the Bulldog, 6, 500-horse power; the Barracouta, 6, 300-horse power; the Hydra, 6, 220-horse power; the Medea, 6, 350-horse power; the Spiteful, 6, 280-horse power; the Nimble, 5, 80-horse power; the Steady, 5, 80-horse power; the Plover, 5, 80-horse power; the Landrail, 5, 80-horse power; and the Cygnet, 5, 80-horse power. The squadron stationed on the South-East coast of America, under the command of Rear-Admiral R. L. Warren, consisted of the Forte, 51, 400-horse power; the Curacoa, 31, 350-horse power; the Satellite, 21, 400-horse power; the Curlew, 9, 60-horse power; the Stromboli, 6, 280-horse power; and the Ardent, 3, 200-horse power. The fleet composing the Mediterranean squadron, under the orders of Vice-Admiral Sir W F. Martin, K.C.B., consisted of 29 vessels of all rates, several of which, however, have received orders to return to England for service elsewhere. During the past year the following vessels were completed and launched from the various royal and private dockyards:—The Defiance, 91, 3,475 tons, 800-horse power; the Perseus, 17, 955 tons, 200-horse power; the Shearwater, 11, 669 tons, 150-horse power; the Pandora, 5, 426 tons, 80-horse power; the Aurora, 51, 2,558 tons, 400-horse power, at Pembroke; the Bristol, 51, 3,027 tons, 660-horse power, at Woolwich; the Glasgow, 51, 3,038 tons, 600-horse power; and the Chanticleer, 17, 950 tons, 200-horse power, at Portsmouth; the Rattlesnake, 21, 1,705 tons, 400-horse power, at Chatham; the Speedwell, 5, 428 tons, 80-horse power, at Deptford; the Black Prince, 36, 6,039 tons, 1,250-horse power, at Glasgow; the Defence, 18, 3,668 tons, 600-horse power, at Newcastle; the Resistance, 18, 3,668 tons, 600-horse power, at Poplar; and the Lily, 4, 695 tons, 200-horse power, at Millwall. The following is the list of the vessels of war now in course of construction, with the places at which they are building:—The Achilles (iron), 50 guns, 6,079 tons, 1,250-horse power, Chatham; the Africa, 4 guns, 669 tons, 150-horse power, Devonport; the Agincourt (iron), 50 guns, 6,621 tons, 1,250-horse power, Birkenhead; the Alligator, 22 guns, 1,857 tons, 400-horse power, Woolwich; the Belvidera, 51 guns, 3,027 tons, 600-horse power, Chatham; the Bulwark, 91 guns, 3,716 tons, 800-horse power, Chatham; the Caledonia (iron-cased), 50 guns, 4,045 tons, 800-horse power, Woolwich; the Columbine, 4 guns, 669 tons, 150-horse power, Deptford; the Dartmouth, 36 guns, 2,478 tons, 500-horse power, Woolwich; the Dromedary, 4 guns, 500 tons, 100-horse power, Millwall; the Dryad, 51 guns, 3,027 tons, 600-horse power, Portsmouth; the Enchantress, 4 guns, 835 tons, 250-horse power, Pembroke; the Endymion, 36 guns, 2,478 tons, 500-horse power, Deptford; the Enterprise, 4 guns, 669 tons, 150-horse power, Deptford; the Favourite, 22 guns, 1,623 tons, 400-horse power, Deptford; the Guernsey, 4 guns, 695 tons, 200-horse power, Pembroke; the Harlequin, 6 guns, 950 tons, 200-horse power, Portsmouth; the Hector (iron), 32 guns, 4,063 tons, 800-horse power, Glasgow; the Helicon, 4 guns, 835 tons, 250-horse power, Portsmouth; the Ister, 36 guns, 3,027 tons, 500-horse power, Devonport; the Jaseur, 5 guns, 425 tons, 80-horse power, Deptford; the Menai, 22 guns, 1,857 tons, 400-horse power, Chatham; Minotaur (iron), 50 guns, 6,621 tons, 1,250-horse power, Blackwall; the Myrmidon, 4 guns, 660 tons, 200-horse power, Chatham; the Nassau, 4 guns, 695 tons, 200-horse power, Pembroke; the Newport, 5 guns, 425 tons, 80-horse power, Pembroke; the North Star, 22 guns, 1,623 tons, 400-horse power, Sheerness; the Ocean (iron-cased), 50 guns, 4,045 tons, 1,000-horse power, Devonport; the Orontes (iron), 3 guns, 2,812 tons, 500-horse power, Blackwall; the Psyche, 4 guns, 835 tons, 250-horse power, Pembroke; the Rattler, 17 guns, 951 tons, 200-horse power, Deptford; the Reindeer 17 guns, 951 tons, 200-horse power, Chatham; the Repulse, 89 guns 3,716 tons, 800-horse power, Woolwich; the Robust, 89 guns, 3,716 tons, 800-horse power, Devonport; the Royal Alfred (iron-cased), 50 guns, 3,716 tons, 800-horse power, Portsmouth; the Royal Oak (iron-cased), 50 guns, 3,716 tons, 800-horse power, Chatham; the Salamis, 4 guns, 835 tons, 250-horse power, Chatham; the Sappho, 6 guns, 950 tons, 200-horse power, Deptford; the Sylvia, 4 guns, 695 tons, 200-horse power, Woolwich; the Tamar (iron), 3 guns, 2,812 tons, 500-horse power, Millwall; the Tartarus, 4 guns, 835 tons, 200-horse power, Pembroke; the Trent, 6 guns, 950 tons, 200-horse power, Pembroke; the Triumph (iron-cased), 50 guns, 3,716 tons, 800-horse power, Pembroke; the Tweed, 51 guns, 3,027 tons, 600-horse power, Pembroke; the Salient (iron), 32 guns, 4,063 tons, 800-horse power, Millwall; the Wolverine, 21 guns, 1,623 tons, 400-horse power, Woolwich; the Zealous, 89 guns, 3,716 tons, 800-horse power, Pembroke.

Foreign and Colonial Jottings.—The Fiji Islands Pastoral, Agricultural, and Commercial Company have purchased the island of Kioa, which has three good harbours and 15,000 square miles of land. It produces cotton nearly equal to good American, arrowroot, cocoa nut, tobacco, and building wood. There are only sixty natives on the island whose labour will be useful to the company. Portions of several of the Fiji Islands are already occupied by Europeans, and preparations are making by them for stocking their settlements with sheep, and to undertake cotton growing.—A large portion of land at Mani, in the Sandwich Islands, has been prepared for the growing of cotton. The King of those islands, and Prince Kamehameha, are both deeply interested in the speedy introduction and rapid development of the cotton culture in their dominions.—Another expedition to India has been proposed to start from Pekin, and travel by the northern frontiers of China to India.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

In the report of the annual festive gathering of the above named useful and highly intelligent body of men, we observe that the president still regrets the fact that employers do not countenance the union of their principal servants, or, at least, do not encourage it by their presence at the meetings, scientific and otherwise, of the Foremen's Society. On a former occasion we, ourselves, referred to the fact that few master engineers had enrolled themselves, as they are especially invited to do, as honorary members of that society.

Possibly, we thought, there may exist some reason for this abstention of the heads of engineering firms from companionship with their assistants—their right hand men—as foremen might be termed. It is in vain that that reason has been sought for by us. The more closely we have scrutinised the rules and watched the proceedings of the association in question, the more thoroughly have we become convinced of its freedom from any taint which should act as a deterrent to the co-operation of employers.

It might be supposed that fifty or sixty foremen of engineering establishments meeting together month by month, as the members of the above society do, would be tempted sometimes to enter into the discussion of forbidden topics—as trade secrets, trade politics, or other mysterious or mythical matters. There is, however, no ground for supposing any such thing, and an intimate acquaintanceship with the mode of conducting the society's business has led us still more urgently to advise employers to take its members cordially and confidingly by the hand. Of one other thing we are convinced, and that is that, whether patronised or not by employers, the association is established on so safe a basis as to prevent its declension. It is, on the contrary, destined, as we think, to become much more extended in its sphere of action, and to desseminate its advantages among a much larger body of foremen engineers than is to be found within the wide-spread districts of the metropolis. We feel assured that if employers would only do as we have done, inquire and examine for themselves into the character of the rules, and of the general transactions of the Association of Foremen Engineers, they would come to a similar conclusion to ours, viz., that it is one deserving of every kind of encouragement and support.—*Mechanics' Magazine.*

The Eastern Counties Railway.—It appears that the great "coal line" projected from this company's railway at March to Askern, on the Lancashire and Yorkshire, is withdrawn for the present, in consequence of the state of public affairs and the strenuous opposition threatened from various quarters. The Ware, Hadham, and Buntingford scheme has also been abandoned for the present. The Bill for amalgamating the Eastern Counties, Norfolk, Eastern Union, Newmarket, and East Anglian companies has been duly deposited, and contains no less than 328 clauses. The Bill proposes to mass the amalgamating companies together under the general name of the "London and East Coast." The agreement to work the East Suffolk, the lease of the Northern and Eastern, and various arrangements entered into by the Norfolk and Eastern Union Companies, are all to be confirmed, and continue in force as at present. The total share capital of the united undertakings will be £13,396,884, of which £7,514,868 is ordinary stock, and the remainder preference shares, bearing various rates of interest. As regards the assimilation of the stock of the Norfolk and Eastern Union, the Norfolk ordinary stock will be placed on rather a better footing than that of the Eastern Counties, in consequence of the higher dividend which it has received: but the Eastern Union A stock will only be reckoned at the rate of £82 10s. for each £100, and the B stock at £55 for each £100. In addition to the £13,396,884 forming the united share capital of the various companies which it is proposed to amalgamate, the debentures issued by them are to continue, of course, in full force, although the bill authorises arrangements for paying them off by an issue of debenture stock. These debentures, as stated in a recent return, amounted to the following sums:—Eastern Counties, £3,038,930; Eastern Union, £758,488; East Anglian, £276,172; Newmarket, £116,666; and Norfolk, £79,510. These amounts, added to the £13,396,884 of share capital, will make the total sum embarked in the united undertakings £17,666,650, for which the amalgamated company will have 567 miles of railway. The Amalgamation Bill propose to authorise a further addition of £1,800,000 by an issue of preference shares bearing interest at a rate not exceeding 5 per cent.

TO CORRESPONDENTS.

Vol. xi. of THE ENGINEER *can now be had from the office, price 18s.*

**** Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

W. M'G.—*Mr. Hackworth, we apprehend, desires facts instead of sentiment.*

X. Y.—*We have illustrated several such machines, but cannot say as to which is the best.*

W. B. (Manchester).—*We published a large illustration of Lenoir's engine rather more than a year ago.*

T. C.—*Messrs. Barratt, Exall and Andrewes, of Reading, and Mr. John Petrie, of Rochdale, have long used the plan.*

W. R. A.—*Certainly you can make any article patented in 1843, provided the patent has not been extended, which is very seldom the case with patents.*

AN OLD SUBSCRIBER.—*We cannot say at this moment, and as you have not sent your name and address we could not transmit to you any answer we might receive were your query published.*

J. J. (Hulme).—*The pressure on the water piston would be equal to the resistance of the boat. It would be no definite quantity, but varying with the resistance overcome. No rule can be applied in the case.*

BRICK-MAKING MACHINERY.—*We have been requested to state that the machine employed for making the bricks for the London, Chatham, and Dover Railway, noticed in our last, was made by Messrs. Bradley and Craven, of Wakefield.*

S. J.—*A bookseller's shop would be best heated by whatever would best heat any other kind of shop where the object was to warm the occupants and visitors rather than the goods. Will not an open grate answer? Or is the shop without one? If so we should recommend making one, if possible, in preference to any other mode of warming.*

VULCAN.—*A 3¼in. piston would have an area of 9¼ square inches, on which steam of 40 lb. would press with a total force of 385 lb which force would act through 91⅔ ft. per minute (100 revolutions and 11in. to each revolution). The product of 385 and 91⅔ is 35,292, which divided by 33,000 gives hardly more than 1-horse power. A boiler that would boil away 5 gallons of water an hour would drive such an engine.*

SURFACE CONDENSATION.

(To the Editor of The Engineer.)

SIR,—Can you or any of your readers inform me what is the loss by evaporation, under the present system of surface condensation?

In other words, for every cubic foot or ton of water supplied to the boilers, what is the quantity returned by the condensers under ordinary circumstances? T. N.

Newhaven, December 30th, 1861.

Advertisements cannot be guaranteed insertion unless delivered before eight o'clock on Thursday evening in each week. The charge for four lines and under is half-a-crown; each line afterwards, sixpence. The line averages nine words; blocks are charged the same rate for the space they fill. All single advertisements from the country must be accompanied by stamps in payment.

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THE ENGINEER.

FRIDAY, JANUARY 3, 1862.

1861.

THE old year has departed for ever, but it is not too late to review its results as accomplished with the help of the engineer and the artizan. Wide and inclusive as our profession is—lending new purposes and directions to so many arts—we shall be prepared to find a lengthy record of progress, the aggregate, however large, being less the result of great achievements, than of a countless number of moderate additions to the original stock. Some of these are, naturally enough, greater than others, and probably the most important constructive works carried to successful completion during the year 1861, were our great iron clad frigates, the Warrior and the Black Prince. These, although not technically works of civil engineering, justify us in commencing our review with

STEAM SHIPS.

The Warrior and the Black Prince form the nucleus of a new navy, a navy for which "improved Warriors" are already in progress. These ships are not only the largest ever constructed for purposes of war, and not only the first which have been so plated as to afford reasonable promise of security, both from the ordinary fire of an enemy, and against the risk of the loss of the plates from the "working" of the hull itself, but they are substantially the first examples of iron fighting ships, deliberately planned and adopted as such. It may be true enough that iron hulls have seen service in engagements in Chinese waters, but the result, if it went for anything, was to condemn iron as a material for war ship building in future, and hardly two years ago there was as little expectation that the Admiralty would take up with iron as with stone for such a purpose.

Turning to commercial steam ships, the Great Eastern has given us a practical illustration that "she can roll," a discovery, it appears, which has been made only very gradually. This matter of the rolling of ships has been a good deal studied of late, and it will, at least, be recognised in the construction of future Great Easterns, that, whether the bottom be flat, wedge-shaped, or semi-cylindrical, and whether there be a keel or no, a hull having great height out of water in proportion to its draught, and having comparatively little weight aloft, in the shape of spars and yards, is sure to roll whenever there is a sea to furnish reasonable provocation. There is a disposition, too, to adopt two screws, one under each quarter, an arrangement patented by Mr. Bennet Woodcroft, as long ago as the beginning of 1832, and occasionally adopted since. The control which two screws give over the movements of a vessel, and the probability that by their combined working the largest ship could be turned out of the trough of the worst sea, and kept head to wind, render it likely that we may soon see the application made on a large scale.

No further notable attempt has been made to modify the proportions of steamships, as regards that of length to breadth, the fate of the Galway steamers having inspired some fear of long ships. In respect, however, of proportionate draught, something has been heard of a scheme for starting a fleet of improved Great Easterns between Bristol and New York, each ship to be 600ft. long, and to draw but 16ft. of water. The vessels, if they are ever built, will however have almost the same proportions as, with about double the linear dimensions of, the ordinary class of American steamers navigating the great lakes and Long Island Sound.

The largest commercial vessel put afloat last year was the Scotia, built by Messrs. Napier and Sons, belonging to the Cunard line, and 400ft. long over all (366½ft. keel and fore-rake), 47ft. 6in. beam, and 32ft. deep.

Mr. Lungley, of Deptford, has launched what he calls an "unsinkable ship," and in which, certainly, those most valuable protections in case of collision, stranding, or leaking—bulkheads—are applied in almost every possible way to exclude water.

Improved river steamers have been built, two of which are plying on Southampton Water. These boats have covered deck saloons for passengers, a definitive declaration of the Board of Trade having removed all fear from the minds of shipbuilders that such saloons would be liable to tonnage measurement. A good deal has been said, too, of some of the new Clyde boats, built by Messrs. Napiers and Messrs. Simons, and which have certainly attained a very high rate of speed, although the proportions appear to be much the same as those of other boats built at Glasgow some years ago.

The Channel has been crossed, between Folkestone and Boulogne, during the last year, in less time than ever before, the new mail packet Victoria, built by Messrs. Samuda and engined by Messrs. Penn and Son, having attained a speed of more than 20 miles an hour.

The Galway packet disclosures, the loss of no less than seventeen North Sea and Baltic steamers, the official condemnation of iron sent in to Chatham, and much general discussion and comment upon the inferiority of ordinary steamship construction, will have done something, we hope, to promote greater caution in this respect, and a higher sense of responsibility than before. Two of the Canadian Mail steamers, the Canadian (the second of the same name lost on the same line) and the North Briton, were also lost last year.

As for new steamship enterprises, the blockade of the American ports has arrested the preparations made for establishing lines of steamers from Liverpool to Charleston, and from Liverpool to New Orleans. The blockade, we have no doubt, will, by one means or another, be raised before long. In the event of war the Galway undertaking may chance to go overboard altogether. Something has been said of a scheme, under the consideration of Government, for the establishment of a line of 6,000-ton steamers to India, and the rapid growth of our Indian commerce renders it likely enough that such a line will soon be needed. The Australian line *via* Panama and Tahiti, so long discussed, is still in abeyance, while the chairman of the Peninsular and Oriental Company boasts that his company have secured a subsidy from Government, "sufficient to make their Australian line pay whether there is any traffic or not." An English steamship line from Panama to British Columbia is beginning to be much needed, and can hardly be much longer delayed.

France has taken a decided start in the establishment of steam ship communication between her own ports and other countries. Besides her monthly Brazilian line, already working, she is about to start a fleet in the East, to run from Suez to China. Contracts have been signed also with a Greenock firm for the construction of steam ships to run between France and the West Indies and New York, should that port happen to be open for the entrance of mail packets and merchantmen. Altogether France has granted subsidies, to her new steam lines, amounting to about £1,000,000 a year, or considerably more than is paid out of the British Treasury for a like purpose.

Spain has subsidised a line of mail steamers to run between Cadiz and Havannah. One of the ships is now on her maiden voyage, and others are in course of construction.

Lines of trading steamers have been established during the past year between Glasgow and Havre, and between Leith and Dunkirk. Nearly all the existing lines also have received new vessels, and in various ways extended their operations.

The marine engine rightly comes in this, our very general summary, under the inclusive head of "Steam ships." The year 1861, we believe, forms an era in marine engine reform, substantial success having been already attained in a path in which much further progress remains to be made. During last year surface condensers were not only generally re-introduced (for they were in use to some extent upwards of twenty years ago) into the commercial steam marine, but also, in one or two instances, into our vessels of war. The saving in fuel, and that, also, in the wear of boilers, is already such as to afford much encouragement, and many of our marine engine builders are already pushing forward in the matter, seeing, as they do, that, with distilled water, boilers may be readily constructed to carry any desired pressure continuously at sea, and that with higher pressures, greater expansive working is practicable. The use of steam jackets is becoming general, both in the merchant marine and in the navy—these terms being now commonly understood to imply steam vessels instead of sailing vessels. It is only with steam jackets, or some equivalent protection against condensation within the cylinders, that high expansive working is practicable, and only thus, therefore, that increased pressures become economical. Those who have attempted very high pressures, say, 100 lb. to 130 lb. for sea-going steamers, have, from what we can see, chosen a most unsuitable boiler, and the consequence has been that Mediterranean steamers, fitted with this contrivance, have broken down at Falmouth, at Gibraltar, at Naples, and at Patras—"all in consequence of the boiler." Superheating is still in favour, and affords a proof of how much waste heat escapes from all our boilers. Were our boilers properly constructed little or no available heat would be left for superheating. As it is, it is found necessary to temper the superheated steam with ordinary saturated steam, in order to prevent "cutting" the cylinders. This mixture of the two qualities of steam, and which forms the whole foundation of Mr. Wethered's patent of 1853, is now practised on more than one hundred English steamers.

HARBOURS AND DOCKS.

During the past year Portland breakwater has been finished for all the essential purposes of a defence from the winds and waves. Holyhead and Dover breakwaters are still incomplete. We have the comfortable assurance that the former will cost £1,920,000, and that it embodies some rare engineering blunders. As for Alderney, it is admitted that we are literally throwing our money into the Jersey sea, but Government, having taken up the matter, cannot withdraw. A great breakwater, something on the scale of Portland, is promised, moreover, at Scarborough.

The Tyne Commissioners have not yet come to a decision as to the formation of the Low Lights docks, and it remains unsettled whether the extensions of the Tyne piers are to cost £550,000 or £880,000. The work upon them, however, is still going forward. The Mersey Docks Board, with £9,000,000 of debentures afloat, are about to expend another million in great works at Liverpool and Birkenhead. Their new graving dock alone, 750ft. long, 100ft. wide at the bottom, 106½ft. wide at the top, and 85ft. deep, is to cost £84,000. Very expensive these things are, but very wise, in our opinion, are the Mersey Docks Board to take them in hand in season, for assuredly the time is not far distant when they will be required. Then there is Hull, where additional docks at a probable cost of £500,000, are about to be undertaken. We must not forget that the new docks at Britton Ferry, Neath, carried out at a cost of £160,000, were opened last summer. The Tyne Improvement scheme includes lengthy quays at Newcastle. The Leith graving dock at a cost of about £50,000, docks at Falmouth, on which nearly £50,000 have been expended, and for which nearly £150,000 more are about to be raised, a new dock at Greenock, to cost upwards of £64,000, and other like works are in progress, while schemes are on foot also for the improvement of the port of Bristol at a cost of £400,000; for great metropolitan docks at Northfleet; for breakwaters on the Tees; for harbour works at Galway to cost £100,000; for docks at Boston to cost £100,000; and drainage of the neighbouring tens, to cost £120,000 more; and for additional docks also at West Hartlepool. The Sunderland people have been "talking" of a new 20-acre dock on the Wear, to cost £165,000, but the scheme has been shelved for the present.

DRAINAGE AND WATER SUPPLY.

Great drainage works, including the Metropolitan Main Drainage, are also in progress. Wolverhampton is about expending £35,000 for a like purpose. Edinburgh, Newcastle and Hull, Leeds, Preston, and many other large towns, will soon find it prudent to incur considerable expense under the same head. Extensive drainage works are imperatively demanded also along the Shannon. Bedford has acquired some notoriety in consequence of the want of thorough drainage there, and our contemporary the *Builder*, which appears to have constituted itself an inspector of nuisances for the whole kingdom, has found that most of our large towns remain yet undrained. Every large town in India will require the same treatment as our own.

As for waterworks, a scheme has been broached in the last year for supplying London with water direct from Wales, a scheme which out-Mydddletons Mydddleton himself. Glasgow is already provided for in the crystal waters of Loch Katrine, Manchester is well supplied from Woodhead, and Sheffield from the opposite side of the "backbone," about Dunford bridge; but there are other large towns in which modern and extensive waterworks are already imperatively required. Even at Bradford, where £592,000 had been expended on waterworks up to last spring, additional works are to be undertaken at a cost of £100,000. During the past year, few new waterworks of any considerable extent have been opened. Worcester, Wallasey, and Bridgenorth have been supplied, in this respect, with works suited to their requirements. New works are to be undertaken at Dublin and at Galway, and works, at a cost of £30,000, are about to be commenced at Birkenhead. The East London and other companies are also about applying for powers to raise additional capital for new works.

RAILWAYS.

The railway extensions of the past year may have been numerous, but, with one or two exceptions, they have been of local importance only. The London, Chatham, and Dover, has been opened throughout from Pimlico to Dover, and the City Extension, including upwards of three miles of viaduct (600 arches of 30ft. span each), and a tunnel of 2,200 yards near the Crystal Palace, is in active progress. This and the Worcester and Hereford, the South Durham and Lancashire Union, the Exeter and Exmouth, the Portpatrick, and the Oldham, Ashton-under-Lyne, and Guide Bridge Railways, have been the most important lines opened in 1861. The West Midland (formerly the Oxford, Worcester, and Wolverhampton) has been leased to the Great Western, and the South Wales, it is expected, will shortly be "taken in" to the same growing establishment. Of the lines in progress, the Charing Cross and the Metropolitan, the latter reaching for three miles under the streets of London, are among the most interesting. They will cost, together, upwards of £3,000,000. The Bedford and Cambridge, the Border Union and Border Counties, the Wansbeck Valley, Mid-Sussex, and the Manchester and Milford, are among the lines which have been making considerable progress, and all of these will prove of much importance when finally opened. Railways have been progressing, too, in Wales, particularly in Montgomeryshire, and a line is about to be pushed clear through to Aberystwyth. Among the works named there is the usual amount of viaducts and tunnelling. That on the London, Chatham, and Dover has been referred to; the Manchester and Milford line will have a tunnel of 2,200 yards; the South Durham line has some lofty viaducts, the Border Union has a tunnel of 1,160 yards, and lesser works abound on the other lines.

Were it not that railway receipts have been suddenly checked, and that, for the present, our commercial prospects are somewhat dubious, we cannot say what great railway undertakings might not at once be carried out. The Eastern Counties has first brought forward, and then abandoned a scheme for a great "coal-line to London; the

North British and Edinburgh, Perth, and Dundee, propose to consolidate their interests and to bridge the Forth at Queensferry, at a cost of £500,000, and the Tay, at Magdrum, at a further cost of £180,000. Last spring it was said that a new line, the Buckinghamshire and West Midland, would be made from Worcester to the Metropolis, but the scheme was dropped. There is a project, too, for a railway line all the way to John O'Groat's!

Among the *bonâ fide* railway undertakings about to be commenced is that of the Garston and Liverpool line of the London and North Western, involving a bridge of five spans of 300 ft. each across the Mersey at Runcorn—the bridge alone to cost £300,000—and the City extensions of the North London and Charing Cross lines, the former to cost £700,000, and the latter hardly less. The Thames, it appears, is likely to be roofed over with railway bridges, the Pimlico bridge being already completed, the Charing Cross and Fulham bridges in progress, and those of the London, Chatham, and Dover, and the City Extension of the Charing Cross being about to be commenced. Great railway stations will be the rage. We have a new one—the Victoria, and we are soon to have others at Hungerford Market, in New Cannon-street, in Liverpool-street, and in Farringdon-street, while others still in Finsbury-square and in Leaden-hall-street are not unlikely to be erected. The Dublin people are to have a "great central station," Manchester is to have no end of money expended in its midst, in station improvement, £100,000 are set down for Lime-street, Liverpool, and the Caledonian are raising no less than £650,000 for new stations "and other improvements"—which sounds like the demolition of the abominable passenger shed at the head of Buchanan-street, Glasgow. The London and North-Western have expended large sums on their Crewe workshops, the London and South-Western will lay out £100,000 for new shops at Nine Elms, and great things are spoken of at Ashford.

Referring more particularly to railway bridges, Mr. Fowler has completed a cast iron span of 200ft. across the Severn at Arley, the Charing Cross bridge has been well advanced, and a new bridge is about to be put across the Trent, at Keadby, near the entrance of the Trent into the Humber. On the Continent the important railway bridge at Kehl was opened on the 6th of April. In India the long pile bridges of the Bombay and Baroda Railway have been mostly completed, and the twenty-eight 150-ft. spans of the Soane and the fifteen 201-ft. spans of the Jumna bridges have been pushed forward. In Holland, it is understood, £2,500,000 are to be expended on railway bridges alone, in carrying out the important system of railways about to be undertaken there.

It is hardly necessary, after speaking of railway bridges, to make any especial distinction between them and those for ordinary highways. As for the latter class of bridges, that at Westminster is now nearly completed, and already have plans been adopted for the erection of a grand bridge at Blackfriars, the central span to be 280ft. wide, with only 22ft. rise. A suspension bridge with a trussed roadway, so long advocated by Mr. Peter W. Barlow, is in progress at Lambeth. The chains of Hungerford bridge will soon be erected over a still wider span (703ft.), at Clifton. It is already proposed to remove Battersea, Putney, and Hampton bridges, and to erect structures more worthy of the situation which they occupy.

A continental scheme has been broached for spanning the Straits of Messina in spans of 1,000 mètres, or 3,280ft. each!

In modern bridging it is remarkable to perceive how completely iron is taking the place of stone, even for great metropolitan bridges like those at Westminster and Blackfriars.

Not having wandered entirely away from railways, we may yet note the frequent and terrible accidents which have so painfully marked the past year. A coroner's jury was unable to find the cause of the disaster which killed Dr. Baly, another jury was unable to ascertain why a passenger train, running at a brisk rate, was hurled off the rails near Tutbury. The Brighton accident taught us how closely trains might be run with only an occasional smash, the Hampstead junction catastrophe let us into the qualifications of signalmen, and a series of collisions elsewhere have shown with how little brake power some managers think fit to supply their trains.

As for railway construction, we are just where we were a year ago. Our lines are imperfect—no one is allowed to perfect them, and great engineers tell us that, *therefore*, the pace is too great. Our engines, meanwhile, are growing more and more portly, and their tread falls heavier and heavier upon the yielding rails.

The Giffard injector is being applied still further to locomotives, and, probably, with considerable advantage. Coal burning remains *in statu quo*.

Iron and Steel Manufacture.

The past has been a discouraging year to ironmasters. A year ago there were 572 furnaces in blast, out of 839 in the kingdom. Six months ago the number in blast had fallen to 524, out of 882 in all. Prices have ruled very low throughout the year, and many bankruptcies have taken place. We do not doubt that this state of things has induced many intelligent ironmasters to turn their attention to the improvement of ironmaking. Some among them have already attained excellent results in taking off the waste furnace gases for heating, in coking slack, and in substituting steam power to a still greater extent in place of manual labour. Increasing attention is being paid to the Lincolnshire and Northamptonshire ores, and, more lately, to those of Wiltshire. Machinery for puddling has been again brought prominently into notice, but, we fear, without satisfactory results. The Bessemer process is being more extensively practised, it having been already adopted on a large scale at some of the largest iron and steel works in the kingdom, as well as on the Continent. By this process, steel rails are already being made and sold in considerable quantities. The manufacture of armour-plates has brought out the fullest resources of many of the ironmasters, the machinery and appliances required being on a larger scale than anything of the kind heretofore used in this country. On the Continent, Krupp has still further extended his already vast steel making machinery, having, among other works, erected a hammer with a head of the enormous weight of 45 tons.

Electric Telegraphs.

The telegraphic achievement of the year has been the successful submersion of the Malta and Alexandria cable, thus cutting off 1,000 miles of the route over which news had previously to be carried between England and India. The Red Sea cable appears likely to be soon resuscitated, thereby affording the hope that 3,500 miles more of the long journey to the East may be practically annihilated, as far as the transmission of important intelligence is concerned. It has just been announced that Messrs. Glass, Elliott, and Co. have offered to lay, and guarantee for one year, a cable across the Atlantic from Milford to Halifax, the price to be £700,000. We are not aware that the North Atlantic line has made any progress during the year. The United Kingdom, or "shilling" telegraph company, have opened their lines to Birmingham, Liverpool, and Manchester, and great is the gain of the public, and the discomfiture of monopoly.

During the year telegraphic communication has been extended across the American continent, and already are arrangements being made to connect it, *viâ* the Pacific coast with the Russian telegraph extending along the valley of the Amoor.

A single span of telegraph wire, 1,400 yards, or four-fifths of a mile in extent, was put up last spring between Edinburgh Castle and Calton-hill.

Miscellaneous.

In legislation, the last year has relieved us of the paper duty and established definite and reasonable rates of toll for road locomotives. In 1838 with 525 paper mills in the kingdom, we made 93,466,286 lb. of paper, in 1849 the production had only risen to 121,800,000 lb., while in 1860, with only 384 mills, 223,575,000 lb. submitted to excise. Henceforth the make of paper is likely, at least, to exhaust the supply of rags, and other materials will doubtless be adopted as substitutes. As for the Locomotives Act, it has already given a decided impulse to steam traction on common roads, and in cases where heavy work is to be done it has been abundantly proved that steam is in all respects superior to horses.

The preparations for the Great Exhibition are regarded with great interest, and the display will doubtless be worthy of the occasion, and of the resources, artistic, commercial, and industrial, of our great empire. That it will make known many valuable novelties we do not doubt.

Last year's census has afforded gratifying proof of the growth and general prosperity of the manufacturing towns. Liverpool, Manchester, and Glasgow, counting, with each, its suburbs, now contain each almost exactly the same number of inhabitants, say 445,000. Birmingham counts nearly 300,000, Leeds 207,000, Sheffield, 187,000, the cluster of towns on Tyneside contains a quarter of a million, and South Lancashire, Staffordshire, and Yorkshire at least are not declining in their working population.

Steam is being worked exactly as it was a year ago, but the advantages of boiler inspection are becoming more and more appreciated. We have now an association for the prevention of boiler explosions in London, where, certainly, one was much needed, and where we hope it will be well sustained. We have recorded, in our own columns, no less than twenty-five boiler explosions, attended with the loss of at least thirty-five lives, since the beginning of 1861. Every one of these, we believe, happened in England, and five of them, attended with the loss of fifteen or sixteen lives, occurred in the metropolis. Of the twenty-five explosions, one was that of the boiler of the steamer Alarm, at Bristol, and two were of locomotives, one on the London and North-Western, and the other on the North-Eastern Railway.

During the terrible storms which have visited our coasts during 1861 the crews of the Royal National Lifeboat Association are understood to have rendered noble service. In 1860 there were no less than 1,811 vessels lost on our coasts, their value being estimated at £2,000,000. 536 lives were lost by these wrecks, the average of the previous seven years having been 800. The Royal National lifeboats rescued 3,679 persons during the year 1860, and the Association has saved, or granted rewards for saving, the vast number of 11,856 men, women, and children since the date of its first establishment.

The past year has been remarkable for a series of most destructive fires, the long memorable disaster in Tooley-street being the greatest of these. The burning of Messrs. Harrison and Wilson's sugar refinery, Davis' wharf, Southwark, the Victoria Hotel at Chester, Messrs. Parr, Curtis, and Madely's works, at Manchester, and the late great fire at Antwerp, make up a sad list. The alarm occasioned by these fires, and the increased insurance premiums to which they have led, have caused much attention to be paid to the best means for the prevention and extinction of fire, and we may reasonably hope that such calamities will be less frequent in future.

Death has wrought more than his accustomed havoc this year, as a nation's mourning too sadly testifies. In addition to our great national bereavement we have lost Sir Peter Fairbairn, Mr. Eton Hodgkinson, Vice-Admiral Moorsom, General Pasley, Sir Howard Douglas, Sir William Cubitt, Mr. Joseph Maudslay, and many other men of mark.

The new year has begun in the height of our national grief, and at the height, also, of the most painful national suspense. We are standing on the verge of war, and at this moment the issue has been decided across the sea, and we stand waiting (how sadly, but how firmly!) the first electric flash which shall give us War or give us Peace. At such a moment we may be spared from speculating upon the prospects of the present year. We have only to strengthen ourselves in the trust that the right will prevail, and that every Englishman will do his duty.

LITERATURE.

Lives of the Engineers: with an Account of their Principal Works, comprising also a History of Inland Communication in Britain. By Samuel Smiles.

[Fourth Notice.]

A path or a pad—from *pedes*—or footway, was such as the Indo-Britons of Hudibras made by the act of walking, and this padway or pathway was also a "highway," for it went along the high ground and ridges to avoid bogs and watercourses, as may be seen in Mr. Smiles' characteristic woodcut of the ancient causeway near Whitby, in Yorkshire. This served very well for the pack-horse, but the road, proper, broad, and hard, whether natural or artificial, was needed for the wheel carriage.

The water road was doubtless older or rather earlier than the land road. The earliest settlements were on the rivers, so that the inhabitants could "go down to the sea in ships." The site of London was doubtless determined by the Thames, and so with cities and towns the world over. Water was a cheap road down stream, but a laborious one up stream beyond tide reach, and, moreover, the utility depended on facile landing places, and the water did not help transit away from its banks. So pathways and bridle-paths grew up. In Spain and the Spanish colonies we find laid down on the maps the high sounding phrase *camino real*, "royal road." From such a phrase we might expect to find something like a Roman causeway, but we find a mere track for riding-horses or pack-mules. But in truth the royal road means a *real* road, that is, a road which does lead through to a given place or places, and is not a mere blind path. In days when kings were leaders, *rex* the king, and *res* the thing, were closely allied. The king represented the thing, the nation. The word thing means the *matter*—in old Saxon a nobleman was a thing, *i.e.*, a reality, which some modern noblemen are not. But there were royal or real roads in Southern America long before the advent of the Spanish king or his commanders. The Ynca, the absolute sovereign of Peru, held Chilé as a conquered province, and from Quito on the Equator to the south of Chilé, a distance of some three to four thousand miles, there existed what is known as the Ynca's road—Camino del Ynca—a veritable highway, for it ran along the table lands of the Andes, and crossed a grand torrent in the Pass of Tapungato by a natural bridge of limestone, still called the Ynca's Bridge. This was a practicable road for animals and foot passengers, simply by obstacles being removed, stones cleared away to right and left, and occasional suspension bridges thrown over streams. On this road there was a regular series of posts, traversed by carriers on foot, who conveyed parcels from one to another.

We are accustomed to call railways an invention, but in truth they were the result of simple growth in the necessity for economy. It is absolutely cheaper to make a narrow track, just wide enough for a wheel, than to make a broad road, and the early timber tramway still exists in the navvies' planks and barrows, which represent one half of the earlier way. When the ground was rough and hilly vehicles could not escape from the track, and it was needful to make it good when worn. On tolerably dry levels, such as the Pampas or Steppes of La Plata, the royal road for wheels consists of a series of roots on vegetable mould, which, when too deep, are abandoned for parallel lines, and in this mode the royal road is something like a mile in width in low ground. It is in half inland countries that the traveller can verify in the present day the early condition of the roads in England described by Mr. Smiles, who has with patient industry dug up a mass of details from the old records.

The present writer remembers, when a boy, being at school in the North of England, at a village where now sweeps through a main line of railway. It was within five miles of a market town. It was in the days when "Boney" was a kind of incubus to rustic imaginations, and a "Lunnoner" was little better. In front of the school was the highway, with ruts some two feet deep, filled, in wet weather, with muddy slush to the brim. On Monday the farmers' carts came by, drawn by the dobbins and old blind Balls, laden with poultry, and eggs, and butter, offering an irresistible temptation to the varlets of boys with constructive engineering faculties. Late on the Sunday evening they would steal away to the brook, on the churchyard wall, and select some efficient boulders or other stones, wherewith a few feet of the ruts were filled up nearly to the top with a perpendicular face towards the market-towns, and sloping backwards in an inclined plane towards the farms. On came Dobbin, in the early morning, with the farmer's wife perched on the cart, with a provision of pillows to make up for lack of springs. Up the incline went the wheels easily, and still more easily they plunged down the vertical front, with a crash that broke half the eggs, upset the farmer's wife with a shriek, and covered the whole with an avalanche of mud. And, meanwhile, the varlets sniggered in the schoolroom at the catastrophe they hoped for. If the *staw*, as it was technically called, was well built, three or four carts in succession might be jolted; if badly built, it crushed down. It became such a nuisance that, at last, a man with a stick went over the ruts on market day, to verify the safety, and that source of amusement was stopped, though pelting passengers with stones—and the more so if they looked like "Lunnoners"—still afforded some satisfaction. The "'Eave arf a brick at 'im" of *Punch* is no caricature.

Mr. Smiles gives us a very interesting account of John Metcalf, the blind roadmaker of Knaresborough, a truly original man of will and power. Born nearly a hundred and fifty years back, he became blind by small-pox, which, however, left him in full vigour otherwise. There is a portrait of him in his habit as he lived. A tall, strong body, a gentle face, a farmer's garb, and a slouch hat, covering up, no doubt, a goodly brain. He was a genius—*i.e.*, his perceptions were instinctive. He could swim, and climb trees, and course hares, and play the fiddle, and, blind as he was, serve as a guide to people with eyes on unfrequented roads. And, out of his own earnings, he bought a horse, who was no fool either, but an intelligent

companion, making up by natural sagacity for some of his master's blindness. And the merciful man was merciful and kindly to his beast, which carried him in hunting, and won races for him. And Blind Jack could play at bowls, too; that true old English game which people might well learn now in order to understand the science of projectiles.

And the landlord's daughter of the Granby Inn, of Harrowgate, fell in love with him and married him, because she could not be happy without him: "his actions are so singular, and his spirit so manly and enterprising that I could not help loving him." She knew how to choose a *man* did this Yorkshire girl. She could look through and behind the blind eyes, and see the brain that was there, and could mark the strong power and healthily glowing blood out of which comes progress. And he was a wandering minstrel, this Blind Jack, and he went to London and elsewhere, maintaining himself by his fiddle, and he walked back from London faster than a colonel could travel in his carriage. He was as multifarious in his faculties as a modern Yankee: was musician to the county assemblies, and then turned pack-carrier and fishmonger; after that helped to raise a volunteer corps, under Captain Thornton, to fight against the Pretender, and became himself the band to the corps. He played them into the fight at Falkirk, and, in the defeat, he lost his captain, who was obliged to run away with the rest. Blind as he was, he penetrated to the Pretender's camp in search of him. He was at the battle of Culloden, after which, in the piping-time of peace, he turned hosier and horse-dealer, and was suspected of doing a little "free-trade" in tea and brandy, and such smuggling ware. Then he became a carrier with a stage wagon between York and Knaresborough, and, in addition to all this, he was a competent mental arithmetician in the matter of weights and measures, timber, and other matters.

When he had attained to 48 years of age the Harrogate and Broughhedge turnpike-road needed making, and Blind Jack, determining to be a road contractor, sold off his carrying stock, and offered to construct three miles, which he accomplished. Next he tendered for a stone arch bridge of 18ft. span, never having made or seen a bridge in his life, and this, too, he executed satisfactorily.

In making roads over bogs he constructed, in a very original method, floating roads, but which, we believe, has been adopted to convert bog into garden ground from the earliest periods. Heath and fern were bound together in sheaves or bundles, and laid side by side. Then another and another thickness was laid on them transversely, forming a kind of hurdle work, on which was laid the ballast forming the surface of the road.

For two and twenty years he wrought at roadmaking and bridgebuilding, and, having lost his wife after thirty-nine years of happiness, he, in his old age, turned spinner and cotton weaver, then again took to roadmaking. When he was 75 years of age he returned to his farm, and took up once more his old occupation of hay and wood salesman. In the year 1810 he died, leaving behind him four children, twenty grandchildren, and ninety great-grandchildren. Several years after that the Stockton and Darlington, and twenty years after the Manchester and Liverpool Railways were in operation. John Metcalf was really of our own time. What he did was not remarkable, otherwise than for the circumstance of his blindness. His energy was remarkable, but it was displayed chiefly upon matters requiring little depth of observation. What he might have done had he possessed eyesight we know not, but it is evident that his energy went largely into contracting speculation, and that he knew how to manage men. Whether the engineering or the contracting quality was strongest in him we have no means of judging, but he was one of England's worthy sons, and we are glad that he has found his way into Mr. Smiles' archives.

In a chapter on bridges Mr. Smiles gives us some cuts of original structures. An ancient British bridge, over a stream in Dartmoor, is probably one of the earliest samples of a girder bridge, *i.e.*, piers of up-piled granite blocks are spanned by long slabs of granite, the primitive architecture of Egyptians and Greeks. The arch bridge at Croyland, in the Fens, is very like a wooden structure imitated in stone, so sharp-pointed is the arch and the coping above it. It is a triangular groin.

The earliest stone road bridge was that at Stratford-atte-Bow, built because an English queen was nearly drowned at a ford of the Lea river, one of the channels of the great marsh where King Alfred did deeds of derring-do against the Danes. Mr. Smiles gives us woodcuts of many curious bridges in stone, from one in Wales, by Inigo Jones, in 1634, to one by William Edwards, in 1755, which, from the steepness, looks almost like a large rock with a hole pierced through it. In fact all stone bridges stand well in so far as they resemble solid rocks. We can imagine that any stone bridge that stands well in pieces would stand well if cut out of the solid; and, were our knowledge of artificial stone making perfect, it would be better to make any future stone bridges moulded in one piece, as the French do with their still imperfect cement called betun. Could we obtain a perfect cement the best bridge would be a skeleton of light iron as a framework, bedded in cement, rendering the iron indestructible by rust, *i.e.*, supposing great spans not to be needed, for in great spans it is essential to avoid great weight. As a sample of strength, the Southwark Bridge is matchless, but it must be kept painted. Were it covered with a solid artificial stone cement, impervious to the atmosphere, it would be eternal. But, to achieve the greatest spans with the smallest quantity of material, the tension principle of small steel wire is doubtless the most effective. Yet it must not be forgotten that lofty towers are needed for this purpose.

After two interesting chapters on Harbours, Lighthouses, Rivers, and Navigable Streams, we come to the Life of Brindley, the early canal maker of England. By his portrait he might be a Dutchman of good type, a veritable Dutchman, not a Spanish Dutchman, one of the true Norse blood, with a territorial name, large browed, clear-eyed, and with a placid smile, a quiet consciousness of worth and power. And it was something to have been born in the High Peak of Derbyshire in the days of the Pretender, amidst a neighbourhood of strong, if not very moral men. We glean a curious piece of ancient history from Mr. Smiles. Our modern term "Flash" takes its rise from a hamlet of that name, inhabited by people with sharp brains and light fingers. How it came by the name does not appear, but probably from some natural phenomenon. James Brindley's father was fonder of sport than work, and until the boy was seventeen years of age, he could only get labourer's work, though from his early years he demonstrated that he was a born mechanic, by the usual process of model making without tools, and at seventeen years of age he was apprenticed to a wheelwright, one Abraham Bennett, who lived at Sutton, near Macclesfield. His master did not teach him, and he simply absorbed knowledge by observation, and turned it to account by thought. And he had unmatched perseverance. Very natural was it that vulgar natured workmen, working by routine, should look down upon him, for they could not see into his depths; and, when his knowledge and skill burst forth at last into action, his master asked how he had got it, and Brindley's simple reply was, "it came natural like." So does all really valuable knowledge. "Cram" is unnatural, and growth cannot go on save in a fruitful soil.

So James Brindley grew to be the best workman in the millwright's shop, and the cunning man, his master, thought it needful to advise him not to do his work too well, or by the time his apprenticeship was out there would be no repairs to do. After this the master undertook to erect the machinery of a paper mill, and "made a mess of it." In this difficulty Brindley, without warning, "natural like," walked twenty-five miles and back between Saturday and Sunday to see a real paper mill at Manchester. The remarkable thing was that his learning was not sufficient to enable him to take notes, so he carried back all the information in his brain, and was at his work again on the Monday morning—his master being in an agony at the idea that he had run away. But not so, he had done the work, and, at twenty-one years of age, he completed the paper mill to the satisfaction of his master's employers.

More than this, as he improved, he became his master's support—the mind of the business, the faculty on which the trade depended. He maintained his master and his family till the master died, by the labour of his brain, and then removed to Leek, in Staffordshire, where his reformed father had, by hard work, become the proprietor of a small estate. Brindley was twenty-six years of age when he opened his first wheelwright's shop.

He was more than a workman—he was instinctively an inventor, a contriver, an improver, and he became known in his neighbourhood as "The Schemer;" not, however, as a term of reproach, as in these latter days, but as a term of respect for mental authority, as sound as it was original. Yet, all this time, he could scarcely spell or write. In 1755 this man cut down and sawed timber with his own hand at 2s. 6d. per day. Verily, he loved his work better than the reward thereof.

Here comes in the oft-quoted story of Mr. Ailbury, of Shelton, and the powdered flint which the ostler, at Dunstable, blew into the eyes of his horse to cure a disorder, and, thenceforward, flint mills became a fact in Staffordshire. The earliest were made by Brindley for the Brothers Wedgwood, and the reputation of this mechanical success gained him employment as an engineer.

A Mr. Heathcote, owner of an estate and coal mines near Manchester, was drowned out, and could not get coal because he could not get rid of the water by any known appliance. He heard of "The Schemer," and sent for him. The Schemer observed that he could drain the mines, and received *carte blanche* to do it. He carried the river Irwell through a rock tunnel six hundred yards in length, and delivered it into a water-wheel to which pumps were attached, and the workings of the mine were laid dry, without other aid than the capital sunk. But for this work it does not seem that he obtained any greater reward than the ordinary workman's wages of 2s. per day. No doubt the man of genius, who could not read books, thought more of his work than of the lucre of gain.

His next operation was to build a silk mill at Congleton, in Cheshire, and he succeeded in turning out "the most complete and economical aarangements of manufacturing machinery that had, up to that time, been erected in the neighbourhood." In this case he had to struggle against a pretender, who failed in what he had undertaken. After this followed some larger flint mills, and a water-wheel to give them motion, and at the same time to pump a coal mine. And this water-wheel and pump worked from 1757 to 1812. The pump barrels gave token of the pursuit of practical machinery under difficulties. They were formed of staves, like a barrel, and hooped with ashen hoops, the sliding portion for the bucket being a tube of cow hide.

His next operation was to construct a mill for grinding flints mixed with water, to prevent the flint dust from flying about and injuring the grinders. The amount of invention in this does not seem to have been great. A far more perfect machine is known in South America under the name of the Chilian mill, yet quite as simple. We shall describe this in our next article.

To be continued.

FOREIGN AND COLONIAL JOTTINGS.—The Swedish Government la year sent a scientific expedition to Spitzbergen. It has just returned to Trorass, whence it started, after having accomplished its mission very satisfactorily in spite of the extreme rigour of the weather. The old maps have been corrected; fresh ports have been discovered, and numerous experiments made which have thrown fresh light on meteorology and natural history. It has been ascertained that animal and vegetable life exists in the sea at a depth of 2,500 yards, and that the great current of the Atlantic Ocean known by the name of the Gulf Stream reaches as far as the coast of Spitzbergen, pieces of broken wood, bottles, &c., having been found there. The Italian Government have determined to lay at once a submarine telegraph cable from Trapani or Marsala to Cape Carbonata, in the Island of Sardinia, a distance of about 200 miles. This will obviate the necessity of messages from Alexandria and Malta for this country being dispatched *vid* Naples, Rome, Turin, &c.

ON THE LARGE BLASTS AT HOLYHEAD.*

By GEORGE ROBERTSON, C.E. F.R.S.E., &c.
Engineer's Office, New Works, Leith Docks.

BLASTING operations may be divided into three distinct classes, according to the effect intended, and the intensity of the charge of gunpowder—1st, Where rock has to be separated by weak charges, with as little injury and fracture as possible, principally for building purposes; 2nd, Blasting for engineering works, as breakwaters, &c., where quantity and regularity of supply are of more importance than size and regularity of fracture; 3rd, Military blasting, where total destruction is aimed at, and where an excess of powder is little or no objection.

In the first class the charges of gunpowder can hardly be too weak, so long as the stone be separated, and small charges are preferable to a large quantity at once—the object being to procure stones fit for masonry, with as few cracks and shakes as possible.

In the third class the charge can hardly be too strong, the chief difficulties being those of carrying on operations under an enemy's fire, with the speed and secrecy consequent thereon.

It is to the second class, that of "engineering blasting," that the following observations are directed.

After describing the system pursued in working the quarries by large blasts I shall give the calculations for regulating the charges, and, lastly, the cost of "getting and filling" stone on the large scale. In an engineering point of view the subject is one of considerable importance.

The period more immediately referred to in the paper is from 1850 to 1853, when the large blasts were first introduced at Holyhead—the late Mr. Rendel being at that time engineer-in-chief. After his death, in 1856, Mr. Hawkshaw was appointed engineer. Mr. G. C. Dobson has been resident engineer since the commencement of the works.

Since 1853 the large blasts have gone on regularly, as matters of everyday occurrence, exciting little curiosity, and giving little trouble. At first, however, they were the subjects of much anxiety and experiment, both in a practical and economic point of view. The best method of working the quarry on the large scale, and the calculations for the charges of powder, were not determined upon without considerable expense, danger, and even loss of life.

The rock of which the breakwater is composed is a very hard quartzose and micaceous schist, slightly stratified; in some places bearing marks of former flexibility, the strata being twisted and contorted in a curious manner. It is intersected by vertical joints, running in a north-east and south-west direction, presenting faces fronting the north-west and south-east. As will be seen hereafter these joints were taken advantage of in fixing the position of mines, and in calculating the expected produce of a charge.

To supply the great demand for the stone required for a bank 350ft. broad at the base in deep water, within a limited contract time, evidently necessitated the most vigorous efforts; and accordingly an extensive system of small shots was at first arranged, giving employment to above 1,000 men. The holes for these shots were of all sizes and depths, according to the judgment of the foremen of the quarries. For convenience sake the quarries were divided into portions, consecutively numbered, or were called by the names of the different foremen, as "Jones's quarry," "Fisher's quarry," &c. The boundaries were, however, ideal, as the face of the rock altered with each great blast.

To avoid the danger and delay of firing shots at all times of the day, whenever the holes were ready and charged a general grand firing took place twice, or, if necessary, thrice a day. When a large bell sounded the quarries were emptied of men, horses, cranes, and all plant easily destroyed. The fuses were simultaneously lighted, on a red barrel being hoisted to the top of a tall mast. Each man, as he lighted his fuse, cried "fire" (or "tân" in Welsh), and made the best of his way by scrambling up ropes to a place of security, or to one of the bomb-proof huts erected for the purpose. As the face of the rock was often above 100ft. high this was a service of no small danger, and accidents frequently happened.

The average work done over the whole quarries, in drilling holes for the small shots, was 14in. per hour, by three men using 1¼-in. drills. The charges were regulated chiefly by the "rule of thumb," or, at most, by the ordinary miner's rule of one-third of the hole, independent of the diameter—a rough rule, certainly, but better than so many "capfulls," the cap being a very common measure. Indeed, where one hundred or more shots went off twice a day it was impossible to be very particular.

I do not intend going into further details regarding these small shots. The system will be found fully described in Sir John Burgoyne's treatise on "Blasting."

Wherever it was possible powder was poured into cracks in the rocks, and the rent tamped as well as its form would admit. There was often a considerable waste of powder, but the shots were very effectual in bringing down large masses of rock. This system is pursued to great advantage at North Queensferry, in blasting columns of whinstone.

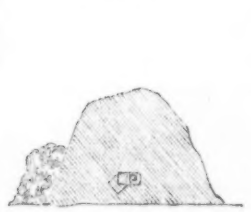
About the year 1850 the contractors for Holyhead breakwater, Messrs. Joseph and Charles Rigby, commenced a system of large mines, rightly conceiving that a quantity of powder fired at once would, in the end, prove cheaper, and afford a greater and steadier supply of stone than a number of small shots. Since then the supply has been over 3,000 tons per diem—often 4,000, weather permitting; 5,000 tons a day was seldom, if ever, reached, not from want of stone, but from the difficulty of depositing such a quantity during working hours, even with five lines of railway on the staging. To do this requires 125 wagons for each line of rails, or a total of 625, to be loaded, run down from the quarries, tipped into the sea, and drawn up again to the quarries every day.

The wagons held about eight tons each; were made of wrought iron, and furnished with tipping gear, which released the scoop when the trigger struck a catch on the rail. The scoop was counterbalanced, to return again to its original position when the stone was discharged.

The first large shots tried were shafts sunk from the top of the quarry. They were about 6ft. by 4ft., of different depths, of course, according to the height of the rock; and were charged with reference to the lines of least resistance, or the shortest distance of the shaft from the face of the quarry.

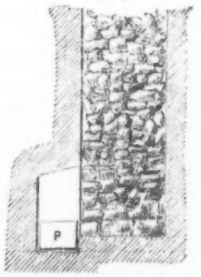
As the danger of blowing out the tamping was greater than in small shots, from the increased diameter of the hole, care had to be taken that the depth of shaft was sufficient to allow the weight

Fig. 1, *a*.



Charge, 600 lb.; produce, 3,000 tons.

Fig. 1,



Enlarged section of chamber.

of the tamping to resist the powder. The rule was that the shaft should have one-third less grip (or distance from the face) than depth as a maximum; and the depth was oftener twice the line of least resistance, or even more.

* Read before the Royal Scottish Society of Arts, and drawings exhibited, 12th December, 1859.

This is, however, not so great a proportion as in small shots; but in the shafts the chamber at the bottom for the powder was bent to one side, so that the tamping was never in the direct upward line of fire (see Fig. 1).

The most favourable position for a shaft is in the centre of a projecting column of rock, where (as in Fig. 1, *a*) the lines of least resistance are nearly equal on all sides. This mine (one of the first) was fired on November 13th, 1850, and was 42ft. deep, with half that, or 21ft., of least resistance on all sides. It was charged with 600 lb. of powder, and yielded 3,000 tons of stone; one of the highest comparative results obtained being five tons of stone for each pound of powder. An enlarged section of the chamber is given in Fig. 1, *b*. Had it not been for the remains of a previous blast on one side the result would have been even higher.

It is seldom that a shaft can be placed in so favourable a position as this, and Fig. 2 shows the most common and the next best position, viz., that of blowing off a corner. I recorded this mine chiefly because it was an example of the effect of inferior powder. The depth of the shaft was 44ft.; the line of least resistance 30ft.; and the charge 1,800 lb. of powder. This only produced 3,500 tons, or less than two tons to the pound of powder, in place of about 5,000 tons which good powder would have given, and generally did give, in so favourable a position

Fig. 3 shows a very common, but very unfavourable position for a shaft where a straight face of rock has to be broken up, and where the powder has to tear its way out under disadvantages. The miners called this a "rooter out," and it was almost always placed so as to

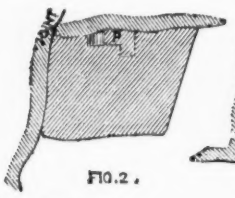


FIG. 2.

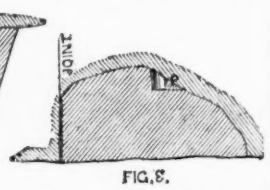


FIG. 3.

Charge, 1,800 lb.; produce, 3,500 tons.

"Rooter out." Charge, 900 lb.; produce, 2,000 tons.

have a joint on one side which determined the line of fracture. The example shown in Fig. 3 had a depth of 44ft., with a line of least resistance of 21ft. The charge was 900 lb., and the produce 2,000 tons, or 2¼ tons per pound of powder.

The very worst position for a shaft is at a re-entering angle, or nearly so, as in Fig. 4, where the rock binds it in on all sides. The ratio of powder for a mine like this had to be greatly increased, according to circumstances.

The powder was not always in one spot, but was often divided into two or three charges, placed at the end of galleries driven from the foot of the shaft in directions determined by the neighbouring joints or cracks. In Fig. 5, for example, the whole charge, 8,000 lb., was divided into P_1 of 2,800 lb., and P_2, P_3, each of 2,600 lb. The depth of the shaft was 67ft., and the line of least resistance 42ft. This mine produced 23,000 tons of stone, or nearly 3 tons of stone to the pound of powder.

It is to be noticed that in most cases it is better to spread the powder along the face of the rock, in two or more charges, than to have the whole in one spot with a greater line of least resistance. In the latter case the rock is thrown forward in larger masses, and is neither so well broken up, nor does the heap present so many points of contact for the wagons to load at.

It was found, from experience, that 30ft. was about the economic limit for the line of least resistance, and the powder was seldom, therefore, at a greater distance than that from the face of the quarry.

Occasionally two separate mines, with their respective shafts, were fired simultaneously side by side. There was some little danger of

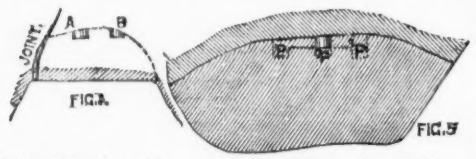


FIG. 4.

FIG. 5

A blew the tamping out; B did not explode.

Charge, 8,000 lb.; produce, 23,000 tons.

the two shots (which were fired by a galvanic battery) not going off together. This actually occurred on the 24th Feb., 1851, when two contiguous shafts were to have been fired at once; but, owing to the accidental fracture of one of the battery wires by a previous small shot, B (Fig. 4) did not explode.

The mass of rock in front was too great to be moved by A without the assistance of B; and the whole tamping in A was blown out. An immense shower of stones was hurled into the air to a great height, and fell amongst the spectators, who lined the side of the mountain. Strange to say, the only person seriously hurt was the gentleman who had planned and directed the mine, Captain Hutchinson of the Royal Engineers. He was struck down with a broken thigh, and died the same night. His wife and several ladies, who were talking to me at the time, had their clothes torn by great stones falling on them, but escaped with some trifling injuries. Captain Hutchinson had had great experience in blasting, having been engaged both at Gibraltar and at Dover when the Round Down Cliff was blasted in 1845.

The objections to shafts are as follow:—

The miners not only work in a confined space, but to great disadvantage, as their work is below their feet.

The materials and men have all to be drawn to the top by a windlass; and the ventilation is bad; so much so that, after a small shot in the shaft was fired, the men could not return to their work for some time; notwithstanding the windsails, water tubs, and other contrivances that were used to help to remove the foul air. Any water, also, which may collect in a shaft, either from rain or wet joints, has to be removed, and will not drain out of itself. Shafts have some advantages, however, over headings. They weaken the whole column of rock, from the top to the bottom, greatly helping the powder, and determining the line of fracture. They are also very quickly tamped; as the debris which came out in sinking the shaft has merely to be thrown down again. This is of some advantage in wet situations, where the powder should be fired off as soon as possible. It is obvious that the same point in the rock may be reached as well from the face as from the top of the quarry, and often by a shorter route.

Headings, or galleries at right angles, or nearly so, to the face, are evidently in some points preferable to shafts sunk from the top. They are of a more convenient form to work in; the men having the rock in front of them instead of below their feet; the chippings can be easily wheeled out; the ventilation is better; no rain falls into the mouth as in a shaft, and any water from joints drains itself out. A heading also forms a convenient place of safety for the miners while neighbouring shots are being fired. The usual size for a heading was 5ft. to 5ft. 6in. in height, by 3ft. 6in. wide. Wherever it was possible headings were driven by the side of joints, and were generally placed so as to blow away a corner (as in Figs. 6, 7, 8, 9). When it was desirable to clear the bottom of the quarry well the powder was placed several feet below the level of the rails.

Headings are more nearly in the direction of the line of least resistance than shafts are, and the tamping is in consequence more liable to be blown out. They have therefore to be filled with greater care, and the direction of the gallery changed and sunk at parts, as shown in the diagrams.

Fig. 6 had a line of least resistance of 28ft., with a height of face of 70ft. The charge was 2,340 lb., placed 3ft. below the rails, and the produce 5,500 tons, or 2⅓ tons for each pound of powder. Fig. 7 is a very simple form of heading run along a joint not at right angles to the face. The line of least resistance was 1ft. more than in Fig. 6, but the charge of powder was rather less, viz., 2,300 lb., as the face

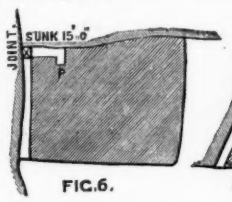


FIG. 6.

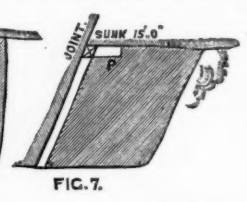
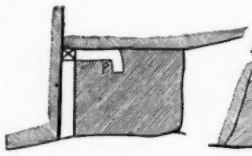


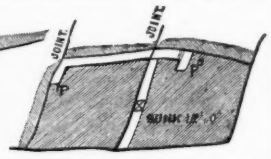
FIG. 7.

Charge, 2,340 lb.; produce, 5,500 tons.

Charge, 2,300 lb.; produce, 5,500 tons.

was but 60ft. high; and in Fig. 6 there was also a heap of loose stones at one side which gave the powder more to do. The produce of Fig. 7 was 5,500 tons, or nearly the same proportion to the pounds of powder as in the last example. Fig. 8 was also driven along a joint, with a line of least resistance of 28ft., and 85ft. height of face. The charge was 2,500 lb. (1ft. 6in. below the rails), and the





Charge, 2,500 lb.; produce, 6,000 tons.

Charge, 4,200 lb.; produce, 10,000 tons.

produce 6,000 tons, or 2⅖ tons to the pound of powder. As in shafts, the powder was often divided into several charges. An instance of a double charge is given in Fig. 9, where the gallery follows the direction of one joint, and the principal charge of powder is placed at another joint. The sinkage in this heading was not, as usual, at the turn of the gallery, but in the centre of the straight portion; P_1 was 2,400 lb.; P_2, 1,800 lb.; the line of least resistance 33ft.; and the produce 2½ tons to the pound of powder, or 10,000 tons in all.

A double heading with three sinkages is shown in Fig. 10, where the face averaged 60ft. in height, and the lines of least resistance 29ft. The produce was 12,000 tons with a charge of 5,100 lb.

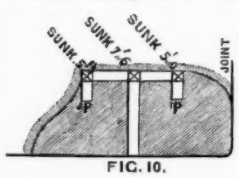


FIG. 10.

Charge, 5,100 lb.; produce, 12,000 tons

During the period referred to in this paper the largest mine fired was one of five tons of powder, producing about 40,000 tons of stone; but since then there have been others larger. One of the most successful ever fired at Holyhead was a heading with four charges, in which the joints of the rock were very favourably situated, as is seen in Fig. 11. The height of face was 146ft., the length 140ft., and the grip of heading 35ft. The total charge was 13,000 lb. of powder, or 6½ tons (2,000 lb. of powder going to the ton); P_1 = 4,500 lb., P_2 = 4,000 lb., P_3 = 3,000 lb., and P_4 = 1,500 lb. The produce was stated in the newspapers to be 70,000 tons of stone, or fully 5½ tons to the pound of powder (unless the rock was very overhanging I think this quantity rather full).

Larger charges were required for headings than for shafts, as the superincumbent rock was not weakened by the shaft column, and the height of face was generally great where headings were most advantageously used. It will be seen, therefore, that shafts and

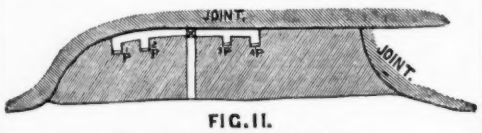


FIG. 11.

Charge, 13,000 lb.; produce, 70,000 tons.

headings have each their peculiar merits and defects, and that a judicious mixture of both is the only proper way of working a quarry on the large scale. On the whole headings preponderated, especially after the first two years' experience.

The usual method, when the face of the rock was not perpendicular, was to remove the upper half by a shaft and the lower by a heading. When the face was nearly upright the heading alone was sufficient, as the top fell in when the root was blown out. A heading and a shaft fired together left a clean perpendicular face for the next mine.

A good deal of forethought had to be exercised in placing the shafts, so that they might be ready in rotation to keep up a steady supply of properly broken stone. They took many weeks to sink; headings, on the other hand, were driven in a much shorter time, and in this respect had the advantage.

The blasting powder was kept in strong vaulted magazines, and was landed from the boys while the men were at dinner and the locomotives out of the way. It was delivered in small barrels holding fifty pounds each, or half a hundred weight (100 lb. being the hundred weight of powder). One pound of powder = thirty cubic inches. The strength was tried in two ways; either by a gun, in which the recoil was measured on a graduated arc, or by a small mortar elevated at an angle of 45 deg. One ounce of good powder ought to throw a ball of sixty-eight pounds weight to a distance of 180ft. The different qualities of powder were sometimes mixed, to bring the strength near this effective standard. It was delivered at Holyhead for about £55 the ton.

There is an idea amongst quarrymen that it is an advantage to mix powder with sawdust or quicklime; the former to divide the particles and cause them to ignite slowly, the latter to absorb any moisture. Both are erroneous notions; true economy is to use good powder, though for blasting it may be coarse grained.

In the shafts a space was sometimes left round the charge. Theoretically, I believe, this is of use in permitting the expanding gases to acquire momentum; but the space was so small in comparison with the quantity of gas evolved from such large charges that it was practically of little use. The 50 lb. barrels were poured into a deal box of the calculated size for the charge. A box 3ft. 4in. cube would hold a ton. Bags were at first used, but were discontinued, and the powder lay loose in the box. There was little fear from damp, as a mine was never charged till the day it was tamped and fired. Inside the heap of powder was the bursting charge, which was a small bag of fine sporting powder enclosing a piece of wood, in two nicks of which the wires from the battery lay with a piece of platinum wire between them. When the circuit was completed in the battery house this grew red-hot and fired the mine.

The battery wires in the shafts had to be protected from the tamping falling on them, and they were therefore laid in a groove cut in a batten placed up one angle of the shaft. At first a length of Bickford's fuse was also placed in this groove, in case of the wires missing fire. This occurred so seldom that the fuse was discontinued, it being cheaper to run the risk of now and then having to untamp a mine than to supply them all with fuses.

The wires from the battery-house were of copper covered with cotton yarn or gutta-percha; these were unrolled from a drum to the required length. A considerable portion was recovered from the heap of stone after the blast was over.

The batteries were placed sometimes in a heading, sometimes in a bombproof hut, according to circumstances. They consisted of earthenware cells, with plates in pairs of zinc and platinum moistened with sand damped with sulphuric acid. The acid was thus economised, and kept from being spilt when the batteries were shifted over the rocks from one mine to another.

Tamping a shaft gave little trouble; quarry debris, clay, and stones, were thrown down promiscuously. Headings required to be tamped with greater care. The charge was generally built in for some feet with a dry rubble wall, and the remainder of the gallery rammed with a red clay found in parts of the quarry.

The great shots were always fired after the usual small ones had gone off, on the hoisting of a red flag on the battery-house. If successful there was little or no noise; the column of rock was seen to heave slowly forward and crumble to pieces amidst a cloud of smoke and dust.

The "rooters out" were apt to make a good deal of noise; and sometimes, in spite of every precaution and care in the calculations, the whole mass was blown across the quarry, tearing up rails, and stopping the traffic for days. Very large lumps of rock were at times thrown a considerable distance, and these had to be reblasted and treated as separate rocks before they could be used. I have known a piece of 1,000 tons thrown forward over the lines of rails.

At the bottom of nearly every blast there was a "core" of solid rock in the heart of the heap, which had to be removed by small shots to prepare a fresh face for the next mine. This core prevented any very accurate estimate of the quantity of stone yielded by a blast. This could only be told exactly by counting the number of wagons which were loaded at that heap. The wagons were all weighed as they went to the breakwater, and the contractor paid accordingly.

For a short time after a blast there was some danger in approaching the heap, owing to the foul air which hung about the stones. I recollect two men nearly losing their lives from this cause, one in endeavouring to help the other.

In entering upon the calculations upon which the charges of powder were based, I must premise that they were not to be relied on as mathematically correct, but were the nearest obtainable in practice. An unforeseen joint or crack, or some weak part of the rock, arising either from texture or cleavage, would upset the best of calculations. But still, in the generality of cases, the charges could be regulated with very great nicety.

Sir John Burgoyne's general rule for small shots is as follows:—One-half of the cube of the line of least resistance in feet = charge in ounces; or, what is the same thing, the charge in pounds = $\frac{1}{32}$nd of the cube in feet.

This rule is sufficient for ordinary mining operations; but at Holyhead the desideratum was not only to move the mass, but to bring it down thoroughly broken up and fit for loading the wagons at once. This the $\frac{1}{32}$nd of the cube would not do unless under the most favourable circumstance. After much experience the general rules determined upon for Holyhead were as follow:—For ordinary shafts from $\frac{1}{15}$th to $\frac{1}{20}$th the cube of the line of least resistance in feet = charge in pounds. For ordinary headings $\frac{1}{12}$th of the same line cubed. In "rooters out" it was found necessary to increase these quantities to $\frac{1}{10}$th of the cube of the line of least resistance. But it will be easily seen that, with the same line of least resistance, the contour of the rock, the position of the mine, or the height of the quarry, might very considerably alter the work the powder has to do. With the same distance also from the face the depth of the shaft, or distance from the top of the heading might be 30ft., or it might be 130ft.

It would be unreasonable, therefore, to base calculations for mines of the size we are treating of upon the line of least resistance alone. In small shots it alone may be considered, because these objections do not apply in the same degree as in large mines, and here the powder is generally in excess of what it has to do; but in operations where tons of powder are in question the case is different.

After a number of mines were recorded, with their charges and produce, a check upon the general rule was obtained. The quantity of rock upon which the powder would operate, and which the mine might be expected to produce, was determined beforehand. By a careful examination of the neighbouring joints this could be ascertained very closely. For a lower heading, where the powder does extra duty (being generally below the rails), one pound of powder to every two tons of stone expected was allowed. When a top shaft was in question 1 lb. of powder ought to produce 3 tons of stone; the average over the quarries of both shafts and headings being 1 lb. of powder to 2½ tons of stone. The difference between the quantity of powder, calculated in this way, and the quantity obtained with reference to the line of least resistance cubed, was the variable quantity, which was altered according to the position of the joints, &c. &c. Half the difference was taken in ordinary cases.

For example, in a lower heading—Let the line of least resistance = 30ft.; the height of rock = 60ft.; the average width of column = 50ft.; then taking this last check rule we obtain—

$$\frac{30 + 50 + 60}{\text{Say 12 (the number of cubic feet to the ton).}} = \text{7,500 tons of expected stone.}$$

$$\text{And } \frac{7{,}500}{2} = 3{,}750 \text{ lb. in the charge.}$$

Now, had we taken the line of least resistance as the only element in the calculation, applying the general rule for headings, we have—

$$\frac{30^3}{12} = 2{,}250 \text{ lb. in the charge;}$$

a difference of 1,500 lb. less than by the other method. In practice about one-half this difference, or 750 lb., would be added to the quantity obtained by the $\frac{1}{12}$th of the line of least resistance^3, to enable the powder to do the work required by the position of the heading. The charge would, therefore, be 3,000 lb.; instead of 3,750 by the one method, or 2,250 by the other.

The only remaining point now to be noticed is the cost of quarrying on the large scale. This I am enabled to give from a very accurate estimate which was made in November, 1855, from the pay-sheets for a week, during which the quantity quarried was 25,095 tons, of which 1,165 tons were debris, not deposited in the breakwater. This estimate includes quarrying, filling the wagons, and moving them clear of the face of the quarry.

1st Quarrying.

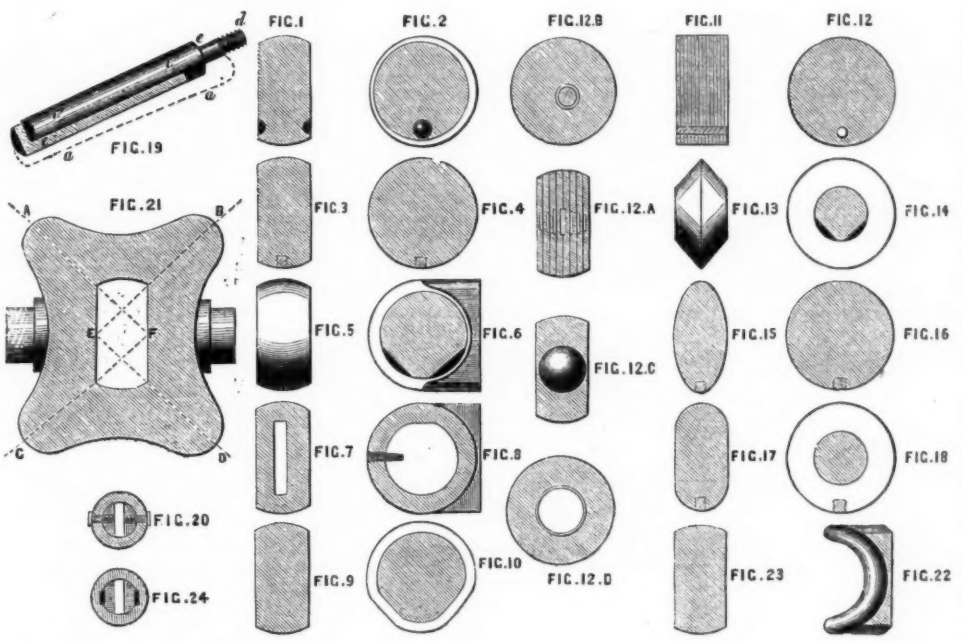
				Pence per ton.
Powder for headings and shafts	£269	8	10	2·80
Driving ditto	168	9	0	1·74
Superintendence	4	0	0	0·04
Total cost of quarrying 23,095 tons	£441	8	10	4·58

2nd Filling.

				Pence per ton.
Wages of fillers and gangers	£202	15	4	2·11
Quarrymen blasting large stones	75	10	0	0·78
Powder used by ditto	11	8	1	0·12
Wages of carpenters, smiths, strikers, point-boys, toolboys, brakesmen, drivers of horses, platelayers, and general labourers	122	9	2	1·27
Foremen's wages	10	4	0	0·11
Cost of filling wagons	£422	6	7	4·39
Total cost of stone quarried and filled, per ton				8·97

The miners' wages varied with the kind of work; in some parts of the quarry they got 25s. per foot run for driving a heading, in others only 14s.; out of which they had to pay about 2s. for the powder, fuses, &c., used in blasting. One man could drive fully 1¼ft. per week, the average over the quarries being 5ft. of heading for four men. In one case four men only drove 3ft. in a week, in another case as much as 10ft.—a low average, therefore, is 5ft.

WOOLLCOMBE'S PROJECTILES AND FIREARMS.



THIS invention, by R. W. Woollcombe, of Stoke, Devon, consists in constructing projectiles in the form of discs, rings, and oblate spheroids in order to obtain cycloidal rotation in contradistinction to helical or rifle rotation as generally employed, and it is preferred to make the projectiles eccentric, but with the centre of gravity in the equatorial plane.

The improvements in firearms apply more especially to large ordnance, and are intended for the discharge of the projectiles above referred to. They consist in forming the bore straight, that is, without twist, and of a section to correspond with the transverse section of the projectile, leaving just sufficient room for the projectile to roll in the bore.

Fig. 1 is a transverse section, and Fig. 2 a side view of a projectile in the form of a disc of metal. *a*, *a*, are cavities one on each side of the discs whereby the projectiles are rendered eccentric; the cavities *a*, *a*, may or may not be plugged with wood, composition, or other material as desired, and of specific gravity different to that of the projectile. Fig. 3 is a transverse section, and Fig. 4 a longitudinal section of similar discs of metal rendered eccentric by holes made in the centre of the zone and filled or stopped with a plug *a* of different specific gravity to that of the projectile. Figs. 5 and 6 are end and side views respectively of projectiles in which the eccentricity is produced by removing a small quantity of metal from four points at the edge of the discs as shown at *a*, *a*. In Fig. 6 a sabot *b* is attached to the disc; Fig. 7 is a transverse, and Fig. 8 a longitudinal section of a hollow shot or shell (with sabot) made according to the invention, having a greater amount of metal on one side of the shell than on the other; this extra thickness produces the required eccentricity; this thickness may, if so needed, be somewhat greater towards the front than at the back, or *vice versâ*, to make allowance for the lightening or the preponderating effect of any particular fuse; when the shell is in the position shown, the centre of gravity will be above the geometrical centre, and it must so be when fired (with a margin to front or rear of a few degrees) in all the eccentric projectiles thus employed. Fig. 9 is a transverse section of a simple concentric disc, to which cycloidal rotation may be given by firing it at a depressed angle; it is also preferred for double shotting; Fig. 9 also represents a transverse section, and Fig. 10 a side view of a disc in which the eccentricity is produced by making of somewhat oval form one side of it; the lower side is shown so shaped, but its lowest part or base is circular in profile and across the zone to permit of due suppression of windage. Fig. 11 is a transverse, and Fig. 12 a longitudinal section of a projectile, in which a series of eccentric discs or plates of metal are laid together and secured by any suitable adhesive material; sixteen discs are here shown, each having a hole made in it, so that when the plates are laid together the holes coincide and form an aperture through the projectile and produce its eccentricity; when the discharge takes place the discs separate from one another, the sides of the discs are roughened to prevent them sliding on one another. Fig. 12ª is a transverse, and Fig. 12 B a longitudinal section of a compound disc, composed as Figs. 11 and 12, excepting that the holes for the eccentricity are not cylindrical but truncated cones with bases towards the equatorial plane of the whole projectile and apices towards the sides. These cavities are in each component of this compound disc to be made wide enough to correct the lateral eccentricity caused by the obliquity of its zone; the cavities extend half through each component plate of this compound disc; Fig. 12 C is a transverse section, and 12 D a side view of inner side of middle component ring of a compound shot eccentric by a spherical cavity, which also tends to counteract lateral eccentricity of each ring; Fig. 14 is a side view of an angular zoned disc, having parts *a*, *a*, cut out to produce its eccentricity, and Fig. 13 is an end view of it; Figs. 15 and 16 are transverse and longitudinal sections of a projectile of the form of an oblate spheroid. *a*, *a*, are the wooden or other plugs for producing its eccentricity; Fig. 17 is a transverse section, and Fig. 18 a side view of the disc, the outline of a transverse section of the zone of which is in the form of a semicircle; the space between the dotted lines in Fig. 17 indicates the extent of plane surface in the projectile. At Fig. 19 is shown in perspective view one method in which an ordinary service gun may be adapted to fire projectiles of any of the forms before given in Figs. 1 to 10; *c*, *c*, are movable cheeks placed in a common cylindrically bored gun *a*. They are made of iron bars planed and turned, and are welded to the bolt *d* behind. This bolt passes through a hole made in the breech end of a common gun in the line of the axis of the cylindrical bore; it is then screwed up on the outside and rear of the gun by a nut. The hole in the breech for such purpose is about $\frac{2}{3}$ths the diameter of the bore of the gun, and is filled by the smooth portion of the bolt *e*. The cheeks are kept close to the sides of the gun, either by bolts screwing into them passing through the sides of the gun, as shown in section at Fig. 20, or by a very shallow dovetailed groove cut straight along each side of the gun, as shown at Fig. 24, in a direction perpendicular to the common axis of the trunnions; a corresponding dovetailed projection running straight along the convexity of the cheeks, which may also be secured by dovetails, thus keeping the cheeks close to the sides of the gun; the long axis of the bore is then perpendicular to the common axis of the trunnions, and it must be so in each gun constructed on the inventor's principle.

Fig. 21 represents a section in advance of the trunnions of a gun to fire the discs shown in Figs. 1 to 10, and with a similarly suitable section of bore, or when the bore is of a corresponding shape to fire the projectiles as shown at Figs. 11 to 17. In each form of section of bore the external transverse section of gun should be in conformity with the section of bore, thus in Fig. 21 the external angles are made to lie in a line prolonged through the angles of the bore A, B, C, D, from the points E and F on the side opposite.

Fig. 22 is a side view, and Fig. 23 a back view of a sabot sometimes attached to the projectiles as shown in Figs. 6 and 8.

DISCOVERY OF ANCIENT REMAINS.—During the week the workmen employed in erecting the Electric Telegraph Company's wires by the side of the Malton and Driffield Railway, which crosses the Yorkshire Wolds, have, in making the post-holes, found several articles of flint, from description presumed to be weapons, probably arrow heads. The district has many ancient intrenchments and other evidences of early occupation, generally attributed to the Britons. This view is strengthened by the finding, on Tuesday, of a skeleton, the bones very far mouldered, but, as usual, with perfect teeth, and near it a stone celt. Unfortunately these stone implements have hitherto had no value in the workmen's estimation, and nearly all have been re-interred—but a pretty sharp look-out will now be kept for any further relics that may be exhumed. Quite recently, also, another human skeleton was found near the foot of the Wolds, at Winteringham, showing every indication of very early burial.

THE ARMSTRONGS.—Under the date of the 11th of November, from the War-office, and with the attached signature of Major-General Alexander Tulloh, the new Director of Ordnance, the public are again in possession of those important changes and additions in arms, accoutrements, harness, tools, and military furniture generally, which the prevailing spirit of improvement at the present time appears insatiably to require. As regards the Armstrong guns, the first important alteration to be noted is in the position of the breech tangent and trunnion sights of the 100-pounder guns, which are now so arranged nearer the axis as to admit of the gun being aimed through an embrasure or port-hole narrower than was before required. A 40-pounder of reduced length, and weighing only 32 cwt., is now approved provisionally for sea service. The 25-pounder gun is in future to be called a 20-pounder, and is to carry projectiles which are not to exceed 21 lb. 4 oz. in weight, with a charge of 2 lb. 8 oz., both for land and sea service. In addition to this we have now approved a 20-pounder for land service, weighing 16 cwt., and 8ft. long, and another 20-pounder weighing 2 cwt., and 5ft. 6in. long, fired with the same charge as the above 25-pounder. In this report is given a complete list of our naval ordnance, by which we find that our sailors have to attend to seven descriptions of Armstrong guns, with their various kinds of ammunition, &c.; and, besides, no less than 29 varieties of the smooth-bore guns, including carronades, mortars, and howitzers, with different descriptions of powder, shells, bursting charges, fuses, &c.; in endless combination. The last important item is the approval of the little 6-pounder rifled gun for colonial and mountain service, with its carriage limber and wagon to match, the limber suiting either gun or wagon. The weight of this beautiful little pocket-pistol is 3 cwt. 11 lb.; of its carriage and side-arms 5 cwt. 3 lb.; of its limbers, 7 cwt. each, packed complete; and of its wagon body, packed with ammunition, 11 cwt. 3 lb. It is 3ft. 10in. in width by the track of its wheels, carries eighty-one rounds of ammunition, and either on its own wheels, or with the aid of mules, when taken to pieces, will be able to scale any difficulties. In it, and with the acknowledged failure of our rocket system, we have found for them a most efficient substitute. In the section of ammunition and projectiles the lead coating of all natures less than 20-pounders, common shells and solid shot of 20-pounders, and lower natures, when made in the Royal Laboratory, is to be attached by means of zinc solder, instead of by undercutting, while segment shells of these natures, *i.e.*, 20-pounders and under, are, however, still to have the lead attached by undercutting. This subject has been freely ventilated in the columns of the press during the last three months, and on account of the liability of the lead to strip when fired over the head of troops is of the highest importance. There can be no doubt that Colonel Boxer's plan of the zinc soldering produces a perfect affinity between the lead and the iron, remedying the dangerous tendency completely; but Sir William Armstrong maintains that a too tight grasp of the lead prevents the shell from bursting into the greatest possible number of fragments, and defeats the main object of the missile: so a compromise has been made as above, and the knotty point remains for perfect solution at a future distant day. The proof and developing proof charges of the 100-pounders have been increased to one-fourth and one-sixth of the weight of the solid shot used, 110 lb.; and finally the whole of the charges for the naval ordnance have been arranged and published for the information of that noble service. In the miscellaneous items packing-cases for what are called the "loose parts of the Armstrong guns" are approved of—these articles consisting mainly of tangents, sights, vent-pieces, levers, patches, hammers, plugs, crutches, pans, screws, and a host of such small fry; the weight for the case of the 100-pounder weighing over 6 cwt., evidently proving that even with Sir William's inventions the millennium of gunnery has not yet arrived.—*Army and Navy Gazette*.

AN ACCOUNT OF EXPERIMENTS ON PUDDLED STEEL, HOMOGENEOUS IRON, AND STEEL IRON, MADE AT HER MAJESTY'S ARSENAL AT WOOLWICH.

By WILLIAM HENRY BARLOW, F.R.S., M. INST. C.E.

THE rapid extension of the manufacture of puddled steel, its great reputed strength, and the cheapness and facility with which it is capable of being manufactured, having excited the attention of the engineering world, the author of the following experiments thought that the time had arrived when it would be useful to ascertain the principal mechanical properties of this and other like materials.

With this object application was made to the Under Secretary of State for War for permission to use the testing machine at Woolwich, for the purpose of the experiments; and, as the object sought was purely in the interests of science, the permission asked for was readily accorded.

The testing machine referred to is a counterpart of that employed by the United States Government for ascertaining the strength of cast iron. The strains are brought on by levers and dead weights, and the machine is capable of recording accurately the ultimate resistances with which rupture ensues under the several strains of "tension," "compression," "transverse strain," and "torsion."

Complete drawings and description of this machine, and all its details, will be found in the reports of Major Wade to the United States Government.

But, although adapted for ascertaining accurately the ultimate resistance at the time of rupture, under any of the strains above mentioned, the machine is not well arranged for recording the progressive action of these strains, excepting that of torsion, and, consequently, in using it to test a material like puddled steel, which rarely yields by rupture, excepting under tensile strain, the machine, in its present form, does not afford all the information which could be desired.

Nevertheless certain facts have been ascertained by these experiments which point out the more prominent mechanical properties of the materials tested; and, although the investigation has not been carried so far as the author desired, yet the results may be relied on as accurate to the extent to which the several materials have been tested.

Puddled steel is made direct from cast iron, by a process analogous to that used in obtaining common wrought iron; but, instead of expelling all the carbon, such an amount is left contained as to impart the quality of steel to the metal so treated.

Considerable experience is required in the selection of suitable qualities of metal, and also to know the precise moment at which to stop the process of decarbonisation in the puddling furnace, and other conditions have to be observed in order to secure the success of the operation; but it is now accomplished with great certainty, and the result is the production at a very low cost of steel, which, although not of high quality, is, nevertheless, possessed of many valuable properties.

In addition to the experiments on puddled steel similar experiments were made on homogeneous metal and steel iron, and on puddled steel melted and cast into ingots.

Steel iron is a condition of the metal when the process of decarbonisation is carried further than in puddled steel: its fracture is fibrous, and it approaches very nearly to wrought iron.

The other materials above mentioned show a crystalline fracture, the crystals being very small, fine, and regular, like that of gun metal; the steel possesses, also, similar properties of malleability, although much harder and of much greater strength than gun metal.

The form and dimensions of the several samples tested are shown on the accompanying figures:—

SUMMARY OF EXPERIMENTS.

On the Resistance to Tension of Puddled Steel, &c.

No. of experiment.	Name of material.	Name of maker.	Ultimate strain per inch in lbs.	Mean.	Remarks.
				lb.	
52	Puddled steel.	Mersey iron works.	84,152		
53	do.	do.	109,117		
54	do.	do.	94,671	95,233	Fracture crystalline.
55	do.	do.	92,330		
56	do.	do.	95,895		
19	Homogeneous metal.	Firth and Co.	91,018		
20	do.	do.	115,133		
21	do.	do.	97,422	100,994	Fracture crystalline.
22	do.	do.	111,850		
23	do.	do.	88,640		
29	Puddled steel.	Naylor and Vickers.	121,095		
30	do.	do.	114,692		Fracture crystalline.
31	do.	do.	119,598	116,336	Not broken.
32	do.	do.	108,648		
33	do.	do.	109,931		
34	do.	do.	123,054		No. 31 reduced in diameter & turn. again.
57	Puddled steel melted and cast into ingots.	Naylor and Vickers.	84,652		
58	do.	do.	101,858		Fracture crystalline.
59	do.	do.	96,629	101,753	
60	do.	do.	124,492		
61	do.	do.	101,136		
8	Steel iron.	Atlas Works.	71,157		
9	do.	do.	69,327		
10	do.	do.	68,151	69,456	Fracture fibrous.
11	do.	do.	71,158		
12	do.	do.	67,487		

From the above experiments it appears that the ultimate tensile strength of puddled steel, homogeneous metal, and puddled steel melted and cast into ingots, is nearly double that of wrought iron.

The variation of strength in the different samples is not greater than is found to arise in wrought iron.

In the detail of the experiments given in the Appendix it will be seen that an endeavour was made to ascertain the relative extensions with different strains; first, by measuring the distance between the nippers called in the experiments the "distance *a b*;" and, secondly, by observing when the weight applied caused a sensible subsidence in the lever which showed that the material continued to extend after the weight was put on.

The construction of the machine, however, does not admit of accuracy in these indications.

Several specimens taken out and re-measured after receiving strain indicate that permanent set first begins to be perceptible at 20,000 lb. per square inch.

Puddled steel and homogeneous metal broke with a fracture presenting a minute crystalline appearance, and there were two distinct

forms of fracture, one being in a plane at right angles to the line of strain, and the other a cup-shaped fracture more or less perfect.

The material called "steel iron" showed a fibrous fracture, and was of much less strength than puddled steel and homogeneous metal. In this material it was evident that the process of decarbonisation had been carried too far, and that it differed but little from iron of good quality.

SUMMARY OF EXPERIMENTS.

On the Resistence to Compression of Puddled Steel, &c.

Number of Experiment.	Name of material tested.	Maker's name.	Pressure per inch in lbs.	Amount of compression produced in inches.	Amount of compression per ton per inch in terms of length.
47	Puddled steel	Mersey Ironworks	21,870	·003	
48	do.	do.	21,986	·003	
49	do.	do.	21,828	·002	
50	do.	do.	21,928	·003	
51	do.	do.	21,928	·005	
	Mean length of sample 1·323in.	Mean	21,908	·0032	·000247
35	Puddled steel	Naylor and Vickers	20,146	·005	
36	do.	do.	20,196	·002	
37	do.	do.	20,298	·002	
38	do.	do.	20,146	·004	
	Mean length of sample 1·368in.	Mean	20,196	·00325	·000263
24	Homogeneous metal Length of sample 1·295in.	Firth and Co.	22,514	·003	·000231
64	Puddled steel melted, and cast into ingots	Naylor and Vickers	22,584	·006	
65	do. do.	do.	20,372	·006	
62	do. do.	do.	22,758	·004	
63	do. do.	do.	22,277	·007	
	Main length of sample 1·4175in.	Mean	21,998	·00575	·000413
13	Steel iron	Atlas Works	22,879	·004	
14	do.	do.	——	——	
16	do.	do.	——	——	
17	do.	do.	22,879	·006	
18	do.	do.	24,963	·006	
	Mean length of sample 1·102in.	Mean	23,574	·00533	·000450

The samples tested were all about 1¼in. in length.

The approach of the steel pistons, between which the samples were compressed, was carefully measured, and the results, as recorded, are correct, as showing the compressions of columns of the length employed.

The amount of compression per ton per inch is, however, so great, and being, moreover, inconsistent with that which may be inferred from the experiments on transverse strain, it is to be presumed that the result is affected by the short length of the samples.

The effect of the pressure is to enlarge the diameter at the centre of the sample.

FIG. 1. FIG. 2.

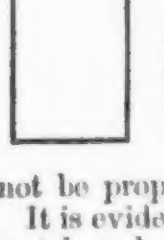




Fig. 1 represents the sample No. 24 before pressure was applied, and Fig. 2 is the same sample after receiving a pressure of 51 tons per inch, and similar effects, though in a less degree, result from smaller pressures.

It is known that, in long bars subjected to compression, the centre portion is not proportionately expanded, and it follows that the decrease of length in short columns will not be proportional to that in long ones.

It is evident, however, that the puddled steel and homogeneous metal are less compressible than cast puddled steel and steel iron.

Puddled steel, whether cast or otherwise, could not be crushed with any pressure the machine was capable of exerting. The only effect was to produce an alteration in the form of the sample.

This property would indicate that, if great pressure were to be resisted, it might be advantageous to submit the material to great compression before using it.

The effect of the pressure appears to produce a re-arrangement of the particles, and, when so re-arranged, they are capable of sustaining a greater pressure than in their original form.

SUMMARY OF EXPERIMENTS.

On the Resistance to Transverse Strain of Puddled Steel, &c.

No. of experiment.	Description of material.	Name of maker.	Mean breadth.	Mean depth.	Deflection produced by 7,500 lb.	Value of E *.	Weight at which deflection ceases to be regular.
			in.	in.	in.		lb.
39	Puddled Steel	Naylor, Vickers	1·935	1·9275	·055		16,000
40	do.	do.	1·925	1·9600	·040		16,000
41	do.	do.	1·985	1·9750	·040		18,000
		Mean	1·945	1·9542	·045	2,870,500	16,666
42	Homogeneous metal.	Firth and Co..	1·955	1·960	·030		14,000
43	do.	do.	1·965	1·970	·060		14,000
44	do.	do.	1·960	1·980	·035		18,000
		Mean	1·960	1·970	·042	2,979,200	15,333
2	Puddled Steel	Atlas Works ..	2·1·0	2·085	·037		16,000
3	do.	do.	2·055	2·050	·042		16,000
		Mean	2·082	2·062	·040	2,568,0·0	16,000
					Deflection produced by 5,800 lb.		
4	Puddled Steel	Atlas Works ..	·975	1·985	·062		8,000
5	do.	do.	1·035	2·020	·055		9,000
		Mean	1·005	2·002	·058	3,100,200	8,500
					Deflection produced by 2,300 lb.		
6	Puddled Steel	Atlas Works ..	2·010	1·005	·065		3,500
7	do.	do.	1·975	·960	·083		3,500
		Mean	1·992	·982	·074	2,830,800	3,500

By comparing these experiments with those of Professor Barlow on wrought iron bars 2in. square (see Barlow "On the Strength of Materials") it will be seen that the deflection under transverse strain is greater in puddled steel, when of like dimensions, and under like circumstances, in the ratio of 10 to 11.

But the weight it is capable of sustaining before the increments of deflection with equal weights cease to be regular is, as nearly as possible, double that of wrought iron. Hence, so far as these experiments go, it would appear that a bar of puddled steel may be bent about twice as much as a bar of iron of like dimensions without impairing its elasticity, or without causing a greater permanent set.

SPECIFIC GRAVITY.

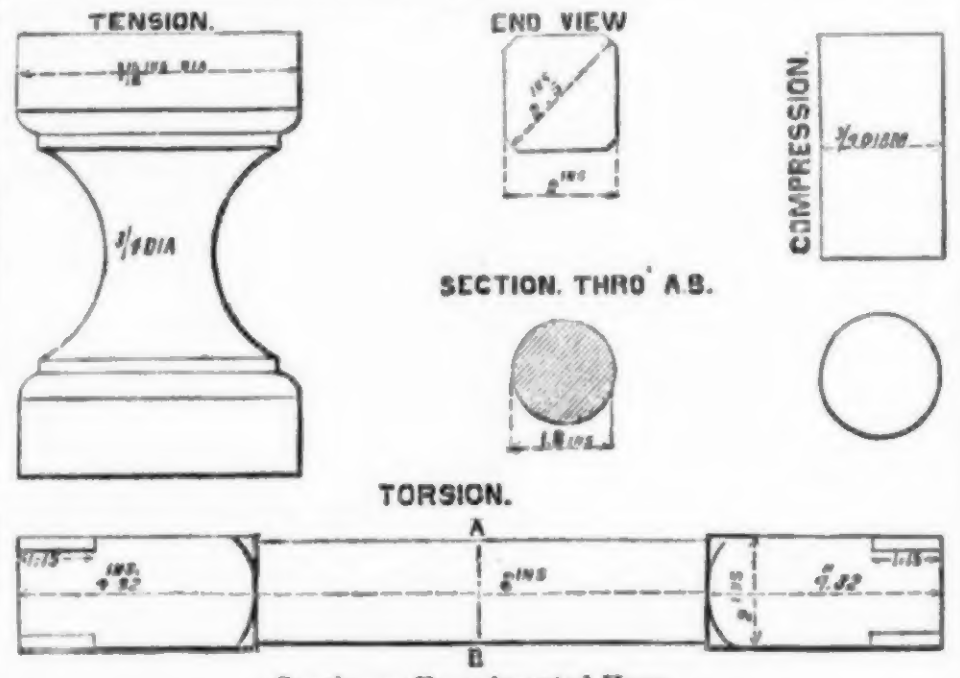
The specific gravity was ascertained to be as follows:—

Puddled Steel	1st sample	7·7805
do.	2nd do.	7·7836
Steel Iron	1st do.	7·7431
do.	2nd do.	7·7580

RESISTANCE TO TORSION.—PUDDLED STEEL.

Weight applied at 25in. from centre.	Firth and Sons. Diameter 1·763in.		Naylor and Vickers. Diameter 1·864in.		Naylor and Vickers. Diameter 1·861in.		Naylor and Vickers. Diameter 1·876in.		Remarks.
	Deflection.	Permanent set.	Deflection.	Permanent set.	Deflection.	Permanent set.	Deflection.	Permanent set.	
lb.	Degrees.								
100	·25		·30		·01		·10		
200	·20		·25		·15		·40		
300	·50	S 0	·50		·30		·30		
400	·59		·75		·40		·50		
500	·70	0	1·00	0	·45	·10	·60	·10	
600	·75		1·00		·60		·70		
700	·85	·15	1·125	·25	·70		·80		
800	1·00		1·150		·70		·90		
900	1·29	R.S. ·20	1·25	·20	·90	·10	1·60	·20	
1,000	1·40		1·30		·90		1·29		
1,100	1·63	30	1·40	·30	·90	S.	1·30		
1,200			1·50		1·25		1·50	S.	
1,300			1·50	·30	3·55	R.S. 2·00	1·50	·30	
1,400			1·60				1·90		
1,500	7·35		1·60	·40			2·00		
1,600	8·85		1·95	R.S.			2·20		
1,700	11·20		2·55	·90			2·30	·30	
1,800	15·50		3·10				2·50		
1,900	19·40		4·15				Broke in putting on 1,900 lb.		
2,000			5·60	3·00					

The strength of puddled steel in resisting torsion will be best understood by a direct comparison between the results in the above table and those obtained by Major Wade on samples of the same form and dimensions in cast and wrought iron.



Specimens Experimented Upon.

The following table is an abstract of such of his experiments as afford a direct comparison. In both sets of experiments the weight was applied at the end of a lever 25in. long.

TABLE SHOWING CERTAIN RESULTS OBTAINED BY MAJOR WADE ON THE TORSIONAL RESISTANCE OF CAST AND WROUGHT IRON.

Description.	Weight applied 1,000 lb.		Weight applied 1,500 lb.		Remarks.
	Deflection.	Permanent set.	Deflection.	Permanent set.	
Cast iron:—					
No. 1, 2nd fusion	2° 2	0° 2	5° 0	2° 2	Mean of four experiments.
Do. 3rd fusion	1° 7	0° 0	3° 0	0° 3	One experiment
10 parts No. 1 and 4 parts No. 3, 2nd fusion	1° 5	0° 0	2° 4	0° 1	Do. do.
8 parts No. 1 and 6 parts No. 3, 3rd fusion	1° 5	0° 0	2° 3	0° 1	Do. do.
Equal parts Nos. 1 and 2, 2nd fusion	1° 9	0° 1	3° 8	0° 9	Mean of two experiments.
Do. do., 3rd fusion	1° 2	0° 0	2° 4	0° 0	One experiment
Mixture of 3 parts No. 1, 3 parts No. 2, and 2 parts No. 3, 2nd fusion.	1° 4	0° 0	2° 5	0° 1	Mean of four experiments.
Do. do. 3rd fusion.	1° 6	0° 1	2° 5	0° 2	Mean of four experiments.
Wrought iron, No. 1		0° 0	17° 5	16° 1	One experiment
do. No. 2		0° 1	16° 6	15° 4	Do. do.
do. No. 3		4° 2	39° 7	37° 7	Do. do.

CONCLUDING REMARKS.

Good puddled steel and homogeneous metal appear to be very similar in their mechanical properties; their tensile strength being nearly double that of wrought iron, the fracture being without fibre, and possessing a fine crystalline or granular appearance.

Both materials are ductile, and may be condensed and consolidated under the hammer. Both materials, also, although bending under transverse strain as much as wrought iron with equal weights, are capable of bearing nearly twice as much strain as wrought iron before producing a greater amount of permanent set.

It is to be regretted that the testing machine in her Majesty's Arsenal at Woolwich is not adapted to receive bars of sufficient length for determining the modulus of elasticity. The very short length of the samples which the machine is capable of receiving, in applying tensile and compressive strains, renders it impossible to arrive at correct conclusions from them in respect of the amount of extension and compression per ton per inch.

* The value of E is obtained from the formula:—

$$E = \frac{l^3 w}{32\, b\, d^3 \delta}.$$

—*See "Barlow's Strength of Materials."*

EMBANKMENT OF THE SOUTH SIDE OF THE THAMES.

THE first meeting of the commissioners was held on Tuesday, December 17. The Lord Mayor occupied the chair; and the other commissioners present were Sir J. Jebb, Captain Galton, Mr. Thwaites, Mr. Hunt, and Captain Russell. The business transacted was not very interesting or important, as the witnesses called simply proved the fact already well known, that the spring tides at times overflow the south bank of the Thames. On future occasions more important evidence may be anticipated, and it will then be desirable that some accommodation should be provided for the gentlemen of the press. Owing, probably, to an oversight, no such provision was made on this occasion, but, doubtless, it is only necessary to mention the matter to ensure its being remedied at future meetings of the commission. The first witness called was Mr. Taylor, one of the churchwardens of Lambeth.

The Lord Mayor, addressing him, explained the object of the commission, and called on him to make any statement for their information which he thought bore upon the matter in question.

Mr. Taylor then entered at some length into the subject. He observed that he had not come there with a view so much to tell the commissioners what should be done as to explain to them what had been endured by poor persons on the occasion of the high tides. He spoke of the district within half a mile of Lambeth Palace. He was frequently sent to ascertain what should be done on the occasion of floods in that district from high tides, and it was not at all uncommon for the parish engine to be employed for the purpose of pumping the water out of the dwellings of the poor creatures. The water came up through the sewers at times, and at others over the bank, and the damage done was so great that they had in the neighbourhood raised a "flooding fund," out of which the sufferers by the floods were assisted. The floods took place to such an extent that he had seen boats in Fore-street, and he entertained the opinion that, if the northern side was embanked, something must be done to protect the southern side; and he had great fears that when the coffer-dams were removed at Westminster-bridge the result would be disastrous to the southern side of the river.

In reply to the Lord Mayor Mr. Taylor said there was a difficulty in embanking the shore throughout the whole length, as in Lambeth there were certain ancient rights of way existing which could not be blocked up. It might, however, be possible to increase the incline.

In reply to the other commissioners he said the bubbling up of the water through the sewers was not owing to any defect in the flaps of the sewers. The overflowing of the banks took place about every two months. The balance in the hands of the flooding fund now was about £75, and the area flooded was half-a-mile in length, and it took in Fore-street, and a portion of High-street, and he had seen it up to the burial ground wall. The water flowed back at least 100 yards for half-a-mile, and it was rising ground. This was at the high tides. He did not think much inconvenience was occasioned by the bubbling up of the water through the sewers, but the overflowing of the banks drove the poor out of their homes into the workhouse, as they had no other place to go to. The medical officers had called his attention to the dangerous state of the walls of the houses of the poor. They were saturated, and the matter carried into their rooms by the floods was most prejudicial to health. Nothing but an universal raising of the wharves would remedy the evils he referred to. The drawdocks established by ancient custom, and to which he had referred, were not much used. the chief one was at Ferry-street, which ran westward from Bishop's Wharf.

Mr. F. Knyvett, Secretary to the Archbishop of Canterbury, said these floods occurred about twenty times a year; they came up to the palace gates, and the porter had to put up boards and sand to keep the water out of the gates and his lodge. This generally happened at the spring tides. The porter was warned of the approach of the water by its bubbling up through the grating in front of the palace, and the barricade made on such occasions was about eighteen inches deep. In the York-road the people erected water tight boards to keep the water out of their areas. He might be permitted to observe that the mud bank at the side of the river was perfectly pestilential; the conservators of the Thames improved the state of things by throwing rubbish into it at the sides, but that had become covered again, and the benefit derived from it had been now decreased. He hoped that any scheme for embanking the Thames would lead to an improvement by doing away with the bone boiling and manure establishments between the palace and Vauxhall Bridge. The floods in Bishop's-walk had increased in depth during the last two years. Any system of embankment to do away with the mud bank in some degree and cover it with water would be a benefit. He had visited the poor after the floods, and observed the smell in their dwellings, which they inhabited immediately after the flood subsided.

Mr. Silk, architect, surveyor, and engineer, was next examined. He said he was acquainted with the south side of the river for some distance above and below London Bridge, and he knew numbers of the buildings there were frequently flooded. He had been engaged in the erection of some of the wharves destroyed by the late disastrous fire in Tooley-street, and although every precaution thought necessary to prevent flooding was then taken those wharves were occasionally inundated. He was now engaged in reconstructing them and the warehouses, and the level would be 12in. higher than they were before, to prevent any further inundation. With regard to making a roadway in front of the wharves, he thought it quite impracticable on the east side of London Bridge, though it might perhaps be feasible on the west side.

The inquiry was then adjourned.

The commissioners appointed for the purpose of considering the propriety of embanking the south side of the Thames met on Saturday, December 21st, at Westminster.

Captain Galton, in the absence of the Lord Mayor, occupied the chair.

Mr. Frederick Doulton was the first witness examined. He said the embankment of the Thames at the south side was rendered necessary or desirable from the fact that floods frequently took place there, by which the poor and the wharfingers were seriously affected. The poor were driven from their homes, and immediately after the water subsided they returned to them, and disease was caused by the dampness of their dwellings and the filth left in them after the flood. It was quite apparent that the wharfingers must suffer by having their places of business flooded. These serious inconveniences could be prevented by the construction of an embankment on the south side of the river, which embankment would afford the means of making a new road, and thus relieving the now overcrowded thoroughfares, the crowding of which would be increased by the construction of Lambeth Bridge, which would be opened next year. A new street was undoubtedly necessary, and it might be made by an embankment, or by widening the waterside thoroughfare street. As to the north side of the river above Westminster, it was already embanked. As to heightening the wharves on the river side it would interfere with all the existing thoroughfares of the neighbourhood, and would entail the entire re-construction of the wharves; and, indeed, most of the existing wharf walls were so bad that any attempt to patch them up would be a failure, and would not remove the evils of flooding, or remedy the over-crowding. He had great doubt that any other course than an embankment would remedy the existing evils. It must be remembered that those on the south side spent a large amount in coal tax, which went to pay for the embankment on the north side.

Captain Galton: That argument would apply thus—every district should have some improvement.

Witness: Well, by the north embankment the whole of the north districts are improved, and by the south embankment the whole of the south districts would be improved. The floods came over the embankments, and went up through the sewers. It would be most injurious to abolish the free landing-places; from one of them 1,000 tons were carted a week; and any road on the south side must be

constructed in communication with free landing-places. The objectionable slime of the sandbanks is due to the sewage.

By Sir J. Jebb: The roads between my wharf and my works are frequently flooded. An embankment would remedy this evil. The value of the property between Lambeth Palace and Vauxhall bears no comparison to that above it.

Mr. Mackintosh, surveyor to the Lambeth Vestry, said he had heard the evidence of the last witness, and could speak strongly in support of all that he had said. He had held his present position for twelve years. The vestry, he had found, had no means of relieving the inhabitants from the evils they suffered. Notices had been served on the wharfingers to improve their wharves, and they took no notice of them, and the board had no power whatever to enforce the improvements. The flood extended sometimes back from the river to Broad-street—a distance of 250 yards. The water, occasioned from the flood, got into the sewers, filled them, and then their contents were mixed with the flood. There were floods from rain water; they affected Stamford-street and the neighbourhood. The main drainage works would remedy this, but not the tidal floods. Beyond this the inhabitants were subject to a daily inconvenience. The subsoil on the banks being gravel and the walls rotten the water penetrated through, and as far back as Kennington-oval the wells were affected by it, and the water in them rose and fell with the tide. This would be remedied by a solid embankment. He did not know the depth at which the clay was.

By Mr. Thwaites: The surface of the land close to the river was higher than the roads inland. The sewers in the neighbourhood were seven or eight feet below the surface of the roads. The sewage washed up by the floods extended inland miles rather than yards. In 1850 there was a tidal flood and wet weather. The flood having somewhat subsided for some time before persons had begun to store goods in the basement of their premises, the consequence was that an immense quantity of cheese, bacon, and hams were destroyed. The poor, whose dwellings were inundated, suffered not only from the dampness of their dwellings occasioned by the flood, but by the filth that was left in them when the flood subsided, and he believed a good sound wall and an embankment would cure the evil, but without a substantial wall the soil must percolate through the gravel—that was proved by the rising of the water in the wells and the ponds on that which was Kennington Common and is now Kennington Park.

By Captain Burstall: Whilst it might be desirable to carry the embankment wall to the clay, it was not absolutely necessary. As to the necessity of improved communication between Lambeth and the West-end there could be no doubt. If the opportunity of making the embankment was now lost it could not be done hereafter without causing great expense. Now the streets could be widened and the district improved at a small expense, as the compensation would not be large.

By the chairman: The old buildings in Fore-street were flooded frequently, but the vestry did not allow the basement of new buildings to be made lower than the level at which good drainage could be secured. Unless power was given to do away with the free draw locks on the south side of the river any raising of the docks would be abortive. Undoubtedly some of the wharf property on the banks of the river was more valuable than the other, the walls being better.

Mr Goddard, a vestryman of Lambeth, said he had paid considerable attention to the state of the south bank of the river. He could bear testimony to the percolation which been referred to by other witnesses. He lived in the neighbourhood of Nine Elms—300 yards from the river. The bottom of his garden was nearly always under water, and in any part of it if he dug three spades, or 16in. deep, he got water. His garden was below watermark, and in the height of summer he found water at 24in. deep. He apprehended that the whole district was built on a quagmire, and this was proved by the fact that the houses were continually settling. His house had a crack down it sufficiently large to thrust one's fist into it. It had been stopped up with masons' putty, and the doors of his house had frequently to be reduced on one side and pieced on the other to make them shut. In his neighbourhood sickness was common. He had frequently seen Bishop's-walk flooded. He was an auctioneer and valuer, and in that capacity he knew that it was in contemplation to form a company to embank the south side of the Thames; it promised a large profit, and the only difficulty was in getting the necessary powers.

Mr. Oddley, medical officer of the Lambeth district, corroborated the other witnesses, and explained that a low typhoid fever was always prevalent in the district, owing mainly to the floods and the deposits they left behind.

The inquiry was then adjourned.

RAILWAYS IN THE SOUTH OF ITALY.—The *Sannita*, a newspaper printed at Campobasso, says:—"The railway between Vasto and Foggia proceeds with great alacrity under the contractors, the Brothers Gianezzini. About 1,000 workmen are employed between Termoli and Campomarino. They work bravely, and are handsomely paid. Termoli has acquired all the look of a little city, so great is the stir and bustle consequent on this incessant work. Houserent has risen to fabulous prices, and provisions are equally dear. Money circulates freely, and the joyful population begins to value the advantages which may arise from roads and the free intercourse between one district and the others." Now the same phenomenon is observable in all other ports of the ex-kingdom. The Minister of Public Works, Peruzzi, after laying out a general plan of the railways to be constructed at the expense of Government, has awarded the trunks and branches of the different lines to a variety of contractors, and the work is being done simultaneously at every point. Were it not for the frequent Appenine Passes the Southern railways would, at the end of 1862, be brought to as satisfactory a state of completion as those which intersect the great plain of the Po, on either side of the river, and in every direction. But the mountain chain, stretching all along the peninsula, precludes the possibility of Florence, Rome, and Naples being joined by railways to Turin, Milan, and Bologna, for any time shorter than two or three years. The works across the Porretta between Bologna and Pistoja and Florence, owing to the treacherous nature of the soil, have taken thrice as much time as their projectors anticipated, and the line will hardly be opened before the end of 1864.

OPPORTUNITIES FOR ENTERPRISE IN HUNGARY.—"A Hungarian,' in a letter to the *Times*, declares "that Hungary is the wealth and power of Austria, and that Pesth, from its position alone, has the means of forming the centre of a great and free country." He proceeds to say that "We are deeply persuaded that had an English consulate been established there the English merchant, great in practical knowledge, clearheadedness, and steadfastness of purpose, would have found a guarantee for embarking in enterprise, and we Hungarians would soon have learnt what we are still ignorant of—how to 'do a good business.' Companies would have been formed because the profits would have been evident. While one, by building steam mills on the largest scale, could have sent in great quantities the flour of the excellent Hungarian wheat to England; another, establishing central wine-cellars at Pesth, would have proceeded to make brandy from ordinary wines, or to prepare good wines according to the English taste. In this way the credit of the Hungarian wines, impaired as it is, day after day, by the adulterations practised by wine merchants, would soon have been restored. Sawmills also would pay, and profits could be made by the formation of a new steamboat company. Tugs are wanted; those now on the Danube pay 12 per cent. Endless fields of enterprise could be pointed out, not alone for the benefit of those actively concerned in them, but for that of mankind in general. From entering into anything of this nature, however, without English capital, we are incapacitated by our present unhappy condition. I submit these details to the English public, earnestly desiring to enlist its interest in the subject on which they treat, and, in so doing, to serve my country, England, and the cause of civilisation itself."

FIREPROOF FLOORS.*

THE *Mark Lane Express*, under the head of "Some Remarks Suggested by the Miscellaneous Implement Department of the Leeds Show of 1861," gives the following particulars relative to fireproof floors:—

We now proceed to describe fireproof floor construction in which iron is used, and that in conjunction with concrete; the first method we shall notice being the patented one of Messrs. Fox and Barrett, of London, a method which has been largely and most successfully introduced. In this form of fireproof floor wrought-iron beams are used, of section and form as shown in Fig. 8, at *a a*. On the lower flanges of these beams small battens (*b b b b*) are laid, in the position shown in the side elevation, at the right hand of illustration. Coarse mortar (*c c*) is then pressed between these strips, so as to form a rough surface for the ceiling below. Above the mortar a layer of concrete (*d d*) is then placed, reaching some height above the iron joists *a a*. The upper surface of the floor may be finished with cement or asphalte. If a boarded floor is desired the flooring boards (*e e*) rest upon quarterings (*f f*), which may be let into the upper surface of concrete before it sets.

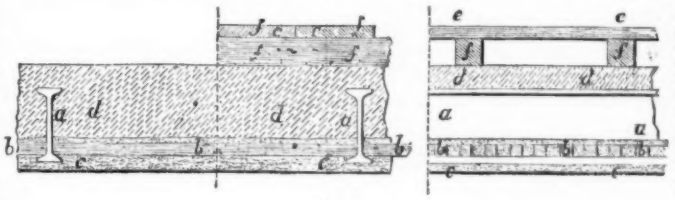


Fig. 1.

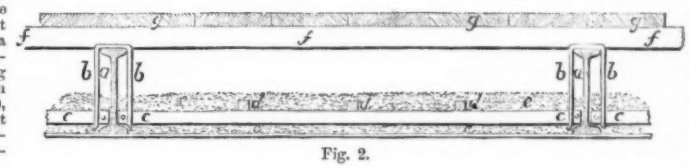


Fig. 2.

In Fig. 9 we give a sectional drawing of the fireproof system of flooring introduced on the Continent by M. Thausne—*a a* are the rolled wrought-iron joists or beams; saddle pieces (*b b*) are passed over the joists, and carry at their lower ends the flat strips of iron (*c c c c*). These again carry at right angles square rods of iron (*d d d*). A platform being temporarily placed below the floor mortar (*e e*) is pressed above and between the bars *d d*, and strips *c c*; the platform being removed on the setting of the mortar. The joists (*f f*) are of timber, and stretch from beam to beam; they support the flooring boarding *g g*. The scale to which this sketch is drawn is 1 inch to the foot.

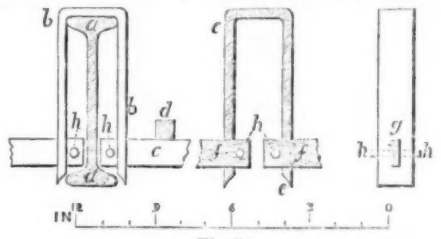


Fig. 3.

In Fig. 10 we give an enlarged drawing of the saddle pieces (*b b*, Fig. 9), showing how the strips of iron (*c c*) are joined; *a a* is the iron joist, *b b* the saddle, *c c* the iron strips, *d* the square rod corresponding to *d* in Fig. 9. A section of the saddle is given at *e e*, the strips *f f* passing through slots *g*, made in the end of the saddle, and secured by a pin (*h*). The sketch to the right is an edge view of saddle.

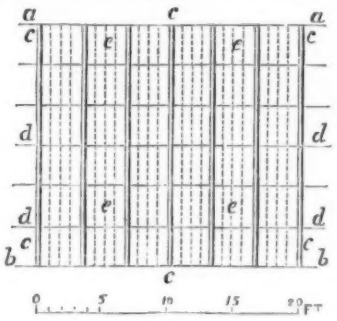


Fig. 4.

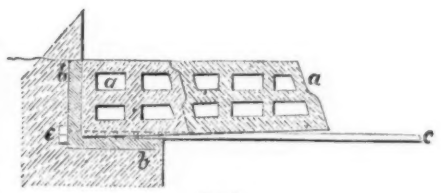


Fig. 5.

Fig. 11 will show the general arrangement of the various parts of this floor, of which simpler modifications may easily be carried out by the farm architect—*a a*, *b b* represent the lines of walls, the space being 18ft. 3in. The iron joists (*c c*) are placed at distances apart of 3ft. The saddle pieces and strips (*d d*) are placed at intervals apart of 3ft., while the square rods (*d*, Fig. 9) represented by the dotted lines in Fig. 11, are placed at intervals of 11ft. each. A very simple and efficient fireproof floor has been recently introduced by Messrs. Bunnett, of Deptford, Kent, in which the flooring material is composed of hollow or cellular bricks, strengthened and supported by iron tie-rods.

In Fig. 12 we illustrate a portion of a flat floor, the upper surface of which may be left as in the drawing, or finished with cemented or boarded floor. The hollow bricks (*a a*) lock into each other on all sides, and being laid to break joint, each brick receives the direct support of six adjoining ones. The last brick at each side rests on a shoe (*b b*) formed of strong angle iron, kept in position by the iron tie-rod *c c*. Floors of this sort can be fitted up with great facility, and at a moderate cost.

Fig. 13 illustrates a fireproof floor and ceiling constructed with Mallet's Buckled Plates, of the principle of formation of which a description is given in the second paragraph from this. In Fig. 13 *a a* are the wrought-iron beams, *b b* the "buckled" plates, *c c* the flooring joists, *d d* the flooring boards.

Partitions may be made of corrugated iron. Where sheds are used, the roofs of which are of corrugated iron, supported by pillars of iron, the sheets of corrugated iron forming the partitions should be stretched between the iron pillars; the pillars being provided on the side next the interior of the shed with snugs (as shown in Fig. 14, on next page) cast on at intervals. The edges of the sheets of corrugated iron are placed in the space *a a* of the snugs, and secured by a bolt passing through holes in the snugs and the plates. The edges of the corrugated plates, where they meet in the interior, should be bolted or rivetted together, and the spaces rusted up.

In place of corrugated iron Mallet's "buckled plates" may be used with great advantage. This is a recent invention of Mr. R. Mallet, the well-known engineer of Dublin, and, from the success which has attended it, is likely to create quite a revolution in the application of wrought-iron to constructive purposes.

The term "buckled plate" has been given to denote the manner in which the surface of any plate of metal, of square, rectangular, or polygonal form, has been curved or arched. The curvature or rise—small in extent—springing from the edges of the plate in all directions towards the centre. The plate may, or may not, have a flat border or margin all round it. A transverse section taken of the plate in any direction shows a curve in it. Such plates, in whatever position they are placed, are capable of resisting enormous pressures. A plate 7ft. by 3ft., ¼-in. thick, and with a rise or curvature of 3in., supported without injury a weight of 17 tons. The principle has been carried out in the construction of fireproof buildings with marked success. The plates are much superior in point of strength to corrugated iron plates, which only resist transverse pressures, and pressures in the line of the corrugations, but do not resist pressure—beyond the mere strength of the plate itself—in a line across these; buckled plates are capable of resisting pressure in all directions.

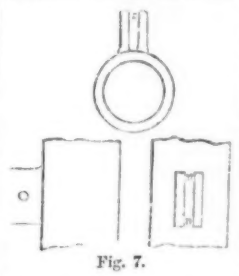


Fig. 7.

Fig. 15 illustrates a buckled plate; *b* is a section through the diagonal *c d*; *e*, a section through *f g*; and *h* a section through *i j*.

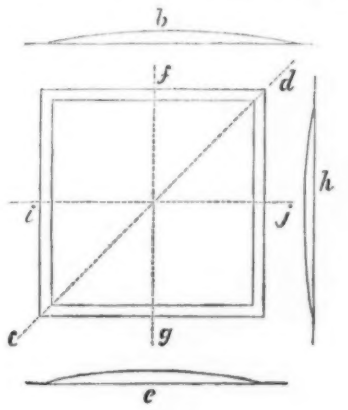


Fig. 8.



Fig. 9.

Fig. 16 illustrates a partition of buckled plates; the spaces *a a* may either be filled up with concrete, some non-conducting material, or left empty. For small spaces, and where no great pressure is anticipated, the simple plates as in Fig. 15 may be used, rivetting them together at the edges or "fillets." The spaces between the pillars or columns of a shed may be filled up with the buckled plates, and with an iron-roof of buckled plates the whole building would be almost absolutely fireproof.

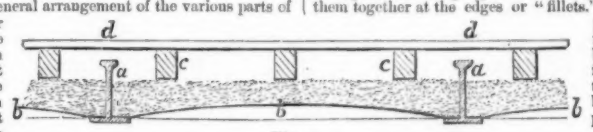


Fig. 6.

BELGIAN ENTERPRISE.—We learn, by advices from Charleroi, that the rolling works of Messrs. De Derdelot Brothers, at Châtelineau, will commence the fabrication of rails this month. Notwithstanding a feeling prevalent in Holland in favour of Belgian rails this establishment did not succeed on the occasion of the adjudication of a recent Dutch contract, in obtaining a preference over an English house, which forwarded a lower tender. Messrs. Evrard and Co., of Brussels, have obtained an order for thirty locomotives and tenders for the Madrid, Saragossa, and Alicante Railway; and have also contracted at Paris for all the iron bridges, locomotives, carriages, trucks, turntables, cranes, and hydraulic apparatus required for a new Russian line in the neighbourhood of the Sea of Azoff. This is the first time a Belgian house has undertaken to execute both the fixed and rolling material of a line of railway.

* For the use of the woodcuts illustrating this article we are indebted to the politeness of our contemporary the *Mark Lane Express*.

SCIENCE EXAMINATIONS AT SOUTH KENSINGTON.

THE Science and Art Department at South Kensington have issued forms containing problems and questions for the examination of candidates for certificates in science. From these forms we select the following:—

Subject I. *Geometrical Drawing.*—Subdivision II. *Mechanical and Machine Drawing.*

Examiner, Professor T. BRADLEY.

MECHANICAL AND MACHINE DRAWING.

N.B.—Where no scale is specified it is left to the candidate's judgment, but in every case he must specify the scale he employs. As ample time is allowed for the drawings the candidate is to make they must be carefully finished, and shaded sufficiently to express the forms. No credit will be given for any drawing not strictly complying with the conditions of the question.

Sections I. and II. refer to the accompanying rough figured sketch (intentionally out of proportion) of a crab or windlass, the candidate to make from it the drawings specified in either of those sections, but not more than three from Sections I. and II., and one only from each of the other sections.

Section I.

1. A front elevation.
2. A side elevation. } Scale, $\frac{1}{4}$.
3. A plan.

Section II.

1. A segment of the wheel, comprising about six teeth and one complete radius. Scale, $\frac{1}{4}$.
2. The pinion, with a side elevation of it.
3. A vertical section of the whole machine perpendicular to the axis of the cylinder.

Section III.

1. Show by a section the double-action pump and valves for a common air-pump.
2. Draw the plan and section of a stage for a microscope, with slow motion adjustments in two directions; the slips to hold down the object-slides to be shown.
3. Draw the plan and section of the compass, and box hung in gimbals in a binnacle. (The "compass" on the card need not be drawn.)

Section IV.

1. Show in skeleton outline, in three of its positions, the grasshopper parallel motion for a marine engine.
2. Draw to its full size the eight-sided nut, with its washers and part of the bolt, for bolting down the cap on the brasses of the paddle-axle of a highly finished marine engine of 400-horse power.
3. Show by a plan and section the solid conical axle, with its socket, collars, flanges, &c., on which a 30-ft. turntable moves. Scale, $\frac{1}{4}$.

Section V.

1. Show the arrangement for reversing the motion of the table of a planing machine or printing press.
2. Show by a plan and elevation, or section, the slide-rest of a lathe for heavy work.
3. Show by an elevation the strike work of an eight-day clock.

Subject I. *Geometrical Drawing.*—Subdivision II. *Mechanical and Machine Drawing.*

Examiner, Professor T. BRADLEY.

MECHANICAL AND MACHINE DRAWING.

Subjects of pencil outline drawings of which two only are to be made by any one candidate.

1. Show some combination of levers by means of which an enormous pressure can be suddenly applied at one point resulting from a moderate force applied at another.
2. A, B, C, representing equal circular disks, show how C can be made to perform 100, and B 10 revolutions, while A makes 1.
3. Show how the action of a clock-weight on the train may be maintained while it is being wound up.
4. Show how two pieces can be so attached that a thin blade may pass entirely through their junction without separating them.
5. Show how the motion of a locomotive is reversed by means of two eccentrics on the axle of the driving wheel, the eccentrics being connected with the ends of a curved bar grooved.
6. Show some combination for producing a very perceptible motion from an imperceptible one, as, for example, in the aneroid barometer or in Daniell's pyrometer.

Whatever detail is shown in these figures must be drawn in a workmanlike manner.

Subject I. *Geometrical Drawing.*—Subdivision III. *Building Construction.*

Examiner, Professor T. BRADLEY.

BUILDING CONSTRUCTION.

Half the ground plan of a double cottage for two families is given; the two cottages to be precisely alike. The building to be two storeys high, the front upper room to be divided into two by a deal framed partition, each room to have a separate entrance, and small sash window, and a small fireplace in two upper rooms.

The ground floor to be 9½ft. high in the clear, floored on joists, 6 × 2½ resting on dwarf walls, the earth to be dug out 2ft. below the under side of the floor, and to be kept dry by open gratings. The walls to be two bricks at foundations, and carried 1ft. below the lowest part of excavated ground, the level of the floor being 15in. above the external ground.

The walls to be one brick thick above the lower storey, carried to the height of 4ft. above the lever of upper flooring boards, which are to be on joists 9 × 3. The roof to be a simple A; tiled, rafters 6 × 2, 18in. apart with tie-beam, but no king-post; strong angle-ties at hips, tiles on battens, all the dwelling rooms to be ceiled, lean-to at back paved with Yorkshire stone, level of pavement 6in. above ground laid on dry brick rubbish, a small copper and sink, window over door.

The drawings specified in Section I. and Section II. are to be made all to the same scale as that of plan. Every drawing to be correct in details and tinted to show the materials, but no candidate to make more than three drawings from these sections, selected at his own pleasure, and only five altogether.

Section I.

1. A front elevation of both cottages.
2. A plan of the upper storey.
3. A cross section on AB (of one cottage only).

Section II.

1. A plan of the roof, to show that over the stairs and the mode of getting entrances to the upper rooms from the landing place.
2. A section on the line CD.
3. A sectional-elevation on EF.

Section III.

1. Give a design for the truss for a roof of 60ft. clear span, rise 20ft., tie-beam scarfed, a gallery down the middle 15ft. broad and 9ft. high, the flooring boards laid on bridging joists carried by the tie-beams, gallery lighted by dormer windows, roof slated on boards with felt covering between, gutters and parapet. Scale, $\frac{1}{16}$.
2. An isometrical projection of the connection of the queen-posts, tie-beams, braces, &c.; the double queen-posts and tie-beams halved together with the braces between; showing the iron ties, stirrups, straps, &c. Scale, $\frac{1}{8}$.
3. The scarfing of the tie-beam shown by plan and elevation, or by one isometrical figure. Scale, $\frac{1}{16}$.

Section IV.

1. Give a plan of a circular angle-turret 7ft. internal diameter with stone walls in segments 10in., 8in., and 6in. thick. An external gallery 18in. wide, with parapet wall 4in. thick, and 4ft. high; floor of the whole 5-in. stone slab in pieces not less than 20ft. area each, dovetailed together; a small stove, two doors and two windows; the whole carried on stone corbels on a corner wall, 3ft. thick. Scale, $\frac{1}{24}$.
2. A section to show the corbels and their jointing and cutting through the door, fireplace, or window. Scale, $\frac{1}{12}$.
3. A drawing of the timbers of the conical roof, with projecting eaves over gallery, roof leaded on boards.

Subject I. *Geometrical Drawing.*—Subdivision III. *Building Construction.*

Examiner, Professor T. BRADLEY.

BUILDING CONSTRUCTION.

Questions to be answered in writing, and subjects for outline drawings in pencil by the candidates for certificates in Building Construction.

N.B.—No candidate to answer more than four questions in writing, nor to make more than four drawings or sketches in illustration of, or in addition to, those answers.

1. State what, in your opinion, was the reason for making the brick in the proportion of 1: 2: 4; and why was it not made twice or more as large as it is made?
2. Give a sketch, to scale, of the bond at the angles of walls of 1; 1½; 2; 2½ bricks thick, respectively.
3. Why is an inverted arch turned under the openings in all large buildings?
4. Give a design for a cornice to a building made of common bricks and tiles.
5. State the constituent materials and their proportions of good mortar, and why are road scrapings with all its impurities allowed instead of clean pit or river sand, formerly insisted on in contracts, and why was sea sand prohibited?
6. Give a drawing, to scale, of one course of the solid masonry of a lighthouse of 25ft. diameter, built on a rock, and exposed to heavy seas and gales.
7. State how you would secure the foundations of a lofty building erected on a clay soil with a dip stratification.
8. Make a section, to scale, of a brick drain 3ft. wide and 5ft. high, and show the fall you think it ought to have.
9. State the reason for mortising the bridging joists into the sides of the girder in floors instead of notching them down on the top.
10. Make a section, to scale ($\frac{1}{12}$), of the timbers of a floor of 35ft. span.
11. State your opinion of the best mode of strengthening a girder 40ft. long and 12in. × 11in.
12. Give a drawing, to scale, of a sash frame with boxings and shutters, linings and architrave, for a good house.

Subject I. *Mechanical Physics.*—Subdivision I. *Theoretical Mechanics.*

Examiner, Rev. B. M. COWIE, M.A.

THEORETICAL MECHANICS.

Section I.

1. If two forces acting on a point are represented by two straight lines in magnitude and direction, and the parallelogram be completed of which these lines are the adjacent sides, show that the diagonal represents the magnitude of the resultant force (assuming that it represents the direction).
2. When several forces given in magnitude and direction act simultaneously upon a point, show how we may most conveniently find out the magnitude and direction of a single force which shall counteract their united effect.
3. Explain the equilibrium of a kite balanced in the air. The forces must be represented by lines drawn in the proper direction through the proper points.

Section II.

1. Find the centre of parallel forces acting on a body, and explain the result when two forces are equal, parallel, and act in opposite directions.
2. Explain the forces acting on a drawer when you are attempting to pull it out by one handle, and it sticks fast.
3. A round table stands on three equidistant legs, and is loaded with a given weight at a given point: how do you find the pressure exerted on the floor by each leg?

Section III.

1. When pulling out a nail with a pair of pincers, explain all the forces which are called into action.
2. Define the centre of gravity, and find that of two spheres touching each other, whose radii are eight inches and three inches respectively, and their densities in the ratio of 5 : 1, the smaller one being the more dense.
3. A cone with its vertex downwards is partly filled with mercury: the depth of the liquid is 6in. and the radius of its surface 4in. If the temperature is raised 100 deg. Fah., find the rise in the centre of gravity (neglecting the expansion of the vessel, and taking the expansion of the mercury in bulk as ·00010415 for each 1 deg. Fah.

Section IV.

1. A rectangular mass of iron rests on an inclined plane: it is on the point of sliding down and also of overturning; its base is 2ft. square, and its height 3·08ft. What is the coefficient of friction?
2. How do we estimate the force exerted by a buttress to support a wall?
3. Enumerate the principle of virtual velocities, and prove it in the case of the lever.

Section V.

1. Define momentum, moving force, and velocity. Enunciate the third law of motion.
2. In uniformly accelerated motion show that the space described from rest varies as the square of the velocity, the force being constant.
3. A body is thrown vertically upwards, with a velocity of 50ft. per second: how many seconds will elapse before it is 100ft. from the ground? Explain the double answer.

Section VI.

1. A body A, moving at the rate of 10ft. per second, meets a body B moving at the rate of 6ft. per second—the mass of A is three times that of B. What is the velocity after impact when the bodies are inelastic?
2. In the previous case if the coefficient of elasticity is ⅓, calculate the motion after impact.
3. A weight of 8 lb. drags one of 2 lb. by a string passing over a fixed pulley: the strings being parallel, find the velocity of the centre of gravity.

Section VII.

1. A pendulum vibrating seconds at the earth's surface is taken down a mine whose depth is one mile: how many vibrations will it make there in 24 hours?
2. A weight of 10 lb. is suspended by a string of 8ft.: when it is whirled round so as to make three complete revolutions in a second, what is the greatest tension which the string has to bear?
3. What is meant by the permanence of the plane of vibration of a pendulum? What remarkable experiment can be performed to show this?

Section VIII.

4. What is the centre of percussion? Show how to find its position in a heavy rod moving about one of its ends.
2. How can a body be made to vibrate in a cycloid?
3. Show how the compound pendulum can be used to find the force of gravity.

Subject II. *Mechanical Physics.*—Subdivision I. *Theoretical Mechanics.*

Examiner, Rev. B. M. COWIE, M.A.

THEORETICAL MECHANICS.

Section I.

1. What is *vis viva?* Show that the amount of work accumulated in a body moving with a given velocity is one-half the *vis viva*.
2. How are the vibrations of thin plates exhibited to the eye? Describe the node lines in some of the simplest instances.
3. What is the form of the curve in which a flexible body will be at rest between two fixed points? Describe it, and mention its principal properties. At what point is the tension greatest?

Section II.

1. Show by mathematical reasoning that the pressures at all points in the same horizontal plane within a fluid at rest must be equal. (The only forces acting being gravity and the pressure of the atmosphere.)
2. Describe an apparatus by which the compressibility of water may be measured.
3. Show that the pressure of a fluid on any surface is proportional to the area of the surface and the depth of the centre of gravity of the surface.

Section III.

1. A ship is floating in fresh water, A is the area of its plane of floatation, it moves into salt water, and the vertical distance between the new and old positions of its plane of floatation is (n) inches. Hence find the weight of the ship, having given the specific gravities of fresh and salt water.
2. A sphere, radius 3in., weighs 50 lb. in vacuo: what force will support it when immersed in water?
3. What is the *metacentre* of a floating body? Show how it is found and explain its use in determining the stability.

Section IV.

1. When water escapes from a small orifice show that the velocity is as the square root of the depth of the orifice below the surface of the fluid.
2. Describe an experiment to show the effect of friction of particles of water in motion, and the lateral exhaustion produced by apertures in pipes filled with moving water.
3. In an open channel where the water flows uniformly at the surface, according to what law does the velocity vary below the surface?

Section V.

1. A piece of wood in vacuo weighs 2 lb.: when connected with a piece of metal (whose weight in vacuo is 3 lb., and in water 2⅔ lb.) the weight of the compound mass in water is 1½ lb.: find the specific gravity of the wood and of the metal.
2. Three globes of the same diameter, and of given specific gravities, are placed in the same straight line. How must they be arranged so that they may balance on the same point of the line in vacuo, and in water?
3. A semicircular tube with its two extremities in the same horizontal line is filled with equal quantities of fluid of different specific gravities: what quantity of the lighter fluid will be expelled before the equilibrium is established?

Section VI.

1. Define mathematically an elastic fluid, and explain the connection between pressure, temperature, and density.
2. How would you measure the pressure of the atmosphere?
3. If a small quantity of air should get into the vacuum of the barometer tube, how would you calculate its effect on the indications of the barometer (its volume being given at the temperature O°C).

Section VII.

1. Define specific heat. How is it measured?
2. Explain clearly why a fall in the barometer should indicate rain, and a rise indicate fair weather.
3. What corrections for temperature are required when you are comparing the indications of a barometer at the base, and at the summit of a mountain?

Subject V. *Mechanical Physics.*—Subdivision II. *Applied Mechanics.*

Examiner, Rev. B. M. COWIE, M.A.

APPLIED MECHANICS.

Section I.

1. Describe and draw the crown wheel escapement, and explain its action.
2. Describe and draw a reversing motion for a planing machine.
3. By what mechanical contrivance can we secure a slow forward motion of the cutter in a shaping machine, with a rapid motion when the cut is accomplished?

Section II.

1. Give a convenient method for reversing the position of the cutter in a planing machine.
2. In wheel-work, if the teeth of the driver have to act upon round projecting pins in the follower, what is the best shape for the teeth?
3. Describe a good parallel motion. Explain the principle of the pantograph, and show how it is applied in parallel motions.

Section III.

1. Describe Watt's steam indicator, and explain clearly how the curve described by the pointer is made use of to measure the work done by the engine.
2. What are the objections to Watt's governor? Show how they are obviated in extreme cases by Siemen's contrivance adapting an epicycle train to a conical pendulum.
3. Describe the snail wheel used in the striking machinery of clocks, and show how it acts in repeaters.

Section IV.

1. Describe the Geneva stop, and show how it is used to prevent overwinding in a watch.
2. Explain the principle of Saxton's differential pulleys.
3. Describe Hook's joint, and find the relative angular velocities of the pieces.

Section V.

1. Explain the different ways in which materials yield to crushing pressure. What is meant by ultimate and proof strength, and working stress?
2. What are the results of experiments on the strength of cast iron columns, solid and hollow?
3. Define unit of work, modulus of a machine. What must be the horse-power of a stationary engine that draws a weight of 150 tons along a level road at the rate of thirty miles an hour?

Section VI.

1. The mean section of a stream is 7ft. by 2ft.; its mean velocity is 30ft. per minute; it has a fall of 20ft.; it is required to raise water to a height of 250ft. by means of a water wheel whose modulus is ·7: how many cubic feet will it raise per minute?
2. A train weighing 90 tons comes to the foot of an incline of 1 in 160, with a velocity of 30 miles an hour, the resistances are 7 lb. per ton, the length of the incline 2 miles, the train has at the top of the incline a velocity of 20 miles per hour; how many units of work have been expended in getting the train up the incline, and through how great a distance would an expenditure of the same number of units have taken the train with a uniform velocity along a horizontal line?

3. When the powder in the bore of a cannon is exploded, the pressure on the end of the bore, and on the shot, are at each instant equal: a shot weighing 6 lb. is fired from a gun free to move and weighing 6 cwt., the velocity with which the shot leaves the gun is 1,000ft. per second: what is the initial velocity of the gun's recoil?

Section VII.

1. A roof has a pitch of 45 deg, the rafters are 40ft. long, the weight of each square foot of roofing is 18 lb.: determine the diameter of the wrought iron tie necessary to hold the feet of the principal rafters with safety, supposing them 10ft. apart. (Take the tenacity of wrought iron bar at 67,200 lb. per square inch.)
2. A mass of earth, the specific gravity of which is 1·7, whose surface is horizontal, presses against a revetment wall whose top is on the level of the ground, and height 20ft., the natural slope of the earth being 45 deg.: show that the pressure of the earth on each foot of the length of the wall is 3,646 lb.
3. A cylindrical log of wood being given, show that the strongest rectangular beam that can be cut out of it is one whose sides are in the proportion of 1: $\sqrt{2}$.

Subject V. *Mechanical Physics.*—Subdivision II. *Applied Mechanics.*

Examiner, Rev. B. M. COWIE, M.A.

APPLIED MECHANICS.

Section I.

1. Find the whole pressure on a conical vessel filled with fluid with its base downwards.
2. Describe Hare's hydrometer, and show how to compare the specific gravities of two fluids by means of it.
3. Describe and explain the action of Appold's centrifugal pump.

Section II.

1. Show how the principle of the syphon is applied to explain the action of intermittent springs.
2. Show how the attraction of the Sun and Moon on the ocean causes the tides, and explain why there is a tide every twelve hours.

Section III.

Describe and explain the action of one of these machines.

1. The moderator lamp.
2. A spring roller blind.
3. A drawbridge.

Section IV.

1. In a musical box describe the mechanical contrivances (1) for making the barrel shift at the end of each tune, and (2) for controlling (1) so as to make it repeat the same tune.
2. Describe hinges that make a door self-closing, and explain carefully their action.
3. Describe a letter weighing machine that shall always point exactly to the stamp to be used.

Section V.

Describe and explain the action of one of the following machines:

1. A sewing machine.
2. A weaver's loom.
3. A saw mill.

Section VI.

1. Describe the process of manufacturing bar iron.
2. Describe the construction of a Bramah's lock.
3. The gates in a lock are to be opened and closed by hydraulic machinery: describe what is required.

Section VII.

Describe and explain the action of one of the following machines:

1. A jack for roasting meat.
2. A windmill for grinding corn.
3. The steam plough.

NEW COMPANIES FORMED IN 1861.

THE *Times* gives the following list of the new companies brought forward in 1861. A considerable proportion of them failed to raise their capital:—

Company.	Capital.	Company.	Capital.
Amman Colliery	£100,000	Montes Aureos Gold	£200,000
Atlas Coal	10,000	Mwyndy Iron	160,000
Asphaltum	200,000	Metropolitan Consumers' Coal	50,000
Bahia Steam	100,000	Metropolitan Rifle Range	60,000
Corsican and Mediterranean Gas	25,000	Mercantile Joint-stock Bank	1,000,000
Commercial Copper Smelting	1,000,000	Metropolitan and Provincial Bank	1,000,000
China and Japan Steam Navigation	300,000	Malta and Mediterranean Gas	60,000
China River Steam	200,000	National Horse Exchange	50,000
Compressed Coal	100,000	National Marine Insurance	1,000,000
Chesterfield and Midland Silkstone Colliery	40,000	National Credit	500,000
Canadian Land and Emigration	250,000	Natal Land	225,000
Cannock Chase and Ogley Land	100,000	Natal Cotton	50,000
Economic Omnibus	50,000	National Boat Building	200,000
Elbe Colliery	15,000	Oriental and General Marine Insurance	1,000,000
East del Rey Mining	75,000	Patent Bituminised Pipe	30,000
General Tramroad	200,000	Patent Waterproof Glue	20,000
General Telegraphic Works	50,000	Patent Screwed Boot and Shoe	40,000
Hindostan (Singhboom) Copper	120,000	Paris Land	100,000
Hafod Lead Mining	50,000	Queensland Cotton	50,000
Indian Carrying	100,000	Rodee Iron	100,000
Liverpool and New Orleans Steam	200,000	River Salado Steam	240,000
Llanmorlais Colliery	20,000	Thames Valley Railway	250,000
London and Burton Brewery	120,000	Staffordshire Potteries Street Railway	20,000
London Suffrance Wharf Company	250,000	Seend Iron	100,000
London and Provincial Discount	250,000	Slate Mountain	30,000
London and Provincial Agricultural	100,000	Trust and Agency of Australasia	500,000
Lambeth Bridge	40,000	Universal Private Telegraph	100,000
		Venezuela Cotton	200,000
		Zamora Tin	12,000

REGENERATION OF BONE.—The Academy of Sciences has received an interesting communication from Dr. Demeaux, on the regeneration of certain bones of the face by the mucous periostic membrane. Our readers know that the larger bones have been successfully renewed by preserving the periosteum, as has been done by Drs. Sédillot, Maissonneuve, and others; but instances were wanting of a similar regeneration of the facial bones. Dr. Demeaux relates the following case:—A young man, aged 22, was in 1855 afflicted with a naso-pharyngian polypus of extraordinary size, which had seriously injured the face, and destroyed a portion of the palate bone on one side, so that the tumour protruded into the cavity of the mouth, being only separated from it by the mucous membrane, which had even been considerably thinned. The tumour was extirpated, and it was then ascertained that a surface of fifteen square millimetres, at least, was wanting in the bone. Six years later Dr. Demeaux met his patient again, and found that the bone had been completely regenerated. The second case stated by Dr. Demeaux is still more curious. In October, 1859, a young soldier of the army of Italy returned to France after a long stay in the military hospitals. He had been hit at Solferino by a musket ball, which had fractured the upper maxillary bone on the left side. On the following day the surgeon had extracted the projectile, a great many splinters of bone of various sizes, three molars, and the portion of maxillary bones in which they were inserted. When this young man was examined by Dr. Demeaux about one-half of the roof of the palate was deprived of its bone, and the mucous periostic membrane was the only separation existing between the nose and the fauces, a circumstance which materially impeded the patient's speech and power of deglutition. In the summer of 1860, when Dr. Demeaux saw him again, the palate, as well as the other missing bone, were found to have been completely regenerated.—*Galignani.*

GREAT RAILWAY SPEED.—The American mails by the Africa, which were landed at Queenstown on Wednesday morning about 8 a.m., left Queenstown by special boat to Cork at 3.40 a.m. A train conveyed them to Dublin, and thence to Kingstown, where a special boat, which had been kept in steam all night, was in readiness to carry them to Holyhead. They left Holyhead by a special engine, which had also been kept in waiting all night, and arrived at Euston-square at 10 minutes before 9 in the morning, having thus accomplished the journey from Queenstown to London in 17 hours and 10 minutes. The distance from Holyhead to London (264 miles) was accomplished in five hours and 43 minutes, including all stops and delays by impediments on the line. This is probably the most extraordinary expressing on record, bearing in mind the fact that the railway company had very short notice of the intentions of the Post-office, and that the ordinary traffic of this important line did not admit of interruption.

THE SHIPPING TRADE. — Messrs. Cunard, Wilson, and Co., of Liverpool, in their annual circular, say:—"Liverpool, Dec. 31.—Reviewing the business of the year in the sales of shipping we estimate the number of vessels sold at 410, equal to 193,821 tons, or about 10 per cent. less than that of 1860. This decrease may to some extent be accounted for by the fact that a number of second-class vessels, familiarly known to shipbuyers as 'timber and cotton ships,' and which periodically traded to the Southern ports of America, have been lost, and that in consequence of the blockade interfering with such employment these have not been replaced. A noticeable feature in a review of the past year is the large amount of United States' vessels sold to British subjects and to foreigners. These, which are included in the above estimate, exceed eighty vessels, amounting to 78,000 tons' British measurement. Of the vessels launched in the North American colonies since the 1st of July last sixty-one, amounting to 42,588 tons, have been classed at Lloyd's, and the majority of these have been disposed of in Liverpool at prices varying from £7 to £8 10s. per ton; but there still remain on sale in this port thirteen new colonial vessels equal to 13,019 tons, the class of which will date from the 1st July, 1862. The total number of sailing vessels of all descriptions now for sale here is seventy-two, amounting to 37,640 tons. Iron ships increase in favour; more have been built in this than in any previous year, and we are glad to notice a marked improvement both in the models and finish of East Coast built vessels. We quote the prices of these vessels, classed twelve years A 1, with a full India outfit, at from £16 to £17 per ton, according to measurement and finish, and we are of opinion that they cannot be built for less without loss to the builder. Steam vessels are in demand, and a large business has been transacted with foreigners. The enormous losses of the year, the requirements of Government, and our increasing coasting traffic, all tend to enhance the value of this description of property. In the face of our complications with the United States and their uncertain issue it is difficult to form an opinion of the prospects of shipping for 1862. Should the present misunderstanding result in war, and the consequent raising of the blockade of the Southern ports by the British naval forces, the transport of cotton stored up by planters will give employment to a large amount of tonnage; but this to a very considerable extent depends upon the ability of our cruisers to keep the sea clear of national vessels and privateers. In any case, however, should affairs become more complicated or hostilities ensue neutral bottoms must have the preference, especially in the case of cargoes intended for distant seas, where our cruisers are comparatively few and scattered. Already the war premium demanded by underwriters is operating injuriously on British shipping engaged in the India and Pacific trades. Should the difficulties between the two nations be satisfactorily arranged, British shipping, though still prohibited from trading to Southern American ports, will be able to carry cargoes at the usual risks only, thereby neutralising the advantages which foreigners would otherwise possess. In the event of the Federal Government continuing its hitherto unsuccessful efforts for the subjugation of the South, and the war promising to be prolonged to an indefinite period, to the vital injury of the trade of foreign nations, the Anglo-French Governments may feel themselves called upon to interfere with a strong hand, and, by an official recognition of the South as a power, compel the cessation of hostilities; but with such uncertainties before us at this particular crisis, and in the absence of definite advices, we regret we cannot but take a somewhat unfavourable view of the prospects of shipping for the ensuing year."

THAMES EMBANKMENT.—A Bill for the Thames Embankment has been printed, and pretty generally circulated during this week; and the plans and sections are deposited with the Clerk of the Peace and other authorities under the standing orders. From these documents we learn the general character and extent of what is now proposed, and which is as follows:—The embankment starts from the lower side of the New Westminster Bridge, ranging with the face of the abutment of the new bridge, and continues in a curved line, following what is generally called Page's line to the back of the first abutment of Waterloo Bridge. It then starts again from the lower side of Waterloo Bridge at the corresponding point, and proceeds in a similar curved line until it terminates abruptly against Blackfriars Bridge, 2¼ chains nearly, or about 100ft. into the river beyond the present wharfs and houses. The embankment is solid throughout, and the projection into the river, in some cases very considerable, is to be filled in by soil taken from the Thames, or otherwise obtained. The height of this new wall from Westminster Bridge to the east side of the Temple is to be 4½ft. above Trinity high-water mark. From that point the embankment ascends rapidly by a steep viaduct to the level of Blackfriars Bridge. This viaduct, we presume, would stand on the level of the embankment, and would be 40ft. above low-water mark. On the surface of the land thus gained there is first to be a public road 190ft. wide from Westminster Bridge to the Temple, where it is to become 70ft. wide only. In addition to this road or street, property is also scheduled for the following new streets—viz., first, an entirely new street from the Banqueting House at Whitehall down to the river; secondly, Whitehall-place is to be continued down to the river, and will form part of an entirely new street between the Strand and the river, terminating at Waterloo Bridge, just opposite the new wing of Somerset House; thirdly, Norfolk-street, Surrey-street, and Arundel-street, are to be made to join the river by a common communication to the new road; and lastly from Blackfriars Bridge a new street is shown from the bridge to the Mansion House, joining also New Cannon-street. This street proceeds first obliquely, and then nearly parallel to the river, avoiding the *Times* office, the Equitable office, and Apothecaries Hall, where it goes off at an obtuse angle, and is continued across New Cannon-street, to the front of the Exchange and the Mansion House. The Bill constitutes a Board for carrying these enormous works into effect, consisting of the chairman and four members of the Metropolitan Board, and two members of that board returned by the Corporation of London, thus forming a board of seven members in all; it empowers the borrowing of one million and a half of money, and gives compulsory powers of purchase, sale, &c., in the usual way. It enables the board to deal with the Chatham and Dover Railway and bridge, but the Hungerford, Blackfriars, Westminster, or Waterloo bridges are not to be interfered with, and the levels appear very embarrassing. Houses may be built on any of the vacant lands, subject to the approbation of the Board of Works, but none are to be built in front of the Temple. The solicitors for the Bill are Baxter, Rose, and Co., and the engineers M'Clean and Stillman. Both these appointments have been matters of some remark, and surprise has been expressed why the solicitors and engineers of the Government, or those of the Office of Works, should not have been entrusted with these preliminaries. The sum provided also appears inadequate for the completion of such an enormous undertaking, and we understand the constitution of the Board is as strongly objected to by the Corporation of London as it is by the Metropolitan Board, and that the public may possibly demand a voice therein. The low-level sewer is but slightly referred to, the only clause relating to its being one empowering and directing the Board to facilitate its construction. —*Observer.*

THE GLASGOW MANUFACTURES.—As to its manufactures Glasgow was early celebrated for its weavers. During the seventeenth century Glasgow plaids had acquired a certain celebrity; and the readers of Sir Walter Scott's exquisite novel of "Rob Roy" will remember how Bailie Nicol Jarvie delighted to dwell on the extraordinary qualifications of his father the deacon. But it was not until the invention of Arkwright had given an impulse to the cotton trade that Glasgow began to excel in that great branch of our national manufacture. The steam engine, too, did good service in the city of its nativity; and, in fact, about the beginning of the present century, the river was covered on both sides with the smoky chimneys and dingy buildings which (to its infinite disgrace) distinguish the genius of our manufacturing industry. After cotton the muslin trade is, perhaps, next in importance. Then we have the Turkey red fabrics, celebrated by Monteith; and after that an infinite variety of soft goods. The chemical works of Glasgow are second to none in Europe. Sulphuric acid, chloride of lime, soda, soap, glass, earthenware, all kinds of pigments, and all sorts of manures are here produced. There are some distilleries and some breweries. In no other city in the British empire, we believe, can there be found a list of manufactures so multifarious. But the most important of all is the manufacture of iron. Glasgow produces upwards of 300,000 tons of pig iron per annum, and support between Gartsherrie, Eglinton, Govan, the Clyde, Dundyvan, and other works, upwards of 150 furnaces.—*Builder.*

RAILWAY TRAVELLING.—Mr. William Hawes had addressed the following letter to the *Society of Arts' Journal*:—Mr. Baker, in his paper on this subject, assumed that constant daily railway travelling produced injurious effects on the health of railway travellers. He also suggested that the injurious effect was less in second-class carriages than in the first-class, and less in third than in second. I will not now stop to inquire whether his view of the cause of the result he affirms be correct, but I hope you will allow me to request that our *Journal* may be used as the means through which facts on this important subject may be collected, and, when collected, compared and analysed for the benefit of the public. The first step in such an inquiry is, to collect facts, and this can only be done efficiently if a large number of railway travellers will be good enough to answer, with care, a series of questions compiled with a view to elicit information on this very interesting question. With your permission I will submit a series of questions to the readers of the *Journal*, and if those whose experience enables them to do so will be good enough to forward their replies to the office of the society, addressed either to the secretary or to me, I will undertake to publish the results in the *Journal*, as soon as my time will permit:—1. Do you travel daily, or nearly so, by railway? 2. How many miles each day? 3. State the hours of travelling and of your meals? 4. For how long a period have you been travelling regularly? 5. Which class do you travel by? 6. Have you found any inconvenience from this regular railway travelling, and, if so, of what nature? 7. Do you sleep while travelling, and, if so, does sleep in a carriage refresh you—as, for instance, in a chair? 8. Do you read, or otherwise employ your time during your journey, or did you do so at one time, and have to give it up?

NORTHERN RAILWAY OF SPAIN.—The construction of this line progresses rapidly. The section from Madrid to the Escurial was opened on the 9th of August last, making the total number of kilometres open for traffic 375 (234 miles), a new section of the line between Miranda on the Ebro and Aksasua, passing by Victoria, will be opened on the 15th of January next, and at the end of April the difficulties at the summit of the Brujula which separates the basin of the Douro from that of the Ebro will be overcome, and the section from San Chidrian to Avila will be completed so far that the Castile branch in the beginning of next year will make the number of kilometres in working 503 (312 miles). The section from the Escurial to Avila will be completed early in 1863, the total length will then be 623 kilometres, which will bring Madrid into direct communication with the richest provinces in the north. The operation of the railways on Madrid has already had the effect of producing considerable trade, and at this moment great progress is manifest in that capital, which bids fair to become one of the most important in Europe. The Northern of Spain Railway will bring to Madrid everything necessary for its improvement, together with an immense traffic, which, even at present, is considerable on the isolated sections. The section from Beasain to San Sebastian and the coast of France will increase the length of the railway early in 1863 to 664 kilometres. In the commencement of 1864 the section from San Sebastian to Irun will be completed. At the same time the Southern of France line will be finished from Bayonne to Irun, thus completing direct railway communication between Paris and Madrid with the exception of a length of 24 kilometres over the Pyrenees.

WORKS ON THE RIVER SHANNON.—On Saturday last the Lord Lieutenant of Ireland received a deputation on the subject of the Shannon works and the drainage of the adjoining districts. It consisted of the following noblemen and gentlemen:—The Marquis of Clanricarde, the Earl of Clancarty, Lord Castlemaine, Lord Crofton, Lord Dunkellin, M.P., Colonel Greville, M.P., Major Ormsby Gore, the O'Connor Don, M.P., Mr. P. O'Brien, M.P., Mr. E. K. Tenison, J.P., Mr. Denis Kelly, J.P., accompanied by Mr. James Lynam, of Raheen, C.E. His Excellency was attended by the Chief Secretary, Sir Thomas Larcom, and Sir Richard Griffith. The Marquis of Clanricarde presented a memorial adopted at a meeting held lately in Athlone, from which it appears that, in pursuance of Acts of Parliament, the sum of £584,000 had been expended on the Shannon works, of which certain baronies with which the memorialists were connected had paid £294,000. But they were prepared to prove that the said works were not duly executed, that the plans were not adhered to, and that in consequence the memorialists are prevented from converting many thousands of acres of bogs and morasses into sound and valuable land. They, therefore, prayed for an immediate and impartial inquiry into the subject, confident that the Treasury and Parliament would not "condemn a large portion of the centre of Ireland to remain in perpetuity a vast swamp, discreditable and injurious to the people and to the Government." Lord Carlisle replied as follows:—"I have desired one or two persons to be here who, I thought, would be well qualified by their acquirements and their experience to supply any explanations that might be desired respecting either what has been done or has not been done. I allude especially to Sir Richard Griffith and Sir Thomas Larcom. It will, however, I presume, be felt that our chief concern is, not to go back to the past, but to see what it would be best to do in the future. Probably one of the main difficulties is to be found in reconciling the somewhat conflicting interests of navigation and drainage. It will be scarcely contested that we ought to annul the whole of what has been done at so vast a cost for the improvement of the navigation. I imagine that when the Shannon Commission Acts were passed, though drainage was not, perhaps, absolutely excluded, the navigation of the river was the primary object in men's minds. On the other hand I apprehend that the creation of railways, though they can hardly be said to follow a parallel course with the stream of the Shannon, may be thought to have modified the urgency of the question of navigation. The problem is, how to do what is most for the benefit of drainage with the least injury to navigation. Another great practical difficulty lies in the almost total want of any fall in the natural bed of the Shannon during very long stretches of its course. It seems, I think, obvious that some trustworthy advice should be called in and brought to bear on the whole subject; and I need hardly say that the Irish Government will put themselves into communication with the Treasury, with the view of seeing what practical measure can be adopted." The subject was discussed by Lords Clancarty and Castlemaine, Colonel Greville, Mr. Tenison, and Major Ormsby Gore. Sir Richard Griffith expressed his concurrence in the expediency of a full inquiry, and stated his conviction that much might easily be done to improve the drainage of the Shannon shores, explaining, at the same time, some of the difficulties which embarrass the operations, in consequence of the character of the river and the small fall, which averages no more than four inches per mile.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

2043. JOHN LIVESEY, New Lenton, Nottingham, "A new textile fabric for embroidery trimmings and other ornamental purposes, and machinery employed in making the fabric into trimmings."—*Petition recorded 16th August*, 1861.

2765. EDMUND SUCKOW and EDWARD HABEL, Manchester, "Improvements in antifriction mechanism for receiving the end thrust of screw propeller and other rotating shafts."—*Petition recorded 20th October*, 1861.

2939. WILLIAM EVANS, Commercial-road East, London, "Improvements in obtaining motive power by machinery."—*Petition recorded 22nd November*, 1861.

2951. VAUGHAN PENDRED, jun., Bully Curron, Kilkenny, Ireland, "Improvements in the construction and materials of surface condensers."—*Petition recorded 25th November*, 1861.

2967. JAMES BROWN, Ribchester-terrace, Bridge-road, Stratford, Essex, "Improvements in fire-bars and furnaces."—*Petition recorded 26th November*, 1861.

3018. JOHN WILLIAM GIBSON, Hammersmith Ironworks, Dublin, "Improvements in ordnance, applicable also to small-arms."—*Petition recorded 30th November*, 1861.

3025. THOMAS WRIGHT GARDENER TREEBY, Westbourne-terrace-villas, Westbourne-square, Paddington, London, "Improvements in machines for boring holes in rocks and other hard substances."

3026. ROBERT ANDERSON RUST, Great Marlborough-street, Westminster, Middlesex, "Improvements in the construction of the cases of pianofortes."

3029. JAMES BURROWS, Wigan, and JOSEPH DOUGAN, Haigh, Lancashire, "Certain improvements in winding or driving drums or pulleys."

3031. GEORGE TOMLINSON BOUSFIELD, Loughborough Park, Brixton, Surrey, "An improved stopper for bottles, decanters, jars, and similar articles."—A communication from William Augustus Shaw, Boston, U.S.

3033. WATSON DUCHEMIN, Charlotte Town, Prince Edward's Island, "Improvements in blocks for hoisting."—*Petitions recorded 3rd December*, 1861.

3035. WILLIAM EDWARD GEDGE, Wellington-street, Strand, London, "Improvements in the manufacture of nose bags and similar articles, and in apparatus connected with such manufacture."—A communication from Felix Loignon and Victor Casse, Passage des Petites Ecuries, Paris.

3037. THOMAS STEAD and WILLIAM HIGHAM, Ashton-under-Lyne, Lancashire, "Improvements in machinery or apparatus for spinning cotton or other fibrous materials."

3039. JAMES EDWARD EOYD, Hither-green, Lewisham, Kent, "Improvements in scythes, scythe handles, and apparatus for connecting the same."

3041. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in pumps."—A communication from Calvin Woodward and George Mills Woodward, New York, U.S.

3043. WILLIAM HENRY BALMAIN, St. Helen's, Lancashire, "Improvements in the manufacture of potash and salts of potash."

3045. ABRAHAM FULLAN and WILLIAM LAKE, New Cross, Surrey, "Improvements in traction and other engines, and in wheels for traction engines and other carriages, and in giving motion to ploughs and other agricultural machines."—*Petitions recorded 4th December*, 1861.

3049. GEORGE WASHINGTON ROBERTSON, Cannon-street, London, "Improvements in machinery for cleaning rice and other grain."

3051. WILLIAM DICKS, Floore, Northampton, "Improvements in pumps."

3053. WILLIAM BUSBY, Newton-le-Willows, near Bedale, Yorkshire, "Improvements in ploughs."—*Petitions recorded 5th December*, 1861.

3057. ADAM WOODWARD, ROBERT WOODWARD, and WILLIAM WOODWARD, Manchester, "Improved arrangements of compound steam engines."

3059. CHARLOTTE CRADDOCK, Orchard-terrace, Kensington, London, "An improved system or method of cutting out ladies' dresses."

3061. EDWIN COLLIER, Aldershot, Hampshire, "Improvements in coverings for the feet and legs."

3063. WILLIAM SMITH, Kettering, Northamptonshire, "Improvements in the construction of horse hoes."

3065. HEINRICH GOTTFRIED SCHRAMM, Rothenburgsort, Hamburgh, "Improvements in rotatory engines and pumps."—Partly a communication from Edouard Rosch, Lindenau, Saxony.—*Petitions recorded 6th December*, 1861.

3069. RICHARD JOLLEY, St. John-street, Smithfield, London, "An improved apparatus for heating, cooling, or drying, infusing, extracting, or absorbing vapours or gases for manufacturing, medical, or domestic purposes, and for preserving liquids and solids, alimentary or otherwise."

3071. DANIEL MAY, Wood-street, London, "An improved method of securing scarfs and similar articles to the neck."

3073. HENRY WILLIAM BRISTOW, Geological Museum, Jermyn-street, London, "Improvements in the manufacture or production of candles."—A communication from Pierre Louis Alexis Boillot, Paris, and Victor François Cochen, Veslay, France.

3075. THOMAS MELLODEW, Oldham, CHARLES WILLIAM KESSELMEYER, Manchester, and JOHN MAYO WORRALL, Salford, Lancashire, "Improvements in dyeing and printing certain descriptions of woven fabrics."—*Petitions recorded 7th December*, 1861.

3081. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improvements in the production of relief designs on metallic surfaces for general printing, gaufering, and embossing purposes."—A communication from François Debons and Theobald Denny, Rue Beauregard, Paris.

3083. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in treating atmospheric air and other elastic fluids for motive power purposes, and in engines and apparatuses to be employed therewith."—A communication from Charles Dickson Archibald, New York, U.S.

3085. STEPHEN WILLIAM SILVER, Bishopsgate-street, London, and HALL PRINGLE, King's-road, Chelsea, Middlesex, "Improvements in shoes for horses and other quadrupeds."

3087. WILLIAM CLARK, Chancery-lane, London, "Improvements in gloves."—A communication from Alfred Alexander Abdon Cressent, Boulevart St. Martin, Paris.—*Petitions recorded 9th December*, 1861.

3089. GOLDSMITH TEAR, Liverpool, "Improvements for facilitating the drying of wet or damaged cotton or wool, or other similar fibrous material."

3091. HENRY SPENCER, Rochdale, Lancashire, "Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous substances."

3093. JOSEPH ANTOINE JEAN REDIER, South-street, Finsbury, London, "Some improvements in pocket-watches."

3094. VICTOR LEON DAGRAN, South-street, Finsbury, London, "Improvements in the method of paving roads and other places."

3095. GEORGE CHARLES LOCK, Liverpool, "Improvements in cinder-sifters."

3097. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in breech-loading cannon."—A communication from John Bryce and Benjamin De Forest, New York, U.S.

3099. DAVID VOGL, Sambrook-court, Basinghall-street, London, "Improvements in garments for gentlemen and ladies' wear."—*Petitions recorded 10th December*, 1861.

3105. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "A new or improved method of treating teazles or thistles to be used in the teazling of cloths and stuffs and otherwise."—A communication from Adolphe André Cohin, Vire, France.—*Petition recorded 11th December*, 1861.

Inventions Protected for Six Months by the Deposit of Complete Specifications.

3190. ORMROD COFFEEN EVANS, Whitton, Twickenham, Middlesex, "Improvements in sewing machines."—*Deposited and recorded 20th December*, 1861.

3197. JOHN REDFERN, Hanley, Staffordshire, "Improved apparatus for raising the temperature of air in order to warm churches, conservatories, houses, and other buildings or places."—*Deposited and recorded 20th December*, 1861.

Patents on which the Stamp Duty of £50 has been Paid

2953. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris.—A communication.—Dated 27th December, 1858.

2992. RICHARD ARCHIBALD BROOMAN, Fleet-street, London.—A communication.—Dated 30th December, 1858.

25. ROBERT TEMPEST and JAMES TOMLINSON, Roach Ironworks, Rochdale, Lancashire.—Dated 3rd January, 1859.

Notices to Proceed.

2035. JOHN THOMAS HUTCHINGS, Charlton, Kent, "An improvement in the construction of tennis and racket bats."—*Petition recorded 15th August*, 1861.

2043. JOHN LIVESEY, New Lenton, Nottinghamshire, "Improvements in textile fabrics for embroidery, trimmings, and other ornamental purposes, and machinery employed in making the fabrics into trimmings."—*Petition recorded 16th August*, 1861.

2057. EDMUND SMALL CATHELS, Shrewsbury, Shropshire, "Improvements in compensating gas-meters."

2058. WILLIAM HENRY SMITH, Philadelphia, U.S., "Improvements in the preparation, application, and manufacture of peat."

2061. THOMAS PEDRICK, Park-place, Brixton, Surrey, "Improvements in obtaining and applying water motive power."—*Petitions recorded 19th August*, 1861.

2066. HANNAH EMES, Adelaide-road, Haverstock-hill, Middlesex, "Improvements in dress fastenings, which are also applicable to other purposes."

2071. JOHN SOMERVILLE, Maidstone, Kent, "Improvements in apparatus for drilling and tapping gas and water mains and pipes, and in preventing leakage therefrom."

2074. RICHARD SYDNEY LAMBERT, White Hall, Clevedon, Somersetshire, "An improved 'skipping dipper' or vessel for removing sugar and other liquids from boiling pans."

2079. JAMES ELLIS, Minories, London, "Improvements in means for sizing corks, or separating the larger from the smaller sized corks."—*Petitions recorded 20th August*, 18 1.

2096. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in the preparation of pulp for paper."—A communication from Jean Françoise Marie de Cassan and Jean Baptiste Meyer, Paris.

2103. THOMAS RICHARDSON, Newcastle-upon-Tyne, and ROBERT IRVINE, Hurlet, Renfrewshire, N.B., "Improvements in the manufacture of paper."—*Petitions recorded 22nd August*, 1861.

2107. AUGUSTUS BRYANT CHILDS, New Oxford-street, London, "Improvements in means to be employed in the dressing or cracking of millstones."—A communication from David Monroe Childs, Rochester, New York, U.S.—*Petition recorded 23rd August*, 1861.

2114. MICHAEL HYAMS, Bath-street, City-road, London, "Improvements in the manufacture of smoking pipes and cigar tubes, and preparing, washing, coating, covering, or otherwise impregnating them with aromatic substances in a solid, liquid, or æriform state."

2115. JEREMIAH DRIVER, Keighley, and JOSEPH JESSOP, Bradford, Yorkshire, "Improvements in means or apparatus employed in washing, wringing, and mangling fabrics, and in the manufacture of part or parts of such apparatus."

2117. JAMES CRANSTON, Birmingham, "Improvements in the construction of conservatories, orchard houses, and other horticultural erections, which improvements are also applicable to the covering of areas, such as are used for drill sheds, markets, railway sheds, colonists' and army huts, and many other similar purposes."—*Petitions recorded 24th August*, 1861.

2136. JEAN BAPTISTE FONDU, Lodelinsart, Belgium, "Improvements in the construction of fire-grates for steam and other boilers, and suitable to all kinds of fires."—*Petition recorded 27th August*, 1861.

2141. JAMES RONALD, Liverpool, "Improvements in machinery for dressing hemp, flax, manilla, and other like long fibrous material."

2146. JAMES DUNCAN, Greenock, Renfrewshire, N.B., "Improvements in the manufacture of sugar, and in the apparatus employed therein; also in the apparatus employed in reburning animal charcoal."—*Petitions recorded 28th August*, 1861.

2148. SAMUEL CORBETT, Park-street Works, Wellington, Shropshire, "Improvements in mills for crushing and grinding mineral and vegetable substances, and for hulling or shelling beans and oats, and other grain and seeds."

2152. PHILIP JEWELL, Bond-street, Brighton, "Improvements in concertinas."—*Petitions recorded 29th August*, 1861.

2156. ROBERT SHAW, Portlaw, County Waterford, Ireland, "Improvements in windlasses, capstans, and other machinery for hoisting and lowering weights."

2166. JAMES BISHOP, Gloucester-street, Camden Town, London, "Improvements in the manufacture or weaving of velvet, or pile fabrics made entirely or partially of silk, and in looms used for that purpose."—*Petitions recorded 30th August*, 1861.

2171. PETER TAYLOR, City-road, Hulme, Manchester, "Improvements in apparatus for removing the sediment from, and preventing incrustation in, steam boilers."—*Petition recorded 31st August*, 1861.

2185. WILLIAM LAKE, Chancery-lane, London, "Improvements in signal apparatus, applicable for the prevention of railway train collisions."—A communication from Antoine Grivel, jun., Boulevart St. Martin, Paris.—*Petition recorded 2nd September*, 1861.

2197. GUSTAV BISCHOF, jun., Swansea, "Improvements in extracting copper and silver from ores containing those metals."—Partly a communication from Dr. Gustav Bischof, sen., Bonn, Prussia.—*Petition recorded 3rd September*, 1861.

2220. THOMAS GREENWOOD, Leeds, Yorkshire, "Improvements in machinery for sawing wood."—*Petition recorded 5th September*, 1861.

2253. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "An improved method of producing mixed-coloured woollen and other threads."—A communication from Stanislas Vigoureux, Reims, France.—*Petition recorded 9th September*, 1861.

2676. JEAN BAPTISTE SCHALKENBACH, Treves, Rhenish Prussia, "A new kind of keyed musical instrument, combining the effects of percussion instruments, or the effect of trumpets and similar instruments, with the effects of ordinary keyed instruments."—*Petition recorded 25th October*, 1861.

2738. WILLIAM JAMES WILLIAMS, Warnford-court, London, "An improved process for correctly transmitting the effect of the main levers in platform scales to the steelyard or weighing beam of platform scales."—*Petition recorded 1st November*, 1861.

2900. GEORGE PARRY, Ebbw Vale Ironworks, Monmouthshire, "Improvements in the manufacture of iron and steel."—*Petition recorded 15th November*, 1861.

2963. GEORGE CLARKE, Gresham-place, Camberwell-lane, Surrey, "An improved fire-escape."—*Petition recorded 25th November*, 1861.

3031. GEORGE TOMLINSON BOUSFIELD, Loughborough Park, Brixton, Surrey, "An improved stopper for bottles, decanters jars, and similar articles."—A communication from William Augustus Shaw, Boston, U.S.—*Petition recorded 3rd December*, 1861.

3036. JAMES HEMINGWAY, Robert Town, Yorkshire, "Improvements in the manufacture and ornamentation of textile fabrics."—*Petition recorded 4th December*, 1861.

3066. JOHN JAMES RUSSELL and BURDETT LAMETON BROWN, Crown Tube Works, Wednesbury, Staffordshire, "Improvements in apparatus used in the manufacture of taper tubes."—*Petition recorded 6th December*, 1861.

3102. HENRY TANNER and WILLIAM PROCTOR, Bristol, Gloucestershire, "Improvements in the method of applying manure to growing crops, and also in the machinery or apparatus to be employed for such purpose."—*Petition recorded 11th December*, 1861.

3191. ORMROD COFFEEN EVANS, Whitton, Twickenham, Middlesex, "Improvements in sewing machines."

3197. JOHN REDFERN, Hanley, Staffordshire. "Improved apparatus for raising the temperature of air in order to warm churches, conservatories, houses, and other buildings or places."—*Petitions recorded 20th December*, 1861.

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

***** Specifications will be forwarded by Mr. Bennett Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.**

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

1524. B. BLACKBURN, *York-buildings, Adelphi, London*, "*Applying oil or lubricating fluid to locomotive and other axle-trees.*"—*Dated 13th June*, 1861.

In this invention the vibration or jolting of a railway carriage in motion is made use of to splash the oil contained in a closed vessel introduced into or forming a compartment of the axle box up to an aperture in the upper part of the vessel or compartment, through which the oil flows out of the vessel, and runs down to the journal beneath. A vibrating spring paddle is sometimes applied near to the bottom of deep vessels to assist in splashing the oil up from the bottom to the aperture in the upper part of the vessel.

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

1505. H. MASON, *Ashton-under-Lyne*, "*Preparing and spinning cotton, &c.*"—*Dated 12th June*, 1861.

This invention relates, First, to an improved stop motion for the drawing frame. The trumpet through which the sliver passes from the drawing rollers to the can or coiler is placed upon pivots and nicely balanced, so that, when the sliver is absent from roller lap, breakage, or other causes, or when a snail or lump is formed, the trumpet falls back, and acts upon a catch or lever in communication with the stop motion, and stops the frame. Secondly, to improvements in rollers with loose bosses working upon fixed spindles, instead of allowing them lateral motion, as hitherto adopted, which has the injurious effect of cutting or wearing into the sides of the bearings. The patentee makes a collar or swell on that part of the spindle next to the cap. The loose boss is countersunk at each end, or has an internal shoulder, the effect being that, if the roller should be set out of line, the bosses will not work outwards towards the cap.

1515. W. E. GEDGE, *Wellington-street, Strand, London*, "*Improved heating apparatus for picking and cleaning substances used in making or manufacturing woven or textile fabrics.*"—*A communication.—Dated 13th June*, 1861.

This apparatus is mounted on a cast iron framing (it may be of wood), and is composed of two cylinders revolving in the same sense, and furnished with teeth; these teeth cross with shorter teeth with which two fixed cylinders are furnished. The two movable cylinders, besides their circular motion, are impelled to a come-and-go movement by means of an eccentric. A grating is so placed as to allow impurities from the wools (or other material) to fall through it into a receiver. An endless cloth motived by a pulley introduces the substances to the cylinders. This apparatus is used in double, so that the operation may be repeated to ensure complete purification.—*Not proceeded with.*

1518. J. KNOWLES, *Bolton-le-Moors*, "*Preparing cotton, &c.*"—*Dated 13th June*, 1861.

This invention is applicable to the lap machines of blowers, scutchers, Derby doublers, and other machines in which a lap of fibrous materials is formed under pressure. It has heretofore been customary to lap the piece of fibrous material on a roller the axle of which is weighted and turned round by the friction of two rollers between which the lap is formed. Now this invention consists in applying one or more additional rollers above the lap, which roller or rollers is or are weighted. The top roller or rollers may be driven by gearing, or not driven, according to the peculiar construction of the machine to which the invention is applied. Another part of the invention consists in an improved mode of applying the side plates or washers to the lap rollers; these washers have trunnions revolving in side bars or levers; the end of each trunnion acts against a handle or tail pin screwed in the bush of the side lever, and, by turning these handles or tail pins, the distance between the side plates or washers is regulated.

1522. S. COOK *and* W. H. HACKING, *Bury*, "*Plaiting or folding woven fabrics.*"—*Dated 13th June*, 1861.

This invention consists in applying to the ordinary folding machines a relieving motion, in order to enable the machine to fold finished fabrics without injury. Each side of the table is attached, by a strap or chain to a quadrant or segment, and then connected to a lever fixed to the ordinary rocking shaft in the centre of the machine, to which shaft a rocking motion is imparted by a rod connected with a revolving crank in the usual manner. When the aforesaid parts are put in motion each end of the table is depressed alternately, and allows the fabric to pass underneath the card rails without contact or friction, and thereby preserves the fabric from fraying or damage, thus enabling fabrics of the finest materials or colours to be folded.

1535. R. W. PITFIELD, *Bolton*, "*Self-acting mules.*"—*Dated 15th June*, 1861.

This invention relates, First, to that part of the self-acting mule known as the fallers, and is designed to prevent the loose winding of the yarn at the upper end of the cop, and the formation of snares caused by too sudden rising of the fallers. The invention consists in the novel application of a wheel or disc to the copping faller shaft, over which passes a strap, chain, band, or clip attached at one end to a spring, the other being connected to a lever having an inclined plane at its opposite end; this is so arranged that, when the fallers are about to rise, the movement of the carriage and the inclined plane lever, coming into contact with a stud or bowl, causes the strap to tighten and break the rotation of the disc or pulley, allowing the fallers to rise at any certain speed required. The Second part of the invention consists in the novel use and application of the well-known differential motion, called the "jack in the box," to the throwing in and out of gear, the scroll governing the running in of the spindle carriage, by means of a sliding rod acting upon the brake of the said differential motion, instead of effecting the same by means of catches, as heretofore employed.

1528. J. SUMMERSCALES, *Keighley, and* M. MASON, *Manchester*, "*Gas singeing apparatus.*"—*Dated 14th June*, 1861.

This invention relates to apparatus for singeing or removing the loose fibre from the surface of textile or other fabrics and yarns by means of a mixture of gas and atmospheric air ignited, which operation is performed by passing or travelling the materials or fabrics over, or otherwise in contact with, a series of gas jets, the gas and air being forced through the burners by a fan, or drawn through by exhausting means, in order to impinge more keenly upon the fabrics or materials.

1531. P. LANGLADE, *Aubusson (Creuse)*, "*Tapestry and other weavings.*"—*Dated 14th June*, 1861.

For the purposes of this invention the patentee employs a loom composed of two beams or rollers, between which the warp is distended. Each roller is furnished with a ratchet wheel, into the teeth of which a click or pawl enters, by means of which the beams are prevented from turning in such manner as to allow the warp to become slack. The harness by which the threads of the warp are crossed is distended between two rollers; on the axis of one of these rollers is an arm, from which a connecting rod passes to an arm on the axis of a treadle, so that, by depressing the treadle, the roller may be rotated, and the threads of the warp thus crossed; the roller is brought back to its first position by means of a spring when the treadle is not held down, and the threads of the warp are thus crossed in the opposite direction. The threads of the warp are divided into a number of equal sets by coloured threads, so that the workman may readily count the threads. In front of the loom are two rollers, between which is distended a sheet of paper, or other material, divided into a number of equal squares, and in each line of squares is marked the number of points for each successive colour for one line of the fabric. And, in order that a workman in weaving may readily follow the pattern, there is placed horizontally across the band a straight rule, along which a pointer slides; to this pointer is attached a cord, the end of which is connected to a pulley, on the axis of which is a ratchet wheel, and to this ratchet wheel motion is given by a click or pawl worked by a treadle; each time the treadle is depressed the pulley is rotated to such an extent as to cause the pointer to move along the rule a distance equal to the length of one division of the pattern. The workman, when commencing the weaving, places the pointer at the left hand end of the rule, so that it points to the first square at the left-hand corner of the first line of the pattern; he then crosses the threads of the warp by depressing the treadle which actuates them, and passes a shuttle containing the colour marked on the first square of the pattern through the crossing of as many threads of the warp as are required by the pattern, the number being marked on the square in addition to the colour. The workman then causes the pointer to move forwards along the rule to the next square by depressing the treadle which moves it, and passes a shuttle of the colour marked on the second square through the crossing of the requisite number of threads of the warp, and so on to the end of the first line of squares of the pattern, a fresh shuttle being used for each successive colour, even if the same colour is used more than once in the same line. The threads of the warp are then crossed in the opposite direction, the pointer is moved back to the left-hand end of the rule, the pattern is moved so as to bring a fresh line under the pointer, and the same operation is repeated. It will be seen by this means that the workman has constantly indicated on the pattern the exact work he has to do. The pattern is prepared by first adapting the design to be executed on a paper covered with square arranged like brickwork, each line of squares corresponding to the threads of the warp to be produced, and the squares are divided by lines into sets to correspond with the sets of warp threads; from this design the pattern is made by marking on the successive squares of each line of the pattern the number of successive squares of the same colour in each line of the paper design. In order to hold the weft threads securely in the fabric the patentee always attaches one thread to another, never introducing a shuttle into the crossing of the warp threads without first passing it around the preceding shuttle thread, by which means the threads will be securely held.

1536. T. KNOWLES *and* P. ALDRED, *Manchester, and* J. HAWORTH, *Salford*, "*Apparatus for raising serrated surfaces on rollers.*"—*Dated 15th June* 1861.

This invention relates especially to the rollers of temples used in weaving fabrics, and consists of a duplex machine with two tools, one at the back and the other at the front, the faces of the said tools having surfaces made to correspond with the design or peculiar form of the serrated surface required on the rollers; the roller and tools being placed in the machine, a revolving motion is given to both the tools and roller, and, as they come in contact the rollers receive the impression from the tools, thus giving or raising the peculiar serrated surface required.—*Not proceeded with.*

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

1501. J. HOPE *and* W. GREENHALGH, *Bedford*, "*Cutting turnips, roots, or other substances.*"—*Dated 12th June*, 1861.

The substance to be cut is, according to this invention, pressed or forced, by means of a piston from a hopper, against a series of knives or plates, arranged so as to cut or form the substance into lengths of a four-sided or other shape or form, and which are afterwards cut transversely by means of rotating blades or cutters, or descending knives, and the turnip or other substance is delivered in pieces somewhat cubical in shape, and of such dimensions as the knives and rotating blades may be adapted to form them. The apparatus is worked by an ordinary description of mechanism arranged and designed for the purpose.—*Not proceeded with.*

1502. W. E. GEDGE, *Wellington-street, Strand, London*, "*Reaping and mowing machines.*"—*A communication.—Dated 12th June*, 1861.

This invention cannot be described without reference to the drawings.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

PRESENT CONDITION OF THE IRON TRADE: *Very Languid: Prospects of Peace well received*—PIG IRON: *Purchases Delayed*—MORE WORKS TO BE RE-OPENED—THE PRELIMINARY MEETING AND TRADE PUFFING—WOLVERHAMPTON CHAMBER OF COMMERCE AND THE BOARD OF TRADE ON THE TRADE WITH FRANCE, &c.—COAL TRADE—GENERAL MANUFACTURING TRADES: *Prospects of Improvement: Unemployed Labour*—BOARD OF TRADE RETURNS FOR NOVEMBER AND THE ELEVEN MONTHS: *Statistics of Metals: Large Decrease to the United States: Increase to France*—IMPORTANT DECISION AFFECTING COLLIERY PROPRIETORS—BURSTING OF THE BIRMINGHAM CANAL INTO A COAL PIT—IRONWORKERS AND THE NATIONAL BEREAVEMENT: *Address of Workmen to the Queen*—SEVERN VALLEY RAILWAY: *Government Inspection of a Portion of the Line*—RAILWAY ACCIDENT AT LICHFIELD—FATAL ACCIDENT AT A BLAST FURNACE.

MANY months have elapsed since the iron trade of South Staffordshire was in so languid a condition as it now is. Only a very small portion of the works of any firm is in operation, and the exceptions are rare in which any of the workmen have employment more than sufficient to provide the barest necessaries of life. Advantage is being taken of this state of things by the masters to make repairs and alterations, for all have confidence that there will not be a continuance of the depression. Nor is the scarcity of orders so much felt as it would be if this were not a period when stocks are usually taken. By the time that this work has been fairly accomplished it is hoped that the present little doubt which hangs over the American question will be removed.

The pacific tendency of the news last to hand had a favourable effect on the minds of those members of the trade who were present yesterday (Thursday) on 'Change in Birmingham, and on the previous day in Wolverhampton, in which latter town a telegram was posted during high change by Mr. Samuel Griffiths, containing a summary of the news by the Africa, which arrived in Queenstown that morning, and the effects of that news upon the London Money Market. Neither in Birmingham, however, nor in Wolverhampton was there any business transacted worthy of mention; nor will there be until it is definitely known what character our future relationship with the Washington Government will assume. The opinion that there will be no war, which was entertained last week, is now very general. Yet the consumers of pigs and the buyers of finished iron will not yet act to any very appreciable extent. A few sales of pigs have been effected, all at last quarter's prices; but the bulk of the sales have to be made. There is more disposition now on the part of finished ironmakers than there was even a few days ago to enter into negotiations for pigs; but those negotiations will, for the greater part, remain open till the Quarterly Meetings. Sales might be effected pretty freely if holders would consent to a reduction upon last quarter's rates—but they will not; and whilst they are prepared to sell now at those rates they argue that if purchases are delayed longer rates will go up. Consumers are, however, quite content to "bide their time." Notwithstanding the existing depression more works are being opened in South Staffordshire. The two Deepfields furnaces that have been out about two years are about to be put in blast by Mr. W. E. Gibbons, a young member of the trade, and a nephew of the well-known pig iron maker of that name in this district. Then the mills and forges that were once connected with the Chillfield furnaces, once worked by Messrs. Riley and Sons, have been taken by Mr. Thomas Rose. Inasmuch as there are no minerals connected with the Deepfields furnaces Mr. Gibbons's venture displays much confidence in the prospects of the future; and the extent of the works which Mr. T. Rose has just added to those before in his possession may fairly lead to a similar encouraging influence. We cannot here omit a little bit of "news" as connected with the Preliminary Meeting last week.

In drawing attention to the present condition and future prospects of the trade, the worthy chairman, Mr. Philip Williams, spoke the manifest sentiments of the numerous body of gentlemen present when, in a tone akin to disgust, he said that things were come to a pretty pass when the iron of a distinguished member of the trade had to be puffed side by side with announcements which bore the well-known empirical stamp.

The following correspondence has taken place between the Wolverhampton Chamber of Commerce and the Board of Trade. The Secretary of the Chamber forwarded the following letter to the Board:—"I am requested, by the Council of this Chamber, to suggest for the consideration of the Board of Trade whether it would not be desirable, in view of the largely increased export to France, under the new treaty, to give the amounts exported separately, in several classes of goods, in which at present that kingdom is included in the general line 'other countries.' The articles of particular interest are cottons and cotton yarns, earthenware, linens, steam engines (under machinery), cast iron, wrought iron, silk manufactures, woollens, and worsted stuffs. No doubt in all these cases the trade with France has hitherto been small, but, judging by the large increase under the head of 'other countries,' it has now, probably, rapidly increased, and it would be a matter of great interest to ascertain the rate of increase. With further reference to my letter of the 19th November I am directed to suggest that it would be convenient if the class of angle iron were separated from that of bars in the revised list of exports." To this the Secretary of the Board replied—"I am directed by the Lords of the Committee of Privy Council for Trade to acknowledge the receipt of your letter of the 20th instant, and, in reply, I am to request that you will inform the Council of the Wolverhampton Chamber of Commerce that the specification of countries in the official returns, both of imports and exports is always carefully considered with a view to revision at the commencement of the year; and in the returns to be published next year the trade with France will receive special attention. I am also directed to state that provision will most probably be made for the separate enumeration of 'angle' iron in the new list of exports."

At the different collieries men are resuming work after the holidays, but the orders in hand are very few.

As with the iron, so also with the general manufacturing trades of Birmingham and Wolverhampton, the orders are worked up, and the proprietors are stock-taking. It has been correctly remarked, that "it will be at least two or three weeks before the country trade begins to stir. In many respects, however, the prospects with regard to the future are much better than they were twelve months ago, the stocks of manufactured goods being low; and we have before us the advantages that must arise from a moderate harvest and good quality in place of the bad yield and worse quality of 1860. There is one other circumstance, too, which must be borne in mind, namely, that traders of every class have been induced to contract all operations; the effect of this must be highly favourable as soon as the springs of trade begin to react." Relative to certain of the heavy trades about Dudley, we may report that the anvil and vice makers are not doing more than half-work, and that the chain makers are said to be even worse off. As may be inferred, there is plenty of unemployed labour in the district, and, if severe weather should set in, there will be numerous applications made to the well-to-do members of society for eleemosynary aid. Already there is a very serious increase in the pauperism both of Birmingham and South Staffordshire. There is much consolation, however, to be derived from the fact that the prospects are favourable to a mild winter; and from the yet more cheering circumstance that trade is sure to stir when confidence in the maintenance of peace with America has been restored. As an instance of this we may mention that there is now in Wolverhampton a firm who are prepared, so soon as peace has been placed beyond doubt, to give out orders of the combined value of £10,000 for the Canada market alone.

The Board of Trade accounts for November show a fall from £10,757,749 to £9,874,762 in the declared value of the exports of British manufactures and produce during the month of November, as compared with the corresponding months of last year, and from £123,714,276 to £115,355,014 in the then expired portion of the year. Machinery, pig iron, and coal, are the only articles which have not figured in the export accounts for much smaller amounts than they did last year; and, if the month of November alone is taken, the sole exceptions to the general diminution among the principal commodities are cast and wrought iron, and silk, worsted, and woollen manufactures. Earthenware and porcelain show a decline, as regards last month, from £109,099 to £71,463, notwithstanding a considerable increase in the exports to India, Australia, and Brazil, the shipments to the United States having diminished about seven-eighths. The chief export business done in glass was in flint articles, the exportations of which was nearly equal in value to that of the corresponding period of last year; but the exports of plate-glass diminished nearly one-third. The total value of the glass exported was £38,129, against £46,664 last year. Hardwares and cutlery show a much less falling off, namely, from £311,918 to £306,359—a decrease confined to the trade with Russia, Australia, South Africa, Canada, and Cuba. It is worthy of remark that there was a slight increase in the exportation of hardwares and cutlery to the United States. Plate, plated wares, jewellery, and watches, to the value of £38,929, were exported against £46,994; but the former amount, we may observe, was in excess of the exports of the corresponding months of 1859. Machinery which, taking the year through, shows an increased exportation, declined in November from £372,541 to £341,585, a diminution confined, however, to steam engines—a branch of manufacture which fell off in its exports nearly one-half last month, notwithstanding the execution of large orders from Spain, and an increased shipment to Australia. Machinery of other kinds shows an increase, which was limited, however, to the demands of France, Holland, India, and Australia. In metals there was a great decline, cast and wrought iron and unwrought tin being the only exceptions, as will be seen from the following table:—

	Month of November.		
	1859.	1860.	1861.
Pig iron	£57,900	£101,575	£77,906
Bar, bolt, and rod iron	168,969	182,134	140,962
Railway iron	168,602	245,926	134,062
Iron wire	17,040	23,752	13,170
Cast iron	46,496	57,106	56,755
Wrought iron	251,851	219,893	240,647
Steel, unwrought	70,723	88,139	59,132
Copper	38,832	42,802	21,607
„ and yellow metal, sheets, and nails	135,627	108,828	94,302
Wrought copper	26,067	16,841	12,979
Brass	13,133	23,894	15,129
Lead	34,926	52,773	39,284
Tin, unwrought	35,279	21,184	24,565
„ plates	84,506	98,324	81,575

Pig-iron, as already stated, shows an increase upon last year as regards the exports of the eleven months ended November 30th; but in the month ended on that day the exports to the United States amounted to only £785 value, against £27,711 in the corresponding period of last year, which sufficiently accounts for the diminution. There was, also, a decline in the exports to France; but the shipments to other countries show an increase. The diminution in bar and rod iron again was due chiefly to the falling off in the American trade, considerable as it was; but there was also a decrease in the exports to Italy, the Hanse Towns, and Australia. There was a slightly increased exportation of railway iron to Russia and Holland, and some large orders were executed for France and Cuba, to which countries no shipments were made in the corresponding period of last year; but the exports to all other countries show a decline, the United States, in particular, having purchased the amount of £2,286 only, against £103,223 last year. The increase in cast iron extended to all countries except Egypt, Australia, and the United States; and that in wrought iron to all except the Hanse Towns and the two last-mentioned countries. The decrease in steel will, of course, continue while hostilities go on in the United States. The decline in unwrought copper was general, and that in copper and yellow metal sheets and nails extended to all countries except the Hanse-towns. There was a sudden and heavy decline in the exports of lead to France, and the shipments to China fell off about three-fourths; but there was an increased exportation to all other countries, and particularly to the United States, to which very little lead had been exported for some months previously, and the entire value of the eleven months' exports being £16,151, against £88,403 in 1860, whilst in November the exports rose suddenly to £14,709, against £12,243 in the corresponding month of last year. There was an increased exportation of tin plates to Australia, but to all other markets a decline.

A case of considerable importance, as affecting colliery proprietors under the winding-up acts, has come before the Master of the Rolls, on an adjourned hearing from Chambers. "The Risca Coal Company" was formed in 1854 for the purpose of working a coal mine in Wales. Upon its formation the company entered into an agreement with Mr. John Russell, the owner of the mine, for the purchase of his interest therein, for the sum of £11,000. The mine was worked until about a year ago, when the company was ordered to be wound up in the usual manner. The list of contributories was very short, comprising not more than six or eight persons whose liability was unquestioned. Four of the alleged contributories are sons-in-law of Mr. Russell, the vendor, to whom there was still due a balance of £35,000 on his purchase money. Mr. Randal Hookey, one of those sons-in-law, held a large number of shares in his own right, in addition to those he held conjointly with his brothers-in-law. Under these circumstances a compromise had been arranged between the official liquidator and Mr. Russell, by virtue of which, in consideration of the reduction by Mr. Russell of his claim to one-half its amount, the official liquidator engaged to release all the sons-in-law from liability as contributories in respect of the shares jointly held by them. Mr. Hookey now objected to this arrangement, upon the ground that Mr. Russell's claim might be considerably reduced without releasing any contributories. After hearing the learned counsel for the parties interested, the Master of the Rolls gave judgment in favour of the proposed arrangement, remarking that, by putting an end to a very expensive litigation, it would necessarily be for the benefit of all persons really interested in the concern.

During the night of Monday week a most serious accident occurred on the Park Head branch of the Birmingham Canal, about a mile from Dudley. At the spot where the accident happened several thick coalpits are being worked by Messrs. Brettle and Cartwright. The mining operations have extended entirely under this branch of the canal, but, from the nature of the supports used to prop up the worked out portions of the pit, no danger was anticipated. On Monday night, however, a fearful crash was heard by some workmen at Messrs. Swindell's furnaces, and, upon hastening to the banks of the canal, they at once saw that the undermined portion had given way. The canal was entirely drained of water for a considerable distance; a large chasm, some yards deep, had opened a passage through which the water had passed into the pit. Such had been the force of the rush of water that one boat, of about thirty tons burthen, laden with limestone, was broken right in two; an iron boat of a similar size was firmly embedded in one of the openings of the chasm, and was a good deal twisted. Fortunately, at the time of the disaster, no work was being carried on in the pits adjoining the canal, or the loss of life must have been fearful.

Of all the addresses of condolence with the Queen on account of the death of the Prince Consort none are of a more gratifying character than one which has just been adopted in Wolverhampton. Conspicuous among the leading ironworks of that district stand the Chillington Company's Works. Here the men have been formed into a literary and educational union. At the first public annual *soirée*, on Monday night, the business commenced with the passing of the following address, which it was resolved should be forwarded to Sir George Grey, the Home Secretary, for presentation to the Queen:—

"May it please your Majesty,

"We, the undersigned officers and members of the Chillington Working Men's Association, beg most respectfully and earnestly to tender our heartfelt sympathy and condolence with our gracious Sovereign in the sad and sudden bereavement she has sustained in the much lamented death of the illustrious Prince Consort, whose honoured name will ever be enshrined in our memories as a 'household word,' in connection with his many virtues and excellent qualities which, on his demise, have excited the homage of a sorrowing people, who have made your Majesty's grief their own.

"We would especially remember his distinguished efforts to promote the welfare of the 'sons and daughters of toil,' by establishing 'model cottages,' while recognising, at the same time, his unwearied applications to all objects for the development of the liberal arts and sciences; but in nothing which his hand and heart adorned do we consider his conduct more conspicuous than the devotedness to your Majesty's person and your royal children.

"We humbly pray, then, that an all-wise and benign Providence may long spare them to tread in the footsteps of their fond and noble sire, and that they may be a comfort to your Majesty in this dark hour of affliction and trial. That the 'God of patience, and consolation, and of hope' may be your friend and supporter under your very severe domestic affliction, is the devout and fervent aspiration of Your Majesty's faithful and loyal subjects,

SAMUEL HILL, President, and others.

Upon the question of the opening of the Severn Valley Railway a Brosely correspondent writes as follows:—"On Friday the looked for visit of the Government Inspector took place. Two large and powerful engines and tenders passed up the line. The inspection was very minute and particular. On the train slowly passing and repassing the various girder bridges in this locality, while the inspector and gentlemen who accompanied him dismounted, and, taking their stand underneath the bridges, accurately ascertained the deflection caused by the passage of these heavy engines. On reaching the Buildmas station, while one of the engines took in a supply of water, the other proceeded up the Wenlock Branch line. On the return from this excursion of inspection both engines proceeded with the inspector to Shrewsbury. In the evening, or rather between seven and eight at night, the return trip was accomplished at a speed not attained during the inspection. The day for opening the whole of the line from Hattleburg to Salop surely cannot now be far distant."

On Thursday morning week a serious accident took place at the London and North Western Railway station, Lichfield, to a passenger train, which had been standing at the station about a quarter of an hour. Some trucks laden with coal ran into the train, completely shattering the last carriage, in the first compartment of which Mr. W. Wright, mercer, of Stafford, was travelling. With great presence of mind, however, he threw himself down and escaped more serious, if not fatal, injuries. A person in the last part of the carriage was not so fortunate, and had to be left at Lichfield.

On Tuesday morning last a singular accident occurred at the blast furnaces belonging to Messrs. Solly and Fletcher, of Willenhall. As is tolerably well known, the ironstone is conveyed to the mouth of the furnace by means of a slanting platform, upon which a man and his barrow of stone or fuel are raised by machinery to the top of the furnaces, in order that he may deposit his load in at the mouth. Whilst a filler was thus engaged on the day named a portion of ironstone fell from his barrow upon two men who were near to the bottom of the incline or slanting stage. On the head of one of these a portion of the ore fell with so much force as to occasion his death in an hour afterwards. The other man has sustained serious injuries, but he is expected to recover.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

NORTHERN MATTERS: *Extraordinary Activity at the Elswick Works: The Coal Trade: The New Plasketts Coalfield: Bedlington Ironworks: Old Newcastle Bridge: Railway Carriage Rates*—MESSRS. HAWKS, CRAWSHAY, AND CO., AND THEIR WORKPEOPLE: *Interesting Proceedings*—STATE OF TRADE AT SHEFFIELD—RAILWAY GOSSIP—THE COTTON SUPPLY QUESTION: *More Hopeful Prospects*—MERSEY DOCKS AND HARBOUR BOARD: *The Coal Trade of the Mersey*—BRITISH ASSOCIATION: *Manchester Meeting*—STATE OF EMPLOYMENT AT MANCHESTER—CLYDE SHIPBUILDING—THE SCOTCH PIG IRON TRADE: *Statistics and Review for* 1861—MONKLAND IRONWORKS *Not to be Stopped.*

WE commence with the north. Whoever else may have reason to complain of diminished business activity, the great Elswick Works cannot do so, for the horrid rumours and anticipations of war which cast such a deep shadow on the departing year have communicated a great impetus to every department of Messrs. Armstrong's operations. So pressing indeed have been the demands upon their time that the *personnel* of the works have had to keep labouring on day and night all through the Christmas holidays, which usually bring a brief respite from toil to every one except railway and gas people, hackney coachmen, and journalists. A huge 300-pounder and forty 40-pounders were last week despatched from Elswick. Business affairs are still spoken of as depressed and dull on Tyneside. Nevertheless, the keen wintry weather has caused a better demand for household coals in the London market, and prices have advanced 3d. per ton. Steam coals have also risen in consequence of a demand experienced for exports. Many of the coking coal collieries are, however, very badly employed, some of them only working half time. The new Plasketts coal field—which will probably augment the traffic on the North British system of railways—promises well, the seam having been reached, and found to be nearly 6ft. thick, and of excellent quality. Messrs. Mounsey and Dixon have entered that portion of the Bedlington Ironworks lately used for the manufacture of malleable iron, and in a circular issued on the subject observe that they are determined to avail themselves of the advantages offered by the position of the works, and to maintain the high character of the Bedlington brand. The old Newcastle Bridge is reported to be in an unsafe and even dangerous condition. The dredging which has been going on for some time below, and the floods from the West, have loosened the piles on which it is built, and there is a prospect of its going the way of its predecessor some of these days. Every flood in the river will shake its foundations, for when the sand and soil around such a structure once begin to wash away, they go rapidly. Mr. Ure, in his report on the general improvement of the Tyne, declared the bridge to be the greatest obstacle which he had to contend with in the whole course of the navigable channel, and recommended its removal as one of the first and most important works which the Tyne Commission should effect. The commission has declined, however, at present to adopt Mr. Ure's suggestions. We make the annexed extract from a circular issued by Mr. Allan, goods manager of the northern division of the North Eastern Railway:—"I beg to inform you that the whole of the railway companies, whose lines are north of the Thames, have decided that, from January 1862, the rates charged for the lower description of traffic, as foreign timber and deals, grain, flour, artificial manures, &c. &c., which have hitherto been applicable to quantities of one ton and upwards, shall be applicable only to loads of not less than two tons; smaller quantities than two tons being charged at somewhat higher rates, or as two tons at the lower rates. Two single tons of the same description of goods, sent at the same time by one consignor to two consignees, at the same station, carriage paid by sender, will be charged as two tons at the lower rate. The reason for this alteration of the minimum weight to be carried at the lower rates is the heavy loss incurred by running a wagon weighing about four tons with a single ton of goods at the low rates hitherto charged."

We announced last week that Messrs. Hawks, Crawshay, and Co. had given a monster dinner party—or rather a congeries of dinner-parties, for upwards of 1,300 persons were entertained at twenty-four different places—to the whole of the men employed in their extensive works at Gateshead. It is interesting to reflect that Mr. Hawks, the founder of these works in 1754, was originally a working blacksmith, as indeed has been the case in some way or another with other eminent mechanical firms. The establishment which the first Mr. Hawks commenced is now the oldest on Tyne-side, and there are more men employed at the Gateshead Iron-works than at any other single establishment in the neighbourhood. The description of work consists chiefly of rolling mills for bar and bolt iron; but extensive contracts have been made with the Government for the supply of chains for war vessels in the service of the Admiralty; and there are also manufactured here Trotman's Porter's anchors, Rogers' anchors, and all kinds of anchors. There are vast fitting and erecting shops for constructing engines for water works, and the establishment is at present finishing one of the finest engines of this description in England for the Hull Water Company. Various descriptions of railway engineering are also executed, and, in short, all kinds of heavy iron-work are conducted by the firm. We have no desire to puff off the interesting festive proceedings which the firm last week so handsomely inaugurated; but, in these days of strikes and class against prejudices, it is interesting to come upon an illustration of the good feeling which in many cases still exists—would that it were universal!—between employer and employed. Mr. Youll, one of the oldest workmen employed by the firm, proposed Mr. George Crawshay's health in the following terms:—"Mr. Crawshay's position as our employer, over a number of years, requires our respect, but his generosity and kindness in his high place to those who are his servants and work-people command our admiration and gratitude. I was born at the Gateshead Ironworks. For sixty-eight years I have stood at the anvils of Hawks, and earned the bread of honesty with cheerfulness, and never worked a day for another master. Still hale and vigorous, I call upon you younger men to respond with heartiness to the health of our good old master, Mr. George Crawshay, of London." Mr. George Crawshay, jun., who presided at this, the central dinner party, responded, and observed that there was scarcely a workman present who had not been thirty years employed at the works. "I think," continued Mr. Crawshay, "that there are a few circumstances which you will all be interested to hear. You know it is only twenty years since the name of Crawshay has been connected with the Gateshead Ironworks, but it is a much longer period since that name has been connected with the iron trade. There are, in fact, some circumstances of an historical nature connected with our family which the present is a proper occasion for mentioning. Before we were known in the North of England the name was known in Wales. My great-grandfather, however, was not a Welshman. He was the son of a small farmer in Yorkshire, and at that period in the history of England when scarcely any development had taken place in her industry he went to London with nothing more than the coat upon his back. He entered the service of an ironmonger, and, at his master's death, he left him his business; and, subsequently, becoming known to capitalists in London, he was sent down to Wales as a proper person to cultivate the mining resources of that district. And what I have now to say is that the original Crawshay—for before that time we are lost in Yorkshire—my great-grandfather was one of the most remarkable men of his period. After a most arduous struggle he succeeded in the enterprise on which he went to Wales, and the consequence was the development of the entire mining riches of that district. He was known in the history of his own times as the 'Iron King,' and was the friend of Pitt. There was no man more respected in the city of London in those days, and it is worth while to go back for a moment to those times. There are now in England hundreds, aye, perhaps thousands, of pounds where there was but one pound before. Since that period steam has been brought into use, and railways invented; steam navigation has been brought into exercise, and this country has gone through a revolution such as has never before happened in the history of man. In these days a name like ours is lost in the infinity of great manufacturing firms which exist in the land; but in those days the man who opened out the district of Wales stood upon an eminence seen by all the world. I recollect the traditions of the family when the 'Iron King' used to drive from home in a coach and four to Wales, all the country turned out to see him, and a commotion was made when he rode down to Bristol to proceed to the works. My great-grandfather was succeeded by his son and by his grandson. The Crawshays followed one another for four generations in the iron trade in Wales, and there they still stand at the head of the trade. My father, after his father's death, not being concerned in the Welsh ironworks, but having spent his youth in them, and being well acquainted with the business, took the opportunity, furnished by a connection by marriage with the late lamented Mr. Stanley, and also by the decease of your former master, Mr. Joseph Hawks, to retire from the works to become the principal proprietor; and in that way, in my own person, in the person of my brother, and I trust it will also be in the persons of our children, a branch of this family continue in the North of England. They pursue the working of iron, by which the family was first known upwards of 100 years ago, and I am sure it is pardonable in me to say I am proud of my descent. . . . It is not necessary for me to tell you anything about the Hawks's. I have been obliged to tell you something about the Crawshays, but you know more about the Hawks's than I do myself. Still a few words may well be put upon record as to that name also. The name of Hawks is a still older name in the iron trade than the name of Crawshay. We are in the fourth generation of workers in iron; the Hawks's are in the fifth. The date of the Gateshead Ironworks is not exactly known, but there are records going back 120 years. The man who founded those works was William Hawks, who worked with his own hands, making claw hammers for joiners, and connected, as I believe, with a still older name than either Hawks or Crawshay, and which may well be mentioned on such an occasion as this—Crowley's Works, at Swalwell. Although there is a proverb that 'two of a trade never agree,' the Hawks's and Crawshays have falsified that proverb. We are of one trade, and we have agreed." At a subsequent period of the evening the chairman proposed the health of Mr. Hosking, engineer-in-chief at the works, observing that when the firm first made Mr. Hosking's aquaintance he was employed by Mr. Robert Stephenson as inspector over them in the erection of the High Level Bridge. The firm were glad to have a conscientious and severe inspector like Mr. Hosking, because their only thought was to do justice to the contract they had undertaken, and the result was, that instead of Mr. Robert Stephenson paying Mr. Hosking for inspecting their operations, it was they who ought to have paid him, because it was in a very great degree owing to Mr. Hosking's supervision that they were enabled to fulfil the contract in the manner in which it was carried out. There was something more to be said in connection with Mr. Hosking and the High Level Bridge. At the time of the completion of the bridge justice required that there should have been some public mention of Mr. Hosking's name. That that was a mere inadvertence, as regarded Mr. Robert Stephenson, he was perfectly confident, for he had himself spoken to him of Mr. Hosking in the very highest terms. The words Mr. Stephenson used, in speaking of Mr. Hosking, were these:—"He is the very best mechanical engineer I ever knew." Let it not be supposed for one moment that in what he was about to say he intended to detract in the smallest degree from the eminent merit of the late Mr. Stephenson; he was only desirous to give his true position to Mr. Hosking. Mr. Hosking responded in suitable terms, and—but we really cannot afford more space to the proceedings, interesting and gratifying as they were.

There is little improvement in Sheffield trade, so long depressed; still the total amount paid for wages on Christmas eve was not more than 10 per cent. below the sum distributed on the corresponding date in 1860. The falling off is mainly among the American firms; but their inactivity has been, to some extent, counteracted by the increased payments of a few firms in the heavy trade.

At the first meeting of the shareholders in the Trent, Ancholme, and Grimsby Railway, held on Saturday at Doncaster, the chairman (the Right. Hon. J. Parker) stated that the erection of the bridge across the Trent at Keadby, under the contract of Messrs. Fairbairn, of Manchester, was being carried out, and by the end of March or in April next great progress would have been made. The line will secure a direct route from the South Yorkshire coalfields to Grimsby, and also open up the Lincolnshire ironstone district. Our readers will have observed that the information communicated in THE ENGINEER last week, with regard to the reported withdrawal of the great coal line promoted by the Eastern Counties from March to Askerne, has proved correct, the bill standing over for the present, probably till that indefinite period known as "one of these days." The Eastern Counties is determined to be the Eastern Counties no longer; when the amalgamation is effected with the Norfolk, Eastern Union, Newmarket, and East Anglian companies, it is coming out as the London and East Coast.

The following table shows the receipts of cotton from Jan. 1 to Dec. 28, 1861. The figures may be taken as substantially the imports of the year:—

	1861.	1860.
American .. ..bags	1,793,396	2,438,236
South American	98,661	99,067
West Indies, Demarara, &c. ..	3,326	1,758
East Indies	981,869	550,663
Egypt, &c.	107,620	110,069
	2,984,872	3,199,793

The new year commences with a stock on hand of 622,000 bales, the adjustments of the weekly estimates on the last day of the year having resulted in an addition of some 90,000 bales. The present actual consumption, both at home and for export, is not likely to exceed 25,000 bales per week, so that there is enough on hand to carry us on to the end of June, and as, during the six months, considerable quantities may be expected to come to hand from India, together with small driblets from other sources, we are inclined to think that there is now comparatively little cause for anxiety on the subject.

At the last meeting of the Mersey Docks and Harbour Board it was agreed to fix the rate of charge for the use of coal-tips at Birkenhead at 2d. per ton. The use of the low level to be free; and a charge of one halfpenny per ton for weighing at either place; and also to lay down an additional line of rails at the coal-yard of Messrs. Battersby and Co., on their agreeing to pay 7½ per cent. on the outlay. Mr. Rankin said a preference in loading would be given, first, to those ships using the tips; next to those using the low level, and requiring the coals to be weighed; and, lastly, to those which only required to load at the low level without the coal being weighed. It was said that the scales would not be much wanted, but he could not help thinking that shipowners would like to know what weight of coal they took on board, and that the charge of a halfpenny per ton, or 50s. per 1,200 tons, would not be objected to. Mr. Smith urged that the Lancashire side of the river should be upon the same footing as Birkenhead as regarded the charge for the use of coal-tips, because if the resolution that day were passed Birkenhead would have an advantage over Liverpool of 1d. a ton. Mr. Boult said the rate of 3d. a ton had been hardly tried as yet; and it should be remembered that that sum was a considerable saving on any other means at present in use for loading ships. He could not see why the rate at Birkenhead should be reduced, and would therefore move that the question be referred back for re-consideration. Mr. Bold said that the charge of 2d. a ton was more than the charge at Newport for similar services; and remembering that the board got 3½d. per ton on the export of coal, the charge now proposed to be made was not unreasonable. The amount transferred from the various warehouses to the general account for the past half-year is £24,500 as compared with £16,400 in the preceding half year.

The Manchester meeting of the British Association appears from a report just issued by the Local Committee to have passed off exceedingly well in a financial point of view. The receipts from members' subscriptions amounted (with £35 14s. 1d. for books sold) to £3,991 14s. 1d. There were 114 new life members, 122 new annual subscribers, 183 old annual, 1,591 associates, and 791 ladies, making a total of 2,801 members. Out of these receipts certain defined expenses having been defrayed a sum of £3,658 9s. 8d. has been paid over to the general treasurer for the use of the Association. The guarantee fund reached £10,503; and the Local Committee called for 30 per cent. upon the amount, in four instalments, thus raising £3,159. Some other small receipts and donations, together with £195 4s. 3d. remaining on hand from 1842 meeting, made the total amount at the disposal of the committee £3,594 4s. 5d. The expenses amounted to £3,481 0s. 5d.

The number of persons working short time at Manchester shows an increase of 2,325, while there is a corresponding decrease in the number on full time. By the last return before us, out of a total of 46,707 operatives, 27,567 were on full time, 12,871 on short time, and 6,269 wholly unemployed.

In connection with Clyde shipbuilding we may state that the new steamship Pladda has made a run from Greenock to Cork, 400 miles, in thirty-two hours. The Pladda was built and engined by Blackwood and Gordon, at their shipbuilding yard, Port-Glasgow, and started in October last, during the severe gales which since that time have prevailed. She has proved herself to be a first-class sea-going vessel, having large carrying capacities, with good speed and very small consumption of fuel. The Pladda is the sixth vessel launched by this firm from their new iron shipbuilding yard during the last year, in which time they have been busily engaged erecting a large iron crane in their yard, alongside their new wet dock, capable of lifting boilers and heavy machinery to the weight of 40 tons. The Livorneo, a screw steamer, launched by Messrs. Connel and Co., at Overnewton, for the Mediterranean trade, is being engined by Messrs. A. and J. Inglis, Whitehall Foundry. Messrs. G. and J. Thomson, of Govan, have launched a fine screw steamer named the Cortes, intended to ply between Cadiz and Havana (Cuba).

The usual annual trade circulars afford valuable information with regard to the state of the Scotch pig iron trade during the past year. Messrs. James Watson and Co. observe:—"The past year has been characterised by disappointment and great distress to almost all classes of the commercial community, ours being no exception; it opened hopefully in the expectation that an early solution of the American difficulty would be effected, and that our successes in China, combined with the fruits of the Commercial Treaty with France, would bring us largely increased orders. These expectations have, to a great extent, been frustrated by the continuance of the American civil war. Prices have been unusually depressed, fluctuating between 47s. and 52s. per ton, according as the chances of peace or war preponderated. The average number of furnaces in blast has been 123, producing 1,050,000 tons. Miners have wrought steadily, and their average wages have been 3s. per day, being 6d. under that of last year. The shipments and railway deliveries during the year have been very satisfactory, being 596,000 tons, or 28,000 tons in excess of those of 1860. There have been shipped, coastwise, 318,000 tons, against 318,000 in 1860, and 316,000 in 1859; foreign, 266,876 tons, against 255,000 in 1860, and 254,000 in 1859. Of which

	Tons. 1861.		Tons. 1860.
France has taken..	61,632	against	50,013
Germany and Holland	94,219	,,	69,469
Russia	876	,,	3,925
Spain and Portugal	13,715	,,	9,934
United States..	34,482	,,	77,632
British America	17,093	,,	15,165
Italy	25,484	,,	15,255

The local consumption is estimated at about 7,000 tons per week, our foundries and malleable iron works being well employed during the first half of the year; now, however, in common with other branches of industry, they complain of orders coming forward too slowly.

Our iron shipbuilding yards have been well filled during the year, 86 vessels having been built, their gross tonnage amounting to 62, 875 tons, and there are now upon the stocks 34 vessels, whose tonnage will amount to 30,350 tons; this result is gratifying, showing larger returns than any year since 1854.

Stocks have increased 106,000 tons during the year, and now amount to 566,000 tons, 380,000 tons being in the hands of makers and 186,000 in the stores of Messrs. Connal.

The average price of pig iron has been 49s. 3d. per ton, being unusually low and unremunerative to the maker. We can only express the hope that an early settlement of the pending American war may give a stimulus to the commercial industry of the world, which is at present so much cramped, and doubt not that iron will be amongst the first to partake in the general prosperity. Messrs. Watson add the following statistics with regard to the furnaces now in and out of blast:—

Works.	Out of Blast.	In Blast.	Built.
Gartsherrie	3 ..	13 ..	16
Calder	2 ..	6 ..	8
Dundyvan	5 ..	3 ..	8
Langloan	0 ..	6 ..	6
Carnbroe	2 ..	4 ..	6
Summerlee	0 ..	8 ..	8
Monkland	1 ..	8 ..	9
Coltness	0 ..	9 ..	9
Omoa	2 ..	2 ..	4
Shotts	2 ..	3 ..	5
Castlehill	3 ..	0 ..	3
Clyde	2 ..	7 ..	9
Govan	2 ..	3 ..	5
Gladsmuir	1 ..	0 ..	1
Glengarnock.. ..	1 ..	8 ..	9
Blair	1 ..	4 ..	5
Eglinton..	0 ..	8 ..	8
Muirkirk	0 ..	3 ..	3
Lugar	4 ..	0 ..	4
Dalmellington ..	1 ..	4 ..	5
Carron	0 ..	4 ..	4
Devon	3 ..	0 ..	3
Forth	3 ..	4 ..	7
Kinniel	0 ..	4 ..	4
Lochgelly	4 ..	0 ..	4
Portland	1 ..	4 ..	5
Nithsdale	3 ..	0 ..	3
Ardeer	0 ..	4 ..	4
Lumphannan	1 ..	0 ..	1
Almondbank.. ..	1 ..	2 ..	3
Wishaw	3 ..	0 ..	3
Total.. ..	51	121	172

They also append the following details with respect to

SHIPMENTS, STOCKS, EXPORTS, DELIVERIES, &c.

Shipped in 1860..	513,345 tons	
,, 1861..	583,932 ,,	
Stock on 1st January, 1861	460,000	
Production in 1861	1,050,000	
		1,510,000
Shipments, Foreign..	242,000	
,, Coastwise	341,000	
Forwarded to England, per rail	13,000	
Consumed in Scotland—		
Foundries	173,000	
Malleable ironworks	175,000	
Stock in Scotland, 1st January, 1862,		
Connal's stores	186,000	
Makers' yards and other stores, including Carron stock, estimated, as usual, at 30,000 tons..	380,000	
		1,510,000

It is stated with regard to the Monkland Ironworks that the creditors who threatened sequestration of the estate of the above company have withdrawn their threat, and there is now every probability that the calamity of the stoppage of the works, and the consequent deprivation of employment to a great many workmen, will be averted.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

	£ s. d.	Dis. p. ct.
IRON, English Bar and Bolt:—		
in London ..... pr tn	5 15 0	3
in Wales ..... ,,	5 0 0	,,
in Liverpool ..... ,,	5 10 0	,,
Staffordshire Bars .. ,,	7 0 0	5
Sheet, Single ,,	8 10 0	,,
Sheet, Double ,,	10 0 0	,,
Hoop ..... ,,	8 0 0	,,
Rod, round ,,	7 0 0	,,
Nail Rod, sq. ,,	7 5 0	,,
SHIPPING IRON, Staffordsh. Bars ,,	7 0 0	2
Sheet, Single .... ,,	8 15 0	,,
Double.... ,,	10 5 0	,,
Hoop..... ,,	8 5 0	,,
Rod, Round..... ,,	7 0 0	,,
Nail Rod, Square. ,,	7 5 0	,,
IRON, Rails, in Wales, cash ,,	5 10 0	nett
,, ,, 6 months ,,	5 10 0	,,
,, Old, to cut up ,,	0 0 0	,,
Railway Chairs, in Wales ,,	4 0 0	,,
,, in Clyde ,,	5 15 0	,,
Pig No. 1, in Clyde .... ,,	2 9 0	,,
3-5ths No. 1 & 2-5ths No. 3. ,,	2 9 0	,,
No. 1, in Wales..... ,,	2 8 9	,,
No. 1, in Tyne and Tees ,,	2 12 0	,,
Ditto, Forge ..... ,,	2 0 0	,,
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom. ,,	3 10 0	,,
Welsh Forge Pig (all Mine), at the Port .. ,,	3 5 0	,,
Acadian Pig, Charcoal.. ,,	7 10 0	,,
Scotch Pig, No. 1, in London ..... ,,	3 0 0	,,

	£ s. d.	Dis. p. ct.
IRON, Swedish, Indian assortments..... pr tn	11 15 0	2½
Russian C C N D to arrive ,,	16 0 0	,,
STEEL, Swedish Keg, ham. ,,	16 0 0	5
Ditto, rolled..... ,,	15 0 0	,,
Faggot..... ,,	17 0 0	,,
SPELTER, on the spot .. ,,	17 5 0	one%
To arrive ..... ,,	17 10 0	,,
Hard, remelted ..... ,,	16 0 0	,,
ZINC, in sheets ..... ,,	24 0 0	5
COPPER, 14lb, 14 to 20 lb. ,,	107 10 0	5
Tough Cake..... ,,	107 10 0	5
Sheathing and Bolts ..pr lb.	0 1 0	,,
Sheets..... ,,	0 1 0	,,
Bottoms..... ,,	0 1 0½	,,
Old ..... ,,	0 0 10	,,
Yellow Metal ..... ,,	0 0 10	,,
South American, nom.. pr tn	109 0 0	,,
Russian..... do. .. ,,	105 0 0	,,
LEAD, British Pig ..... ,,	20 0 0	,,
Spanish ..... ,,	19 10 0	,,
W. B. .. .. ,,	21 0 0	,,
Sheet ..... ,,	21 0 0	,,
TIN, English Block, nom.. ,,	120 0 0	,,
Bar ,,	121 0 0	,,
Refined ,, .. ,,	122 0 0	,,
Foreign Banca ..... ,,	120 0 0	,,
Straits ..... ,,	116 10 0	,,
TIN PLATES, Charcoal, IC..... pr box	1 2 0	,,
Ditto IX ..... ,,	1 15 0	,,
Coke, IC ..... ,,	1 2 0	,,
Ditto IX ..... ,,	1 8 0	,,
Do. at Newport, 1s per box less	—	,,
Do. at L'pool, 6d. ,,	—	,,
CANADA, Plates ..... pr tn	13 0 0	5
QUICKSILVER ..... pr lb	7 0 0	5

RAILS are tolerably firm, at our quotations.

SCOTCH PIG IRON has advanced a little since our last report, and the market closed on the 31st ult. at 49s. cash, and 50s. three months open. The stock on Warrants is 184,000 tons, and there is about the same quantity in makers' yards.

SPELTER.—The nearest price on the spot is £17 to £17 5s., with a dull market. The stock increased 864 tons during the past month, being on the 1st. inst. 6,040 tons.

COPPER.—Very dull of sale.

LEAD.—But little business doing in English or foreign.

TIN.—English in fair demand. Banca is quoted £120, and Straits £116 10s.

TIN PLATES in moderate demand, at 22s. for IC. coke. The shipments to United States continue large.

Jan. 2nd, 1862. MOATH AND CO., 65, Old Broad-street, London.

SCOTCH PIG IRON REPORT.

	s. d.	
No. 1 Gartsherrie	58 3	f.o.b Glasgow.
,, 1 G.M.B.	48 3	,, do.
,, 3 Do.	47 3	,, do.
M. Nos. Do.	47 9	,, do.

WARRANTS.

		s. d.	
3-5ths No. 1 and 2-5ths ,, 3 .. G.M.B.	Cash prompt, ...	49 0	per ton.
	1 mo. open, ...	49 3	do.
	2 mos., ,, ...	49 9	do.
	3 ,, ,, ...	50 0	do.

MANUFACTURED IRON.

	£ s. d.	
Bars, Govan	7 0 0	
,, Common	6 17 6	
Drumpellar, Common	6 17 6	
Do. Best	7 17 6	
Plates and Sheets	9 0 0	to £10.
Rails	7 5 0	
Pipes	5 0 0	
Chairs	4 0 0	

GLASGOW, 31st December, 1861.

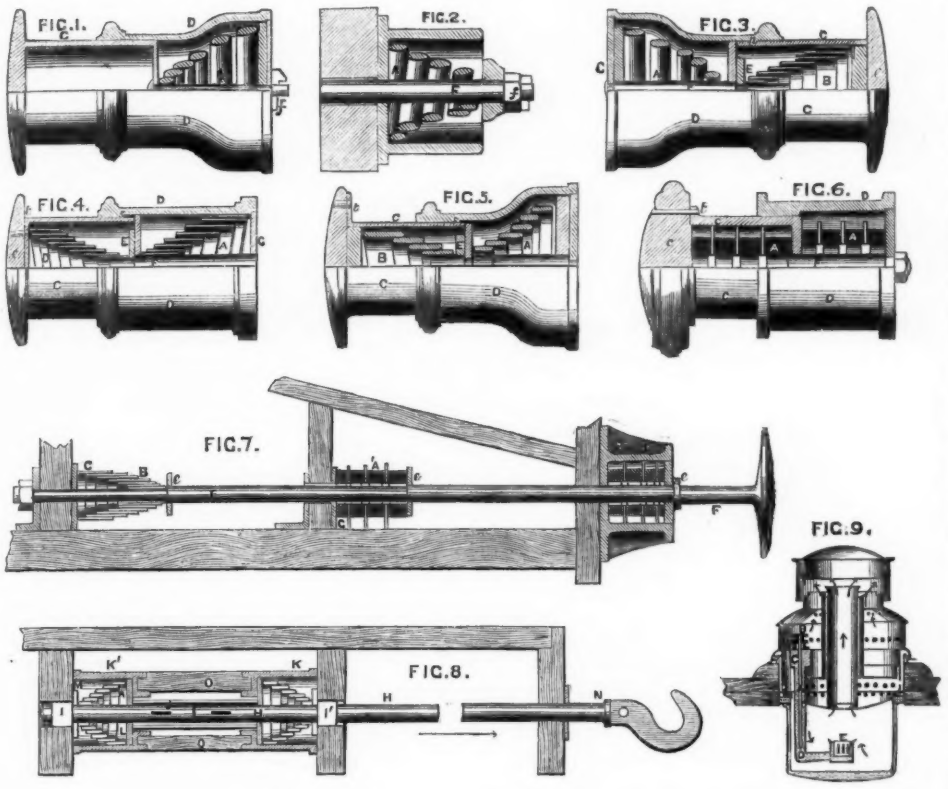
Operations in our market continue very restricted, both for speculation and consumption. The uncertainty as to what may be the result of our demands from the American Government, as well as the indisposition to contract fresh engagements at the end of the year, stopping business.

Exports last week were 8,246 tons, against 8,317 tons in the corresponding week of last year.

SHAW, THOMSON, AND MOORE, Metal Brokers.

BENSON'S WATCHES AND CLOCKS.—"Perfection of mechanism."—*Morning Post.* Gold watches 5 to 100 guineas; silver watches, 2 to 50 guineas. Benson's new Illustrated pamphlet, free for two stamps, descriptive of every construction of watch, enables persons in any part of the world to select, with the greatest certainty, the watch best adapted to their use. Watches sent free by post on the receipt of a remittance. J. W. Benson, 33 and 34, Ludgate-hill, and 46 and 47, Cornhill, London, E.C. Established 1749.—ADV.

RAILWAY BUFFER SPRINGS.



INSTITUTION OF ENGINEERS IN SCOTLAND.

December 11th, 1861.

ON IMPROVED DUPLEX SPRING BUFFERS AND DRAW SPRINGS FOR RAILWAY PLANT.

By Mr. ALEXANDER ALLAN.*

OWING to the increased amount of traffic to be carried over our great iron highways there has arisen the necessity of employing more powerful engines, the working of larger trains, composed of heavier vehicles, at higher velocities, and the performance of marshalling or shunting with greater rapidity; consequently we find a proportionate increase in the wear and tear of all classes of plant, particularly wagon plant, which has to stand very rough usage. Hence arises the necessity of improving and strengthening the stock, with the view of reducing its wear and tear, and of lessening the risk of damage both to plant and goods.

To this end the writer has turned his attention more particularly to the improving of spring buffers and draw springs. From a number of experiments made he found that outside spring buffers, with a stroke of from 3in. to 4in., at present in use for ordinary wagon stock, would stand a pressure of from 2 tons 10 cwt. to 3 tons each, the buffers tested being by various of the best makers; whilst with laminated springs used for buffing purposes the maximum resistance was 3 tons, or 1½ tons on each buffer rod. A spring of the latter description so tested was, between the bearing points. 5ft. 7in. It consisted of twenty plates, 3in. by ⅜in., giving a section in the centre of 7½in. by 3in., an area of 22½in.; and the spring, previously to being tested, had a compass of 15in., the weight named forcing it straight. In other words, the resistance offered by outside or box and plunger buffers may be stated at from five to six tons, and of laminated spring buffers at three tons at each end of a vehicle fitted with these appliances.

In respect of draw bars coupled to laminated springs, as the action is usually limited, the resistance on the average will be about two tons, and with a single conic-volute or rubber spring about three tons, at each end of the vehicle.

The improvements forming the subject of the present paper are confined to box or plunger buffers and long rod buffers, with other than laminated springs and draw-bar springs, unconnected with buffer springs.

The improvements have for object the obtaining of increased action or power in a given space, and the springs to be used may be of any of the well-known varieties of conic-volute springs, of various sections of steel, and with springs of rubber or caoutchouc: or a combination of any of the above named varieties may be employed, the strength, size, and stroke being modified as circumstances require.

Fig. 1 is a section of one of the well-known varieties of outside spring buffers in common use. It will be seen that one conic-volute spring A is used in a cylindrical case D, and it is acted on by a movable plunger C. This plunger is held in position by the bolt F, and cutter *f*; and it will be obvious that the amount of resistance offered by the buffer is equal to the force required to compress the spring A. Fig. 2 is a section of a very common and largely-used variety of draw-bar and spring arrangement. The draw-bar F passes through the spring A, and is secured by a nut *f* and washer *e*. The case D is sometimes used, but this is not essential. In this arrangement of draw-spring the resistance, as in the buffer, is equal to the force required to compress the spring, and it acts only in one direction, another spring being required for the draw-bar of the other end of the wagon. It may be noted that, within the limits usually adopted in practice, it has been found undesirable to increase the thickness of the steel used for the purposes under discussion, as the springs would be more expensive and much more difficult to manufacture, and they would be too rigid and liable to failure. Further, to place two springs, the one acting directly through or upon the other, would give no increase of strength, but the result would be to increase the traverse merely, while the resistance would remain the same. Thus, if two springs, each capable of resisting three tons, with each a travel of four inches, are placed the one over the other, and subjected to pressure, the result will be the same resistance (three tons), with a travel of eight inches as against four inches, if used and tested separately. It, therefore, follows that, to get increased resistance, and still keep within the limits of strength of springs and travel, each spring must be so arranged that it shall have a separate and independent action.

Fig. 3 is a section of a buffer on the improved principle. In this arrangement two springs are used. The second or supplementary spring B is placed within the plunger C; and whilst the first spring A acts between the bottom of the cylinder D and the inner end of the plunger C, the second spring B acts between the front of the plunger C and the collar or washer E, on a central rod or pillar F, formed on or fixed to the cylinder bottom or abutment plate G. In this arrangement (Fig. 3) the buffer head C is welded to the plunger barrel C, and the plunger is held in its place in the cylinder D by means of the ring *p* shrunk on to it after it is entered into the cylinder D.

Figs. 4 and 5 represent buffers which are the same in principle as that shown in Fig. 3, but with a different class of steel springs applied. In both cases the plungers are held in position by the internal flange or collar *s*, and the buffer head *c* is rivetted to the outer flange *t*. The outer flange *t*, Fig. 5, is turned over after the plunger is placed in the case.

Fig. 6 is a section of a modification of the improved buffer, wherein the first and second springs A and B are of rubber or caoutchouc. In this arrangement the plunger is held in position by the collar on the central pillar E which is screwed to the lower abutment plate G.

In all these modifications the resistance offered by each buffer supplied with two springs of three tons power each is exactly the united power of the springs, namely, six tons, or, in other words, twelve tons for each end of the vehicle, or four times the resistance of the ordinary laminated springs.

Fig. 7 is a sectional view showing the improvement as applied to the long-rod buffer. With this class of buffer any convenient number of springs may be applied according to the resistance required. The figure shows three used in combination; and for the purpose of giving the springs independent action each is furnished with a separate fixed abutment plate G, on or against which the springs, A, A^1, B, are placed. The central rod F is then fitted with collars and washers, *c*, *c*, *c*, so that the force required to press the buffer-rod home will be equal to the united power of all the springs used in this manner. In this arrangement two of the springs used are of rubber, the other of steel; but the whole may be of either material, according to preference.

In applying the improvements to draw-bars two or more springs may be used, according to circumstances. In the arrangement shown in section in Fig. 8, two springs are used, and these are made both to act independently of each other, yet with combined power, whichever end draw-bar receives the strain. The draw-bars H, H^1, have collars I, I^1, forged on each at the part where it passes through the mid-beams, and the rods are coupled in the centre of the vehicle by means of the coupling ferrule or tube J. Within the cases K, K^1, are circular wrought-iron washers L, L^1, M, M^1, and these form the bearings of the springs A, A^1. The limit of the stroke is fixed in the drawing at three inches by the collar N on the draw-bar hook. If the drawing strain be in the direction of the arrow it will be seen that the end of the tube J will press against the disc L, and compress the spring A, whilst the collar I will simultaneously press against the disc M, and compress the spring A^1. The resistance will thus be equal to the joint power of both springs; whilst if the force be applied from the other end of the vehicle a similar result will be produced, but in the opposite direction. The pieces of timber O, O, are inserted between the cases so as to reduce the risk of breakage of the latter to a minimum.

ON AN IMPROVED ROOF LAMP FOR RAILWAY CARRIAGES, &c.

By Mr. ALEXANDER ALLAN.

IN the roof lamps generally used for railway carriages the supply of oil is held in suspension above the burner, on the principle of the bird-fountain, the oil reservoir being perfectly air-tight, whilst the atmospheric pressure acts on the surface of the oil in the burner dish. The supply to the burner is consequently irregular and fluctuating, as the burner dish must be exhausted to a small distance below the orifice communicating between it and the reservoir, so as to allow of the passage of air-bubbles into the latter, before the supply can be renewed for feeding the wick. By this means the liquid level in the burner dish is constantly varied, causing an unequally charged wick, variable light, and, by frequently overflowing into the lamp glass below, a waste of the necessary supply of oil required for long journeys. This last is also a great objection, as, besides its unsightly appearance, it serves to dim the light, which, from the other causes mentioned, is perhaps already far from brilliant. This overflow, it may be remarked, arises from two causes; first, from the excessive inflow of air into the reservoir when once the oil has been consumed to the necessary level; and, secondly, from the heat generated in the immediate vicinity of the reservoir, causing an expansion of the air contained within it, and thus forcing down more than the requisite quantity of oil.

The dip pipe-fountain lamp, represented in vertical section in Fig. 9, has been designed by the writer to remedy these defects, by maintaining the oil in the burner dish at a constant and invariable level, and thus insuring the uniform saturation of the wick, and a steady flame under all circumstances. And it is intended in the present paper to describe the extremely simple means by which this is effected, together with some improvements in ventilating the lamp, for the purpose of supplying air to the burner, and for keeping the reservoir cool.

For the first mentioned purpose the writer uses, in connection with the lamp fountain, a pneumatic dip pipe, or tube A, which is inserted through the filling screw B, and descends down the fountain C, and oil tube D, to the level at which it is desired to maintain the oil in the burner dish E. There is a counterpoise in this arrangement between the surface of the oil at the bottom of the dip pipe A, and the surface of the oil in the burner dish E, both parts being subject to the same fluid pressure, and consequently the oil will not rise in the former. Whilst the fountain remains otherwise air-tight the oil may stand in it to any height, and will be disturbed only to the extent of supplying the consumption from the burner dish, but without affecting the equilibrium existing between the burner dish and dip pipe.

Whenever the surface of the oil in the dish E falls below the level of the lower end of the dip pipe A, the surface also falls below the bottom of the dip pipe, and a bubble of air passes from the latter, and rises to the surface of the oil in the fountain, liberating exactly as much as, and no more than will, restore the true level in the dish E; and this action will continue so long as there is waste by burning, and until the oil is exhausted. The top screw B is supplied with a leathern washer, for the purpose of keeping it perfectly air-tight.

The action of the dip pipe fountain will be readily seen by reference to the glass model exhibited. It has been applied by the writer to gas meters, and may be used for other purposes where it is required to maintain an invariable liquid level in any one vessel supplied from another at a higher level.

The general construction of the lamp is arranged with the view of supplying the burner with air, and also of keeping the oil reservoir cool. The air for this purpose is taken by preference from inside the carriage, as by this means the lamp acts as a ventilator. The direction of the various currents will be seen by reference to the arrows in the figure.

A large number of the improved lamps are in use, and give every satisfaction.

THE EXHIBITION BUILDING OF 1862.—Since our last account of the progress of the International Exhibition Building much has been done towards its completion; and, although an enormous deal of work has yet to be accomplished, the whole may be considered to be going on hopefully and satisfactorily. With a very slight exception the entire exterior outline, reserving of course the great domes themselves, may now be examined. The exception is at the west front, looking upon Prince Albert's-road; but this a few days will render complete. A dwarf tower has been added to the north end of this facade just where the annex abuts upon the more permanent brick building: this greatly improves the outline, and somewhat redeems that extreme tendency to flatness and horizontality which we fear the domes, violently opposed as they are to this by their immense height, will render more conspicuous than it is already. The introduction of the tower in question is an acknowledgement of the shortcoming which it is not grand or grave enough thoroughly to remedy. We should be glad to be able to reverse our condemnation of the weak and commonplace dormer windows which have now become actualities at the corners of the building at the junction of the Cromwell-road, with those named after Prince Albert and the first Exhibition respectively. There they are now, in all their poverty and unmeaningness; large staring oval lights brought foward from the bowed roofs of the angle towers so as to break in the most effectual manner the simple mass of the portion of the edifice to which they belong, without adding richness or any boldness of character whatever to its outline. We have no doubt that when the domes are completed the public eye will not be able to endure these unmeaning excrescences, and accordingly a bolder feature, probably real angle towers in the place of the stumpy masses that only break the roof-line feebly, will be introduced. Although the great domes, from their enormous height, will dominate the whole front even in the Cromwell-road, by overlooking all the facade, except where the spectator is almost beneath it, yet there will be points of view whence the long monotonous line of the south front will be almost insupportable. Such breaking of the line as we advocate, whether applied at the angles by the road junctions, or introduced in the centre, either by way of a single central tower or cupola, of form diverse from that of the grander domes; or, what may probably be found best of all, by placing square towers of moderate but sufficient altitude over the wings of the grand central entrance on the south front, will beyond question be of essential service to the *coup-d'œil* of a first impression. As if to make the result of the employment of the dormer windows more unfortunate the very glass that has recently been placed within them is not in an unbroken, effective sheet, as it should obviously be, but is introduced in cross-barred frames, precisely as in ordinary domestic windows.—*Athenæum.*

STEAM ON COMMON ROADS.—A correspondent of the *Mining Journal* gives the following particulars of the performance and economy of traction engines:—"An engine weighing about 12 tons, two cylinders 9in. diameters, 1ft. 6in. stroke, steam 60 lb. pressure, will draw on a level road at 4½ miles per hour 100 tons gross; and at 3 miles per hour, up an inclination of 1 in 10, 80 tons gross, by a consumption of 11 bushels of coal. The cost for 4½ miles, or one hour, is as follows:—

11 bushels of coal	.. ..	11s	0d.
Wages	.. ..	1	6
Oil, grease, &c.	.. ..	0	6
Wear and tear (6d. per mile)	.. ..	2	3
Interest on cost for 1 hour, 6 hours being equal to 1 day for 1 hour, or 80 tons conveyed 4½ miles.		1	3 = 16s. 6d.

Then, on an average road, 80 tons gross, or 50 tons nett, carried 4½ miles costs 16s. 6d., which gives us cost of carrying 1 ton 4½ miles 4d., against 3s. 9d. by horses, taking horse draught at an average of 9d. per ton per mile, showing a reduction of $\frac{1}{11}$9ths, leaving a large margin for the rate of horse draught, if I have put it too high, but as "Young" gives 1s. per ton per mile as the cost, I cannot think I have. By reducing the steam pressure from 60 lb. to 23 lb., and, consequently, the consumption of coal from 11 bushels to 4½ bushels per hour, other expenses remaining unaltered, even this heavy engine may be made to convey 20 tons gross, or 5 tons nett (the load of four horses), for 10s., which makes the cost of carrying 1 ton 4½ miles as 2s., against 3s. 9d. by horses, showing a reduction of $\frac{7}{15}$ths. But by the use of a smaller engine, built for light work, weighing about 5 tons, 6in. cylinder, 12in. stroke, 20 lb. steam pressure, consuming 1½ bushels of coal per hour, and moving at 3 miles per hour, the cost for 3 miles, or one hour, is as follows:—

1½ bushels of coal	.. ..	1s.	6d.
Wages	.. ..	1	6
Oil, grease, &c.	.. ..	0	4
Wear and tear (4d. per mile)	.. ..	1	0
Interest on cost	.. ..	0	8 = 5 0

Then cost of conveying 12 tons gross, or 5 tons nett, 3 miles being 5s., makes the cost of 1 ton carried 3 miles as 1s., against 2s. 3d. by horses, showing a reduction of $\frac{2}{9}$ths in favour of steam over horses. This small engine, by raising the steam pressure from 20 lb. to 80 lb. would take on an average road 40 tons gross. I would also call your correspondent's attention to the advantage of the use of an endless railway, on a principle similar to Boydell's, especially in passing over bad roads, or soft or ploughed ground, as far less injury results from the pressure of the endless railway than from the feet of horses. A draught horse weighs on an average 15 cwt., and the bearing surface of its foot is equal to 15 square inches; when in motion it bears upon two feet only at a time, consequently each square inch of its feet must bear upon the ground with a pressure of 56 lb. The four shoes or bearing surfaces of the endless railway of an engine of 12 tons would be equal to 1,536 square inches, which will give 17½ lb. pressure per square inch of the engine upon the ground, against 56 lb. per square inch of a horse's foot; but supposing that $\frac{2}{3}$ths of the whole weight of the engine is borne by the driving-wheels the greatest pressure of the engine upon the ground is only 21½ lb. per square inch.

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* From the Transactions of the Institution of Engineers in Scotland.

ON ENTERING PRACTICE.

The following is the conclusion of Mr. T. Roger Smith's excellent paper, lately read before the Architectural Association:—

"A business legimately and honourably got together goes on increasing and extending, unless some extraordinary misfortune or failure intervenes, or actual incompetence exists. One founded on success in repeated competitions, that success being based, not on superior merit and skill, but on underhand practices, will have a brilliant and dazzling appearance of success for a few years, and then will collapse, leaving the unfortunate man in solitude, disgrace, and desperation.

"Still, compete. If you are to be the architects of your own fortunes, and are to build those costly and lasting structures in London, you will probably find the foundation as bad as actual builders find the treacherous London clay. Some cartloads of competition drawings, worked up with a fair proportion of miscellaneous disappointments, form the best concrete that I know of to improve this foundation; and, therefore, whenever a big roll of drawings comes back, prepaid or not prepaid, with or without the 'thanks of the committee,' while the columns of the local paper inform you, 'that the design for the town-hall at Pogford Parva which had unanimously been pronounced to be the best, was the one with the motto "Fiat justitia, ruat cælum," and on opening the sealed envelope was found to be by Mr. Jabez Johnson, of Pogford Magna, architect, son to the present mayor of Pogford, and whose brother is the distinguished solicitor and town clerk,' &c. &c. &c. Don't go into a passion, don't write to the newspapers about it, don't even feel unmitigated regret, but hang up the perspective as a bit of wall-paper in your room, kick the other proceeds of a month's anxious toil into the corner with as light a heart as you can, and say, 'Thank goodness there goes another barrowful of concrete to the foundations of my fortune.'

"Does all this sound very formidable? Well, perhaps, it does; and, therefore, let me put what encouragements I can before you, and these are neither few nor light

"Perhaps the greatest comfort is that this is a battle in which, with ordinary powers, opportunities, and advantages, and with sufficient constancy of purpose, you may make sure of winning in the long run; while there is hardly a single personal advantage that you possess, whether of fortune or natural qualities, general education or professional skill, which you may not in some way bring into the field, and which will not in some way help you.

"Then there is constantly the pleasure of overcoming difficulties, and the growth of self-reliance and self-respect; there is the feeling too that your struggles are fitting you for, as well as bringing you nearer to, the position you hope to attain; and, lastly, in each difficulty overcome you have a pledge of your future security, for that which is hardly won is not easily lost.

"The delay while waiting for practice is the heaviest trial attendant upon entering professional life in all its branches; and here an architect has an immense advantage over every other profession that I know of, in being, as I have just observed, able to occupy himself during this delay in a way which directly tends to fill up his time and to improve his skill, while it presents at least a possibility of professional advantage.

"Let me conclude what I have to say on the subject of seeking business by recommending to you as your motto the old proverb, 'Leave no stone unturned.'

"Possibly it will fix this proverb more strongly in your remembrance, and explain exactly the sense in which you are to make use of it if I tell you its reputed origin.

"It appears, then, as an accomplished naturalist has informed me, that the creature who has had the honour of reading to young architects by his own habits the all important lesson that they must 'leave no stone unturned' is none other than one of the tropical baboons, I believe the blue-nosed baboon. This creature's favourite relish is to eat a scorpion for dinner. Now the scorpion lives under flat stones, and leaves no trace behind him to show under which particular stone he is hid. So the baboon in his scorpion hunting expeditions systematically turns over every stone as he comes to it, not passing one by, lest perchance his desired repast should be hidden under that one. Be so good as apply this rule to your opportunities and your acquaintances. Neglect no opportunity that is an opportunity by possibility; leave no friend in ignorance of your being in practice who is possibly a friend, and you will certainly be rewarded by sooner or later meeting with a great success from a most unexpected quarter. Pursue an opposite course and you will be equally certain some day to pass by what might have turned out a good thing, perhaps, the best thing that ever was within your reach.

"Let us now suppose that you have found what you want under some stone or other, and that some one offers you your first professional employment, and by degrees other things come in. So much of your future success will depend upon how you now acquit yourself that I must be excused if I venture to follow you during the first few steps of your professional career.

"In the very few topics which I shall select out of the many which under this division of my subject present themselves, I shall do as I did when considering student life, and shall omit all that relates to soundness of construction, excellence of design, and the method of studying and working out your buildings; not because these material and artistic considerations are of no importance—they are the most important of all—but because they are the very things which, if you learn anything at all, your ordinary studies ought to teach you, and the things which are frequently and most properly pressed on your attention. What I am going to say refers now to matters which you might often omit to notice while a student, and which, yet, you ought to be somewhat aware of when you engage in business on your own account.

"You ought early to take in the exact nature of your position, its responsibilities and risks, its honour and its duties: and with all this you should never lose sight of your own youth and inexperience, and of the comparatively slight hold which you most likely have at starting upon your clients' confidence.

"Let me start, then, by recommending you never to do less than your very best; you cannot do more, but you cannot afford to do less; and this maxim made into a principle of action, both for your student life and your after life, is the only one which is a sure clue to that continual progress without which you cannot even hold your own.

"Settle it in your own mind that though in skill, knowledge, and science you may stand high, your inexperience is your great obstacle, and a source of great danger to you. This want of experience you must make up for by much additional labour, by watchfulness, by forethought, and by occasional recourse to the advice of friends.

"It will be of infinite advantage to you through your practice if you cultivate the habit of constantly saying to yourself "What next?"—that is to say, the habit of forethought; but when you first undertake to carry out a building it becomes absolutely necessary, if you would not forfeit alike your client's confidence and your own chance of success.

"Let me illustrate what I say by a simple instance. Probably you know all about making plans, and your competition experience has enabled you to understand well how to grasp the main idea and details of a subject and embody them in drawings, and you have got on very well thus far.

"Suppose, now, you take the plans to the client one day and he asks you to go to the ground with him, and you find some men, some pegs, some cord, and some long bits of wood, and your client says, 'I thought I should like to see how your building will occupy the ground, and so I got these men up, and all is ready if you will just take out the principal walls; the men do not know much about such a job, but, of course, you do, and they will do as you tell them.'

"Now, suppose (and many a really well-informed young architectural pupil and assistant is so circumstanced) you had never seen a building set out, and had never given it a thought before, the chances are you would not, thus taken aback, hit intuitively upon a neat and rapid way of doing it, even if you got it done at all. Your client will see you are embarrassed, and that you are bungling, and will probably take an unfavourable impression which months may not efface, and which may be a most untrue one; whereas, had you just exercised forethought enough to inform yourself, before it was likely to be wanted, of the method of setting out, a quarter of an hour would have taught you all you needed, and your forethought would have been as good to you as experience.

"It is just the same thing if, instead of your client, it is your builder, and a difficulty is brought, requiring prompt solution, which you might have foreseen by care, but for which you are quite unprepared. You may unguardedly sanction some egregious blunder or some gigantic extra, for many builders' foremen will coolly propose one or the other, or a combination of both to you; and you may get your whole work spoiled through having no experience to exercise, and having failed to exercise that careful forethought which will be as valuable as experience.

"Consider beforehand all points likely to turn up; try to foresee requirements; be prepared as to the tradesmen to recommend and the course to advise; and if you are only careful enough you may manage to think over nearly every point at your leisure, and, if necessary, talk it over with friends, before it actually turns up on the building, so as to have your mind made up when the time comes.

"Let me recommend you great caution as to anything which may lead either yourself or your client into liabilities. This you will often do (if you are not wide awake) very unwittingly, for you are recognised as your client's legal agent, and you may easily make him liable for an expensive bill of quantities, or for any amount of extras without his being aware, while, if he has a large sum of money to pay through your incompetence, he has a legal remedy against you, and will very possibly proceed to make use of it.

"Always, from first to last, and above all things, keep your client as fully and fairly informed as possible of all you are doing for him and in his affairs. You have no right to attempt to keep him in the dark, and above all things you have no right to attempt to do in his name what he would not sanction. Let me here add, for this reason as for several others, that you ought never to run the risk of misleading your client and ruining yourself by guessing at an amount of money for work. Never, under any pressure, name a probable sum, unless you have some pretty reliable grounds for believing you are correct, and then use every possible caution to prevent your estimate from being over-rated as to accuracy. Disregard of this rule will be safe to bring you into trouble; conformity to it will also give you trouble sometimes, but of a less serious kind.

"All clients, as a rule, want more accommodation than they can have for their money, and consequently, as you cannot let them have all their wishes, an unpleasant alternative must at some period or other be placed before them; either they must pay more money or they must do with less in the building.

"By all that is honourable and just let me implore you always to put this alternative before your employers at the earliest moment that you are yourself quite clear about it. Many men habitually wait till it has become no longer an alternative; they get a contract omitting certain works; they get authorisation in that contract to order additions; they do order those additions as extras, and then they present their client with what he wanted indeed, but at a price he had never dreamed of paying. I do not think I need say much to characterise this not infrequent course of procedure, and I have only to add that because a client, so treated, may possibly be wise enough to make the best of a bad bargain and pay both the architect's bill and the builder's, it does not follow that he is not calling his professional adviser a scoundrel, whom he will never employ again, in his heart, and vowing that your whole profession is little better than a den of thieves.

"Again, try to enter into, not to overrule your client's views, so far as he has formed any of the building he requires. And in points where you and he entirely differ, inasmuch as the cause of that difference will be, I presume that you are right and he is wrong (is it not always so?), just go to work, not to oppose him, but to convince him; not to overrule his wish, but to change it. You will succeed much oftener than you suppose, even where at first you think there is no hope. If individuals or committees think well enough of you to entrust you with a work which is to them of importance they will not lightly go against the repeated expression of your own opinion, temperately but decidedly urged.

"Wherever you can adopt the plans your clients propose to you (for you often will have a ground-plan, sometimes a very good one, given you by your employers), and throughout hold yourself bound to fulfil their intentions as far as possible, but on the other hand preserve the most manly independence towards them where necessary. Remember that as architect to a building it is your duty to act impartially between your employer on the one hand and the contractor on the other. Absolutely refuse to permit anything unfair or unjust, and take care not to sanction anything that is unjust to yourself or the other members of the profession, such as, for example, working below the usual commission or under circumstances manifestly unfair to your brethren.

"Remember to be punctilious to a fault in all that affects the honour of the profession; abhor and avoid all commissions, fees, bribes, and other back-door iniquities; and, above all things, never take up work that has been taken out of another professional man's hands, without first yourself personally seeing him and satisfying yourself that all is fair and above board.

"In several particulars the welfare of the profession may be said to be at stake whenever any member of it goes wrong. I hold, therefore, that in your difficulties you have a right to the advice and assistance of almost any of your brethren, certainly of your friends; and I feel sure that any member of this association would readily place at the disposal of any other member, even if a personal stranger, any information or advice he can afford him. Such assistance is especially necessary as to fees and commission, a subject upon which many at commencing practice know little or nothing.

"The best general advice for you as to remuneration is this: recognise that you are likely to have to do more for your money than your elders, but chiefly in the way of making up for want of experience by extra labour, and of doing with your own hands that which in a large office is the work of a clerk, so that you will be paid the same sum for attaining the same result. You ought to stand out for the regular commission on works usually paid for by commission, and the regular fees on works usually paid for by fees. In all other cases you ought to book your time, as a guide to you in arranging your charges; but you ought, I think, to book the time when you are doing principal's work, and that when you are tracing, copying, or running errands for yourself, separately, and money them out at separate rates.

"You will, I hope, keep a good diary, and early commence to keep a simple but sufficient set of books. Provide good forms for certificates, accounts, and all other formal documents, and keep all your transactions as regular in form as possible.

"In dealing with a committee let me advise you to get them to appoint some one person (who will ordinarily be the secretary) through whom alone orders are to be communicated to you, or else you will be liable to get the wishes of single members expressed to you in a way which the committee would not in all cases sanction, and will be in great danger of getting into trouble.

"Some of your first commissions will probably perplex you as to how on earth you are to do them. For instance: you will have, perhaps, been studying the higher branches of your profession, and have started hoping your first work may at least be to restore a parish church, if not a cathedral; when in walks a solicitor, and asks you to make a specification for dilapidations at a public-house in Vinegar-yard, or some such elegant locality; thrusts a lease and a rusty key into your hands, and is off before you have quite gained self-possession enough to remember that you never have done dilapidations in your life. Under such circumstances you may do well to remember a general rule laid down by many people—'never refuse business.' I thoroughly endorse this rule, with the explanation that by business you mean your own business—namely, such as you can honestly undertake; and to honestly undertake business it is not, I think, necessary that at the moment you engage in it you should be personally competent to work out all the details of it so long as you know the general principles of it, and know how it ought to be done. Work that you know less of than this you had better decline, and in work that you only know so well as this you had better get help from those more familiar than yourself with details.

"Try to acquire, before you actually start, some notion of every branch that an architect's practice embraces, and to get a good knowledge of men capable of doing work; and then, I think, you need not refuse any work which you yourself understand, though you cannot execute it, provided you are sure you can get the details perfectly well done for you and under your own eye. As, however, under such circumstances you become personally responsible for another's work, I would advise you always to go through the whole business, every inch of it, with the person you employ, so as to know all that has been done, and to be able to speak to all if you are asked. I would also advise you to get for such services the very best assistance procurable.

"If, however, a commission be proposed to you of which you really understand nothing, so that you would really have to delegate it entirely, take no share in the work, and then be entirely responsible for the results I say at once the less you have to do with it the better.

"Let me advise you, however, as far as possible, whenever you delegate work to delegate responsibility also, and in such cases for some years to come, always regardless of any other consideration, to go to the best sources known. If for instance you have to recommend a surveyor, or a tradesman, &c., let me tell you, harsh as it may seem, that you, as a young man, unknown and untried yourself, cannot afford and ought not to venture to recommend any one except a man of the highest standing, and, having recommended him, leave him to bear the blame or take the credit as the work turns out. The chances are that he will do the work well, and then you will get the credit which you really deserve of recommending a good man; but if he does it badly you can say to your client, and say with truth, 'that man stands at the head of his profession, or of his trade, and I could not do better for you than I did in employing him.'

"This rule applies to builders, gasfitters, hot-water apparatus makers, in fact all tradesmen; and to surveyors, land-surveyors, and clerks of works.

"You as a beginner had better never venture to recommend to a client another beginner, however much you may wish to befriend him, the time for doing that will come as you yourself gain standing, but at first your duty is, alike for the client's sake and your own, to supplement your own inexperience by as much experience and as high a character as possible in the people you recommend.

"I will again advise you in your early works to adhere as much as possible to regular and formal modes of procedure, such as you have seen carried on in offices where you may have been, although you may not be quite aware of the force of such methods. It may save your client from litigation, and you from ruin, if you stand out for having a complete set of drawings and a specification signed before an inch of ground is turned, and if in that specification you embody the best and most complete code of general clauses you can lay hands upon.

"Do not do solicitor's work yourself, and do not do without it. If you get a work to build of some importance have a contract, and resist all your client's endeavours to make you draw it yourself, and if your client will not employ a solicitor, then let the agreement stand upon an interchange of letters, but do not be tempted into thinking you are safe in trying to manufacture a legal document.

"And, lastly, having introduced a mention of the legal profession, let me advise you, if you resort to them in time of peace, to keep clear of them in time of war; keep your client out of law if you possibly can, and exert yourself to the very utmost to keep him not only out of law but out of all other annoyance. Let your foresight, if possible, make provision enough to spare him that terrible infliction—a bill of extras—and let the testimony borne to you at the end of every transaction be that you have been inflexibly upright, that you have proved yourself thoroughly master of your profession, that you have spared no pains, and that you have never lost either your head or your temper.

"I have now but one or two words to add, and I have left them to the very last, because they relate to a subject the most important of anything that has to do with your success in life, and to which, consequently, I wished to assign the crowning position.

"I have told you something of what you must do for yourselves, and I hope that you will all do it, and will, as a consequence, feel a self-respect which shall place you above all meanness, and a self-reliance which shall make you rise superior to all difficulties.

"I have told you something of what your friends must do for you, and I trust you will all experience both the support of your professional brethren and the help of your personal connections, and that the thought of how much you owe to others will make you anxious to be ever helpful to many of those whom you will encounter on your onward path, whom you may, in turn, have an opportunity of helping.

"I should, however, be guilty at once of misleading you, and of failing to express my personal convictions, if I closed here, and led you to believe than any exertions of your own, however able and however active, or any support from your friends, however influential and however zealous, could of themselves suffice to ensure you success in practice or in life. It has not been in my own case, and it will not be in yours, the fact that these efforts, or any efforts such as these, will overrule the many circumstances entirely beyond our control, which may concur to produce or to prevent success, and with regard to which we must seek aid higher than human.

"I have already spoken to you of your architectural fortunes under the figure of a building. Let me, then, conclude by reverting to that figure, and by quoting the words of inspiration—words true, not only of your own house, but of every edifice, the safe completion of which will contribute to your success, namely—'Except the Lord build the house, they labour in vain that build it.'"

Rifled Cannon.—The report of Colonel Harvey Brown, representing the comparative uselessness of his smooth-bore guns as against the rifled guns of the rebels, in the late action at Fort Pickens, will, of course, receive the attention which it demands of the Ordnance Department. It was not necessary, however, to await the result of a battle in order to reach Colonel Brown's conclusions. The theory of the rifle projectile—the perpetual correction of the deviation of the projectile, due to its irregularities of surface and weight, by revolving it on its own axis—proclaims the fact, and all practice establishes the vastly superior range and accuracy of the rifled cannon. But Colonel Brown was fighting at long range. In case of defending such of our harbours as have fortifications within short range of their channels, as at the Narrows, for instance, against an iron-clad enemy, in case of breaching a fort with the guns of our own iron-clad vessels, the service required of ordnance is altogether different. In such cases round shot can be fired with all the accuracy required; living force—smashing power, are the results demanded in close quarters. Now the initial velocity of the rifle shot is but one-half to two-thirds that of the round shot of equal weight, because while the former has not only a small area exposed to the action of the powder, but the immense friction in the grooves of the gun necessary to give it a spinning motion of sometimes 400 revolutions per second, the latter has the greatest practicable area, and hardly any friction at all. And in close quarters the execution of the two are nearly in proportion to their initial velocities. The practice as well as the theory supports this conclusion also. The extensive experiments of Mr. Stevens, at Hoboken, have shown that the sphere, fired from a smooth-bore gun, is the most destructive shape that a given weight of shot can be put into as against iron targets. At the late meeting of the Mechanical Engineers in England the results of experiments to the same end were shown. In the present and most proper demand for rifled cannon, therefore, it is important that the place and power of the smooth-bore should not be overlooked. We cannot tell how soon our forts and fleets may be placed in circumstances where they would willingly dispense with the long reach of the spinning bolt for the *vis viva* of the round ball.—*New York Times.*

AMERICAN STEAMERS.

THE *Scientific American* contains the following notes on shipbuilding and the construction of machinery in New York and vicinity.

The Steamer Po Yang.—Hull built by Messrs. Rosevelt, Joyce, and Co., New York; the machinery was constructed by the Allaire Ironworks, New York; owners, Messrs. Olyphant and Sons, New York; intended service, coast of China.—*Hull:* Length on deck, 220ft.; breadth of beam, moulded, 30ft.; depth of hold to spardeck, 11ft. 6in.; floors, moulded, 14in.; sided, 6in., and the frames are 18in. to 28in. apart at centres; draft of water at load line, 7ft.; tonnage, 956 tons.—*Engines:* Vertical beam; number and diameter of cylinder, one of 50in.; length of stroke of piston, 12ft.—*Boilers:* Two, return tubular, located in hold; they are constructed of the best material, and are of the most durable character.—*Water Wheels:* Diameter over boards, 28ft.; material, iron. This vessel was constructed with extraordinary strength, her material being live oak, chesnut, &c. She is fastened with copper and treenails, and around her frames, iron straps, diagonal and double laid, 3½in. by ⅝in. are placed, making them very secure. Her rig is that of a fore topsail schooner; her bunkers are of wood, and she has an inclosed forecastle, but no sponsors under water wheel guards; she has two water-tight bulkheads, an independent steam fire and bilge, and the ordinary bilge injections. The whole construction of the Po-Yang is highly creditable to the skill of Messrs. Rosevelt, Joyce, and Co., and gives great satisfaction to her owners.

The Steamer Continental.—Hull built by Messrs. J. Sneden and Co., Greenpoint; the machinery was constructed by the Morgan Ironworks, New York; owners, New York and New Haven Steamboat Company; intended service, New York to New Haven.—*Hull:* Length on decks, 282ft. 6in.; breadth of beam, moulded, 35ft. 8in.; depth of hold, 11ft. 5in.; floors, moulded, 6in., sided, 12in., and her frames are 24in. apart at centres; draught of water at load-line 6ft. 6in.; tonnage, 1,130 tons.—*Engines:* Vertical beam, number and diameter of cylinders, one of 70in.; length of stroke of piston, 11ft.—*Boilers:* Two, tubular, located on guards, and have one blower to each.—*Water Wheels:* Diameter over boards. 34ft.; number of blades, thirty-two; material, wood.

The Steamer Constitution.—Hull built by Mr. William H. Webb, New York; the machinery was constructed by the Novelty Ironworks, New York; owners, Pacific Mail Steamship Company; superintendent of construction, Captain Francis Skiddy; commander, A. T. Fletcher; intended service, San Francisco to Panama.—*Hull:* Length on deck, 338ft.; length over all, 364ft. 6in.; breadth of beam, moulded, 44ft.; depth of hold, 23ft. 6in.; depth of hold to spar deck, 31ft. 6in.; floors, moulded, 15in., sided, 1sin.; and the frames are 36in. apart at centres. These frames are fitted in solid, and have iron straps, diagonal and double laid, 4½in. by ⅞in., running around them, securing them in the best possible manner; draught of water at load line, 20ft.; rig, brig; tonnage, 3,446 tons.—*Engines:* Vertical beam; number and diameter of cylinders, one of 105 inches; length of stroke of piston, 12ft.—*Boilers:* Four, return flue; length, 32ft. 4in.; breadth, 13ft. 3in.; height, 14ft. There are, in addition to these, four single return boilers, each being 3ft. 4in. in breadth.—*Water Wheels:* Diameter over board, 40ft.; material, iron. This vessel is built of live oak, chesnut, hacmetac, &c. She embraces all the modern improvements for securing great strength, safety, and comfort. She was intended for the service, as mentioned above, but owing to her great capacity, and her moderate draught of water when loaded, she was looked upon as a desirable steamer for transport service, and chartered by the National Government.

The Steamer Stars and Stripes.—Hull built by Mr. C. Mallory, Mystic, Conn.; the machinery was constructed by Mr. C. H. Delamater, New York; owners, New Haven Propeller Company; intended service, New York to New Haven.—*Hull:* Length on deck, 150ft. 6in.; breadth of beam, moulded, 34ft. 6in.; depth of hold, 8ft.; frames are securely fastened and strapped with iron braces diagonal and double laid; draught of water at load line, 9ft.; rig, three-masted schooner; tonnage, 410 tons.—*Engines:* Vertical direct, number and diameter of cylinders, two of 26in.; length of stroke of piston, 2ft. 6in.—*Boiler:* One, return tubular, located in hold, and uses a blower.—*Propeller:* Diameter, 9ft.; material, cast iron. This vessel is constructed of white oak, chesnut, &c., and put together in a masterly manner. She was intended for the service as above mentioned, but upon her completion she was purchased by the National Government, and is now doing excellent blockading duty upon the southern coast.

The Gunboats Unadilla, Seneca, Ottawa, Pembina, Chippewa, and Winona.—Hulls constructed by Mr. John Englis, New York; Mr. Jeremiah Simonson, Greenpoint, L. I.; Messrs. Jacob Westervelt and Sons, New York; Mr. Thomas Stack, Williamsburgh, L. I.; Messrs. Webb and Bell, Greenpoint, L. I.; and Messrs. Poillon and Co., New York; the machinery was constructed by the Novelty Ironworks, Morgan Ironworks, and Allaire Ironworks, New York; owners, United States Government.—*Hulls:* Length of the load line from foreside of the rabbet of the stem to the aft side of the forward sternpost, 158ft.; breadth of beam, extreme, 28ft.; depth of hold, from inside of floor timbers to under side of deck plank, amidships, 12ft.; frames of young white oak of the best quality; floor and first futtocks, sided, 8in. to 10in.; the remaining futtocks are sided, 7in. to 7½in.; and the top timbers and stanchions, sided, 6½in.; throat of floors amidships, 12in.; moulding size at the turn of bilge, 9½in., and at the plankshear, 5½in.; the timbers of the frames are close together, and each scarf is bolted with three iron bolts, ⅞in. in diameter, and care was taken that the bolts were clear of the lodge knee and waterway bolts; the stanchions forming the sides of the ports are of locust and live oak, being sided 1in. more than the other stanchions, and between the ports the stanchion of every other frame runs up to the rail; keel of white oak of the best quality, sided, 13in., depth, 10in.; the thickness of the garboard stroke is 6in., and the lower side of the main keel runs below it some 4in.; at the distance of 2in. above the lower edge of the keel it is bolted athwartships every 8ft. 8in. with copper bolts ⅞in. in diameter, and rivetted on the alternate sides of the keel; keelson of tough white oak, sided, 14in., moulded, 14in.; the scarfs of the keelson are 6ft. 6in. in length and are bolted with copper bolts, ⅞in. in diameter, and doweled to the timbers; draught of water at load line, 7ft. to 8ft.; rig, schooner; tonnage, 458 tons.—*Spars:* Foremast, including head of 8½ft., 72ft. in length; mainmast, including head of 7½ft., 72ft.; foretopmast, including head of 5ft., 43ft.; maintopmast, including head of 5ft., 43ft.; bowsprit, outboard, 14ft.; bowsprit, inboard, 10ft.; foregaff, including head of 2ft., 20ft.; maingaff, including head of 5ft., 30ft.; main boom, 56ft.; square sail yards, 42ft.—*Engines:* Back action, horizontal indirect acting, &c., all of the same dimensions and of the same motive power; number and diameter of cylinders, two of 30in.; length of stroke of piston, 18in.; diameter of air and circulating pumps, 10½in.; length, 32in.; diameter of main journals of crank shaft, 7in.; collars, 9in.; length of each of the main journals, 18in.; length of the centre journal, 20in.; where the eccentrics and the counterbalance are keyed on the shaft, it is 8in. in diameter.—*Boilers:* Martin's vertical tubular, two to each vessel; length, 12ft. 3in.; width, 8ft. 3in.; height, 9ft. 3in.; number of tubes in each boiler, 880; length of tubes, 28in.; diameter, external, 2in.; these tubes are expanded on one side of the tube plate, and rivetted over on the other. Each boiler contains two furnaces, of 3ft. 5in. width in the clear, with a grate 6ft. 6in. long; height from bottom of ash-pit to crown of furnace, 3ft. 3in.; total grate surface, in boilers, 88⅝ square feet; total heating surface, 2,700 square feet; the fire-grate bars are 1in. in width on top, with ⅝-in. spaces between them, and they are in two lengths of 3ft. 3in. each: these boilers are made of the best quality American charcoal iron, with the best quality American lap-welded iron tubes; they are placed in the vessel side by side, with a space of 6in. between them, and have one smoke pipe in common to both; the smoke pipe is 48in. in diameter, and 32ft. in length; before the boilers were placed in the vessel they were subjected to a hydrostatic pressure of 60lb., per square inch, and made safe and perfectly tight under it.—*Condenser:* One to each vessel, Sewell's patent; the shell is of cast iron, 1¼in. thick; the condenser contains 2,900 brass tubes of ⅝in. external diameter, and 42in. exposed length, the total length being 4ft.; each end or the tubes are fitted with gum grommets; the tube plates are of brass, 2in. thick, planed one side, and they have faced strips for joint on the other; they are in eight pieces, and bolted to faced flanges of condensers by brass bolts.—*Propeller:* Diameter, 9ft.; diameter of hub, 15in.; length of hub, 2ft. 3in.; thickness of blades at hub, 4½in., tapering to ⅝in. at periphery; length of blade on hub is 15in., curving back on the forward edge 6in. from a perpendicular to a length of 15in. at the periphery; the after edge is curved parallel with forward edge, and the angle slightly rounded; pitch at forward edge of blade, 11½ft., expanding to 13½ft. at after edge; mean pitch, 12ft. 6in.; composition of screw propeller, by weight, 9 parts copper, 1 part tin, ½ part zinc; number of blades, 4. The hulls of these vessels are braced with diagonal braces of iron on the inside of timbers, 3½in. wide, by ⅜in. in thickness. There are two sets of braces at right angles to each other, one of which lets into the frame, and is laid at an angle of 45 deg. with the joint of it, the upper ends being 6in. below the planksheer, and the lower end at the turn of the bilge amidships. The other tier are laid on the timbers, and the inside plank jogs over them. There is also an iron strap, 3½in. wide by ⅝in. thick, running around the stem, and lying on the timbers above the turn of the counter timber, and extending forward within one frame of the forward sternpost. This strap is fastened to each timber with bolts ⅞in. in diameter, and the planks jog over it. The above-mentioned vessels, together with those reported in our last issue, have been launched and completed within a brief period. The following are still on the stocks, or about being commenced:—*At Jeremiah Simonson's, Greenpoint, L. I.* Preparations are being made at this yard to construct two first-class ferry-boats for Commodore Vanderbilt. They are to run between New York and Staten Island, taking the place of the Clifton and Westfield, recently sold to the United States Government. Their machinery is in process of construction by the Allaire Ironworks, New York. Their principal dimensions are as follow:—*Hulls:* Length on deck, 225ft.; breadth of beam, moulded, 34ft.; depth of hold, 15ft. 6in.; frames, moulded, 15in., sided 7in., and 24in. apart at centres; draught of water, 5ft. 9in.; tonnage, 960 tons.—*Engines:* Vertical beam; number and diameter of cylinders, one of 36in.; length of stroke of piston, 8ft. *Boilers:* One, return flue; located in hold, and will use blowers.—*Water Wheels* Diameter over boards, 26ft.; material, iron.

At Henry Steers', Greenpoint, L. I.—A beautiful side-wheel steamer is being constructed at this yard under the superintendence of Edward J. Dickerson, Esq. She was originally intended to run in conjunction with the Florida Railroad, along the Gulf coast between Cedar Keys and New Orleans, but our domestic troubles caused a suspension of work upon it for several months. She has, however, recently been sold to the house of Messrs. Forbes and Co., China, and will, upon completion, take up her position upon the coast of that empire. Her machinery is in process of construction by the Allaire Ironworks, New York. *Hull:* Length of keel, 270ft.; length in decks, 285ft.; breadth of beam, moulded, 38ft.; depth of hold, 14ft.; depth of hold to spardeck, 20ft.; frames moulded, 18in. sided, 7in., and are 24in. apart at centres; they are filled in solid under engine; draught of water at load line, 8ft.; tonnage, 1,998 tons; rig, schooner. *Engines:* Vertical beam; number and diameter of cylinders, one of 76in.; length of stroke of piston, 12ft., to be fitted with Sickles's cut-off. *Boilers:* Two, return flue; length, 30ft. 3in.; breadth, 12ft. 6in.; height, 11ft.; located, in hold, and will not use blowers. *Water-Wheels:* Diameter, over boards, 28ft.; face, 12ft.; material iron. This vessel is built of white oak, cedar, and hacmetac. Her model is one of much beauty, and her easy and graceful lines betoken great speed. She has iron straps, diagonal and double laid, running around her frames, securing them in the best possible manner, and making the vessel one of great strength. When completed she will be another proof of the skill of American shipbuilders and American mechanics.

THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

AT the last ordinary monthly meeting of the Executive Committee of this association, held at the offices, 41, Corporation-street, Manchester, on Tuesday, December 31st, 1861, Hugh Mason, Esq., Vice-President, in the chair, Mr. L. E. Fletcher, chief engineer, presented his monthly report, from which we take the following very brief extracts:—

"During the past month 256 engines have been examined, and 364 boilers, 10 of the latter having been examined specially, 4 internally, 38 thoroughly, and 312 externally, in which the following defects have been found; Fracture, 5 (1 dangerous); corrosion, 29 (3 dangerous); safety-valves out of order, 9; water-gauges, 4; pressure-gauges, 2; blow-off taps, 13, (1 dangerous); fusible-plugs, 5; furnaces out of shape, 6. Total, 73 (5 dangerous). Boilers without glass water-gauges, 22; pressure-gauges, 4; blow-off taps, 18; feed back-pressure valves, 38.

"No explosion has happened to any boiler under the inspection of this association during the past month, nor in fact throughout the whole year. A few cases of injury to furnaces have occurred, arising from deficiency of water consequent on the derangement of the glass water-gauges, which would have been prevented had there been two gauges to each boiler, so frequently recommended. In another case injury arose from the attendant lighting a fire in his boiler when empty, while, in another, from a defective blow-out tap. There has, however, come to my knowledge, in a casual way, the occurrence in various parts of the kingdom during the past year of no less than twenty explosions, from which twenty-seven persons have been killed and forty-seven wounded, the boilers in question being of every variety—factory, colliery, marine, locomotive, agricultural, &c.

"Relative to 'economy in the raising and use of steam,' I have brought before the attention of the members during the past year the importance of surface blowing out, and the advantage to be derived from the use of steam-jackets, as well as from superheating. Surface blowing out is in very general use elsewhere, and found successful; it is not monopolised by patents, but is free to all. The use of steam-jackets and superheated steam, aided by surface condensation (a subject on which I shall take an early opportunity of communicating with the members), are now working a perfect revolution in marine engine economy, and are extensively adopted by various large steam navigation companies. In the report of the last annual meeting of the Peninsular and Oriental Steam Navigation Company the chairman stated that in a new vessel called the 'Mooltan,' of 2,600 tons burthen, having engines of 400 nominal horse power, in which the above principles had been adopted, the consumption of fuel had been reduced to rather less than one-half the usual amount; and the chairman added that the shareholders would readily perceive the importance of such a reduction in the consumption of fuel, when he reminded them that they had paid as much as £800,000 for coal in one year. It seems to me the very province of this association to circulate reliable information on such points as these—carefully avoiding, of course, at all times the recommendation of anything untried and experimental. In this way I am convinced that the association will continue to be a source of wealth to its members, as well as to the surrounding district; and I am desirous that no year should pass without a decided mark of engineering progress being clearly stamped upon it by the association. Surface blowing out is now being adopted by several of our members; superheating is being introduced, and steam-jackets, so long undervalued, are being revived. I shall take the earliest opportunity of ascertaining full results of their working, and of disseminating this information throughout the entire body of our members."

MISCELLANEA.

THE railway capital called up during the year 1861 amounted to £13,593,609; and the payments to be made during January reach a total of £447,035.

THE North Metropolitan Railway has been projected to connect the Eastern Counties, Great Northern, and Hampstead Junction Railways. The estimated cost is £200,000.

IT appears that 228 applications to Parliament for railway bills are to be made in the ensuing session, of which fifty-seven are for the incorporation of new railway companies.

THE Great Northern Railway Company propose to extend their "loop line" from Gainsborough to their main line at Rossington, near Doncaster. The estimated cost is £330,000.

THE estimated cost of the proposed line from the Great Western Railway at Bristol to Brandon-hill, near Clifton, with tramways communicating with the quays of the Bristol Docks, is £250,000.

THE Government of the Cape of Good Hope have subsidised a line of telegraph between Cape Town and Graham's Town, and a line is about to be undertaken also in Natal between the seaport and the capital.

THE directors of the Eastern Counties Railway have determined on adopting the system of warming carriages with the waste steam from the engines. The plan has been for some time adopted on the French lines, and has recently been tried on the London and North-Western Railway.

THE number of Cornish pumping-engines reported last month is twenty-nine. They have consumed 2,105 tons of coal, and lifted 16·6 million tons of water 10 fathoms high. The average duty of the whole is, therefore, 53,100,000 lb. lifted 1ft. high by the consumption of 112 lb. of coal.

THE managing committee of the London Fire Brigade, seeing the success which has attended the steam fire-engine of Messrs. Shand and Mason at the various fires it has assisted in extinguishing, have determined to have three more of the same description manufactured and stationed in different parts of the metropolis.

A BOILER explosion occurred on Tuesday evening at Byers' Moor Colliery, eight miles west of Newcastle-on-Tyne. Three men were killed and two more injured. The boiler was 46ft. long, 5ft. 3in. diameter, made of ⅜in. iron, and nearly new, the makers being Messrs. Palmers, of Jarrow. No cause is assigned for the explosion.

ADVICES from Naples state that the railway from Rome to Ciprani, the Neapolitan frontier, is now open, and that the contractor, M. Salamanca, expects to complete the line to Naples in a few weeks. The viaduct over the Valley of Velletri, which has been pushed forward by Messrs. Kennard Brothers, of London, with great energy, is 500ft. long, and 170ft. high, and is a reproduction of the Crumlin Viaduct in South Wales.

THE amount of capital required by the French railway companies for new works for the year 1862 is from £14,000,000 to £16,000,000, being rather less than the sum raised last year. The total required to finish all the lines conceded up to the present moment amounts to about three milliards of francs. It is hoped that the Government will see the necessity of spreading this over at least 10 years. Foreign railways conceded to French companies will require this year at least £10,000,000.

THE first part of the Cape Town Railway will, it is stated, be opened on the 1st of February. As soon as it is completed to Wellington it is intended to extend it still further to Worcester. A tramway, six miles long, is projected from Durban—a village eighteen miles from Cape Town—to the nearest railway station. Mr. Marcus Smith, C.E., has been appointed engineer of the Cape Town and Wynberg line, eight miles long, about to be commenced.

THE Minister of Public Works has appointed a commission, composed of MM. Michel Chevalier, Alfred Leroux, Vuillefroy, De Franqueville, Avril, Busche, Talabot, Didiou, Toulon, and Prosper Torneux, to inquire into and report on the construction of railways, and the cheapest mode of working them; the speed at which trains ought to travel; the terms of the contracts existing between railway companies relative to carriages in correspondence, and on all other questions relating to the working of railways which the minister may from time to time submit to it.

DR. SEYMOUR observed, in his evidence in the Windham case, "From what I have heard in society I believe that certain young noblemen are in the habit of driving railway engines. I can give you on paper the names of the young noblemen in question. One of them is now a duke. Another is connected with the court."—Mr. Chambers said, "I can state that, although such is the public report, it is not correct."—Dr. Seymour further said, "I am not aware that one of the noblemen to whom I have referred was a director of the railway and drove the engine in his official capacity. I understood he did so for his own amusement."

SEVERAL complaints having been made of the numerous railway accidents which have lately occurred on the French lines, the following statement has been published in reply:—"2,150 trains run daily on the lines of the Northern, Eastern, Western, Orleans, and Paris, to the Mediterranean Railway Companies, extending over a distance of 192,000 kilos., which makes 777,450 trains yearly, passing over a distance of more than 70,000,000 kilos. During this period the number of travellers who have lost their lives by railway accidents was forty-four, which is equal to one in 7,000,000 travellers. These figures, taken from an official source, cannot be controverted. When the deaths by railway accidents are compared with those caused by carriages in the streets of Paris, it will be found that there are more deaths caused by carriages in Paris in one year than by all the railways in France during ten years.

THE following appointments of naval engineers have been made since our last:—W. Hardie, engineer, to the Cumberland, for the Racehorse; H. Gair, engineer, to the Cumberland, for the Cormorant; James Hopkins, in the Forester, promoted to engineer; H. Onions, second-class assistant-engineer, confirmed in the Impérieuse; W. R. Abbott, A. Stewart, G. Fancian, G. Nicholls, J. W. Compton, and E. Irish, acting second-class assistant-engineers, to the Impérieuse, additional, for disposal; W. H. Sedgwick, promoted to first-class assistant-engineer in the Ajax; Robert Hodge, in the Cornwallis, E. T. Read, in the St. George, Walter Ash, in the Asia, for the Blazer; H. G. Pilcher, in the Simoom, J. Matthews, in the Hardy, and J. E. Derrick, in the Weser, have been promoted to engineers; J. Weir, in the Algiers, W. Castle, in the Alecto, and F. H. Morgan, in the Queen, have been promoted to acting engineers; W. Hammond, in the Vigilant, promoted to first-class assistant-engineer; D. B. Keiller, and R. Sutherland, acting second-class assistant-engineers, to the Asia, as supernumeraries; J. T. Rose, acting second-class assistant-engineer, to the Cumberland, and lent to the Formidable.

THE traffic receipts of railways in the kingdom for the week ending the 28th of December amounted to £492,745, and for the corresponding week of last year to £471,390, showing an increase of £21,355. The gross receipts of the eight railways having their termini in the metropolis amounted to £223,486, and for the corresponding week of 1860 to £207,144, showing an increase of £16,342. The increase on the Eastern Counties Railway amounted to £3,434; on the Great Northern to £1,433; on the Great Western to £4,490; on the London and North-Western to £1,595; on the London, Brighton, and South Coast to £801; on the London and South-Western to £3,604; and on the South-Eastern to £995—total, £16,352. But from this must be deducted £10, the decrease on the London and Blackwall, leaving the increase, as above, £16,342. The receipts on the other lines in the United Kingdom amounted to £269,259, and for the corresponding period of the preceding year to £264,246, showing an increase of £5,013, which, added to the increase on the metropolitan lines, makes the total increase £21,355 as compared with the corresponding week of 1860. This increase nearly covers the decrease in the two preceding weeks, as compared with the corresponding period of 1860, although the total amount of traffic for the week was less than for any preceding week sin last March.

ROBERTS' VICES AND SCREW BENCHES.

THIS invention, by William Roberts, Millwall, Poplar, has for its object improvements in vices and screw benches. In constructing vices according to this invention the fixed jaw thereof is formed with a plate projecting out horizontally from the back of the jaw; this plate passes underneath the top or surface of the bench to which the vice is secured, and is screwed to it. The screw of the vice passes through a nut in the fixed jaw immediately under the horizontal plate. The stem of the screw at its outer end passes as s usual through the moving jaw of the vice; this jaw is not hinged as commonly to the fixed jaw, but is at its lower end turned up horizontally and passes through a hole under the screw in the lower part of the fixed jaw. There is also a hole through the fixed jaw over the screw just on a level with the horizontal plate before-mentioned, and through this hole a horizontal bar fixed at one end to the movable jaw passes, and this bar is continued along in a slot in the horizontal plate until it comes to the end of the screw where it has a lump attached to it which serves as a bearing for the end of the screw, and an arm on this lump or bearing connects it with the end of the horizontal portion of the movable jaw. When the screw is turned the lump at its end, and consequently the movable jaw, is drawn by it in one or other direction, and this jaw when a piece of work is being held is prevented tipping by the arm which connects the lump or screw bearing with the tail of the moving jaw. The head of the moving jaw is made to turn on a centre at a point over that where the screw passes through the jaw, so that the nipping surface may adapt itself to the surface of the work should this be inclined. The screw is worked by means of a small wheel at its end, so that it can be turned rapidly, and to give the nip a lever is employed turning on the axis of the wheel and capable of being made fast to the wheel by a bolt entering holes in the periphery of the wheel; for the use of carpenters and other workers in wood a similar apparatus may be constructed principally or entirely of wood.

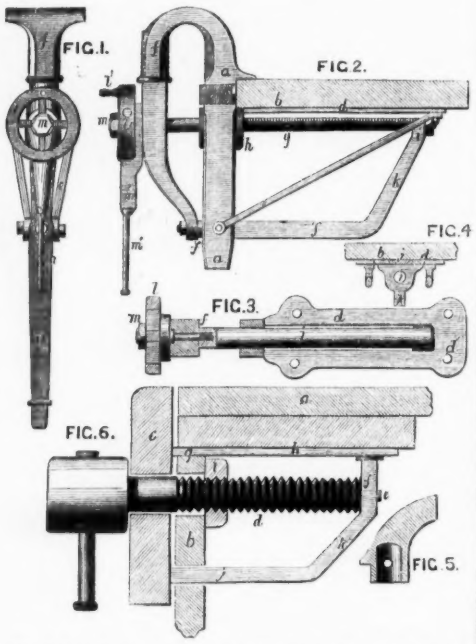
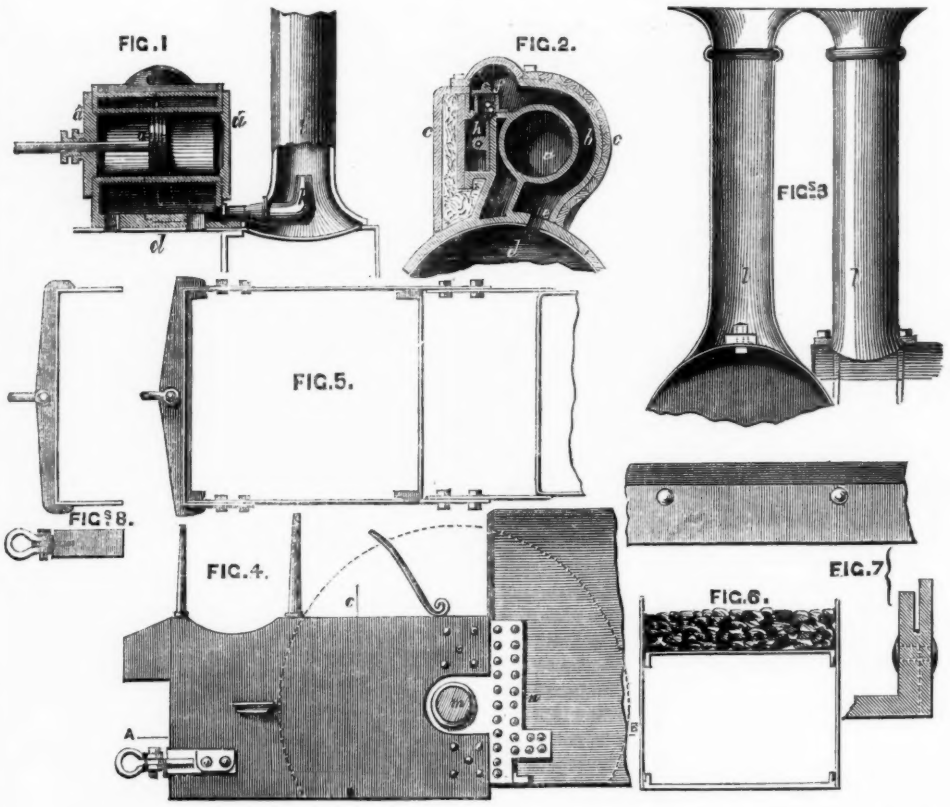


Fig. 1 is a front view; Fig. 2 a side view; Fig. 3 a horizontal section taken at the line 1, 1, Fig. 2; and Fig. 4 a vertical section taken at the line 2, 2. Fig. 2, of a vice constructed according to this invention. *a* is the fixed jaw; it is secured to the bench, of which a portion is shown at *b* by the strap *c*, and the lower end of the stem a^1, on which the fixed jaw is formed is fitted into a hole formed for it in the floor of the workshop, or is otherwise suitably retained; *d* is a slotted bar or plate fixed to the jaw *a*; this plate or bar has holes d^1 in it to receive screws, by means of which, in conjunction with the strap *c* already mentioned, the vice is firmly fixed to the bench; *e*, *e*, are tie rods connecting the further end of the plate or bar *d* with the stem a^1 of the fixed jaw; these tie rods are for the purpose of stiffening the plate or bar *d* and preventing it bending at the point where it is connected with the stem of the fixed jaw; *f* is the movable jaw; the lower end f^1 of its stem is turned up into a horizontal position, and passes through a hole formed to fit it in the stem a^1 of the fixed jaw; *g* is the screw of the vice; its stem passes through the movable jaw *f* so that the screw can turn freely; the screw also passes through a nut *h*, by preference of brass, and which is fitted into a hole formed to receive it in the stem a^1 of the fixed jaw; the further end of the screw is carried in a bearing *i* in which it can turn freely, but retained from longitudinal movement by the nut j^* at its end; the bearing *i* is fixed at the end of a bar *j* attached by a screw to the movable jaw, and passing through the fixed jaw at a point immediately over the nut *h*; this bar *j* is formed with a dovetail which enters and slides in the slot in the bar or plate *d*, and the sides of this slot are suitably formed to retain it; *k* is an arm connecting the bearing *i* with the horizontal portion f^1 of the stem of the movable jaw. In the drawing this arm is shown made in one piece, both with the bearing *i* and the horizontal stem f^1, the latter being secured by a screw and nut to the movable jaw, but this may be varied, and in small sizes very conveniently, by making *f* and f^1 in one piece, and forming a joint between the end of the latter and the arm *k*. The end of the screw is squared and receives a small wheel *l* which is retained in its place by a nut *m*; l^1 is a handle for turning the wheel, and by means of it the screw may be worked very rapidly when there is no strain upon it. In order to nip work firmly between the jaws a lever m^1, is employed; it is capable of turning freely on the screw as a centre; in the periphery of the wheel *l* are holes l^2, and there is a bolt m^2 on the lever which can be pushed forward and made to enter either of these holes, and the lever can then be employed to turn the screw. In order that the vice may hold inclined work more conveniently, the head of the movable jaw is made capable of turning; to permit of this the upper part of the stem of the jaw is made to terminate in a cylinder, and the head of the jaw is formed with a socket to fit the same as is clearly shown at Fig. 5; the two parts can be secured the one to the other by a pin if desired.

Fig. 6 is a vertical section of a similar arrangement adapted to a carpenter's or other bench; *a* is the top of the bench supported on a leg *b*; *c* is a wooden jaw; *d* is a wooden screw passing through the same and working in a female screw cut in a hole in the block *l* fixed to the leg *b*; into the further end of the screw a metal pin *e* is fixed, and this turns in a metal beaaing *f*; this, as before, is fixed to a bar *g* connecting it with the jaw *c*, and it slides in a groove in a slotted plate *h* fixed underneath the top *a* of the bench. The jaw *c*, as in the former case, has a horizontal bar of metal *j* fixed to it; the said bar passes through the leg *b* and is connected or formed in one piece with an arm *k* attached to the bearing *f*.

THE estimated cost of constructing the Carnarvonshire Railway from Carnarvon to Port Madoc and Pwllheli is £200,000.

AVELING AND RAWLINSON'S LOCOMOTIVE ENGINES.



THE object of this invention, by Thomas Aveling and Henry Rawlinson, of Rochester, Kent, is to effect an economy in the manufacture of agricultural locomotive engines, and also to increase their efficiency and durability.

Fig. 1 shows in longitudinal section so much of a locomotive engine as will serve to explain the chief improvement, and Fig. 2 is a cross section of the same taken through the working cylinder and steam dome or chamber. In order to prevent as far as may be the condensation of the steam in the working cylinder the cylinder is placed in the steam dome and the steam dome brought to the forward part of the engine. *a*, *a*, is the working cylinder, surrounded by a casing *b*, *b*, which forms the dome or chamber from which the steam is taken for supplying the cylinder. This casing *b* is "lagged" or covered with a jacket *c* of non-conducting materials in any well-known way. The steam chamber is brought into direct communication with the boiler *d*,*d* by means of steam ways *e*; steam is therefore constantly circulating round the working cylinder. *f* is the cut-off valve; *g* the throttle valve; and *h* the slide valve for regulating the supply of steam and the discharge of the exhaust steam to and from the cylinder in the usual way. The exhaust steam passes off by a port *i*, Fig. 2, to a pipe *k*, Fig. 1, opening to the funnel *l*. This arrangement it will be seen not only prevents priming when the engine is ascending steep inclines, but also avoids the necessity for using a pipe for conveying the steam from the steam chamber to the cylinder, or for the employment of a long pipe (as is now commonly used) for conveying the exhaust from the cylinder to the funnel; and further, by enclosing the cylinder in the steam chamber instead of in the fire-box or smoke box, as is now usual, access to the cylinder, when repairs are needed, will be greatly facilitated, it being only necessary to remove the end plates a^*, a^*. In forming the shell of the boiler *d*, *d*, instead of dividing it into three parts as is usual, by making a break corresponding to the three divisions of fire-box, boiler and smoke box, we carry the wrought-iron plates straight through from end to end without a break in the configuration of the boiler, except at the under side, where the dip is made for the ash-pit, as shown at Fig. 1, and we thus avoid the necessity for using angle iron or flanged plates to connect the fire-box and smoke-box with the boiler.

In constructing the funnel *l* cast iron is used, it being made by preference, all in one piece, and secured in position by bolts passing through lugs cast on the lower end of the funnel, as shown at Fig. 3.

By forming the funnels of locomotive engines of cast iron there is not only effected an economy in the first cost, but it is found that the iron is capable of sustaining the intense heat to which the lower part of the funnel is exposed much better than wrought iron.

As an improvement in the water tank their ends and top and bottom are made of cast flanged plates, and wrought-iron sides are bolted thereto, which sides are carried past the front plate of the tank and bolted or rivetted to the axle plates, which are themselves secured to the fire-box of the engine.

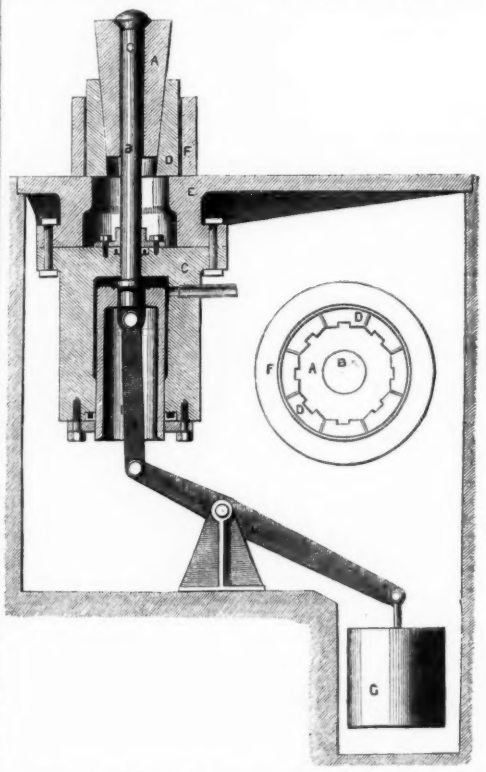
This arrangement will be best understood by reference to Fig. 4, which is a side elevation of the tank, Fig. 5 a sectional plan, and Fig. 6 a vertical cross section taken respectively in the lines A, B, and C, D, of Fig. 4. *m* is the axle of the hind wheels of the engine, and *n* (Fig. 4) shows one of the axle plates by which, through the aid of rivets, the connection between the box of the engine and the tank is made good. The mode of connecting together the wrought iron sides of the tank with the cast sides and top and bottom is shown at Fig. 7.

As an improvement in the construction of the draw bars they are formed of angle or T-iron, the ends of which are returned or bent back at right angles, as shown in the detached views, Fig. 8. These draw bars are rivetted at their ends to the wrought side plates of the tank, as shown at Fig. 5, and the feather of the T-iron is chamfered off towards the ends, thus making the draw bar taper and sufficiently elastic to act as a spring, whereby the shocks occasioned by the starting of the engine will be to a considerable extent neutralised.

RENDEL'S WROUGHT IRON CYLINDERS FOR ORDNANCE.

THE nature of this invention, by George W. Rendel, of Elswick Ordnance Works, near Newcastle-on-Tyne, consists in a process of enlarging the diameter of hollow wrought iron cylinders used in the construction of ordnance, for the purpose of making them truly round and exactly of any given diameter after they have previously been forged approximately true, but of a less interior diameter than that required.

A is a taper bar or block of polygonal section attached by means of a rod B to the piston of a hydraulic press C; D, D, are loose segment pieces arranged in a ring round the taper block A, resting on the bed plate E, and made of any sizes to suit the diameters of cylinders required. Each segment piece D has a plane inclined face on the back fitted to bear against and slide upon one face of the taper block A, and a curved face on the outside forming in section an arc of a circle of or about the interior diameter required for the cylinder to be operated upon. The small end of the taper block A is next the press C, and the amount of taper is such that when the block is elevated into the position shown the segment pieces D, D, lying against the taper faces of the block, may be made to converge towards the axis of the block, and thus allow a forged cylinder of less interior diameter than the finished size required to be passed over and round the whole of the segment pieces; F is a cylinder placed in position to be operated upon by the apparatus, having been first brought to a sufficient heat in a furnace or otherwise. While the cylinder is in this position the hydraulic



press is put into operation, and the taper block A, being thus drawn downwards while the segment pieces D, D, and cylinder F remain supported by the bed plate E, its inclined faces slide upon the inclined backs of the segment pieces, and press the pieces out with great force radially; and so stretch the cylinder to any required extent according to the amount of the inclination and the length of stroke given to the block A; G is a counterweight acting by means of the lever H and connecting rod I to return the taper block to its original position. Sometimes the thickness of the segmental pieces is varied so as to obtain different diameters of parallel cylinders, and the external form is varied so as to make the cylinders of less diameter at one end than at the other, or of any required form

COMPENSATION CASE.—The landlord of the Rising Sun public-house, in the Euston-road, having brought a suit against the Metropolitan Railway Company, claiming £1.000 damages for injury occasioned by the company's works to the walls of his house, has succeeded in recovering £20.

TRACTION ENGINES.

FIG. 1.

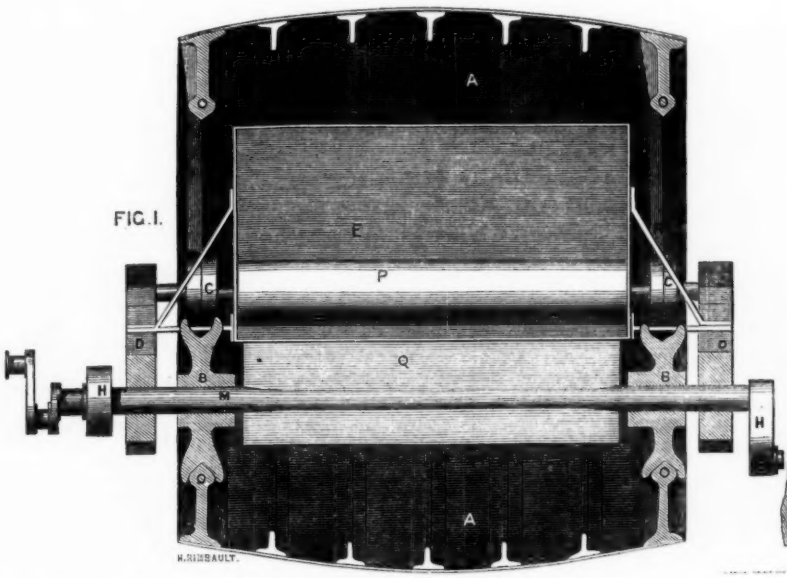
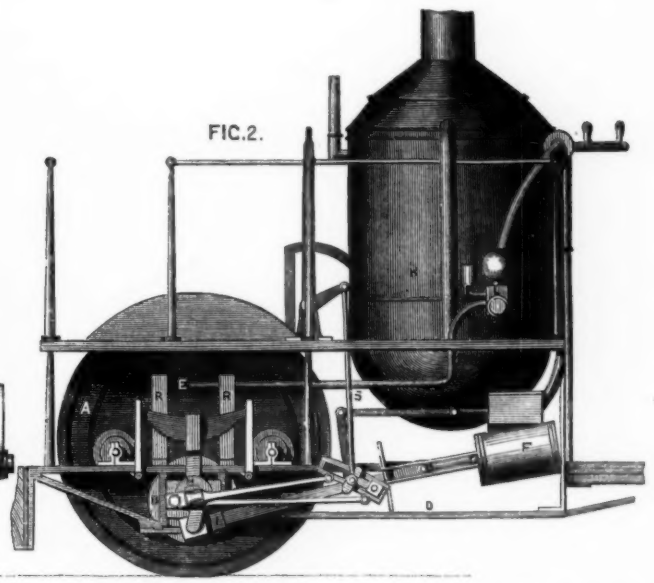


FIG. 2.



THIS invention, by Simon Stevens, of Lancaster, Pennsylvania, U.S., relates to that class of steam engines intended to move along the common road or unprepared ground, and without the interposition of tracks, tramplates, tramways, or rails, and to be employed as a self-moving machine, capable of travelling alone, or as a tractive power, for the purpose of hauling, drawing, or setting in motion wheel or other carriages attached thereto; or for giving motion to agricultural implements, machines, or apparatus, whether for the purpose of tilling or otherwise cultivating or preparing or treating the soil; or for removing the produce from or cutting and collecting the crops thereoff. And it consists in a novel arrangement of the parts of such engines or apparatus, and in the mode or method of communicating and transmitting the power for giving motion, as well as in the disposition and distribution of the weights or masses of material of which such tractomotives or engines are composed.

Fig. 1 is a vertical section view of the drum or cylinder forming the leading and forward-bearing wheel, or the means of propelling the tractomotive machine; and Fig. 2 is a side view or elevation of an engine constructed according to the present invention.

D, D, D, is a frame similar to that of a railway locomotive; F, F, the steam engines for actuating through the connecting rods I and cranks H, H, the driving axle M, and driving or first-motion wheels B, B, which driving or first-motion wheels are supported by and run upon the circular tracks or internal flanges or rails, O, O, O, O, secured in each end of the traction drum A, A, while the other end of the frame is supported upon the axle of the guiding wheels J by means of springs, as shown; C, C, are small supporting and guiding rollers mounted upon the frame at a height equal, or nearly equal, to that of the centre of the traction drum A, A, and serve to hold the drum in proper position while running; K is the boiler secured to the frame D, D, D, and J the guiding wheels supporting the end of the frame. The engines are shown with the link-motion applied, for the purpose of so working the slide-valves that a ready and exact control of the admission of the steam to each cylinder may thereby be secured.

The traction drum A, A, is constructed of a length nearly equal to the inside width of the frames, or their distance apart, to secure the broadest tread possible within a given width; and, by preference, the drum is made slightly barrel-shaped, or of greater diameter at its middle length than at its ends, so that it may turn easily. The circular tracks O, O, O, O, are secured in the ends of the drum, and their faces for the support of the driving wheels B, B, are angled or inclined each way, as shown, and the treads of the driving wheels B, B, between their flanges of a similar or corresponding form, so as to fit, that the adhesion between the wheels and the tracks may be greater than if the treads were plain flat surfaces; the degree of inclination being proportioned to or in accordance with the weight carried, and the tractive force to be exerted. It is so obvious as not to require especial illustration, that the adhesion may be greatly increased by dividing the treads and tracks into two or more series of more acute angled treads, somewhat similar to the "tongue and groove friction gearing." Within the drum A, A, the water tank E is introduced with two pipes P as shown, running across it to accommodate the shafts of the small supporting and guiding rollers C, C, and a recess Q to accommodate the driving axle M, the tank being supported upon the frame D, D, D, by the brackets R, R, and the pipe S, leading from the tank E to the pump L, thus economising space upon the frame.

CRYSTAL PALACE FOR THE PARISIANS.—A *société anonyme*, with a capital of 25,000,000 francs, is in course of formation for constructing a "palais de cristal" in the Bois de Boulogne. The council of administration comprises a number of gentlemen well known both in France and this country—the French portion including the Marquis de la Roche-Aymon, Count de Santivy, the Marquis de Monclar, M. Pasqualini, and Prince A. Galitzin; and the English portion Messrs. S. Beale, M.P., T. N. Farquhar, and William Jackson, M.P. Sir Joseph Paxton has accepted the office of architect in chief; Mr. Edwin Clarke that of consulting engineer; and Mr. Thomas Brassey that of contractor-general.

GRIFFITHS ON IRON.—The iron trade during the past year has not kept pace with the favourable anticipations entertained on all hands this time last year. The unsettled state of Italy created considerable alarm in January and February. Under the adverse influence of a war in America, &c., the price of bars was reduced in July from £7 10s. to £7, at which it now stands. In October the new French tariff came more fully into operation, and, we are glad to say, has answered the expectations of its best friends and promoters, the shipments of Scotch pigs and all kinds of finished iron having since considerably increased. The stocks of hæmatite pigs on the pig banks of the great works in the North are reduced considerably, and large orders for forward delivery are booked by at least three of the great producing firms in the North. The trade in the Cleveland district is comparatively prosperous; Cleveland iron is becoming, day by day, more appreciated, and bids fair to rival most other districts. Best Staffordshire iron, such as is made by the leading houses, will always find a market at fixed rates; but we regret to say that general languor is now the prevailing characteristic in every district in England—a general pause having set in since the unfortunate complications have arisen between our own Government and the Washington Cabinet. If war with America should happily be averted we hope the trade may assume a more cheerful aspect.—Mr. Thomas Rose, of the late firm of Rose, Higgins, and Rose, has taken the Millfield Works (forges and mills) for the manufacture of plates, sheets, and bars. These works will be started immediately. We wish Mr. Rose every success.—*Griffiths' Circular.*

LIGHT DUES.—Landsmen are hardly aware that a considerable amount of local taxation falls upon the shipping employed in our oversea and coasting trade in the shape of harbour and light dues. These are the turnpike tolls of the ocean, and are as familiar to our mariners as the analagous impost on *terra firma* was to travellers in post-chaise or gig in days before the railroad age. From the latest account published, which relates to the year 1859, it appears that, for the United Kingdom, the amount received for light dues was £273,570, of which British vessels paid £179,985, and foreign vessels £93,585. These, though considerable sums, are considerably less than those levied formerly; *e.g.*, in 1853 the light dues amounted to £413,191; during the seven years there was a gradual reduction of three payments, the decrease in 1859 being £139,621, or 34 per cent.; and this notwithstanding the enormous expansion which, in that period, the whole of our maritime trade experienced. But no diminution has taken place in the sums expended for the maintenance of the old, or for the building of new lighthouses. In 1858 the two items involved an expenditure of £226,697; and they have been considerably in advance of that sum since. In the last year for which this information was given (1858) the figures are £278,557. The estimated expenditure for future years for the maintenance of lighthouses, including those recently built, or which are now building, is £235,000, and for building new lighthouses £300,000; this expenditure, however, is to be spread over several years.

THE GLASGOW BRIDGES.—The bridges across the Clyde bear a singular resemblance to the bridges across the Thames. The Broomielaw Bridge seems to us a counterpart of London Bridge. It is 560ft. in length, and 60ft. wide over the parapets. Telford was the engineer; Gibbs, of Aberdeen, was the builder. It is constructed of freestone, cased with granite; it has seven arches, and it cost £37,000. The iron foot Suspension Bridge corresponds to Hungerford Bridge; although not so large the proportions are the same. The Victoria Bridge across the river at Maxwell-street is, perhaps, one of the best and most elegant structures of the kind in the kingdom. It consists of five arches, very flat in the segment. The span of the centre arch is 80ft.; while the height from the base line to centre of intrados is only 10ft. 6in. The span of the adjacent arches is 76ft.; and the rise 9ft. 4½in. The span of the outermost arch is 67ft.; and the rise 7ft. 2½in. Each of the two centre piers is 10ft. in thickness; each of the two end piers is 9ft.; and each of the two abutments is 20ft. 6in. The total length of the bridge is 445ft.; the total clear waterway 366ft.; and the total river space occupied by piers 38ft. The length of the piers at the foundation is 80ft.; the breadth of the roadway is 60ft. The material is compact white sandstone from the neighbouring quarries, externally cased with granite from Kingston, near Dublin. The engineer was Mr. James Walker, of London; and the builder Mr. William Scott, of Glasgow. The cost was £40,000.—*Builder.*

THE TIN STANDARD.—To most people not intimately acquainted with Cornish mining the system of computing the quantity of black tin in the stone, or even the mode of estimating the money value of this black tin from the standards fixed by the smelters, is an almost inextricable riddle. Local customs have certainly managed to involve a matter, simple enough in itself, in a very unnecessary amount of complication; as M. Moissenet very justly says:—"On arrive à introduire des complications, presque mystérieuses, là où une simple règle de trois pourrait suffire." As we shall continually have occasion to refer to both these points, and assume an acquaintance with them on the part of our readers, we think it advisable to give a short explanation of them. The first step is to find the produce, which is estimated at so much in twenty. This is done by trying a sample of one ounce = 20 dwts. in a crucible with a proper mixture of anthracite (generally about 5 dwts.) for reducing the oxide, and sometimes a certain proportion of borax for flux. The weight in dwts. of the button resulting from this assay is the produce of the sample—let us say 13¾ in 20 (which equals 68¾ per cent). From this produce of 13¾ a fixed reduction (which remains the same whatever the produce may be) of 1½ is made for returning charges, which reduces the nett produce to 12¼. The quality of the metallic tin is next examined into, and its class is fixed as common or fine, as the case may be. A standard being fixed periodically by the smelters for each of these qualities the money value is found by multiplying the standard by the nett produce, and dividing by twenty. For example, let us take the instance assumed above of a produce of 13¾, and let us suppose that the quality of the tin was common. We then have 13¾ less 1½ (for retaining charges) giving the nett produce as 12¼. At the time we write the standard of common tin is £109, to which, if we apply the above rule, we have (£109 × 12¼) ÷ 20 = £68 2s. 6d., value per ton of the black tin. Besides the allowance of 1½ for returning charges the smelter also receives an allowance of 3lb. per cwt. for "wastage;" the black tin being weighed off at 115lb. to the cwt., or 20 cwt. 2 qrs. 4lb. to the ton. From the above data an adventurer in a tin mine is in a position at once to ascertain what his black tin should realise per ton, knowing the produce and quality, which he can, at any time, ascertain from a sample of the black tin. The two following examples may make the matter still plainer:—With a sample of black tin giving a produce of 13½ common tin, find the value per ton, the standard for common tin being £111. If from 13½ we deduct 1½, we have 12¼ for nett produce, which gives us (£111 × 12¼) ÷ 20 = £67 19s. 9d., value per ton of black tin. With a sample of black tin, giving a produce of 13½ fine tin, find the value per ton, the standard for fine tin being £114. Deducting the 1½ we have 12 for nett produce, which gives (£114 × 12) ÷ 20 = £68 8s. value per ton of black tin. Almost all the tin ore raised in Cornwall is sold by private contract at prices, thus calculated, from fixed standards. —*Mining and Smelting Magazine.*

GLASGOW WATER SUPPLY.—The water supply of Glasgow, from Loch Katrine, is one of those gigantic and colossal undertakings which distinguish the engineering enterprise of our generation. It is a work, its engineer tells us, that surpasses the greatest of the nine famous aqueducts which fed the city of Rome. It is also, we think, a happier conception than the largest of our modern works—the New York aqueduct. For, with a singular invention of the engineer, this magnificent supply of water is brought to Glasgow for the most part through tunnels cut in the solid rock. In truth the Glasgow aqueduct may be described as almost one continuous tunnel. The cost was of course enormous, something, we believe, about £800,000 sterling. The very blasting materials—the powder and the tape fuses—cost, on the average, about £2,000 per mile. The tunnels were connected by a double series of cast iron pipes, 4ft. in diameter. The inclination on the whole length of thirty-five miles is about 5ft. per mile. The quantity of water delivered is from 300,000,000 to 400,000,000 gallons per day; that is, from 70 to 80 gallons to each individual of the whole population. The quality of the water is very pure, and so soft that it is calculated by Mr. Bateman that a saving to the community will be effected in the consumption of such articles as tea and coffee, soap and soda, to the amount of £100,000 sterling in the year. These statistics are, in all probability, somewhat overcharged; but we must allow for some natural exaggeration on the part of the projectors of so great and so successful a work.—*Builder.*

IMPROVEMENT IN FLAX-SCUTCHING MACHINERY.—We have had the pleasure of inspecting, at the York-street Foundry, a highly important improvement which the inventor of "Rowan's Patent Flax-scutching Machine" has just perfected and introduced. Our readers are, of course, aware that last summer Mr. William Rowan solved one of the main difficulties in flax-scutching by inventing a machine which, at a small cost, with little labour, and at a low power, performed the operation in a manner superior to any scutching machine previously constructed. This machine was at once taken up by the trade of the United Kingdom, and was exported in large quantities to the Continent and to Canada, where it was most favourably received, as our readers must have observed from time to time by extracts published in our columns from other journals. In the course of working, however, it was found that the ends of the flax were not so thoroughly cleaned as might be desired, and that when weak flax was being used the fibre was sometimes tangled and broken. The defect was not so great as seriously to impair the efficiency of the machine, but the inventor was not satisfied to leave any imperfection in his machine, and, accordingly, set to work to remedy it. It was found that the defect lay in the unyielding nature of the "beaters," which, being fixed, necessarily treated all straw and fibre alike, and with an equal amount of force. Compensation for this was sought in the direction of a "spring" in the drum, which would accommodate it to the differences of fibre. In experimenting in this direction Mr. Rowan hit upon a most beautiful application of centrifugal action, which, in its effect on the "beaters," completely and effectually accomplished the object sought; and, having patented the improvement, he has now brought it into operation. The extent and value of this improvement are immediately apparent even to a non-professional eye; and it has a great recommendation in the fact that it will not add to the cost of the machine, and can without difficulty be applied to all machines now in operation.—*Belfast Northern Whig.*

THE ALLOTROPIC STATE.—Of all the wonderful facts embraced in the science of chemistry there is none more wonderful than that curious property which certain substances have of passing into an allotropic condition. Prof. Younans compares it to the state of man when he is asleep. The substance, by being subjected to certain manipulations, has its properties so completely changed that it seems to be no longer the same substance. This property has lured some of our most eminent modern chemists into the old dream of the alchemists, of changing iron and other cheap metals into gold. Perhaps the most valuable use that is made of the power of putting substances into an allotropic state is in the manufacture of friction matches. Phosphorus takes several allotropic conditions, in one of which it is known as red phosphorus. In this state it does not take fire from friction, nor does it emit the deleterious vapours which have produced such frightful effects upon persons employed in match manufactories. The phosphorus is, accordingly, by exposure to light under certain conditions, and other manipulations, passed into the allotropic condition of red phosphorus, when it can be transported or handled with impunity. In this state it is used for making matches, and it then slowly returns to its normal condition. By several processes iron can be thrown into an allotropic condition which has been called the passive state. In this state it is not acted upon by nitric acid, and its properties vary in several particulars from those which it ordinarily exhibits. If a piece of iron is put into nitric acid of specific gravity of 1·3, it dissolves freely with effervescence, but if a piece of platinum wire be placed in the acid and then the iron be introduced in contact with the platinum, the acid will not now act upon the iron even if the platinum is withdrawn. Another piece of iron put into the acid in contact with the previous piece will become affected in the same way, and so on with a third or more pieces. Another mode of making iron passive is to oxidise one end of the piece in the flame of the lamp. It may also be effected by making it the positive pole of a battery, by a blow, and in other ways. A piece of passive iron can be restored to its normal condition by rubbing it, or by bringing it in contact with active iron. The allotropic state of substances is a comparatively new and very inviting field for chemical research. It is supposed by some chemists that all of the elements may be subject to this mysterious change, and the investigation of the subject will probably yield some very curious results.—*Scientific American.*

IRON ROOFS.

UNDER the head of "Some Remarks Suggested by the Miscellaneous Implement Department of the Leeds Show of 1861," the *Mark Lane Express* gives the following particulars of iron roofs:—

In the show-yard at Leeds a roof adapted for a shed or farm-building was exhibited, if we mistake not, by Francis North Clerk, of Ann-street, Birmingham. We give rough sketches of some of its parts, to show the extreme simplicity of the arrangements.

Fig. 1 is a diagram of the truss, 20ft. wide.

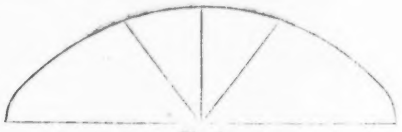
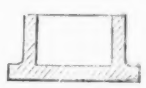


Fig. 1.



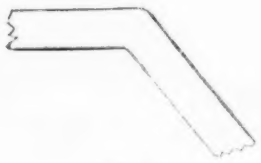


Fig. 4.



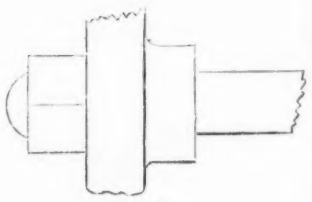


Fig. 2.

Fig. 5.

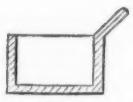




Fig. 3.

Fig. 6.

Fig. 2 upper part of the pillar or pipe of cast iron, a range of which supports the roof. From pillar to pillar a cast iron gutter stretches, a section of which is shown at Fig. 3.

Fig. 4 shows the upper portion of strut, the bent part being bolted to the corrugated plate.

Fig. 5 is the tie-rod which is bolted to the side of the gutter in Fig. 3.

Fig. 6 is the plan of the tie-rod in centre; the king bolt is shown in detail in Fig. 7, the top part being bolted to the corrugated plate at top.

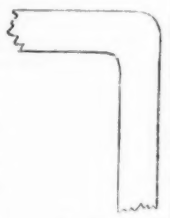


Fig. 7.

Messrs. Francis Morton, of Liverpool, who have done much to bring corrugated iron and galvanised iron into use for the construction of the farm, exhibited at Leeds a movable shed roof of galvanised iron; also a model of a farm yard, wholly covered in with a galvanised iron fire-resisting roof. This, we think, a capital idea, and well elaborated in Messrs. Morton's model. For covering hay-sheds we should like to see the more general introduction of iron roofs. Where Mallet's buckled plates are used for roofing, for which their lightness admirably adapts them, or where Francis Morton and Co.'s galvanised iron tiles are used, an iron truss will have to be constructed. As a fitting conclusion to this paper we here give drawings, and a description of one.

In Fig. 8, a skeleton sketch of the truss, *a b*, *b c* are the two inclined rafters meeting at the apex *b*, and connected with the cast iron gutter hereafter described. A king bolt *b d* is connected at its upper end with the rafters, and at its lower end with the tie-rod, *c d a*.



Fig. 8.

Fig. 11 illustrates the upper part, the king bolt *b d* (Fig. 8). In Fig. 11 *a* is the side, and *b* the edge view. The part *a* of the rafter, Fig. 10, is embraced by the part *c*, Fig. 11, and the whole secured together by a bolt or nut.

The central part of the tie-rod *c d a*, Fig. 8, is widened out, as shown at *a a*, Fig. 12, and provided with a bolt-hole, through

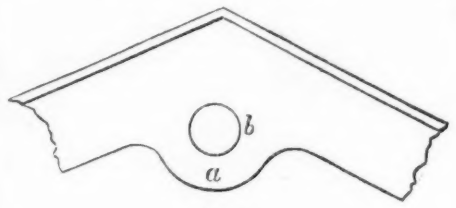


Fig. 10.

which the lower part of king bolt *c* is passed and secured by the nuts *d e*. The method of securing the feet of the rafters to the gutter of cast iron is shown in Fig. 13. The gutter is at *a a*, and

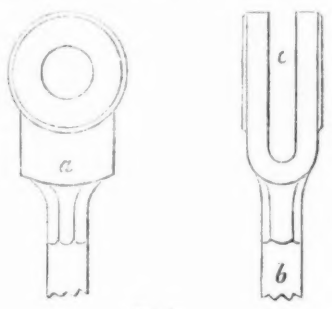


Fig. 11.

runs along the whole length of wall, or is continued from pillar to pillar, being bolted down by the bolt *b*; *c c*, the end of rafter; the end *d* goes into a slot or shoe *e*, shown in side elevation of

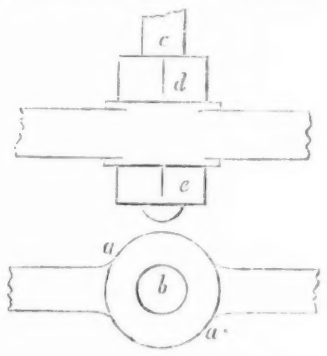


Fig. 12.

gutter. The end of the tie-rod is at *f f*, jointed to the rafter *c c*, or to a snug *h* (*i* in the side elevation) cast on the side of the gutter. In the plan *j j* are the nuts screwing gutter to column or wall; *k k* the shoes to receive end of rafter, *l l* being the apertures into which they are passed; *m m* the snugs to which the end of tie-rods are jointed.

There are sundry other considerations connected with farm construction, suggested by a retrospect of the show-yard at Leeds, and which shall receive due attention at a future period.

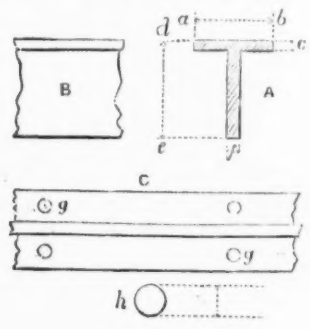


Fig. 9.

In Fig. 9 we give a section A of the rafter, B a side elevation of ditto, and at C a plan of rafter *g g*; *h*, section of tie-rod.

In Fig. 10 we give the upper termination of the rafters, the two parts *a b*, *b c*, Fig. 8, being welded together; and a rounded part *a* formed, which has a bolt-hole *b*.

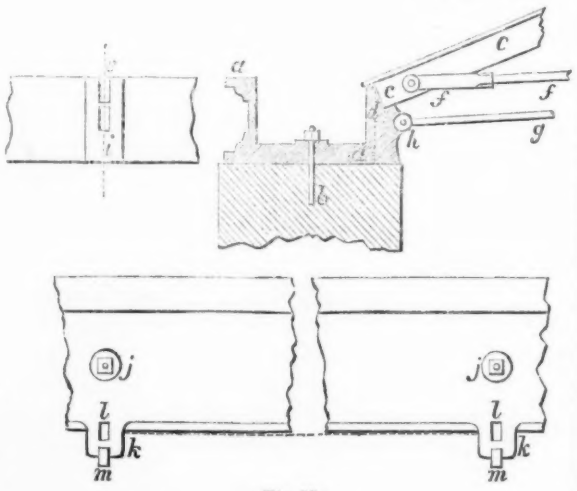


Fig. 13.

TIMBER BEAMS.

A CORRESPONDENT of the *Builder* gives the following mode of ascertaining the proportions of the strongest rectangular beam which can be cut from a tree of circular section:—



Let O P $= r$ be the radius of the tree.
„ O M $= x$ the half breadth of the beam.
„ M P $= y$ the half height of the beam.

1. To find the breadth and depth of the beam whose resistance to fracture shall be a maximum. The power of resistance to fracture depends on the product of the breadth and the square of the depth; therefore, $x \cdot y^2$ is to be made a maximum. Since x and y are co-ordinates of a circle therefore $y^2 = r^2 - x^2$, and $x \cdot y^2 = r^2 \cdot x - x^3$. And in order that $r^2 \cdot x - x^3$ may be a maximum its differential co-efficient must be made $= 0$; or we have

$$r^2 - 3x^2 = 0 \therefore x = \frac{r}{\sqrt{3}}, \text{ and } y^2 = \tfrac{2}{3} r^2$$

Hence, $x : y = 1 : \sqrt{2}$; or, as 1 : 1·4142; or, the breadth multiplied by 1·4142 gives the depth; and the breadth is one-third of the radius of the tree multiplied by $\sqrt{3}$ or 1·732.

2. To find the breadth and depth of the beam whose resistance to deflexion is a maximum. The power of resistance to deflexion depends on the product of the breadth and the cube of the depth; therefore $x \cdot y^3$ is to be a maximum; this is $x \cdot (r^2 - x^2)^{\frac{3}{2}}$ which, differentiated and equated to 0, gives $r^2 - 4x^2 = 0$,

$$\therefore x = \frac{r}{2}, \; y = \frac{\sqrt{3}}{2} \cdot r, \text{ and } x : y = 1 : \sqrt{3} = 1 : 1{\cdot}732$$

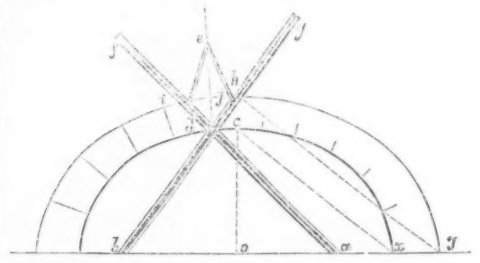
Therefore the breadth multiplied by $\sqrt{3}$, or 1·732, gives the depth; and the breadth is one-half of the radius of the tree.

This latter beam is stiffer than the former, but will not bear so great a load without fracture; it must, therefore, depend on the use to which the beam is to be applied which section shall be adopted.

JOINTING ELLIPTIC ARCHES.

A CORRESPONDENT of the *Building News* gives the following method for drawing the joints of elliptic arches:—

Two bars (*a f*, *b g*), with grooves down their centres, are fixed so as to revolve each round one of the foci of the ellipse *a b* respectively; they are connected by a pin *d*, which slides in the grooves of each, to which it is attached a rhomboidal framework (*e j i h*), movable at all its angles, two of which, *h i*, are united as to slide in the grooves.



It is easily seen that if the pin is placed on that point of th curve at which it is required to draw the joint, the line joining it and the extreme angle, *e*, of the framework is the line of such arch-joint.

The two foci are the points from which the ellipse would be described by means of a cord—a method well known to workmen.

The ellipse for the extrados can easily be described in this manner: the depth of the vouissoir must be set out on a base line *x y*, and a line *y n* drawn parallel to one from *x* to the crown, will cut off on the vertical through the centre the depth of the key-stone; the foci of the ellipse can then be found by describing from the centre *h* a circle of radius *o y*, which will cut the base line of the arch in the points required, if the ellipse is to be described with a cord, but if the trammel is employed no such construction will be necessary.

THE NAVY.—That portion of the fleet of gunboats fitting at Devonport which is to be armed with smooth-bored guns is receiving its armament. The Armstrong guns for the others are not yet in hand. The Warrior, on Saturday, took up a fresh position off Osborne, where she remains. Among the many contemplated additions to the ship's fitment is an improved mode of steering by hydraulics or steam, the lighting of the ship internally by gas, and the introduction on board of the electric light.

FOREIGN AND COLONIAL JOTTINGS.—Further great improvements in Paris are in progress of execution. The vast plain which extends from the fortifications at the gate of Reuilly to the wood of Vincennes has been purchased for the city of Paris. The intention of the Municipal Council is to plant it, and to annex it to the wood of Vincennes, from which it was separated by a wall which has been levelled. The few houses which existed in the plain have been removed. A grand avenue, already far advanced, leads from the wood of Vincennes, and is to be continued into Paris as far as the Bastille, between the Rue de Charenton and the Vincennes Railway. Another avenue which is in progress will lead to Charenton, passing the park of Bercy. The plain of St. Mande is likewise completely transformed. It is converted into an English park, with a river and lakes, shady walks, and seats for visitors. Before two years the wood of Vincennes, extended to the gates of Paris, will have no cause to envy the wood of Boulogne.—A letter from Smyrna of the 22nd ult. says:—"It may be interesting to know that the Pacha has bestowed great attention on the cotton question, having taken part in the former proceedings of the Government for the introduction of American agents, seeds, and machinery, as well as having taken part in the recent inquiries. M. La Fontaine and others are taking considerable interest in the improvement of the next crop. A large quantity of cotton is coming in from the interior.—Every portion of space occupied by France in the Exhibition of 1862, whether in the picture galleries or in the industrial sections, is to be carpetted. Mirrors and girandoles will be hung in every available position, and the great court which has been assigned to them in the south-western part of the building will be hung with curtains stretched from column to column, shutting off this portion from the rest of the building, and, in effect, rendering it a distinct exhibition.—Russia is drawing supplies of cotton from Khiva and Bokhara, and the cultivation of the staple in these countries has been very largely extended. The value of that sold recently at the fair of Novogorod was estimated at £150,000.—India is indebted to European enterprise and capital for her tea cultivation, which is rapidly increasing. The produce of the Assam Company's gardens alone is now about £1,000,000 sterling, and the wastes of Cachar, which, five years ago, scarcely yielded to Government a revenue of 50,000 rupees, now yield upwards of 3½ lacs per annum.—A large collection of specimens of Canadian timber will be on view at the approaching Great Exhibition.—Great Britain and Ireland import annually some 27,000,000 cubic feet, or 540,000 loads of Canadian pine timber, the greater part of which is produced on the Ottawa river and its tributaries. The operations of this manufacture extend over upwards of 11,000 square miles, and give employment to more than 40,000 men.

BLACKBAND IRONSTONE.—Mr. Moore, mining engineer, lately read an interesting paper before the Royal Scottish Society of Arts, on the blackband ironstone in the Edinburgh and East Lothian coalfield, which has been published. The probable extension of the rich seams of blackband now wrought near Airdrie into the Edinburgh coalfield does not quite please the *Scotsman*, as—"If this opinion is correct we (*Scotsman*) may make up our minds to see this fair city (Edinburgh) environed by iron furnaces vomiting forth torrents of dark smoke, and slowly building up huge mounds of slag and scoriæ where now there are only green fields, with hedgerows and ricks of corn." The *Scotsman* thinks "there is no immediate prospect of seeing iron furnaces erected near Edinburgh. However, any day a fortunate discovery of a rich seam of ironstone might overturn all such prophecy.

LETTERS TO THE EDITOR.

We do not hold ourselves responsible for the opinions of our Correspondents.)

PORTABLE ENGINES.

SIR,—I agree with "Portable" in thinking that counterweighting alone will not prevent oscillation in portable engines.

Oscillation, no doubt, is chiefly caused by the alternate pull and thrust of the connecting rod, and though counterweighting may, in some measure, rectify this, it would be folly to expect it to prove a perfect panacea for "rocky" engines. The cure is to be looked for elsewhere, and I think more attention should be paid to the following points:—

In the first place, the centre of gravity in most horizontal portables is placed much too high, the boiler is too high from the ground, and we very often see the cylinder and crank-shaft too high from the boiler. Again, the attachment of the fore carriage and wheels to the boiler is often faulty in the extreme, and cannot but lead to oscillation. If we lay our hands on the dash-board of a Queen's pattern phaeton, which has been in use a couple of years, we will see how easy it is to make the whole machine rock on the fore carriage by almost the touch of a finger.

The chimney is generally too long, and as it is always fitted with a hinge, it is almost sure to be loose—the effect of this is obvious.

Again, very little care is taken in putting these engines to work, that they should stand straight, with the wheels firmly blocked; instead of that they are generally put to work "any way," and a very large amount of oscillation is conveyed to them from the threshing machine, through the belt.

I would suggest that the cylinder should be placed in an inclined position on the side of the fire-box, in such a way that the thrust of the piston should pass exactly through the hind axle, and that there should be no cranks, but, instead, a pin in a spoke of the fly-wheel which should drive the belt. You will ask, how is the belt to be got on and off in this case? But that need be no difficulty, as a screw clamp can be used to join the belt.

Both cylinder and valve-chest should be enclosed in a handsome casing bolted to the side of the fire-box, and an arrangement can easily be made for having a current of hot air direct from the furnace through this casing. The waste-steam pipe should pass along under the boiler, and the feed-water pipe should enclose it for a length of 5ft. or 6ft., in order to warm the feed-water.

I quite agree with "Portable's" remarks about feed-water, and my experience goes to show that they are the worst used boilers in the world in this respect. I have seen water used so thick that two inches of mud were left in the tub from which the feed hose drew its supply at the end of the day's work! No boiler can stand this sort of thing, and although, of course, less in degree, such cases occur every day. The only boiler which can be cleaned properly is a horizontal square water tube boiler, and, although more costly at first, I have not the least doubt that in the long run they will be found the cheapest, and incomparably the safest generators which can be used for agricultural purposes.

Another improvement I would suggest is a separate cut-off valve for expansion. Portable engines nearly always have the same amount of work to do, and a fixed slide on Dr. Alban's principle, fitted to cut off at one-third or one-fourth of the stroke, would, I think, be found highly advantageous, and could be fitted at very small cost.

If "J. D." has any wish on the subject I will send him a sketch of a rotatory engine, superior, I think, to any other I have ever seen—and I think I know them all—but I must admit that my opinion is that, except for some very special purpose, they are the most worthless class of engines in existence. V. P.

January 7th, 1862.

SIR,—Your correspondent "Portable" puts a meaning to my words in some cases which I never intended them to convey. Perhaps he will be kind enough to read my letter again. He appears to confound gravitation with centrifugal force. The crank and connecting rod-end are the only parts that can be properly balanced in the crank shaft itself, the other parts (piston and rod, cross-head, and remainder of connecting rod) cannot be properly balanced by any such means as he advocates, and would, therefore, still produce a distortion of the crank shaft such as I spoke of in my last. But then the counterweight should be so applied as to revolve in the same plane as the other revolving parts which they balance. If "Portable" is sceptical about this necessity for them to revolve in the same plane, let him take a small round rod of iron, weight it on the one side and counterweight on the other, but with the weight and counterweight in different planes, and set it revolving in a lathe. He will find, if he makes it revolve rapidly, that it will distort his rod to such an extent as to throw it out of the lathe. Then let him fix the weight and counterweight so as to revolve in the same plane, he will find that no velocity, however great, will distort the rod. Respecting the oblique oscillation I spoke of, it is not of much importance that he does not understand me, as he seems to have arrived at the same conclusion himself. His plan of weighting each end of the crank shaft would, doubtless, obviate the obliquity of the oscillation, but would not prevent the direct oscillation or diminish the distortion of the crank shaft. Respecting the double cylinder engine I proposed, I maintain that it would prevent all oscillation and distortion by the reciprocatingly moving parts of the one engine being balanced by the reciprocatingly moving parts of the other engine, and the rotating parts of the one by the rotating parts of the other; but I do not wish to force it upon the public, as the correction of the oscillation would not be a sufficient compensation for the extra expense. There may be other and more simple plans of effecting the same object, but his is not one of them.

I suppose he wishes me to abandon the rotary engine because he does not understand it. I am not aware that the theory of it has yet been exploded. His exhortation is more worthy of the middle ages than 1862. I am aware that pure water is most advantageous where it can be procured, but this would not stop the oscillation.

To put the question on its broadest basis I would ask, Can a body having a reciprocating motion be balanced by another body having a rotating motion? J. D.

Grand Sluice, 7th January, 1862.

SIR,—The letter of your correspondents, Messrs. Brown and May, in THE ENGINEER of December 20th, is calculated to mislead those who have not given much attention to this subject, and calls for some remarks. I assume that it will be admitted that the crank, &c., when at rest, may be balanced by a weight in the rim of the fly-wheel. This can be proved to be equally correct when in motion at all velocities. The momentum of a body being equal to its weight multiplied by its velocity applies to both crank and balance weight, which revolve in circles whose circumferences bear the same proportion to each other as their radii. This may be proved by a very simple experiment. Thus: to each end of a rod fasten unequal weights; suspend the rod by a string from a point between the weights, so that it shall be perfectly balanced when at rest; cause it to revolve in a horizontal plane, and it will be found to preserve its balance at all velocities, the string remaining concentric with the circles described by each weight, proving that it is unnecessary to balance the crank and moving parts by a weight "as near the centre of the shaft as the crank itself." If the balance were disturbed the string would vibrate isochronously with each revolution. R. LAYBOURN.

Newport, Monmouthshire, January 2nd, 1862.

THE NAVAL ENGINEERS.

SIR,—A correspondent in your last week's number comments, with very just indignation, upon the treatment of the engineers in our two new iron ships. Unfortunately these are not isolated cases of inconsiderate treatment, nor is want of accommodation the only grievance of which engineers have still to complain.

Your correspondent seems to be under the impression that "on paper," in the matters of "rank, uniform, and pay," engineers are tolerably well off. If you will allow me, I will show that even on paper the engineers of the navy have much to obtain before they can be expected to perform their duties with energy and zeal.

It is not many months since THE ENGINEER pointed out the fact that "the naval engineers were most miserably paid." Not the slightest increase has taken place since that time, and, as this is an improvement which, if conceded on paper, could not very well be evaded on quarter day, it has been most pertinaciously withheld by the authorities.

As the Warrior has been taken for a specimen of the kind of accommodation afforded to engineers, it might not be amiss to ascertain how they fare in the question of pay. I do not know the rates of pay received by the various "heads of departments" on board that vessel, but I assert, without fear of contradiction, that the chief engineer is by far the worst off in that respect. I much doubt if any other service in the world would think of offering the chief engineer of such a vessel as the Warrior the comparatively paltry sum of £20 per month. That, however, is the sum which the Admiralty think sufficient to secure strict attention to duty and constant care in the expenditure of valuable stores on board our largest men of war.

With regard to uniform, even on paper, invidious distinctions are made to the detriment of the engineers. No engineer, below the rank of chief, is allowed to wear the cocked hat, while assistants junior to them, in other branches, are—nay, the assistant-surgeon, of only six years' standing, wears the same uniform as a chief engineer, who has most likely been twenty years in the service, while the uniform of the second assistant-engineer is inferior to that of the youngest clerk.

As to rank, the concessions certainly appear considerable; they could not well be otherwise, seeing that previous to the last circular engineers had no relative army rank whatever; but when we perceive that those collateral advantages which rank is supposed to carry with it are only partially conceded "on paper," and in every possible case entirely ignored in practice, it is not to be wondered at that there should be much discontent in the navy, and great reluctance on the part of talented engineers to join such a service.

The articles which appeared in THE ENGINEER some time since on this subject I have good reason to believe were of great service, and I can only attribute their discontinuance to a belief on the part of the editor that the Admiralty really intended, fairly and honestly, to consider the case with a view to its satisfactory settlement. Now that you will perceive, sir, how illusory and inadequate have been the concessions made, I trust you will again call the attention of the authorities to the necessity of dealing with this matter in a more liberal spirit. E. S. A.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

December 24th, 1861.

J. P. JOULE, LL.D., President, in the Chair.

MR. BROCKBANK exhibited some samples of steel manufactured by Mr. Bessemer's process. These specimens had been bent and twisted cold, and showed a remarkable degree of ductility. He stated that the Bessemer steel was one of the most plastic and manageable of metals—more so even than copper. It could be bent, flanged, or twisted either hot or cold, without annealing, and over a considerable range of temperature—which is not the case with ordinary steel or copper.

A plate of 18in. diameter had been forced through a series of dies until it formed a tube 13ft. long and 1¼in. diameter without any crack or flaw.

A ring of metal could at one heat be hammered into a die to form a locomotive engine chimney top.

In drilling a circular hole into a plate continuous shavings are formed, whereas, in copper, or Low Moor plates, or any other metal, the shavings break into pieces $\frac{1}{10}$in. long.

Thin sheets of the Bessemer soft steel can be bent backwards and forwards hundreds of times without a fracture, and are almost as flexible as paper.

THE CONSETT IRON WORKS AND THE GOVERNMENT.—A further series of trials has just been made in Chatham Dockyard, for the purpose of testing specimens of plate and angle-iron from the establishment of the Derwent Iron Company, at Consett, proposed to be used in the construction of the iron-plated frigate Achilles, 50 guns, now building in that yard. The result of the trials of the angle-iron was deemed satisfactory, nearly the whole of the specimens subjected to the hydraulic tests standing the strain of 22 tons to the square inch, with the grain, without sign of fracture. In the second series of trials with some additional specimens of iron, consisting principally of plate-iron, the result of the several tests was not deemed so satisfactory by the dockyard officials, under whose superintendence they were made. A quantity of the largest kind of chain cable, constructed of the best iron at the establishment of Brown and Lennox, intended for the frigate Defence, built by Messrs. Palmer, of Jarrrow-on-Tyne, and the other vessels fitting for commission at Chatham, was also subjected to a variety of tests to ascertain its strength and quality, with very satisfactory results.—*Colliery Guardian.*

THE WELSH IRON AND COAL TRADES.—The *Colliery Guardian* speaks hopefully of the prospects of the Welsh coal trade, but, after observing that the iron trade is much depressed, expresses apprehensions that in the present complicated state of affairs respecting the difficulties with America the trade will not much improve for some time to come. The reports which have been received from the great marts of the manufacture of iron continue, however, to state that trade is better than could reasonably be anticipated, and the men pretty well employed; and South Wales, generally speaking, does not appear to suffer from depression of trade so seriously as other parts of the country. A new pair of 25-in. engines, lately erected at the new pit of the Primrose Collieries, Pontardawe, Swansea Valley, were started on Monday, in the presence of Mr. Morgan, the proprietor, and a few friends.

RAILWAY TRAFFIC FOR 1861.—It appears that the total traffic receipts on railways in the United Kingdom for the year 1861 amounted, on 10,811 miles of railway, to £28,263,374; and for the year 1860, on 10,273 miles of railway, to £27,576,783, showing an increase in the mileage of 538 miles, and in the receipts of £686,591, against an increase in the year 1860 over the year 1859 of 2,000,666, and in the year 1859 over 1858 of £1,812,353. Were it not for the depression of trade and the war in America it is probable that the increase of receipts in 1861 over 1860 would have been more than £686,591, the average increase of traffic for the seven preceding years having been at the rate of £1,418,000 a year, or £731,409 more than the increase in the traffic receipts of last year over the preceding year. The total capital expended on the 10,811 miles of railway in the United Kingdom amounted to £342,086,100, being at the rate of £31,633 per mile; while the expenditure of capital on the 10,273 miles amounted to £329,827,203, or at the rate of £32,106 per mile, showing an increase of 538 miles, and of £12,258,900 in the capital expended, but an apparent decrease in the cost of £473 per mile. The average cost of railways per mile in 1855 amounted to £35,425, and in 1861 to £31,633, showing a decrease of £3,792 per mile, or 10·7 per cent. The gradual extension from existing lines of cheap and useful railways into various districts now destitute of railway communication will tend to reduce the average cost of railways per mile very materially, and also when completed tend to increase the traffic on the main lines. The traffic receipts in 1861 averaged £2,614 per mile, and in 1860 £2,685 per mile. The working expenses were in 1861 about 48½ per cent. against 47½ per cent. in 1860. The percentage of traffic receipts to capital expended amount to 8·27 per cent., and the percentage of profit on the working to 4·26 per cent on the capital expended.

REMUNERATIVE PATENTS.

WHATEVER doubt the sceptical may entertain as to the superiority of the United States over Europe in arts, arms, and literature, it is certain that in one thing, at least, they "whip all creation," and that is, in making patents remunerative. In this country patentees are often content if, by means of a patent, they can obtain some slight advantage over a competitor in respect of the cost of production—never dreaming that the invention will be required beyond their own works. Others, again, will protect what they consider a good thing, and leave the world to find out its merits—never troubling themselves further than to reply to applications for the patentee's terms for a license to use the patent. And even those who patent with the view of pushing their inventions to the utmost will not unfrequently reject all offers for the privilege of working under their patent. Thus opportunities are neglected or frittered away which would not only bring large profits to the inventor, but the benefits derivable to the public from his discovery are retarded, or, perhaps, entirely lost—new circumstances arising to render the patented process altogether inapplicable. In the United States, however, patentees seem to have learned the art and mystery of making money to an extent scarcely credible by sober-minded Europeans; but that there is no romance about the statements, or exaggeration of the facts, which every now and then are published, is manifest from the pecuniary interest of the inventor being to estimate his profits at the lowest sum consistent with truth.

It is only when an extension is required of an expiring patent that the profits of the patentee are brought to light. The extension is sought, in the States or in this country, on the ground of inadequate remuneration; and to prove this a sworn statement of the outgoings and incomings has to accompany the petition. From such accounts we learned that the original patentee of the sewing machine had realised the large sum of £97,000, which was deemed by the Patent Commissioner disproportionate to the benefits conferred by his invention on the community, and he, therefore, became entitled to a renewal of his patent. In a recent number of the *United States' Railroad and Mining Register* we find that the invention of the reaping machine, which carried off a gold medal at the 1851 Exhibition, applied for an extension of his American patent, but failed from not being able to prove to the satisfaction of the Patent Commissioner the inadequacy of his profits. From the filed accounts it appears that the receipts from his manufacturing business nearly touched four millions of dollars, and that his clear profits amounted to one million four hundred and nine thousand dollars, or £293,593 sterling. To realise this sum from an implement of such limited use as a harvesting machine is to the European mind almost incredible, but the truth cannot be questioned.

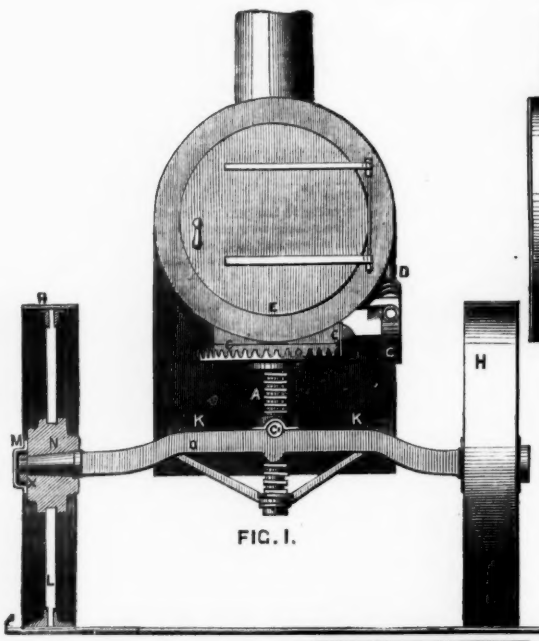
There are other American patents which we know to have been more profitable than this, but we cannot call to mind one English patent that has yielded to its owner one-third of this sum. A singular case occurred, some few years ago, of a patent, during the first year of the grant, producing a profit of £20,000; but, having to do with dress, the fashion changed, and there was an end of it. The *Times* reviewer of Dr. Percy's book on Metallurgy refers to Mr. Muntz's patent for yellow metal, or ships' sheathing, as one of the most lucrative patents known, and bases his assertion on the fact that its proprietor died, leaving property that was sworn under £600,000. This is, however, an unjust conclusion of the value of the patent, for Mr. Muntz's evidence, adduced before the Privy Council, when applying for an extension of this patent, showed that his profits did not exceed £55,000. Again, the enormous fortunes made by Sir Richard Arkwright and the first Sir Robert Peel give no satisfactory evidence of the value of the patents which helped them to those fortunes; for it is not unlikely the greater bulk of their profits was derivable from their prudent mercantile enterprise, which, if otherwise directed, would most probably have yielded them similar returns. The fact then remains that American patentees possess a secret which European inventors have, as yet, failed to discover, but which, as we think, is deserving of careful investigation, both on account of the patentees themselves and of the public; for we hold that, in respect of the extended working of an invention, really worthy of the name, the interests of the patentee and of the public are identical. We would, therefore, advise that, instead of ignoring statements which cannot be controverted, the proprietors of valuable British patents should seek to apply the means by which American patentees are enabled to bring their inventions so extensively into use, and instead of obstinately persisting in a course which has created the odious term of "obstructive patents," follow in the steps of their more "cute" cousins. —*Newton's London Journal of Arts.*

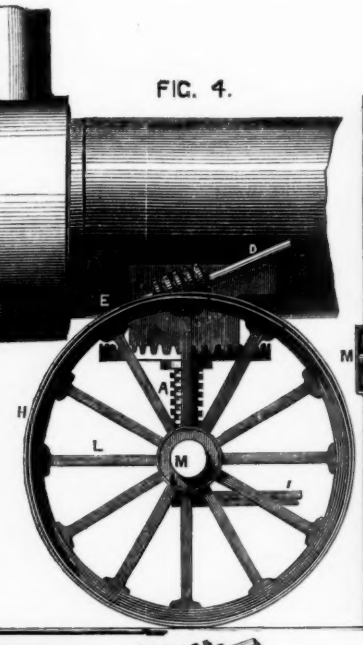
FIRE AT A FRENCH SHIPYARD.—An extensive fire occurred on the 2nd. inst. at the celebrated shipbuilding works of M. Arman, at Bordeaux. The damage occasioned amounted to about £20,000.

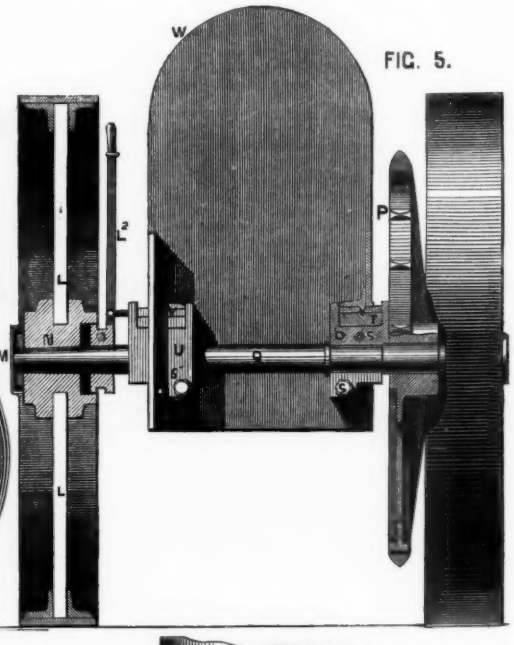
MORE RAILWAYS WANTED IN FRANCE.—Although the receipts on the Paris, Lyons, and Mediterranean Railway are increasing at the rate of from £25,000 to £30,000 per week, having now attained a weekly total of no less than £130,000, the company cannot accommodate all the traffic which is pouring on their system, and great delays and inconvenience are the consequence. One firm has even gone to law with the company on the subject.

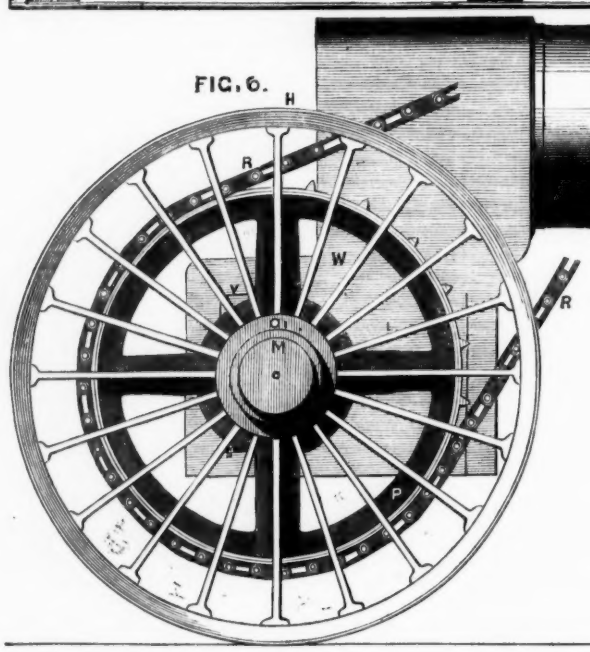
LONDON SEWAGE AND ESSEX LAND.—At a meeting of the Metropolitan Board of Works, on Friday, a report was brought up from the Main Drainage Committee, stating that the committee entertain very favourably the proposition for dealing with the sewage of the northern area of the metropolis, contained in the communications from the Hon. William Napier and William Hope, Esq., and recommending the board to assent to the principle of a concession of the sewage for a term of fifty years, provided the requisite authority be granted by the Legislature, to the board, and subject to the introduction of all necessary clauses in the bill for the protection of the board, and of the public interest confided to them, and for ensuring the fulfilment by the company of the obligations undertaken by them. Mr. Wilkinson said the committee, when they met on Friday last, had before them the consideration of four schemes, and they ultimately came to the conclusion of recommending to the board the adoption of the propositions of Messrs. Napier and Hope. The object of their plan is to deal with the sewage in such a way as to meet the requirements of the Act, and to prevent the possibility of a nuisance to the public. The object is to obtain an Act of Parliament and a grant from the crown of 20,000 acres of land on the Essex coast. They proposed to construct a certain culvert, taking all the sewage proper, except the rainfall mixture, down to these flat lands in the manner that had been adopted with so much success in Edinburgh. The works were so constructed as to carry off only the sewage, and involving in no way whatever an interference with their present outfall, and they were so constructed that no alteration whatever in their present works would be required, that any time they found themselves unable to carry out the works the board would simply have to discharge the sewage into the Thames as at the present time. After the realisation of 10 per cent. profit it was proposed by the company that if any surplus should remain (which it was expected there would be) it should be equally divided between the company and the board, and in like manner if the profits should be sufficient to recoup the company in the amount of outlay and the payment of 10 per cent. profit, then the ultimate profit to be derived from the lands, &c., should be divided between the board and the company. He could well conceive the board would not like to involve itself in a commercial concern which might render them liable to any responsibility. He could assure them that the committee in coming to their reports carefully considered, and had made provisions (should any such thing occur, which, in the opinion of the committee, they thought there would not), for protecting the board from any such result. He concluded by moving that the report be printed and circulated among the members of the board, and that the consideration be adjourned for a week. The motion was carried *nem con.*

LEE AND TAPLIN'S TRACTION STEAM ENGINES.

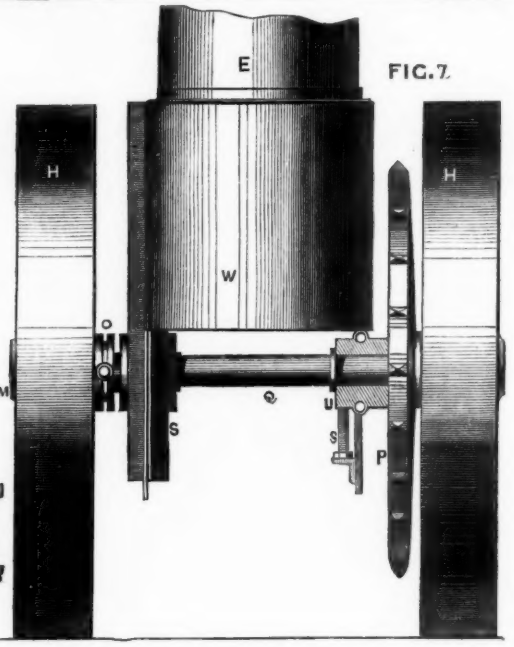












This invention, by J. Lee and B. D. Taplin, of Lincoln, has for its object improvements in the manufacture of portable or traction steam engines, and in apparatus for cutting joints, heads of connecting rods, and other articles.

The first part of the invention consists in arranging the carriage axles so that they may move backwards and forwards at pleasure by means of adjusting screws, eccentrics, or otherwise.

The second part of the invention consists in improvements in apparatus for raising and lowering the front end of the boiler when going up or down hill or along irregular roads for the purpose of maintaining an equal amount of water upon the fire-box end of the boiler under all circumstances.

Fig. 5 is an end view showing the sliding axle of the portable engine in section on one side of the brackets; O^1 is the cast iron bracket in which the shaft Q works; S, S, are two set screws which are used for tightening the chain or otherwise; T is a space for india-rubber springs. It will be seen in Fig. 6 that a piece of plate is allowed to project over the end of the fire-box, and in the plate a slot is cut which takes the weight of the axle Q, there is also a space allowed for the carriage O^1 to move backwards and forwards some 4in. or 5in., which is effected by turning the screws either way. On the left-hand side of the sketch No. 5 is a section of the clutch *o* which is made to throw in and out of gear by the levers L^2 when the engine is going round corners or otherwise. The engine is supported upon four wheels made of wrought iron rims and spokes, and cast iron naves, as shown in Figs. 5 and 6, the spokes are drawn taper with a shoulder at the top which fits between two angle irons as in section at Fig. 5.

Fig. 1 is an end view of raising and lowering apparatus. A is the centre screw working through the nut or ball C^1; this nut or ball has two studs welded upon it, one on each side, and takes a bearing across each side of the centre of the axle Q, which is made round on each side for that purpose. A space is left in the centre of the axle Q to allow the free action sideways of the nut or ball C^1; this space is seen best on Fig. 3; this side action allows the carriage wheels to play freely under all circumstances without damaging the screw in the centre; (1), (1), are two angular rods going from the boiler to the centre of the screw, and perform an important duty in holding the screw in position when travelling. Upon the top of the screw A is fitted a bevel or toothed wheel C which is moved by the small wheel and pinions C, C; these wheels are acted upon by the worm-wheel or screw D, seen best in Fig. 2; upon this screw is welded a long rod D to reach the engine-driver at the fire-box end of boiler, and by turning this screw or worm-wheel the screw may be raised or lowered at pleasure while the engine is travelling; Fig. 2 is a side view of same with spherical ball B working in a hollow casting B, A, and allowing the free action of the carriage wheels sideways in the same manner as Fig. 1, the casting B, A, is fitted to a wood bed similar to those generally used in ordinary steam engines to carry the front end of same, and can be applied to any kind of portable engine.

Figs. 3 and 4 show a plan and side view.

The third part of the invention consists in improvements in apparatus for cutting joints, heads of connecting rods, and other articles. The apparatus is constructed in the following manner:—A mandril of cast steel is turned in the lathe, and a screw cut upon it with two lock-nuts made to fit the screw; circular cutters of refined cast steel are then bored to fit upon the screw, and after the teeth are cut, and the cutters properly tempered, they are placed upon the mandril at the requisite distance apart. For cutting joints three cutters are fixed upon the mandril, and are kept at the requisite distance apart by means of turned collars placed between them and the collars and cutters, and made fast by the two nuts above mentioned. The joint to be cut is placed in the slide rest of the lathe, which, being set in motion, the centre cutter takes out the two sides of the inner part of the joint, and the two outer cutters the two outsides, as the slide rest moves gradually towards the centre. For different purposes any number of cutters may be placed on the mandril at pleasure. When cutters of a large size are required they are made in segments and fitted upon a cast or wrought iron flange, the flange being bored to fit the mandril and fastened with nuts or keys, if required.

THE MACHINERY DEPARTMENT OF THE EXHIBITION OF 1862.

The business of the machinery department, in classes 5, 7, 8, and 10, is, perhaps, the most onerous of all the business of the classes into which the industrial products are to be distributed for exhibition.

The supply of steam to work the numerous machines which are to be in motion is to be furnished from a number of large double-flue boilers, 30ft. in length, of 50 nominal horse power each, to be supplied by Messrs. Hick and Sons, of Bolton, sufficiently powerful to work the whole of the machinery in motion at once, without any necessity for stopping any portion of it, or of working parts of the machinery alternately. The disadvantage of an under-supply of steam in former exhibitions was strongly felt, and it has been the aim of her Majesty's Commissioners, in this particular, to have an ample supply of steam for every demand, without restriction. The steam from the boilers, which is to be of 70 lb. pressure per square inch, will be conveyed through large pipes down the passages of the western annex, which is to contain all the machinery in motion; the extent of steam pipe will be unprecedented in engineering practice. The annex is nearly 1,000ft. in length from north to south, and the boiler-house will be built at a distance of at least 100ft. from the north end, near Kensington-road. There will be two lengths of pipe about 900ft. each, and a third and shorter length, which, with the junctions required, will amount to a total length of upwards of 2,500ft. for the ramification of steam pressure throughout the annex. It is not intended by her Majesty's Commissioners to erect steam engines specially for the services, but to make free use of the numerous and various steam engines which will be exhibited, the intending exhibitors of which generally are desirous to have them put in motion. The steam pipe will be provided with expansion-boxes at frequent intervals, to take up the unavoidable expansion and contraction of metal pipes subjected to heat and cold alternately, and they will be thickly clothed in felt, and bedded in ashes, sand, or other non-conducting substance, so as to prevent loss of heat by radiation and condensation of steam within the pipe. Such a provision, though essential and highly important, is by no means so difficult to mature as appears to have been assumed by certain writers for the press; indeed, the proportion of steam lost by condensation may be reduced to a very small fraction, by the expedient of superheating it before it leaves the boiler-house, and drain-cisterns will be provided at suitable spots for the reception and collection of the water precipitating within the pipes.

The exhaust steam, discharged from the numerous steam engines at work in the annex, will be intercepted by large return exhaust pipes, laid parallel to the steam pipes, and conducted back to the shaft or chimney attached to the boiler-house, into which it will be discharged. Thus, the whole operation of the steam, conducted to the steam engines and back again, will be conducted without noise or nuisance; and the spectacle which would otherwise be presented of numberless clouds of spent steam escaping from the various engines through the roof of the annex, according to the usual routine of workshops, will be wholly prevented. The exhaust pipe, like the steam pipe, will be fitted with expansion-joints and drain-cisterns.

The gross area of the western annex is little more than four acres, or about 180,000 square feet; of this area 16,000 square feet are to be set apart for branch refreshment rooms, about 70,000 square feet for the exhibition of foreign machinery, and about 90,000 square feet for the machinery of the United Kingdom. An additional area of 20,000 square feet will probably be reserved in the eastern annex for the exhibition of machinery.—*Society of Arts' Journal*

Ingenious Mechanism. — During the Christmas vacation Mr Osborne, the well-known provision dealer on Ludgate-hill, exhibited in his window a novel application of water power; complete models of a well-arranged dairy-farm, representing the various processes for the production of butter, cheese, bacon, &c., and each operator busily employed. The water-tank from which the hydraulic power was obtained which set all this in motion was concealed in a cottage of a rustic character. Added to the attributes of the farm there were several very cleverly arranged accessories; volunteers were made to march in time over a bridge, and, disappearing, appear again with the numerical economy of a minor theatre. A splendid trout stream, fretted gurgled, and dashed down the estate, and found for a while a quiet resting place in an artificial lake, where a fountain disported and renewed the oxygen which gave additional vigour to the tiniest of minnows, which we were pleased to consider as salmon, or trout at least. Nor was the great power of water as steam unrepresented, for an admirable model of a locomotive engine ran with unusual regularity from terminus to terminus without an accident. Although the whole affair was doubtless "got up" to attract customers, it was certainly a most ingenious and pleasing instance of how much can be done in a comparative small space, and moreover had its educational tendencies in the science of hydrostatics. — *Mechanics' Magazine.*

TO CORRESPONDENTS.

Vol. xi. of THE ENGINEER *can now be had from the office, price* 18*s.*

*** *Covers for binding the volume can be had from the publisher, price* 2*s.* 6*d. each.*

*** *We must request those of our correspondents who desire to be referred to makers of machinery, apparatus, &c., to send their names and addresses, on which, after publishing their inquiries, we will forward any letters we may receive in answer. Such answers, published to catch the eye of an anonymous querist, are in most cases merely advertisements, which, we are sure our readers will agree with us, should be excluded as much as possible from this column.*

W. C. T.—*We will endeavour to ascertain by next week.*

C. R. H.—*Are we to understand that the present speed of the pistons of marine engines ought to be reduced to 50ft. or 2ift. per minute?*

S. J.—*We cannot recommend any good hot-water apparatus, although we believe that mode of heating to be the best, except by low-pressure steam.*

A. B.—*Address Mr. Henry Cole, of the Science and Art Department, South Kensington, for any information relative to the competition for certificates in science.*

T. J.—*We are obliged for the information given in your note. We do not know how to advise you, unless we recommend you to advertise for a situation—a course which occasionally succeeds.*

C.—*A "communication" means that the invention is not that of the one in whose name the patent is taken, but that he has received a description of it from some foreigner—and, generally, that the patent is for the foreigner's benefit. The fees, stamps, &c., are the same as for a resident in Great Britain.*

G. G.—*We do not recollect to what number of* THE ENGINEER *you refer, but we may say that there is no evidence that the effect of a train is less when in motion over a bridge than at rest. On the contrary, it is somewhat greater. The evidence adduced in 1847-48 before the Commission upon the Application of Iron to Railway Structures abundantly proved this.*

A WORKING ENGINEER.—*We believe the best work on the turbine is that of J. B. Francis, published by Little and Brown, of Boston, U.S., and which can be procured, we suppose, through Trübner and Co., of Paternoster-row. Messrs. Spon, of Bucklersbury, E.C., publish a useful work on the Fourneyron turbine, price, we believe, 5s. 6d. Use the best Chinese ink for your drawings: there is nothing better.*

R. T. B.—*To find the tractive power of a locomotive engine, having two cylinders, as usual, proceed as follows:—Multiply the diameter of one cylinder in inches, by itself, and multiply the product by the average pressure in pounds per square inch upon the piston. Multiply this product by the length of the stroke, taken in inches, and divide the final product by the diameter of the driving wheel, also in inches. The quotient will express the tractive force in pounds at the surface of the rails.*

T. C. (Derby).—*Mr. John Petrie, of Rochdale, and Mr. James Brownlee, of the City Saw Mills, Glasgow, have employed mechanism whereby the governor regulated the amount of expansion on each stroke. In America this mode of regulating is common. The Corliss Steam Engine Company, of Providence, State of Rhode Island, have long practised it, and we are not certain that Mr. Corliss has not secured patents in this country. We saw it stated, not long since, that one of his engines had been purchased and set up by Messrs. Alexander Pirie and Sons, of Aberdeen, in which case you would have no chance of a patent. M. Eugène Flachat, the eminent engineer of Paris, also applied similar means of regulating the engines of the St. Germain's Railway. This was prior to 1847. Shall we return the pamphlet?*

BELTS.

(To the Editor of The Engineer.)

SIR,—If I have a belt taking a strain or power of 4,000 lb. from a pulley 6in. in diameter, touching two-thirds of its circumference, what width and thickness ought the belt to be? BELT.

THE VELOCITY OF STREAMS.

(To the Editor of The Engineer.)

SIR,—Is there any instrument by which the velocity of a running stream can be obtained, when the fall is unknown, so as to ascertain the quantity of water used by a waterwheel? J. H.

January 6th, 1862.

THAMES BANK.

(To the Editor of The Engineer.)

SIR,—Will you have the kindness to inform me of the length of the embankment at Thames Bank, Pimlico, the width, top and bottom of the river wall, the height of the wall from the foundation, the contract price, and the name of the contractor? J. S. F.

January 7th, 1862.

THE FORCE OF IMPACT.

(To the Editor of The Engineer.)

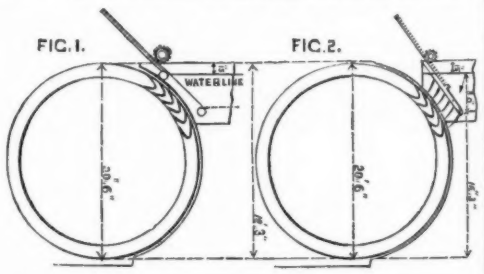
SIR,—Will any of your practical correspondents favour me with a solution of the following:—Supposing a weight 66½ lb. to fall perpendicularly from a height of 35·625in., what weight will it exert when it comes to rest? Also, a rule for finding the force which any body exerts falling from any given height. C. AND N.

Glasgow, 3rd January, 1862.

WATER WHEELS.

(To the Editor of The Engineer.)

SIR,—I have a breastshot iron water wheel 20ft. 6in. diameter, 4ft. wide, from 7-horse to 8 horse power, which takes its water from a rising hatch, as shown in Fig. 2 of the enclosed tracing, having about 3ft. head of water.



Being about to put in a new trunk and hatch, I should esteem it a favour if you, or any of your correspondents, would inform me if I should gain power by pulling a leather falling hatch, as shown in Fig. 1, taking the water from its highest point, which is about 1ft. 3in. from the top of the wheel.

7th January, 1862. ENQUIRER.

MEETINGS NEXT WEEK.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, January 14th, 1862, a eight p.m.—1. "Address on taking the Chair," by Mr. John Hawkshaw, President. 2. Renewed discussion upon Mr. Bailey Denton's paper, "On the Discharge from the Under Drainage, &c."

SOCIETY OF ENGINEERS.—Monday evening, 13th January, at seven o'clock, a paper will be read by E. Olander, "On the Enclosure of Lands from the Sea, and the Construction of Sea and other Banks."

SOCIETY OF ARTS.—Wednesday, at eight o'clock p.m., "Comparison of the year 1851 with the year 1861," by Blanchard Jerrold.

Letters relating to the advertisement and publishing department of this paper are to be addressed to the publisher, MR. BERNARD LUXTON; *all other letters and communications to be addressed to the Editor of* THE ENGINEER, 163, *Strand, London, W.C.*

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THE ENGINEER.

FRIDAY, JANUARY 10, 1862.

PROGRESS OF ENGINEERING PRACTICE AND OPINION.

IN our brief record, published last week, of the more important engineering and collateral works carried out in the year just closed, we made no attempt to note in what respects those principles and opinions, affecting engineering practice, were being modified or abandoned. That men's views, in respect of everything admitting of discussion, are undergoing constant although gradual change, none can doubt. In practical science especially the field of discussion and discovery appears well nigh boundless. It may be a somewhat delicate and difficult task to attach new interpretations to the views of others, but there are certain directions in which engineering opinion has so visibly taken its course that we shall hardly lay ourselves open to the charge of presumption or partiality in mentioning the points in which this change is most apparent.

In bridge construction we have the result of the Blackfriars competition to show how generally engineers have come to prefer iron, not only for railway purposes, but for those also of a vast metropolitan traffic. It has been customary to hear it said that, "for a work like London bridge, granite is the only proper material." Yet there is no reason why a preference of this kind should not apply as well to Blackfriars, and even to Westminster bridges, as to that occupying the site of the oldest bridge on the Thames. If London bridge were now to be rebuilt we do not doubt that iron would be selected as the material for its construction. Greater strength with less weight can be attained with iron than with stone, and, therefore, with more security in the foundations. So, too, with equal strength, a very much lower rise may be adopted with iron, and the new Blackfriars arch will probably be the flattest in the world of any span above 150ft. The value of every foot saved in the rise of a great metropolitan bridge is enormous. The number of vehicles passing London bridge is upwards of 20,000 daily, and their whole weight, with that of their horses, cannot be taken at much less than 40,000 tons. To raise this weight 1ft. only requires nearly ninety millions of foot-pounds, equal to the constant exertion of 135-horse power for the twenty hours daily over which the bulk of the traffic extends, and, if this power be rated as low as one shilling per horse-power per hour, the money value of the work thrown away on a rise of 1ft. would be £135 daily, or nearly £50,000 yearly, a sum which, capitalised at 5 per cent., would justify the expenditure of £1,000,000 to avoid a rise of 1ft., the value of the corresponding fall, of the same amount, on leaving the bridge, hardly affecting the result. It hardly need be said, moreover, that, with iron, the cost of ornamenting a bridge is nothing like what would be necessary with stone.

In respect of railway bridges, it is useful to note the expedition, economy, and security with which two of the great Indian rivers, the Taptee and Nerbudda, have been spanned by light iron trusses, supported on hollow iron columns, founded on screw piles. The adoption of such structures for crossing alluvial rivers furnishes an illustration of the progress making in engineering.

Suspension bridges with trussed roadways are, at last, gaining ground. We have no doubt that the number of believers in this system of bridge construction is very much greater now than it was a year, or, certainly, two years ago. The continued favourable reports as to the Niagara bridge, together with the demonstrations of Professor Rankine, Mr. Peter Barlow, and others advocating the trussed suspension bridge, cannot have failed to induce confidence in many quarters where the principle was formerly scouted.

The principle of the inverted arch, too, has received some attention, and we do not doubt that its properties will be still further investigated.

In respect of railways and locomotive engines, discussion has reverted, during the past year, to iron permanent way, and notwithstanding that what were brought forward as the results of actual practice were criticised as the deductions of theory, we are inclined to think that something useful was attained. With that morbid dread of change which now operates upon the minds of the railway authorities, induced, as this dread undoubtedly is, by the capricious findings of coroner's juries in cases of accident, this disinclination to improvement is not so much to be wondered at. If a wheel, or a tyre, or a rail break on any of our lines, and one or more passengers be killed in consequence, a coroner's jury, and, after them, an ordinary jury in a civil case, set themselves to ascertain whether the wheel, the tyre, or the rail was of the common material, applied in the usual mode. If not, the verdict is tolerably certain to convey the impressions of the jury—composed, probably, of country squires, tradesmen, and farmers—to the effect that there has been a neglect of the ordinary precautions observable in such cases, and the railway company is cast in damages. If there could be such a thing as an Act compelling railway companies to pay a suitable sum for every passenger killed upon their lines—from whatever cause except from his own conspicuous carelessness—and if the railway companies were left to adjust their fares according to their risks, we believe they would pay out less money in compensations than they now do, and we believe that they would, furthermore, find themselves greatly the gainers in being left absolutely free to adopt whatever might appear to be an improvement. During the past year or two, a footing has been gained by one improvement which, like the cloud no bigger than a man's hand, is likely to grow to a great size. It is that of interposing an elastic medium between the tyres and rims of railway wheels. Here and there the thing has been carried out with excellent results, and we shall have greatly mistaken if a principle, so demonstrably good, does not become generally adopted. In locomotives, the improvement has not been extraordinary. In cases, however, where heavy engines are really wanted, the issue has been fairly met, and engines of great size are now in course of construction. Wherever there is work for heavy engines they are cheaper in use than light locomotives, provided only that not too much weight is concentrated upon a single wheel. In the Great Indian Peninsula engines, to which we are referring, the whole weight is distributed upon ten points, viz., six coupled wheels and a bogie. The greatest weight upon any one wheel can hardly exceed six tons, at least if the weight is distributed with anything like equality. The use of the bogie is, indeed, lately becoming more general. The Great Western, Bristol and Exeter, North London, Great North of Scotland, and other lines, now work engines with bogies, and, as is understood, with much advantage. In other cases the "Bissell truck," the latest improvement upon the common bogie, has been adopted with marked success.

With respect to heat, steam, and the steam-engine, we cannot doubt that practical opinion is more advanced now than it was even a year ago. If no absolutely new facts have been discovered, others have become more widely and usefully known. The belief in the advantages of high-pressure steam has been constantly increasing, and we have lately had Mr. Fairbairn's declaration of his confidence in the ultimate adoption of a pressure as great as 500 lb. to the square inch. We may not yet be prepared to work advantageously pressures greater than 100 lb., or even 50 lb. at sea, but some of our engineers are already working from 100 lb. to 150 lb. in ordinary land boilers, and the Messrs. Perkins were last year working an engine at pressures varying from 350 lb. to 600 lb. per square inch. The extent and influence of condensation within the cylinder have been more carefully attended to, and, in addition to superheating, steam jacketting has been taken up as a necessary condition to expansive working. It would appear, too, that a considerable gain is likely to attend the superheating of steam on its passage from the high to the low-pressure cylinder of a compound engine—a plan patented some years ago by Mr. Wenham, and since carried out by him in successful practice. About a year ago a series of experiments were made, under the direction of the United States' Government, upon an American steamer, to test the gain by expansive working. It was found that, with steam of 20 lb. pressure, not superheated, and worked in an unjacketted cylinder, 3ft. in diameter and 8ft. stroke, and at a speed of piston of only 176ft. per minute, the steam condensed in the cylinder when working at one-third stroke, was about equal to that usefully expended in the production of power.

With regard to boiler explosions, much sounder views have prevailed of late years, and—we think we are justified in saying—since the announcement in these columns of a theory which, if not absolutely demonstrable with all the exactness of a problem in mathematics, is in exact accordance with well-understood principles, and is, furthermore, corroborated by abundant practical evidence. Until the appearance of this theory—since published over Mr. Colburn's name—no account appeared to have been taken of the occurrence of (or, at least, of the evidence afforded by) local ruptures of either the seams or plates of steam boilers—more generally below the water line—and no consideration appeared to have been given to the obvious effect resulting from the sudden liberation of the steam pressure from the surface of a large quantity of already heated water. The fact that not one in a hundred of all the boilers made ever do explode, the fact that, without warning or suspected weakness, boilers more frequently become ruptured in a seam of rivets, or in a plate, generally below the water line, and the fact that, on the sudden removal of the pressure under which alone water can be heated to above its ordinary boiling point, water so heated is violently displaced and dispersed under the tremendous impulse of its disengaging steam, are facts which constitute, when taken in connection with each other, a clear and ample basis for the explanation of steam boiler explosions under ordinary, or very little more than ordinary pressures. When a boiler explosion takes place without apparent cause the disaster is very commonly attributed to some mysterious source. If a plate or seam of rivets give way, harmlessly, and without any greater apparent cause, the circumstance is attributed as it should be to local weakness, aided or not by a slight excess of pressure. If, now, it be shown that while a rent may happen, and without causing further damage, in the lower part of the boiler, the occurrence of a precisely similar rent in the upper part of the boiler must inevitably liberate forces clearly sufficient to account for the destructive results which characterise an explosion, the mystery, if one there be, is well-nigh solved. Those who reflect that, in the case of a locomotive running at a maximum speed, the actual space of time occupied in the exhaustion of a cylinder-full of steam is less than the one-fiftieth part of a second, will understand with what lightning-like rapidity the steam space of a boiler might be emptied of its steam upon the occurrence of a rent of a few square inches area of opening at any point above the water level. Those, too, having any knowledge of the properties of steam and heated water will also perceive that while the disengagement of steam from heated water could not be absolutely coincident with the escape of the free steam through the rent in question, it must follow it within an exceedingly brief interval of time, and that in its disengagement it must hurl the water with it and before it, with a force due to the energy of the steam itself. This violent projection of heated water by steam in course of disengagement from it is almost too well known to require notice. The sudden and considerable opening of the safety valve of a steam boiler is often attended with the projection of a jet of water to a great height; Papin's digester may be made to afford an illustration of the force with which, under such circumstances, the whole of the water is projected, bodily, and by a simple experiment with a stoppered flask, over a spirit lamp, a pint of water heated to 218 deg. or 220 deg. only may be discharged violently against a lofty ceiling. The force thus brought into play is therefore unmistakable, and it does not seem at all improbable that it is

sufficient, when suddenly arrested by the iron plates of a boiler, to dash the strongest materials to fragments.

With regard to the mode of formation, and the constitution of steam, the publication, by Mr. C. Wye Williams, of some novel views has led many engineers and men of science to reconsider the whole subject, and although we are necessarily unable to say with what result, in each case, we can at least state the conclusions to which certain well-informed minds have arrived. All matter is known either to exist in a state of, or to be capable of, exceedingly minute subdivision, a subdivision extending far beyond any known means of determination. It is, of course, quite within the power of the mind to conceive the infinite subdivision of the smallest molecule of matter, but it by no means follows that, because we can imagine the division of an atom, any means exist whereby it may be actually divided. If we cut a fragment of wood, triturate a stone, or dissolve any substance whatsoever, we have no grounds for presuming that we have done more than separate atoms of certain sizes and weights. The fact, moreover, that chemical combinations occur in definite proportions only, almost forces the conviction upon the mind that all matter must consist of ultimate atoms, each absolutely impenetrable and incapable of division. Otherwise it would remain incomprehensible why, for example, oxygen and hydrogen, mixed in any proportion, would not form a chemical compound having some resemblance to water, the normal product of their combination. The existence of ultimate indivisible atoms being adopted, some physicists have attempted to explain the *cause* of heat by supposing these atoms to be constantly engaged in minute and exceedingly rapid vibrations. Without stopping to remark that the mere fact of such vibrations would hardly explain the origin of heat, we may note that the assumption is manifestly incomplete, as it merely substitutes an imaginary for a real and unmistakable phenomenon, the former being, if anything, more inexplicable than the latter. At present there appears, unfortunately, to be no more comprehensible idea of heat than that it is an imponderable, impalpable influence, surrounding but never penetrating the individual atoms of matter. We have seen no explanation of heat which gives us to know more than this. It is certainly the simplest view which can be taken of the relations of heat and matter, and it is, on the whole, more explicable than any other yet brought forward, involving, certainly, no greater stretch of the imagination than the conception of the force of gravitation. It is, too, the view adopted by Leslie and Dalton. Regarding the atoms of matter, therefore, as drawn towards each other by the force of attraction, and repelled by heat, we have all we require to enable us to comprehend the formation of steam. While the force of attraction greatly exceeds the repellant force of heat, the atoms of water approach each other, and cohere as in ice. While the opposing forces are nearly equal, the atoms of water are neither consolidated nor dispersed, but move readily among themselves. The range of fluidity—that from 32 deg. to 212 deg. Fahrenheit—is an exceedingly narrow one, when the greatest known range of temperature—many thousands of degrees—is considered. It was Dalton's opinion that the actual temperature of ice was about 8,000 deg. above absolute privation of cold, and that water was "more liquid" at 200 deg. than at 40 deg. The absolute zero of gases has since been fixed at nearly 500 deg. below the freezing point of Fahrenheit's scale.

The quantity of heat which can collect around an atom of matter is totally independent of the intensity of that heat. In some respect analogous to steam, the intensity of a given quantity of heat may be said to bear a certain proportion to the space which it occupies. There is no reason to suppose that, by hammering an iron bolt upon an anvil, we increase the quantity of heat already existing among the particles of matter composing the bolt or the hammer. But that we increase the intensity of this heat is evident. Dalton explained the reason of this increase of temperature by showing that, as the atoms of the iron were made to approach each other, heat, already in existence, was expelled, much, we may suppose, as steam in a cylinder would be increased in pressure and temperature by compressing it forcibly by means of a piston, or otherwise. Not only may we increase or diminish the intensity or temperature of heat in a body without affecting the total quantity of heat, but we may increase the quantity of heat in a body while the temperature is falling off, merely by increasing the distances between the particles of the body, as in evaporating a liquid. In heating a quantity of water the particles become more separated from each other than before, each particle not only taking its heat, in turn, directly from the source of heat, but receiving heat by conduction also from contiguous particles. The notion that water is a non-conductor of heat was ridiculed by Professor Leslie, and elaborately opposed by Dalton, and can be readily disproved by experiment.

Now, with so much before us, it is not difficult to follow the formation of steam, or, to use a more correct term, vapour. The moment a body of water acquires a heat greater than that of the air above it (supposing it to be open to the air), an outward flow of heat must commence. Instead of leaving behind it the atoms around which this heat had collected, as would be the case in the radiation of heat from a solid body, the force of attraction is already so nearly overcome that the surface atoms of water are ready to separate still further from the general mass. It is evident that the actual separation of the atoms would (at least until the boiling point was reached), take place at the surface of the water, since the resistance to separation is necessarily least there. The grasp, so to speak, with which heat retains its hold upon all atoms, the irrepressible effort with which heat, still collected about a series of atoms, radiates in the direction of any colder substance, and the slight attraction which the heated atoms of water have for each other, are sufficient reasons to explain the elopement of successive atoms of water with their enveloping heat, and their assumption of the vaporous form. While the atom is rising, however, from the general surface of the water, and before it has escaped entirely beyond the limited range through which contiguous atoms of water attract each other, it will receive an additional quantity of heat without, however, acquiring any increase of temperature, the sphere of its enveloping heat having simply become larger than before, and the intensity or temperature of this heat necessarily bearing some proportion to the diameter or capacity of the sphere itself. The additional dose of heat which the atom of water receives in the act of bounding into the vaporous state is commonly called "latent heat," a term which, as adopted by Dr. Black and other early physicists, was well enough until the announcement of the Atomic Theory, but which even Leslie took pains to show was unsuitable, and which Dalton still further demonstrated was meaningless and inconvenient. The moment we consider that the total quantity and the temperature of the heat collected about an atom must bear some proportion to each other (although clearly not the inverse ratio which exists between the bulk and pressure of a given weight of steam), we shall discover that "latent heat" is not the best term by which to distinguish the heat whose quantity is measurable by its effects, although its existence does not happen to be indicated upon the thermometer, an instrument contrived for the sole purpose of showing the intensity of heat without regard to its quantity. We might as well, after admitting steam of 50 lb. pressure into a box containing all the bullets it could hold, force that steam into another box of ten times the capacity of the first, but containing only the same number of bullets, and then speak of "latent pressure." The bullets would serve to illustrate the atomic *nuclei* in the case of heat; but we should readily perceive what had become of the pressure without perplexing ourselves and mystifying others with the term "latent."

We have thus given what we believe to be the soundest *rationale* of the formation of vapour at the surface of water. If the heat be applied from above, the process of vaporisation must proceed from the surface. And where the heat is applied from below, the transfer of heat from the rising heated atoms of water to those around them is so rapid that, in addition to any steam which may actually rise all the way from the bottom to the surface, a further evaporation of atoms which have not descended to the bottom probably occurs also. It is only when the boiling point has been reached, and the whole mass of water has the same temperature as the rising atoms of vapour, that the latter can visibly shoot to the surface and invisibly escape as steam.

In this somewhat lengthy review we have touched upon very few of the subjects upon which engineers are acquiring new opinions. We have given most attention to those which appear to be the least understood, and the length to which our remarks have thus been extended precludes anything further, under this head, for the present.

ON ENTERING PRACTICE.

Few, we think, of our younger readers will have failed to read the admirable paper of which we this week conclude the re-publication, and entitled "On Entering Practice"—a paper lately read by Mr. T. Roger Smith before the Architectural Association. Although addressed to young architects, and, in fact, really entitled "On Entering *Architectural* Practice," it is in most respects as serviceable to young engineers in its advice upon many matters which greatly serve to determine future professional success. It presents a portrait, drawn in firm lines, of the clever and sensible young professional man, one who has the ambition and energy to win honourable fame and a fair fortune. A youth possessed of some degree of talent, and having the invaluable faculty of organising his thoughts and applying his efforts to advantage, may, in glancing over Mr. Smith's paper, see how he is to become a useful, respectable, and, more or less, successful practitioner. But if such an youth, in his fulness of professional ambition, suppose that all the virtues and accomplishments which Mr. Smith has set forth are indispensable, or, more especially, that their possession is at all likely to secure anything like complete success, then is that youth likely to be disappointed, and, possibly, broken-hearted. For Mr. Smith has by no means told all. There are hidden sources of success of which professional lecturers are not so apt to speak, and of which those high in the profession prefer that little should be said. It is not probable that the comparatively small number of engineers, at least, who monopolise practice in this country, have also an exclusive monopoly of that skill, personal fitness, and general weight of character which make the able and trustworthy engineer. Mr. Smith is doubtless well aware that scores of high-minded, noble-hearted, intelligent (and even accomplished, if that be anything) young and middle aged engineers, well up in their business, are left to kick their heels in their lonely offices, while men who will only recognise them so far as to appropriate the whole credit of their occasional services, take up the whole of public consideration of our profession. Genuine engineering talent is by no means so rare as some would have us believe, and as for those personal qualities which beget trust, and are most held to deserve success, the employers of engineering services might do well to extend their customary range of observation.

Successful engineering now-a-days is less professional than political. Supplied with practically unlimited means, and accustomed to leave many grave difficulties of execution to be got over by the contractors, an engineer can hardly chance to lay out foundations that will yield, to plan bridges that will break down, or to make a railway that is not passable by a test train. These works are carried out commercially rather than professionally—the commission to lay out so many miles of railway being taken in hand much as an iron master would proceed with an order for iron, or a manufacturer with an order for cloth. Railways, bridges, docks, &c., are manufactured now-a-days; they are not created by a process of mental origination, as was the case in days gone by. The man who can skilfully select the route for a railway, who can determine the best site for a harbour, who can set out foundations of unquestionable stability, who can design structures with consummate skill, is not the man to receive popular homage. He is rather the appendage of the great engineer who can operate upon capital, shine in parliamentary committee-rooms, and who especially knows how to organise and combine real engineering talent, and, while overshadowing the real workers, gain the credit of the whole. Let Mr. Smith give us a paper on entering engineering practice, and tell us the secret of all this. George Stephenson declared that he had no difficulty in engineering *matter*, but that he found it hard work to engineer *men*. There are hundreds of young engineers who have reason to mourn their incompetence in the same respect. Let them pursue their profession, but let them look well to that rare and intangible faculty by which only, it would appear, the profession now rises to success. Say what we will of professional honour, it is the political engineers who get on best.

LITERATURE.

Lives of the Engineers: with an Account of their Principal Works, comprising also a History of Inland Communication in Britain. By Samuel Smiles.

[Fifth Notice.]

In most countries early instinct in the arts of life induces similar conclusions. Mining and metallurgy have been very much alike in their early operations. In minerals that require disintegrating in order to extract the metal there are two processes resorted to—stamping or crushing, and grinding. The first is performed by lifting heavy pestles or beetles, the latter by bringing centrifugal movement to bear over a large surface with different rates of speed, just as a millstone, receiving the grain in the centre, and delivering it at the periphery, increases the running speed by the greater rapidity of movement in approaching the edge. In the process of amalgamating ores with mercury, to extract the metal, it is necessary to reduce them to an impalpable powder. So in Chilé the quartz rock, which contains gold, is broken into pieces the size of a walnut before it goes to the mill, which is a granite circle of solid stone, 6ft. in diameter and 2ft. in thickness, with a circular hole through it 18in. in diameter. This stone is laid horizontally on two parallel walls about 10ft. high and 3ft. between. Around the outside of the stone, staves are placed, hooped tightly together, and rising some 18in. above the flat surface of the stone. Around the central hollow are fixed a similar lot of staves, and thus a circular trough of wooden sides with a stone bottom is formed, which will hold water. Through the central hole passes a vertical shaft with an iron centre pin at the bottom, which is stepped in a plate of iron fixed on a beam. Around the shaft, commencing a foot from the bottom, are framed four to six large wooden spoons with bowls 1ft. wide and 2ft. long, making up a circle of about 6ft. in diameter, arches being formed in the lower part of the walls to permit the spoons to pass round. Each spoon has its face at an angle of 45 deg. with the horizon. The upper part of the shaft has a pin revolving in an upper cross beam. At a height of 2ft. 6in. above the flat stone a vertical slot is formed in the vertical shaft, through which passes a horizontal shaft of timber, the ends of which are formed into axles. On these axles are placed two vertical stones, 18in. in thickness, and 4ft. in diameter. A gush of water being driven against the spoons, the two vertical stones are put in motion, running over the horizontal surface with the friction due to the difference in speed of the inner and outer sides. The nodules of quartz ore are poured in at the centre, and, as they crush gradually, work to the outer side, the circular trough being filled to the brim with water, which continually runs over the edge in a small stream. Quicksilver is placed in the troughs, which catches the particles of gold. As the water runs over it is received into skin bags, some half-dozen in number, one below another, and all containing quicksilver. A simpler, and, at the same time, a more perfect arrangement could not be contrived. The only metal used in it is the iron bearing for the vertical shaft; and modern gold miners tell us that the Chilian mill beats all others for useful effect. When granite cannot be found large enough a jointed surface is formed, and, instead of circular running stones, large flat pieces are attached by hide ropes to the horizontal axles and dragged round.

Brindley tried his hand at steam engines, but without proper materials. Wooden tubs would not do for cylinders, and Brindley had, moreover, found other occupation in canals; so, after erecting a practical steam engine of metal at the Walker Colliery, in Newcastle, in 1763, he left steam altogether. Canals were wanted, and just then came forth a man with the foresight and energy to embark capital in them. And no man but Brindley could be found with the requisite skill and invention to put them in operation, finding in the resources of his own mind a solution of every mechanical difficulty, and a plan for every new operation. The Duke of Bridgewater had travelled in France, and seen canals there. His father had, before him, obtained an Act of Parliament to make a canal, which was not made, and, being disappointed in love, his son turned his thoughts to money-making. He wanted to improve his property, and it was not mere patriotism that actuated him, or he would not subsequently have vituperated the railroads, which, he feared, would interfere with his monopoly. He was a man of shrewd brains and strong business faculties, throughout determined never to embarrass his landed property by mortgages, instead of which, when the pinch came, he borrowed small sums as he best could from his tenants, and all others with whom he came in contact. He was no enthusiast, sacrificing all his worldly wealth to an idea, but a careful calculator of results, and turning all people to account in the process, working the Legislature, and working his servants and others whom he employed, for his own especial benefit, at the lowest possible cost. The portrait, as given by Mr. Smiles, is that of an intensely selfish egotist, not the *great* Duke of Bridgewater of our youthful dreams, not a man of high aspirations, but a vulgar speculator heaping up money, albeit by novel processes. His face looks the very miniature of greediness—intense egotistical greediness, the very stuff of which the mere vulgar contractor is made. Turning to the companion portrait of Brindley, we come to the involuntary reflection

that this man was the true *dux*, the creator, and the nominal duke was the clerk and accountant, who somehow had turned his true master to account, and usurped his property. If this be a true portrait of Brindley it is clear that he was a man in his own right, with fine brows, clear, intelligent eyes, and a generously smiling mouth—a noble-man by nature, and above all meanness, though circumstances had denied him other than mechanical cultivation, the natural sprouting forth of his instincts in the process of work. And now for a digression.

In the town of Newcastle-under-Lyme there lived a young man named Samuel Mayer, a name indigenous in the Potteries and thereabouts. Possessing no property he, nevertheless, courted and married a girl with money, and, setting up in business, became in time one of the burgesses of the town—then a borough belonging to the Marquis of Stafford. The aspect of our friend was very Oriental, and assuredly, in a turban and caftan, he might well have passed for an Eastern pacha. Probably all the Mayers, and Miers, and Almieras, are of Hebrew extraction.

Our friend had a love for shooting, and one day, on the town-lands, he shot a partridge, which, nevertheless, got off, and fell dead on the other side of the fence, on the land of the marquis. He got over the fence and reached his spoil, but at that moment up came one of the marquis's gamekeepers, and demanded his gun. He refused it, and a struggle ensued. The gamekeeper's helpers came up, and the gun, broken in the struggle, was carried off. As the spoilers turned away the proud and indignant burgess called out, "Tak my message to thy mester, my lad, and tell him it shall be the domdest dear goon he ever had in his loife."

The next day an apology came from the marquis, with another gun of a more valuable kind, requesting his acceptance of it. "Tell thy mester it's too late, lad," exclaimed the still irate burgess. And it was; for, on his return to the town, he had called his brother burgesses together, and so impressed on them the insult which they had suffered in his person, that they agreed to take up town-land amongst them, and thereon build a sufficient number of four-roomed cottages to oust the marquis with their own tenantry from his two seats in Parliament. Assuredly their tenantry were a heterogeneous company, and the landlords did not even know their names till they came up to vote; but they paid them eighteen pence per week, and occasionally complained of the absence of a door or window which the last tenant had carried off, and "Tom of Jacks," and "Dick near the Midden," and the "Woman in the red petticoat," and "Red-eyed" and "Black-eyed Mary," served well enough as names to chalk down on the counter for distinction on the Saturday night.

A son of this Samuel Mayer went to Liverpool, and became a goldsmith (just as Myddelton came to London), and there, in virtue of original shrewdness and a self-educating power, became Joseph Mayer, Esq., known far and wide as an antiquary. He, amongst other matters, became possessed of the literary remains of James Brindley, consisting of his diary, to which he gave Mr. Smiles access for the purpose of his work, and a more curious collection is not often met with. The orthography is phonetic, and in the Derbyshire and Staffordshire dialect.

So the duke, after consulting with his land-agent Gilbert, called Brindley to his aid, who at once decided to carry the canal over the Irwell—a navigation in the air over another navigation—and this he accomplished, though it was pronounced impracticable by another engineer. And the duke was shrewd enough to believe him. He knew, from practical demonstration, that clay could be made to hold water. Brindley had no doubt ascertained that all water is held by nature in basins of rock or clay; and he imitated nature. And so coal was brought into Manchester, and the price reduced from 7d. to 3½d. per cwt. by the brain of one man and the energy of two, the man with the brain getting only labourer's wages all the time.

Brindley was a man of business as well as a universal engineer and mechanic; he negociated for land, and bought and sold materials; and was "landmonger, carpenter, mason, bricklayer, boatbuilder, paymaster, and engineer, counting bricks and selling grass."

One evening the duke and his land-steward Gilbert, and Brindley the engineer, sat smoking in a small public-house in the Chat Moss. And the duke all at once asked, "Well, Brindley, what's to be done now?" And Brindley answered, "Well, duke, I can't tell. I only know, if the money can be got, I can finish the canal, and it will pay well." "Aye," said the duke; "but where are *we* to get the money?" Brindley consoled him with a "Don't mind, duke; don't be cast down; we are sure to succeed, after all!"

And so the duke who, all this time, would not raise money on his many estates, but preferred borrowing, finally mortgaged his first canal to his bankers in order to finish his second. And, all this time, the man who helped him was pinched in means, and worked for the lowest wages. In fact, his value was not recognised other than as a servant, and it has been said that the duke, in lieu of pay, offered him the run of the servants' hall. We know not if he accepted the offer, but we trust not, and that he had the satisfaction of doing his work for the sake of his name. He was the duke's benefactor; gave to him all for mere nourishment—his great natural gifts; and, when he had done his work, the great landowner was content to receive it without helping the man who had helped him. The spirit of the speculator was shown by his constant endeavours to get out of the men employed, overtime gratis, even to extent of making the clock strike thirteen, instead of one, at the return dinner-hour, lest they should not hear it. Till the work was done, it was "what shall *we* do?" When done, it was "I, duke, will take the rents, and you, Brindley, may do what you can."

To be continued.

ANOTHER TELEGRAPH TO IRELAND.—A prospectus has been issued of the London and South of Ireland Direct Telegraph Company, with a capital of £100,000, in £10 shares. The line will cross from Milford to Wexford, Cork, and Queenstown.

A RAILWAY is projected from Rickmansworth, *viâ* Amersham to Chesham, the estimated cost being £100,000.

THE SCOTCH IRON TRADE.—We gave last week some interesting information with respect to the Scotch iron trade during 1861; and we now add a few remarks on the same subject from Mr. Thorburn, of Glasgow. Mr. Thorburn, whose observations are entitled to considerable weight, writes:—The iron trade continues to manifest an irrepressible expansion. The quantity of pig iron produced in the last twelve months has been 135,000 tons, showing an increase of 35,000 tons over that of the preceding year. During the year the total deliveries amounted to 927,000 tons, and exhibit an increase of 24,000 tons when compared with those of 1860. The stock has therefore increased 108,000 tons, and is now (exclusive of Carron stock, which is estimated about 70,000 tons) 535,000 tons, lying in the makers' and warehouse-keepers' stores. It must not, however, be forgotten that it is only here the stocks of iron have accumulated, and when a great demand for the article shall arise it is from Scotland alone that a prompt supply can be obtained. The fluctuations in the price have scarcely exceeded 2s. 6d. either above or below the average price of 49s. 3d. per ton for the year, and were chiefly governed by conflicting operations for a rise or a fall. The lowest price reached was 47s. in March; the highest, 51s. 9d. in August. The malleable works, foundries, and ship-building yards on the Clyde have, as well as other branches of industry, felt, though not as yet severely, the disastrous effects of the American revolution. Still the quantity of iron used in the local consumption has been only 3,000 tons less than that in the last year."

DECADENCY OF GLASGOW.—We have before us a copy of *Oliver and Boyd's Almanac for* 1862, which contains, as an introduction to its Western Supplement, a chapter on the "Vital Statistics of Glasgow." There we are told that "unless new branches of industry are introduced it is difficult to see how Glasgow can continue to increase" in a ratio similar to what it has done in the past. And then is added—"The cotton trade has apparently reached its acme—the coal and iron ore in her ambit are rapidly being diminished. The probability, therefore, is that during the ensuing ten years the rate of increase in population will be lessened, although there are at present no signs that such will be the case to any serious extent." The cotton trade of Glasgow may have reached its highest point, it is true, but that the expansion of the city is in future to be at a diminished rate unless new branches of business are to be introduced is not quite apparent, nor does the writer put himself to any trouble to give the desiderated information. It is a truism that the coal and iron ore are being diminished within a certain circuit by a constant output, but these important minerals are not being worked at so rapid a rate as to cause us to fear that there will be less employment for our mining population in the ensuing decade than there has been in the past; indeed, the recent prospecting of scientific men indicates that mining will yet attain greater magnitude in the ten years we have entered upon than it has even done in the past, and new mineral fields are being opened all around us. We take the writer, therefore, in the *Almanac for* 1862 to have antedated his prognostications of our decadence by some few years, and we rather suppose it will have to fall to the hands of a successor down the years of the century a good way from 1862 to record the predicted decline in our population.—*Glasgow Mercantile Advertiser.*

PROGRESS OF INDIA.—One of the pleasantest prospects of the coming year lies in that direction. We see great clearings going on in the jungles, and lofty trees falling on the slopes of the Ghauts, designed for our timber yards. We see floods brought back into their channels, and droughty wastes fertilised by the opening of ancient waterworks and the construction of new. We see the cotton plant blossoming over tens of thousands of acres of lapsed lands; and mulberry plantations in the north-west reminding travellers of Lombardy; and tea-grounds creeping up the mountain slopes; and grain springing up in immeasurable quantities. We see long trains of laden boats descending the great rivers, and cargoes of merchandise carried up among the springheads of those mighty streams, among villages where it is a distinction for any old man to have seen one of the white race, the very existence of which has hitherto been a sort of myth—a theme for the narrators of legends. We see the rail cutting through the forests, and mounting the passes of the Ghauts, and dividing the plain, and the third-class carriages crowded with native traders or excursionists, while the priests are discussing in private conference the great question of how the merit of pilgrimage is affected by this new facility of travelling. We see the sensible order of colonists sitting down on their new lands and making up their minds as to the best method of interesting the old fashioned Hindoo labourers in obtaining good crops; and we see the quickening of the markets within the range of such colonists—markets to which the peasantry bring all the cotton they grow, and where they purchase cloths cheaper than they can now make them at home. Where the household loom was in its pit under the palm or tamarind tree we see the ground filled in because the family are more profitably employed. We see the children thronging to school, to fit themselves for doing business in European style. There may be yet better spectacles, and there may be worse; but it is certain that the coming year will present much that is new and significant in this direction.—*Once a Week.*

WILLIAM FAIRBAIRN.—Mr. Fairbairn was born at Kelso, in the early part of 1789; and in the parish school of Mullochy, in Rossshire, he obtained the only portion of his knowledge which he owes to any tutor but himself. That portion consisted of the art of reading, and of an imperfect acquaintance with writing and arithmetic. "Chill penury" could not, however, "freeze the genial current" of this soul, or "suppress its noble rage" for information. Apprenticed at the usual age to an engine-wright at the Percy Main Colliery, near North Shields, he devoted the hours that could be snatched from repose after the bread-winning labour of the day was over to the study of geometry, and to the perusal of such books of general literature as were accessible. There was at that time a good old custom, less in vogue now, among the superior class of mechanics, of making, once in their lives, a tour of the country in search of new ideas and varied experience in their business. Following this plan William Fairbairn went to London at the expiration of his apprenticeship, where he worked for two years as a journeyman, occupying his leisure in study and in the construction of some useful novelties in machinery. Thence intent upon the same pursuits, and observing the practice of various places while maintaining himself by his labour, he passed through South Wales and Ireland. This process was pursued until October, 1813, when good judgment, or a happy accident, stopped the wandering son of genius and labour at the town where fame and fortune were awaiting him. In Manchester Mr. Fairbairn commenced business on his own account, with no capital except his natural endowments, and the copious stores of professional experience which he had collected in his travels. There can be few prouder subjects of recollection now than the fact that the struggle, even for subsistance, was a hard one for a considerable time. His partner was Mr. James Lillie, in conjunction with whom he fought, for a period, as hard an uphill fight as it has often fallen to the lot of brains without money to sustain. But firmness and perseverance achieved in the end their old reward. Henceforth the only available record of this long and useful life is to be found in an account of the chief contributions it has made to human knowledge, comfort, and happiness. . . . . Honour as well as fortune have not failed to crown accomplishments and public services so great as those we have described. The poor engine-builder's apprentice of 50 years ago is a Fellow of the Royal Society, a corresponding member of the Imperial Institute of France, a member of the Institution of Civil Engineers, and of the Institution of Mechanical Engineers, honorary member of the Institution of Engineers in Scotland, and a member of many other scientific bodies, English and foreign. On the occasion of his receiving, in 1860, the Queen's medal of the Royal Society, for his researches, it was justly remarked that scarcely a single individual living had made so many and so careful experimental inquiries on subjects of primary importance to the commercial and manufacturing interests of the country, and had so liberally communicated the results to the world at large.—*London Review.*

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

2120. ROBERT WATRIN JONES, Glenbrook Baths and Hotel, county Cork, Ireland, "Improvements in heating and ventilating, especially applicable to Turkish baths."—*Petition recorded 26th August*, 1861.

2207. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "An improved combination of machinery for the production of Valenciennes, Chantilly, Brussels, and other similar laces."—A communication from Jean François Régis Laporte, Rue St. Fiacre, Paris.—*Petition recorded 12th September*, 1861.

2295. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "An improved apparatus for the conveyance of medicinal substances into various parts of the human body."—A communication from Salvator Vinci, Rue de la Pepinière, Paris.—*Petition recorded 14th September*, 1861.

2362. CHARLES BOARD, Bristol, "Improvements in veneering presses."—*Petition recorded 21st September*, 1861.

3042. ROBERT KENNEDY and JAMES ARMSTRONG, Lisburn, Ireland, "An improved arrangement of driving gear."—*Petition recorded 4th December*, 1861.

3047. ALLEN THOMAS CARR, Carlisle-street, Soho, London, "The addition to horses' shoes of certain material to prevent slipping."

3050. JOHN WILSON, Glasgow, Lanarkshire, N.B., "Improvements in frames used for displaying trade show cards, pictures, or other similar devices."—*Petitions recorded 5th December*, 1861.

3056. EDGAR DARIUS SEELY, THOMAS FOSTER WELLS, and GEORGE ARTHUR PHILLIPS, Norfolk, Massachusetts, U.S., "An improved apparatus for holding and placing percussion-caps on fire-arms."—*Petition recorded 6th December*, 1861.

3092. WILLIAM FORD STANLEY, Great Turnstile, Holborn, London, W.C., "The use of aluminium for the construction of mathematical instruments used for geometrical drawing, surveying, and nautical purposes, and improvements connected therewith."—*Petition recorded 10th December* 1861.

3105. JOSEPH SCHLOSS, Cannon-street, London, "An improvement in forming the leaves of albums and books for containing photographic portraits and views."—A communication from Simeon Schloss, Paris.

3107. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in decorating or printing upon china, porcelain, earthen, and other like wares."—A communication from Joseph Robert Prevost, Paris.

3109. JOHN POTTER, Leeds, Yorkshire, "An improved mode of jointing or connecting telegraph wires, which is also applicable to jointing or connecting signal wires, fencing wires, and other wires or rods."—*Petitions recorded 11th December*, 1861.

3111. RICHARD SEARLE, Woodford Wells, Essex, "Improvements in the treatment, preparation, and combination of metals used for sheathing ships and marine erections, also for roofing buildings and other purposes."

3114. WILLIAM WIGGINS GODFREY, Whiskin-street, Clerkenwell, London, "An improved fastener or protector for Albert guards."

3115. WILLIAM EDWARD WILEY, Great Hampton-street, Birmingham, "An improvement or improvements in pencil cases and holders for crayons and other solid writing or marking materials, which improvement or improvements may also be applied to crochet needle holders."

3116. ROBERT MUSHET, Coleford, Gloucestershire, "An improvement or improvements in the manufacture of iron and puddled steel."

3117. WILLIAM SMITH LONGRIDGE, Alderwasley Ironworks, Derbyshire, "Improvements in railway wheels and tyres."

3118. AUGUSTUS TONNAR, Eupen (Rhenish Prussia), "Improvements in the method of, and apparatus for, drying and cleansing malt, as well as any other species of grain and seed intended for brewing, distilling, and agricultural purposes."

3119. JOHN WILLIAM SCOTT, Worcester, "Improvements in wads for fire-arms."

3120. JOSEPH DOMINIQUE JOBIN, South Island-place, Clapham-road, Surrey, "Improvements in locomotive engines, parts of which improvements are also applicable to marine and stationary engines."

3121. HENRY BAILEY, Frump-street, Cheapside, London, "An improved button or stud."—*Petitions recorded 12th December*, 1861.

3122. RICHARD ASHWORTH, GEORGE SHEPHERD, JOHN CORMACK, and JOHN DEARDEN, Stacksteads, Lancashire, "Improvements in looms for weaving."

3124. WILLIAM BELL, Leamington, Warwickshire, "Improvements in kitcheners or cooking ranges."

3125. FREDERICK BRAMPTON, Birmingham, "An improvement or improvements in the manufacture of the middle joints of measuring rules."

3126. HENRY JOHN OLDING, Smith-square, Westminster, Middlesex, "Improvements in the mode of, and apparatus for, feeding steam boilers; also in apparatus for supplying fluids for other purposes, and in apparatus for raising fluids."

3127. EDOUARD CLAUDE BARBOTTE DE BEAULIEU, Avallon, Yonne, France, "Improvements in the manufacture of spirituous liquors, and in apparatus employed therein."

3128. GREGORY BIRD, Glasgow, Lanarkshire, N.B., "An improved grease for lubricating frictional surfaces."

3130. THOMAS WALKER, Birmingham, "Improvements in means or apparatus for indicating the speed of vessels and for taking soundings."

3135. ALFRED VINCENT NEWTON, Chancery-lane, London, "An improved arrangement of fire-escape."—A communication from Aaron Shute, Flushing, New York, U.S.

3136. JOHN HETHERINGTON, Manchester, THOMAS WEBB, Smallwood Manor, Uttoxeter, and JAMES CRAIG, Tutbury, Staffordshire, "Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous materials."

3137. HENRY APPLEBY, Tavistock-place, Plumstead Common, Kent, and HENRY HARRISON, Grand Junction Works, Northampton, "Improvements in machinery for boring wood and other materials used in the manufacture of brooms and brushes."

3138. THOMAS KILLINGWORTH ADKINS, Wallingford, Berkshire, and JOHN BONTHRON, Regent-street, London, "Improvements in the manufacture of starch, and in apparatus employed therein."

3139. JOHN KELLY, Brook Lodge, Roscommon, N.B., "Improvements in the treatment of milk for the manufacture of butter, and in apparatus for the same."

3141. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in blowers or apparatuses for supercheating steam and other gases, and for projecting them, combined with atmospheric air, upon ignited combustible matter."—A communication from Felix Alexandre Testud de Beauregard, Paris.—*Petitions recorded 13th December*, 1861.

3143. JACQUES EDOUARD DUYCK, Tutsham Mills, West Farleigh, Kent, "Improvements in the expression of oil from cake and seeds, and in apparatuses employed therein."

3146. WILLIAM RODRIGUES ROGERS, Gray's-inn-road, London, "An improved mode of constructing dovetail joints."

3147. WILLIAM ELLIOTT DERENHAM, The Terrace, Kensington-garden's-square, London, "An improved plate-holder for photographic purposes."

3148. WILLIAM HUSBAND, Hayle, Cornwall, "An improved water safety-valve."

3149. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in railway rolling stock."—A communication from Thomas Jefferson Thompson, Logrono, Spain.—*Petitions recorded 14th December*, 1861.

3151. JOHN WILLIS, jun., Newcastle-on-Tyne, Northumberland, "Improvements in the preparation of materials applicable to the manufacture of paper."

3153. GEORGE DAVIES, Serle-street, Lincoln's-inn-fields, London, "Improvements in the manufacture of textile materials."—A communication from Alois Chevalier Auer de Welsbach, Vienna.

3154. WILLIAM BARTRAM and WILLIAM SHELDON HARWOOD, Sheffield, Yorkshire, "An improved apparatus for filling and ramming cartridges for breech-loading and other fire-arms."

3155. DAVID CHALMERS, Glasgow, Lanarkshire, N.B., "Improvements in looms for weaving, and in the manufacture of cloth therefrom."

3157. WILLIAM GEORGE LAWS, Tynemouth, "Improvements in railway point signals."—*Petitions recorded 16th December*, 1861.

3161. JOHN BICKERTON BUNNEY and THOMAS WRIGHT, Birmingham, "Improvements in ornamenting metallic and non-metallic beadsteads and other articles made principally of metallic rods or tubes."

3162. ROBERT SHAW, Marple, Cheshire, "Certain improvements in carding engines."

3164. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improved hoisting apparatus."—A communication from John James Doyle and James Christison, New York, U.S.—*Petitions recorded 17th December*, 1861.

3166. ROBERT SCOTT, Great Portland-street, London, "An improved method of rifling or grooving the barrels of fire-arms and ordnance."

3168. JAMES PERRIN, Hyde, Cheshire, "An improved equilibrium valve."

3170. WILLIAM DICEY, Waltham Abbey, Essex, "Improvements in submarine electric telegraphic cables."

3172. MORRIS HANFF, Tottenham-street, Tottenham-court-road, London, "Improvements in the manufacture of boxes and cases."

3174. JOSEPH THIEBAUT, Mile-end, London, "Improvements in the ornamentation of textile fabrics."

3176. EDMUND FACE, Queen-street, London, "An improved lath for Venetian blinds."

3178. JAMES BANNEHR, High-street, Exeter, "Improvements in apparatus for desiccating grain, seeds, and other articles."—*Petitions recorded 18th December*, 1861.

3180. WILLIAM BETTS, Wharf-road, City-road, London, "Improvements in the manufacture of coverings for the ends of cigars."

3182. WILLIAM TATE, Horsley-hill, near South Shields, Durham, "Improvements in armour, and in making and applying the same for protecting

wood and iron ships of war and batteries."—*Petitions recorded 19th December*, 1861.

Patents on which the Stamp Duty of £50 has been Paid.

2995. SAMUEL STEPHEN BATESON, Bolton-street, May Fair, London.—Dated 30th December, 1858.
5. JOSEPH EUGENE DROUOT, Rue St. Appoline, Paris.—Dated 1st January, 1859.
17. JAMES HARRIS, Hanwell, Middlesex.—Dated 1st January, 1859.
39. JAMES HOWARD, Bedford.—Dated 5th January, 1859.
84. DAVID EDWARD HUGHES, Northampton-square, London.—Dated 11th January, 1859.
153. RICHARD GARRETT, jun., and JAMES KERRIDGE, Leiston Works, Saxmundham, Suffolk.—Dated 18th January, 1859.
52. ISAAC HOLDEN, St. Denis, near Paris, and ANGUS HOLDEN, Bradford, Yorkshire.—Dated 7th January, 1859.
37. FREDERICK CLARK, King-street, Bloomsbury, London.—Dated 5th January, 1859.
42. WILLIAM COPFIELD, jun., Charlton-Adam, Somersetshire.—Dated 5th January, 1859.
50. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London.—A communication. Dated 6th January, 1859.

Patents on which the Stamp Duty of £100 has been paid.

73. EDWARD HALL, Dartford, Kent.—Dated 11th January, 1855.
25. GEORGE WALKER MUIR, Glasgow, Lanarkshire, N.B.—Dated 3rd January, 1855.

Notices to Proceed.

2108. SAMUEL ELSON, Oldham, Lancashire, "Improvements in apparatus for heating the feed-water of steam boilers, superheating steam, and surface condensation."—*Petition recorded 23rd August*, 1861.
2120. ROBERT WATKIN JONES, Glenbrook Baths and Hotel, county Cork, Ireland, "Improvements in heating and ventilating, especially applicable to Turkish baths."
2123. GEORGE NYE, Mount-street, Lambeth, London, "Improvements in apparatus for administering injection in a continuous stream, also applicable as an eye douche, and other purposes."
2124. AUGUSTE LECHENE, Stanhope-street, Hampstead-road, and CHARLES NATHAN, Westmoreland-street, Pimlico, London, "Improvements in the manufacture of ladies' collars, cuffs, or other ornamental articles for dress or furniture, to imitate such articles made of lace or embroidery."
2125. JOHN LYON FIELD, Colton Haverthwaite, near Newton in Cartmel, Lancashire, "Improvements in the construction of armour plates, and in their application to ships and batteries."
2126. FREDERICK TOLHAUSEN, Boulevart Bonne Nouvelle, Paris, "A new kind of artificial fur, to be made by means of the jacquard or other loom, with silk or other textile material."—A communication from Antoine Denis and Adolphe Mottet, Boulevart Bonne Nouvelle, Paris.
2130. HENRY ATTWOOD, Wapping-wall, London, "Improvements in cleansing and in feeding boilers."—*Petitions recorded 26th August*, 1861.
2135. JOHN CHRISTOPHER CÆSAR AZEMAR, Mark-lane, London, "The manufacture of an instrument to facilitate the practice of the drum."
2139. JOHN MATTHIAS HART, Cheapside, and ROBERT LAVENDER, Acacia Cottages, New-road, Hornsey, London, "Improvements in handles or knobs of locks and latches, and in the means of applying them."—*Petitions recorded 27th August*, 1861.
2140. ARTHUR GRANGER, Holborn, London, "Improvements in the manufacture of shirt collars and fronts, wristbands, or cuffs, neckties, or other similar articles of wearing apparel."
2142. BENJAMIN BROWNE, King William-street, London, "An improved process and apparatus for concentrating ores or tailings, or separating pulverised mineral substances of different kinds or qualities from each other."—A communication from Henry Eberhard Roeder, Broadway, New York, U.S.—*Petitions recorded 28th August*, 1861.
2151. VICTOR ALEXANDRE JANVIER, Wilton-square, New North-road, London, "Improvements in fastenings for gloves, belts, and other articles."
2153. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improved machinery for cleaning rice and other grain."—A communication from Albert Hubbell Wright, New York, U.S.—*Petitions recorded 29th August*, 1861.
2155. LEMUEL DOW OWEN, New Oxford-street, London, "Improvements in ploughs."—A communication from Martin Buck, Lebanon, New Hampshire, U.S.
2159. ALEXANDRE JAILLE, Agen, Lot et Garonne, France, "An improved manufacture of manure."
2161. HENRY WILLIAM SPENCER, Stepney-causeway, Commercial-road, London, "Improvements in the manufacture of animal oils, the said improvements relating more particularly to the processes of refining them to be used for lubricating purposes."
2164. HIPPOLYTE LECAUDEY, Wellington-street, Strand, London, "Improved apparatus for succouring persons interred before life is extinct."—A communication from Raymond Maleville, Bordeaux, France. — *Petitions recorded 30th August*, 1861.
2172. THOMAS MORETON JONES, Great Pulteney-street, London, "Improvements in apparatus for suspending and turning meat, fowls, and such like articles for roasting."
2174. CHARLES PEMBERTON, Deptford, Kent, "Improvements in railway, ship, and other signals."
2177. JOHN JONES, North John-street, Liverpool, "Improvements in clasps or fastenings for garments, belts, harness, and like articles."
2179. JOHN MACMILLAN DUNLOP, Manchester, "Improvements in cleansing cotton seeds, and in machinery used for such process."—*Petitions recorded 31st August*, 1861.
2187. JOSEPH HALL, Oldham, Lancashire, "Improvements in portable pumps or engines for extinguishing fires and other purposes."
2188. JOHN WATSON, Glasgow, Lanarkshire, N.B., "Improvements in furnaces."
2189. EMILE ALCAN, Coleman-street-buildings, London, "Improvements in machinery for carding and combing wool and other filamentous substances."—A communication from Celestin Martin, of Forge Thiry lez Verviers, Belgium.—*Petitions recorded 2nd September*, 1861.
2195. EDMUND SUCKOW and EDWARD HABEL, Oldham, Lancashire, "Improvements in machinery or apparatus for producing a strong blast or current of air."—*Petition recorded 3rd September*, 1861.
2201. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in self-acting brakes applicable to railway or locomotive engines and carriages."—A communication from Léon Isidore Molinos, Rue St. Sébastien, Paris.—*Petition recorded 4th September*, 1861.
2211. PETER EFFERTZ, Manchester, "Improvements in machinery or apparatus for making bricks, tiles, drain-pipes, and other similar articles."
2213. FREDERICK BENNETT, Upper Works, Bagillt, Flintshire, "An improved method of coating the interior surface of lead and lead composition pipes with tin or its alloys."—*Petitions recorded 5th September*, 1861.
2234. MICHAEL HENRY, Fleet street, London, "Improvements in apparatus for signalling on railways by means of electricity."—A communication from Eugene Vincenzi, Parma, Italy.—*Petition recorded 6th September*, 1861.
2240. GEORGE NORRIS, Broadesbury-terrace, Kilburn, London, "Improvements in the manufacture of soap."
2244. GEORGE HENRY BIRKBECK, Southampton-buildings, Chancery-lane, London, "Improvements in the construction of saddles."—A communication from Louis Friese, Stuttgard, Wurtemburg.—*Petition recorded 7th September*, 1861.
2267. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "An improved combination of machinery for the production of Valenciennes, Chantilly, Brussels, and other similar laces."—A communication from Jean François Régis-Laporte, Rue St. Flacre, Paris.—*Petition recorded 12th September*, 1861.
2284. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in guns."—A communication from William McCord, New York, U.S.—*Petition recorded 14th September*, 1861.
2332. JOHN GURMAN, Onslow-road, Southampton, Hampshire, "Improvements in the fittings and method of hanging window sashes, to facilitate their removal for cleaning and other purposes."—*Petition recorded 18th September*, 1861.
2421. GEORGES JOSEPH GANIER and EMILE EUGENE COLLET, Place de la Bourse, Paris, "Improvements in envelopes."—*Petition recorded 27th September*, 1861.
2464. WILLIAM THOMAS HENLEY, St. John-street-road, Clerkenwell, London, "Improvements in magnetic and electric telegraph apparatus, which are also applicable to other purposes."—*Petition recorded 3rd October*, 1861.
2576. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improvements in the construction of grain and grass harvesters."—A communication from Edwin Perry Russell and Porter Tremain, Manlius, Onondaga, New York, U.S.—*Petition recorded 16th October*, 1861.
2607. JAMES WEBSTER, Birmingham, "Improvements in manufacturing oxygen gas, and obtaining certain other products."—*Petition recorded 19th October*, 1861.
2665. JOHN MCCALL, Houndsditch, London, and BEVAN GEORGE SLOPER, Walthamstow, Essex, "An improvement in the preservation of articles of food."—*Petition recorded 24th October*, 1861.
2776. CHARLES FREDERICK HAYES, Enfield, Middlesex, "Improvements in means or apparatus for generating steam."
2778. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in steam generators, and in furnaces for the same."—A communication from Alexandre Friedmann and Frederic Emile de Erlanger, Paris.—*Petitions recorded 5th November*, 1861.
2920. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in the treatment of zinc ores, and in the apparatus employed therein, which improvements are also applicable to the manufacture of phosphorus."—A communication from Adrien Muller, Paris.—*Petition recorded 20th November*, 1861.
2973. GEORGE BOTTOMLEY, St. George's-place, Leeds, Yorkshire, "Improved machinery for cutting up linen, cotton, woollen, and other rags, fibrous waste, or vegetable substances, for various purposes in the industrial arts."—*Petition recorded 26th November*, 1861.
3043. WILLIAM HENRY BALMAIN, St. Helen's, Lancashire, "Improvements in the manufacture of potash and salts of potash."—*Petition recorded 4th December*, 1861.
3052. JAMES COCHRANE, Harburn, Mid-Lothian, N.B., "Improvements in wet gas meters."—*Petition recorded 5th December*, 1861.
3098. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in knapsacks."—A communication from Joseph Short, Boston, U.S.—*Petition recorded 10th December*, 1861.
3124. WILLIAM BELL, Leamington, Warwickshire, "Improvements in kitcheners or cooking ranges."
3127. EDOUARD CLAUDE BARBOTTE DE BEAULIEU, Avallon, Yonne, France, "Improvements in the manufacture of spirituous liquors, and in apparatus employed therein."—*Petitions recorded 13th December*, 1861.
3143. JACQUES EDOUARD DUYCK, Tutsham Mills, West Farleigh, Kent, "Improvements in the expression of oil from cake and seeds, and in apparatuses employed therein."—*Petition recorded 14th December*, 1861.
3153. GEORGE DAVIES, Serle-street, Lincoln's-inn, London, "Improvements in the manufacture of textile materials."—A communication from Alois Chevalier Auer de Welsbach, Vienna.—*Petition recorded 16th December*, 1861.

Invention Protected for Six Months by the Deposit of a Complete specification.

3251. MICHAEL HENRY, Fleet-street, London. — A communication.—*Deposited and recorded 28th December*, 1861.

Errata.

2117. For "nuts" read "huts."
No. 3150. For "Cajoz" read "Cajot."

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 4th January, 1862.

1090, 3d.; 1222, 3d.; 1268, 5d.; 1269, 3d.; 1270, 7d.; 1271, 4d.; 1272, 6d.; 1273, 2d.; 1274, 3d.; 1275, 6d.; 1276, 5d.; 1278, 1s. 4d.; 1279, 6d.; 1280, 4d.; 1281, 3d.; 1282, 7d.; 1283, 7d.; 1284, 3d.; 1285, 3d.; 1286, 1s. 4d.; 1287, 10d.; 1288, 7d.; 1289, 9d.; 1290, 6d.; 1291, 9d.; 1292, 3d.; 1293, 6d.; 1294, 7d.; 1295, 1s. 4d.; 1296, 11d.; 1297, 1s. 4d.; 1298, 10d.; 1299, 3d.; 1300, 3d.; 1301, 6d.; 1302, 6d.; 1303, 7d.; 1304, 4s. 7d.; 1305, 6d.; 1306, 10d.; 1307, 10d.; 1308, 9d.; 1309, 3d.; 1310, 5d.; 1311, 6d.; 1312, 5d.; 1313, 7d.; 1314, 1s. 1d.; 1315, 3d.; 1316, 3d.; 1317, 3d.; 1318, 1s. 6d.; 1319, 5d.; 1320, 5d.; 1321, 3d.; 1322, 4d.; 1323, 10d.; 1324, 6d.; 1325, 8d.; 1326, 6d.; 1327, 3d.; 1328, 3d.; 1329, 4d.; 1330, 5d.; 1331, 1s. 7d.; 1332, 10d.; 1333, 10d.; 1334, 7d.; 1335, 3d.; 1336, 3d.; 1337, 6d.; 1338, 3d.; 1339, 1s. 4d.; 1340, 3d.; 1341, 3d.; 1342, 6d.; 1343, 2d.; 1344, 5d.; 1345, 3d.; 1346, 3d.; 1952*, 3d.

*** Specifications will be forwarded by Mr. Bennett Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5*s.* must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

(Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.)

1544. S. B. SMYTH, *Dover*, "*Steam boiler.*"—*Dated 17th June*, 1861.

This invention consists in constructing boilers with the upper and lower surfaces so curved as to form an arch, the said surfaces being plain or corrugated longitudinally, as may be required, and provided with flange projections at the sides or ends for taking into the brickwork, or otherwise. At the upper portion of the said boiler an arched or horse-shoe shaped steam chest is to be placed, and secured centrally and longitudinally, and furnished with suitable openings communicating with the interior of the boiler for the flow or passage of the steam. By this arrangement the flues may be carried above and below the boiler, so as to extend the heating surface, and permit the exposure of any portion of the said boiler to the external air.—*Not proceeded with.*

1555. J. MILLER, *Greenwich, and* H. E. SKINNER, *Wapping-wall, London*, "*Rotary engines.*"—*Dated 18th June*, 1861.

This invention consists in the combination of a barrel or roller with a sliding piston working in a cylinder or steam case, such barrel or roller being fixed concentric in the cylinder, and the piston sliding through the barrel or roller, and covering and opening at the required intervals the ports, which are formed in one or both of the cylinder covers in such a manner as to dispense with the use of slide valves. Also the form of the cylinder in the cross section is slightly varied from the circular, so as to admit of the piston fitting the interior thereof in every part of its revolution. The diameter of the barrel or roller is about two-thirds of that of the cylinder, and the centre of the axis thereof is so placed as to admit of the barrel or roller touching, or nearly touching, the interior of the cylinder, the ports being formed on each side of the hole in the cylinder cover or covers through which the said axis is passed.

1558. R. FELL, *Great Saint Helen's, London*, "*Obtaining motive power.*"—*Dated 18th June*, 1861.

This invention consists in obtaining motive power by means of compressed air acting upon water in manner hereafter described. The inventor obtains motive power and applies it in the following manner:—He provides a pair of dished wheels fitted on each end of a cylinder axle, with chambers and valves for the outlet and inlet of the water employed to work a pair of driving cylinders, which are in connection with the crank axle of other wheels. He introduces collapsing and expanding cylinders or bags between the discs of the dished wheels, within a few inches of the circumference thereof, and provides a flanged ring with a channel on the interior thereof for the wheels to revolve in. When put in motion the weight of the engine and load on its truck or carriage will force the circumference of the dished wheels, as they revolve, into the grooved rings, thus compressing the collapsing bags between the discs, and forcing them to discharge the water held in them into a vessel containing compressed air; from thence the water passes to driving cylinders, and the exhausted water from the driving cylinders is conveyed to a cistern, and from thence through the axle of the dished wheels into the high pressure vessel, and so on. As long as the wheels are allowed to revolve the high pressure vessel must be kept supplied. To put the machine in motion the high pressure vessel must be supplied with water up to a certain level; then air is forced in, so compressed as to obtain the required pressure on the water, and communication is opened with the cylinders, whereby the wheels will be made to revolve on the rails or road. The wheels in revolving cause the bags to collapse, whereby the water is forced from them, as before stated.—*Not proceeded with.*

1565. W. E. NEWTON, *Chancery-lane, London*, "*Apparatus for transmitting motion.*"—*A communication.*—*Dated 18th June*, 1861.

This invention consists in the employment of disc wheels which transmit motion by frictional contact upon their sides. The frictional surfaces are mounted on an intermediate shaft, and are pressed together by means of a coiled spring, so as to insure contact only upon the line of centres of any two wheels. The edges or peripheries of the driving and driven wheels are placed between the discs, and the pressure required to produce the necessary adhesion is applied by means of the spring upon the opposite surfaces. The desired result is obtained without producing much, if any, pressure upon the journals upon which they revolve. The discs are fixed upon a kind of universal joint, and the side pressure will, therefore, follow up the wear and inequalities of surface without interfering with the position of the centres of rotation.

1572. J. LOUCH, *Fenchurch-street, London*, "*Furnaces, boilers, and condensers of steam engines.*"—*Dated 19th June*, 1861.

The First part of this invention consists in forming the grate bars of boilers or other furnaces of two or more plates or bars of iron, rivetted or bolted together, leaving suitable air spaces between each of such plates or bars. The Second part of the invention is for the prevention of smoke from boiler and other furnaces, and consists in inserting tubes of metal, or in lieu thereof perforated fire-brick, in the inside of the furnace doors, through which the air in passing becomes heated. The inventor also introduces tubes of metal suitably perforated within the furnace above the fuel, extending through the whole or part of the length of such furnace, the further or bridge ends of such tubes being closed, and the other ends open to the external atmosphere. The Third part of the invention relates to improvements in surface condensers of steam engines, and consists in certain arrangements by means of which a thin film, or several small jets, of water are allowed or made to run over and upon the inner or outer surfaces of the tubes or other condensing surfaces (according as condensation takes place within or on the outsides of such tubes or other condensing surfaces), while a current of air is at the same time allowed or caused to pass through, over, or amongst the said tubes, or other condensing surfaces.—*Not proceeded with.*

1602. HOBSON *and* T. CAVILL, *Sheffield*, "*An improved piston.*"—*Dated 21st June*, 1861.

The object of this invention is to secure for engine pistons a resilient surface or packing capable of adjusting itself to the wear and tear of the cylinder. On the block of the piston, between the top and bottom plates, the patentees secure two or more rings of cast iron, brass, or other metal; these rings are formed with indentations on the concave side, and are disjoined at one point, the abutting ends at this point being formed to admit of the introduction of a wedge pointing outwards from the piston block. The wedge is acted upon by a spiral spring, and advances or recedes as the condition of the cylinder demands the distension or otherwise of the packing.

1578. J. FAULDING, *Euston-road, London*, "*Locomotive engines.*"—*Dated 19th June*, 1861.

This invention consists in so combining the mechanical parts of a locomotive engine that all the momentum resulting from the working of the various parts of the engine shall be on the longitudinal central line of the locomotive. To effect this object the patentee places the two cylinders of the locomotive at right angles to each other or thereabouts, and unites the connecting rods of each to one central crank-pin on the driving axle.

1598. J. HANNAN *and* J. HAMILTON, *Glasgow*, "*Indicators, such as are used for ascertaining the power devloped by steam engines.*"—*Dated 21st June*, 1861.

This improved indicator is made with a spring contrived so that the tendency to coil and uncoil is compensated for, so as to prevent or avoid the inaccurate indication which, in the instrument as ordinarily constructed, is caused by the increased friction due to the coiling and uncoiling action of the spring.—*Not proceeded with.*

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

1542. H. C. SIMPSON, *Shrewsbury*, "*A new or improved vehicle or car.*"—*Dated 17th June*, 1861.

This invention cannot be described without reference to the drawings.

1557. R. WALKER, *Glasgow*, "*Propelling vessels.*"—*Dated 18th June*, 1861.

In one modification of this invention the propelling instrument consists of a blade, which, when at rest, lies horizontally, and which is fixed by its front ends at right angles to a vertical rod arranged at the stern of the vessel, for example, and made to reciprocate vertically. The blade is constructed so as to possess an elastic flexibility, and when it is moved downwards its outer back end is bent upwards, its surface being inclined in such a way as, with the downward motion, to propel the vessel forward. When the blade is moved upwards it becomes bent in the opposite direction, so as to be inclined downwards towards its outer back end, and so that it still propels the vessel forward. There may be two or more such propelling blades on the same reciprocating rod, or on separate rods, and they may be arranged to work at the sides or other part or parts of the vessel.

1579. G. T. BOUSFIELD, *Loughborough Park, Brixton*, "*Brakes for railroad cars.*"—*A communication.*—*Dated 19th June*, 1861.

The object of the First part of this invention is to render the pressure of the brake standard (which is now sustained by the framework of the car) available for the purpose of forcing the brake shoes against the running wheels; also to render the brakes of the cars automatic in their operation when the speed of the engine is slacked, and consists in combining the bearing of the brake standard with the brake shoes by mechanism, in such manner that the pressure exerted upon the bearing of the brake standard is propagated to the brake shoes, and made available in holding them in contact with the running wheels. The object of the Second part of this invention is to enable the brake mechanism of any car of a train to operate automatically, and apply the brakes whenever the speed of the next preceding car or carriage of the train is slacked. To this end this part of the invention consists in combining the brake mechanism of the car with a thrust plate, which projects in advance of the bumper of the car, intervenes between the bumpers of the two adjacent cars when the cars are coupled together, and is made available in applying the brake shoes of the car to which it appertains whenever that car surges towards the preceding car. The object of the Third part of the invention is to enable a thrust plate of the preceding description to be applied to each end of a car, and to permit but one only to act at a time, so that the brakes of a car may be operated automatically by the bumper of the preceding car, whichever end of the car be run foremost, and that the succeeding car may not interfere with this operation. This part of the invention consists in combining the brake mechanism of the car with two reversible thrust plates, one at each end thereof, and capable of being placed either in the line of motion of the bumpers, or out of that line of motion, so that the position of each thrust plate can be reversed when the car is run in the opposite direction, the forward one being put in position to be operated by the bumper of the adjacent car, and the hinder one being thrown out of such position. The object of the Fourth part of the invention is to enable a brakesman to apply the brakes of all the wheels of that description of cars for street railroads in which the car body is reversed end for end by turning it upon its truck, and in which the brake standard turns with the car body, whichever end of the car body be run foremost, and it consists in the combination of the brake standard with the brakes of the cars through the intervention of ring plates. The object of the Fifth part of the invention is to enable the first part of the invention to be applied to four-wheeled cars, and consists in a certain combination of brakes with the brake standard by means of brake beams, levers, rods, and slide bars. The invention cannot be fully described without reference to the drawings.

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

1537. S. BARNWELL, *jun., Coventry*, "*Upholsterers' fringes.*"—*Dated 15th June*, 1861.

This invention consists in manufacturing fringes for upholstery of chenille, either plain and by itself, or variegated, or mixed, or powdered with buttons or drops of plain silk, or trimmed with bullion tips and hangers, to which a rich and ornamental fringe for window cornices and other upholstery purposes may be produced.—*Not proceeded with.*

1547. T. MELLODEW, *Oldham*, C. W. KESSELMEYER, *Manchester, and* J. M. WORRALL, *Salford*, "*Dyeing and printing velvets, velveteens, &c.*"—*Dated 17th June*, 1861.

The patentee claims, First, the application of the solution of iron or other mordaunt by the process of padding to the back only of velvets, velveteens, cords, or other such fabrics as aforesaid. Secondly, the use, for the above described fabric, of yarn, of cotton, or other such material as aforesaid, which is prepared only for dyeing by the application of a mordaunt.

1552. W. TODD *and* J. TODD, *Heywood, Lancashire*, "*Power looms.*"—*Dat 17th June*, 1861.

This invention relates to an improved picking motion for looms, wherein the novel arrangements of mechanism employed shall cause a direct action to be given to the picking apparatus by a peculiar arrangement of studs, plates, or fingers, so formed and adjusted in their respective levers that, by their being brought into contact from two opposite centres, a sharp, clear, or slightly yielding motion shall be transmitted to the picking stick, without any deteriorating wear to the picking apparatus employed.

1556. F. ZIFFER, *Vienna*, "*Carding engines.*"—*Dated 18th June*, 1861.

This invention consists in the novel application and use of a semicircular grid or cage beneath the main cylinder and other cylinders in carding engines, for the purpose of retaining the fibre or loose filaments of cotton or other fibrous substances, and allowing dust and other extraneous matter to fall through.

1563. J. DUNN, *Preston*, "*Apparatus for slubbing, roving, spinning, twisting, and doubling cotton, &c.*"—*Dated 18th June*, 1861.

This invention relates to certain modifications of the apparatus for which provisional protection was granted to the present patentee the 6th April, 1861 (No. 840), and consists in the introduction of drawing rollers, carried by a suitable frame, to the inside of the flyer which is mounted horizontally, the frame being suspended loosely from each internal extremity of the flyer. A full bobbin of the material to be operated upon is placed upon a spindle, also inside the flyer, from which bobbin the material is unwound or drawn off by the action of the drawing rollers, to which the requisite motion is imparted from the neck of the flyer by means of an endless screw and worm wheel. From these rollers the material passes through the tubular neck of the flyer, and along the side thereof, which is either hollowed, or channelled, or solid, and furnished with guide eyes for that purpose, finally issuing through another tubular neck on the opposite ends of the flyer, a double twist at each revolution of the flyer being consequently imparted to the material. If desired the flyer itself may be dispensed with, in which case a single twist only will be imparted to the material at each revolution of the apparatus. In this second modification the drawing rollers are carried in a rotatory frame, driven by a pulley fast on a hollow neck, which forms the axis of rotation of the frame. The full bobbin is carried vertically upon a tin tube, supported by a creel peg of iron on the top of the frame. By the action of the driving rollers the material is unwound or drawn off the bobbin through a suitable guide attached to the rotating frame, and, after passing through the drawing rollers, issues through the hollow neck of the frame, when it receives its twist, and is wound on to a reel or made into a cop.

1568. T. WEBB *and* J. CRAIG, *Tutford, Staffordshire*, "*Spinning, doubling, and winding cotton, &c.*"—*Dated 18th June*, 1861.

This invention relates to those spindles and flyers which are provided with

top bearings, and consists in adapting such bearings to the spindle direct, instead of to the flyer, and the inventors form a passage for the yarn by boring the spindle vertically from the top, and with an outlet on one or both sides.—*Not proceeded with.*

1575. J. FISKEN, *Wharf-road, City-road, London,* "*Glazing or calendering by steam, horse, or water power textile fabrics.*"—*Dated 19th June,* 1861.

The apparatus for carrying out this invention is attached to a strong transverse beam or iron rod, which is elevated from the ground ten feet or upwards, and consists of an iron suspended lever about three feet and upwards in size, to which a joint is attached about three inches from the top. This lever forms what is called the glazing stick, and at the lower end a small iron case is made for inserting the pebble or flint which is to come in contact with the fabrics. It is also perforated with holes so as to adjust its sweep or stroke, and in any one of those holes there is a horizontal lever attached which, in its turn, is connected with another small horizontal lever, and which, being attached to a crank, are all set in motion by steam, horse, or water power, and causing the first-named upright lever with the pebble or stone attached to move backwards and forwards with any amount of power and stroke it may be necessary to obtain. This lever is made to press against a wooden or iron cradle by a compound leverage worked by the foot, and between the cradle and the pebble or stone the fabrics to be operated on are placed, and are kept in their position by the person attending to the apparatus.—*Not proceeded with.*

1583. L. HANNART, *Brussels,* "*Gloves.*"—*Dated 20th June,* 1861.

This invention consists in applying between two textile fabrics of any kind a more or less thick adhesive coat of caoutchouc, purified and deprived of its unpleasant odours, so as to form a material appropriate to the manufacture of gloves.

1597. J. S. WRIGHT, *Birmingham,* "*Reels or spools.*"—*Dated 21st June,* 1861.

The inventor, according to this invention, makes reels or spools of *papier mâché*, which he moulds or presses in one piece, or in two or more pieces, which he joins together by some adhesive substance; and he also makes reels or spools with the ends of paper or *papier mâché*, and the tubes of wood, metal, paper, *papier mâché*, or any suitable material; and he also makes reel or spools with a cap of metal on the ends when made of paper or *papier mâché* in the same manner as is now done with reels of wood and metal.—*Not proceeded with.*

1599. T. R. HARDING, *Leeds,* "*Pointing of steel or other wire for teeth of cards, &c.*"—*Dated 21st June,* 1861.

This invention cannot be described without reference to the drawings.

1604. A. L. LE HARIVEL, *Tufnell Park-road,* "*Paper, papier mâché, cardboard, &c.*"—*Dated 22nd June,* 1861.

This invention relates to the manufacture of these and other similar articles from wood. This object is effected by the employment of certain novel arrangements of machinery for the purpose of operating upon wood, in order, First, to convert the same into fibres and pulp; and, Secondly, to separate and assort the fibres according to their different degrees of fineness, preparatory to their being manufactured into paper, *papier mâché*, cardboard, and other similar articles.

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

1521. F. GREGORY, *Manchester,* "*Apparatus for cutting hay and chaff.*"—*Dated 13th June,* 1861.

This invention consists, Firstly, in fixing upon the driving shaft, or the shaft to which the knives or cutters are attached, a pin wheel with one or more teeth, pins, or pegs working in a tangent, star, or intermittent wheel, for the purpose of giving an intermittent feeding motion to the hay, chaff, or other matter to be cut; the edge of the intermittent wheel is formed with concavities corresponding with the circular part of the pin wheel, for the purpose of preventing the turning of the intermittent wheel until the tooth or teeth, peg or pegs, on the said pin wheel enter the slots or openings of the said intermittent wheel. Secondly, in employing a vertical shaft for driving the upper feed roller. The said shaft works in an antifriction box, in order to enable the roller to rise and fall with ease according to the thickness of the feed. To the shaft is fixed a shed on each side at right angles to its length, which sheds are mounted with antifriction bowls working in grooves in the box, which is driven by toothed wheels from the bottom roller.

1620. W. BAYLISS, *Wolverhampton,* "*Chain harrows.*"—*Dated 13th June,* 1861.

These improvements in chain harrows consist in keeping the combined links forming the chains fully extended, and which the patentee purposes effecting by the use of a suitable number of thin strips of steel, iron, or other suitable material, sufficiently elastic or pliable that, as the harrow is drawn over or obliquely across ploughed land, it shall readily adapt itself to the inequality or unevenness of the surface over which they pass.

1532. T. W. WEDLAKE, *Hornchurch, Essex,* "*Haymaking machines.*"—*Dated 14th June,* 1861.

This invention consists, First, in means of causing the drum or frame carrying the forks to rotate in a reverse direction when required to that in which they are ordinarily driven, and in driving the drum by bevel gear, substantially as hereafter explained. The patentee effects this by fixing on the axle of the bearing wheels a bevelled tooth-wheel, and by placing upon a shaft, carrying on one end a bevelled toothed pinion, two other bevelled toothed pinions, capable of being moved upon their shaft, so as to bring one or other in gear with the bevelled wheel on the axle of the bearing wheels. The pinion upon the end of the movable pinions shaft gears into a bevelled wheel upon the shaft or axle of the drum or frame carrying the rakes or forks. The invention consists, Secondly, in means of raising and lowering the drum or frame carrying the rakes or forks further from or nearer to the ground. This is effected by connecting the box or frame, which carries the axle of the skeleton drum or frame carrying the rakes or forks, by arms, one curved and attached to the lower part of the box at one end, and to the shafts at the other; and the other arm straight, connected to the upper part of the box at one end, and at the other end to a box hollowed out and formed with a rack on the inside, and a rachet or detent on its upper edge; a pinion on a rod passing through the shafts works inside the box and gears into the rack.

1533. G. LEACH, *Leeds,* "*Improvements in implements for tilling and cultivating the soil, and in boilers applying steam to engines for driving the same, which latter improvements are applicable to boilers generally, and especially to boilers of traction engines.*"—*Dated 14th June,* 1861.

This invention consists, First, in mounting upon a shaft, and at an incline, plain or toothed discs, the teeth being formed in a piece with the disc, or made separate therefrom, and fixed thereto. Rotatory motion is communicated to the shaft, and, consequently, to the discs, which cut or break up the soil, pulverise it, and turn it over. The patentee denominates this improved implement the "steam mole." Similar effects may be produced by mounting toothed discs at right angles upon a shaft, and while the same are rotating upon the shaft, lateral oscillating motion is given to the shaft and discs equal to the distance the discs are set asunder, by which means a breadth of land may be cut up or cultivated equal to the distance between the extremity of the traverse of the two endmost discs upon the shaft. By having a drum, and mounting or bolting upon the periphery thereof single teeth, or segments of more than one, two, or any other number of teeth, such teeth may be made of any desired shape or form best adapted to the soil to be operated upon. The improvements in boilers consist in the employment of series of upright water tubes let into cases at top and bottom, those at bottom forming water spaces, and at top water and steam spaces opening into a steam dome. The fire-place is surrounded by the tubes. Between every, or some of the, series of tubes he places baffle plates of fire-brick or iron. These baffle plates are pierced with holes either circular or elongated, and through these holes the gaseous products and heat pass. Against the baffle plates duplicate plates are fixed, also pierced with holes. The duplicate baffle plates are made movable, so that the apertures may be slidden opposite, or so as to cover any required area of those in the main or fixed baffle plates. By this means, and by arranging the series of holes in each baffle plate so as to suit the intensity of the fire or the velocity of the current or draft, the heat is caused to act upon any portion of the tubes, or to flow in any required direction between one series of baffle plates and another, either in a zig-zag or straight direction, in passing from the fire to the chimney.

1540. W. SMITH, *Little Woolstone,* "*Machinery for giving motion to ploughs, cultivators, &c.*"—*Dated 15th June,* 1861.

For the purposes of this invention two drums or cylinders are used, and are placed on the same shaft or axis, in such manner that one at a time only of the drums or cylinders revolves on or with such shaft or axis. These drums or cylinders are as heretofore suitable for winding and unwinding the wire ropes to which the agricultural implements are attached. The shaft or axis receives motion (or the drums or cylinders thereon) from a steam engine by means of an endless chain which gears into a chain-wheel on the shaft or axis on which the drums or cylinders are placed. The steam engine gives motion to a smaller chain wheel with which the endless chain also gears. It is preferred that the chain-wheel (which is on the same shaft or axis as the drums or cylinders) should be between the two drums or cylinders, but this is not essential. The drums or cylinders are each capable of being held by clutches, one part being affixed to the nave of the cylinder or drum, and the other part capable of sliding on the shaft or axis; and there is a wedge or filling piece introduced when the clutches of one of the cylinders or drums are engaged, so as to keep them engaged to the plough, or other agricultural implement attached, till the rope comes to the end of a bout, when the wedge or filling piece is to be removed; the steam engine is then also stopped, when, by reason of there being inclined or screw threaded feathers on the axis or shaft, or on the nave of the chain-wheel thereon, and in the sliding part of the clutch, such part of the clutch will be caused to slide along the shaft or axis, and to disengage itself from the other part of the clutch which is on the drum or cylinder by reason of the tension on the wire rope causing such drum or cylinder to make a partial back turn. It should be stated that both of the cylinders or drums are similarly actuated, so that the description above given to one applies to both.—*Not proceeded with.*

1562. A. W. GIBSON, *Belfast,* "*Mills for the manufacture of barley and rice.*"—*Dated 18th June,* 1861.

This invention refers to a previous patent, dated 28th April, 1854 (No. 962), and is carried into effect as follows:—Under one modification or arrangement the mill is driven from a cone pulley, which gives motion by means of an endless band to a second pulley arranged beneath it. On the shaft of this pulley is a worm which gears with a worm-wheel on a vertical shaft, and gives motion thereto. The shaft has fitted to it three horizontal discs or plates, and these discs are perforated round the margins to admit of studs or other adjustable details being fitted therein. One of the discs is fitted on the shaft at the upper part, and the studs arranged in it give motion to a horizontal slide working to and fro in the spout of the mill, which conveys the grain from the hopper or source of supply into a receiver beneath. The spout has fitted to its lower part a secondary spout or sliding piece, which moves freely up and down the exterior of the spout. This sliding spout is connected to a hand-lever, which is centred on a contiguous part of the framing, and by means of a slotted guide, through which a stud in the lever projects, the sliding spout may be fixed to any required position. The receiver fitted beneath the spout into which the grain falls is of a funnel-shaped figure at the lower part to convey the unmanufactured grain into the mill. The admission of the grain into the mill is regulated by means of a slide fitted in the contracted part of the hopper, and actuated by means of the second or central disc on the vertical shaft. The studs or other details in the upper and central discs are so arranged that the slides are opened alternately to admit the grain first to the spout, and then from the receiver to the mill, one being opened while the other is closed. The lower disc on the vertical shaft has a stud or cam fitted in it, which at each revolution of the shaft raises a lever, so as to bring it into contact with a projection on a slide fitted on the periphery of the mill case. This slide in one position covers a series of openings which are formed in the mill case, and, when the slide is actuated by the disc, these openings are uncovered, the slide is closed by its projecting part coming in contact with a stud or other equivalent detail fixed to a convenient part of the framing. Thus, with the rotatory movement of the mill, the slide is actuated with an intermittent motion, so as to admit of the manufactured grain falling down to the sifters below, which are actuated from below. These sifters separate the grain from the dust, and both are conveyed down to their proper receptacles.

1589. W. E. GEDGE, *Wellington-street, Strand, London,* "*Apparatus for drying, sifting, and cleansing grain, &c.*"—*A communication.*—*Dated 20th June,* 1861.

This invention cannot be described without reference to the drawings.

CLASS 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

1504. J. DURRANT, *Fitzroy-square, and* N. A. HARRIS, *Bayswater, London,* "*Improvements in the construction of chimney tops, or appliances for surmounting chimneys, in order to regulate the up currents and prevent the down draughts.*"—*Dated 12th June,* 1861.

This invention consists of a cylinder of metal, preferably zinc or earthenware, or other suitable material. On the top of this the patentees fix or attach or form a series of corrugated cells, opening towards the bottom, so as to receive the external air which passes out of the top into the interior of an open conical cap fixed there. These cells may be either slightly inclined or vertical; the band on which these cells are affixed, as before stated, opens into a conical cap, which is affixed to and opens into and encircles the cylinder. Round the outer periphery or surface is another series of conically-shaped cells, the bottom of which, being open, receives the outer air, and passes it into the interior of another conical cap placed directly over it, and concentric with the cylinder.

1509. G. COX, *Holloway, near London,* "*Floor dog or cramp.*"—*Dated 12th June,* 1861.

The object of this invention is to obtain sufficient pressure against the edges of floor boards to keep them in position and close together during the operation of nailing to the joists. The inventor proposes using a lever of cast or wrought metal, about the thickness (or rather more) of the floor board; on the under side of this lever are placed two lugs or pegs, rather further apart than the width of the joist, so that, when the lever is brought back from the right angle to the joist, the lugs or pegs firmly grip each side of the joist, while a wooden bar, which is jointed to the lever, presses a driver (also of wood) against the edge of the floor board. This driver is to be driven by blows from a hammer or mallet in a parallel line with the floor boards, which tends to bring the driver from the oblique line to the rectangular, thus forcing the floor boards together during the operation of nailing to the joists.—*Not proceeded with.*

1519. E. BING, *Ramsgate,* "*Sliding winding sashes.*"—*Dated 13th June,* 1861.

This invention consists in a method of fitting and furnishing sliding window sashes whereby they may be readily removed from their position for the purpose of cleaning, and which may thereby be effected entirely within the building to which they are fitted.

CLASS 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defences, Gun Carriages, &c.

1508. J. DREW, *Weymouth,* "*Adaptation of plates or shields to fixed and floating batteries.*"—*Dated 12th June,* 1861.

This invention consists in adapting elastic material or springs of metal, in combination with plates of metal or shields, applied to the sides of ships, gun-boats, or floating batteries; also to fixed batteries, fortifications, and other places of defence.—*Not proceeded with.*

1527. W. C. THOMAS, *Wells-street, Oxford-street, London,* "*Metal casing, &c., armour for the defence of ships and batteries.*"—*Dated 14th June,* 1861.

This invention consists in the use of laminated plates in the defence of ship and batteries, which is effected either by simple lamination, that is, by laminated plates of a single metal, such as iron, steel, copper, or lead; or by compound lamination in which iron, steel, or copper plates will be alternated with leaden layers or strata, or with some flexible material, such as leather, or by diagonal lamination, simple and compound, in which the layers or strata of metal or material will be inclined to the longitudinal and vertical axis of ships and batteries; or by the application of lead to armour plates; or by the application of hexagonal concentric blocks, concentric to points within the ship or battery covered with a thin plate of metal.—*Not proceeded with.*

1538. S. GRANT, *St. James's-street, Westminster,* "*Breech-loading fire-arms and fowling-pieces.*"—*Dated 15th June,* 1861.

This invention cannot be described without reference to the drawings.

1541. T. PAGE, *Middle Scotland-yard, London,* "*Facilitating the working and discharge of ordnance placed below the water level.*"—*Dated 15th June,* 1861.

The patentee claims the use and application of a chamber, and maintaining a pressure of air therein, for the purposes of firing and discharging projectiles below the water level.

1550. W. CLARK, *Chancery-lane, London,* "*Improvements in batteries, and in breech-loading ordnance and projectiles for the same.*"—*A communication.*—*Dated 17th June,* 1861.

This invention consists, First, of a portable battery formed of plates of iron connected together by bars and bolts countersunk in ribs on the plates. The structure is made of dimensions suitable for holding several persons, is provided with a shot-proof roofing, and has also port holes in the sides for the muzzles of the guns. The whole battery may be made to run on lines of rails by means of any suitable dynamic engine. The Second part of this invention relates to a breech-loading cannon adapted for these improved portable batteries, either for land or sea service. The breech-piece is formed of a plate engaging in a mortise made in the back end of the gun; when this plate is raised it leaves an opening for the free passage of the shot or charge, and, when lowered, it again closes the breech as before. This breech-piece is handled by levers or other gearing; it may also carry a pin or striker for igniting the charge. The Third part of this invention relates to improved projectiles to be used with the foregoing breech-loading ordnance, which are of a cylindro-conical form; the conical part carries a screw thread which engages in the grooves of the gun; the head of the cone is formed of a steel cap for penetrating objects, while the cylindrical part is hollow, and varies in diameter in order to prevent windage.—*Not proceeded with.*

1564. J. A. LIMBERT, R.N., *Gravesend,* "*Mounting and fitting ships' guns and other ordnance.*"—*Dated 18th June,* 1861.

In carrying out this invention the inventor mounts ships' guns on a pivot or cross bearing placed above the gun, from which it is suspended and free to oscillate in the direction of its length. From the bearing depend four rods, two on each side of the gun, each pair spreading the one towards the muzzle, and the other towards the breech of the gun. The lower ends of the depending rods carry sliding pieces fitted to arcs fixed to or formed on the side of the gun, such arcs being described from a centre more or less below the gun. The suspending bearing is supported from the lower part of the gun carriage by two wrought iron uprights, and such stays as are necessary. These uprights are in or about the same lateral vertical plane as the suspending rods, and have surfaces of abutment and contact for the sliding pieces, carried by such rods and sliding in the arcs.—*Not proceeded with.*

CLASS 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

1691. R. A. BROOMAN, *Fleet-street, London,* "*Pianofortes.*"—*A communication.*—*Dated 20th June,* 1861.

One of the great drawbacks to the perfection of the pianoforte, as a musical instrument, is, the inventor states, non-continuity of sound, which, owing to the arrangement of the hammer, only lasts a stated time. To overcome this defect the inventor adds to the instrument an arrangement somewhat similar to the bow of a violin, which he causes to act separately or simultaneously with the hammer. To the intermittent percussive he adds a continuous action, and produces continuous sound, without, in any way, lessening the effect usually produced in pianofortes.

1594. J. H. BARTHOLF, *New Oxford-street, London,* "*Children's nursery chairs, &c.*"—*A communication.*—*Dated 20th June,* 1861.

Children's nursery chairs made according to this invention consist of a framing with four upright posts or standards supporting a cover or table, round the sides of which are arranged hanging curtains, the whole forming an ornamental canopy. The said chair is fitted with low sides, its back is hinged and adjustable, and can be set to any angle, or lowered to a horizontal position, and it is fitted in front with a footboard, which is also adjustable. The seat, back, and sides of the said chair are stuffed in the ordinary manner. By using certain apparatus in combination with the said chair the same may be conveniently used as a baby-jumper.—*Not proceeded with.*

CLASS 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

1507. J. WATT, *Camberwell, Surrey,* "*Converting vegetable fibrous substances into pulp.*"—*Dated 12th June,* 1861.

This invention relates to a peculiar mode or process for converting vegetable fibrous substances into pulp, and consists in subjecting the vegetable fibrous substance to the action of proto-carbonate of soda, or bi-carbonate of soda, or proto-carbonate of potassa, or of potassa, bi-carbonate of soda, or soda ash, in solution in water, and heating the whole to the boiling point, and boiling the same until the fibrous substance has been so acted upon that, on being washed and treated with an aqueous solution of chloride of lime or chloride of soda, it is converted into pulp.

1543. T. GRAY, *Union-road, Wandsworth,* "*Bleaching coloured rags and vegetable fibres.*"—*Dated 17th June,* 1861.

The patentee claims the steeping and immersion of the substances to be bleached in a solution of muriatic acid and water previously to their being submitted to the action of bleaching liquor.

1548. T. ROUTLEDGE, *Eynsham Mills, near Oxford,* "*Paper.*"—*Dated 17th June,* 1861.

This invention consists in the preparation of half stuff (paper pulp) and paper from Esparto or Spanish grass (comprising *spartum lignum, stipa tenacissima, ais* or *alfa*) the same being applicable to straw and other raw fibrous substance, the general details of the process are the same as specified in a patent (No. 274) dated 2nd February, 1860, the improvement consisting in that portion which relates to the preparation of the leys employed in boiling the Esparto or other raw fibres, and in order to preclude the presence of lime in the caustic state, or even too much causticity in the leys.

1566. —MCKAY, *Birmingham,* "*Cements or adhesive solutions for joining or connecting together surfaces or articles of leather, wood, paper, &c.*"—*Dated 18th June,* 1861.

In manufacturing these improved cements, or adhesive solutions, the patentee takes the bisulphuret of carbon, or its chemical constituents or equivalents, in which he dissolves pure gutta percha, leaving the vessel in which he is working open to allow the bisulphuret of carbon to take up a sufficient quantity of oxygen.

1582. J. CULLEN, *North London Railway, Bow,* "*Preserving wood and iron.*"—*Dated 19th June,* 1861.

For the purposes of this invention a composition, consisting of coal tar, quick lime, and charcoal is used. The charcoal is reduced to a fine powder, and such is the case also in regard to the quick lime; these materials are to be well mixed together and subjected to heat. In order to preserve wood the composition is heated, and the wood is immersed therein.

1592. C. HODGSON, *Ballard, Rathdrum, Wicklow,* "*Improvements in the manufacture of fuel from peat, and in apparatus employed therein.*"—*Dated 20th June,* 1861.

The patentee claims, First, compressing peat, coal, or other material in a dry state, without heating the same, as described. Secondly, retaining a number of blocks under continued pressure in the same machine, and at the same time, for the purpose of completing their solidification, as described. Thirdly, the construction and employment of a supplementary tube for the purpose of continuing, and at pleasure modifying, the pressure given to the blocks during manufacture, as described.

1593. C. HODGSON, *Ballard, Rathdrum, Wicklow,* "*An improved method of partially drying peat before removing the same from the bog.*"—*Dated 20th June,* 1861.

This invention is carried into effect in the following manner:—Having first cut drains in the portion of bog about to be used in the ordinary manner, and to such an extent as the local circumstances require, the patentee proceeds to clear off and remove the top rooty surface of the bog, leaving what is called by bog turf-cutters "a clean floor." This, from the action of the drains, speedily becomes dry and tolerably solid, and as soon as it does so he at once harrows up the surface to the depth of, say, from 1in. to 4in., or to any required depth, with any convenient harrow drawn by animal or other power. He leaves the harrowed surface exposed to the air for a time, say from half a day to two days, according to the state of the weather, and he then proceeds to collect and heap up the tolerably dry mull, which is the result of this process, by any convenient mode of scraping.

CLASS 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

1503. J. A. CALLAND, *Nantes, France,* "*Construction of electrical piles.*"—*Dated 12th June,* 1861.

The principle by which the patentee is enabled to dispense with the porous vase employed in Daniell's pile, and others, of which it has always proved the most embarrassing piece, is the following:—If a vase be about half filled with a solution of sulphate of copper, saturated cold, and then pure water, or water slightly charged with sulphate of zinc or marine salt, be slowly, and with much precaution, poured thereon, the new liquid, being less dense, will remain on the top of the first, and from that moment there will be disengagement of electricity from the contact of these two different liquids or solutions. If electrodes be placed in each this electricity may be employed. The positive electrode may be formed of a small plate furnished with a conductor intended to carry the positive electricity outside the pile, and this plate may be placed at the bottom of the vase; the conductor being coated with an isolating substance will pass through the upper liquid. It may be without such coating, but in such case there will be a slight loss of electricity. Without, or on the outside, a conductor not coated may be used, by passing it through the centre of an isolating cup or funnel. But these means demand the most cautious and careful manipulation, which the new arrangements used permit of being dispensed with, while facilitating the attainment of a constant current.

1512. R. JOBSON, *Dudley, and* C. F. VARLEY, *Kentish Town, London,* "*Posts or supports for telegraph wires.*"—*Dated 12th June,* 1861.

For the purposes of this invention the patentees employ tubes of cast iron, made either conical or parallel, and in lengths or sections which, it is preferred, should be capable of fitting one inside the other, for facility of carriage. These lengths or sections fit together with suitable joints.

1539. F. POTTS, *Birmingham,* "*Metallic posts for supporting telegraph wires.*"—*Dated 15th June,* 1861.

This invention consists in making or constructing metallic posts for supporting telegraph wires of sheet iron of a taper form, and of any desired shape in their transverse section.

1554. J. BANKS, *Salisbury-street, Adelphi,* "*Electro-magnetic telegraph printing apparatus.*"—*Dated 17th June,* 1861.

This invention consists in certain novel arrangements of electro-magnetic apparatus, by which the needle or style used for producing certain marks, undulations, indications, or signals, in the shape of dots and lines upon ribbons or slips of paper, is made to operate direct and rapidly with the minimum of power.—*Not proceeded with.*

1567. W. E. NEWTON, *Chancery-lane, London,* "*Electro-magnetic engines.*"—*A communication.*—*Dated 18th June,* 1861.

This invention relates, mainly, to an improvement on what is known as the metallic frotteur wheel or plate of magneto-electric engines, whereby the currents which are induced alternately in opposite directions are taken off, and caused to return continuously in the same direction. The Second part of the invention, which also relates to an improvement in magneto-electric engines, consists in connecting the cores of a series of spools or coils arranged in a circle by a ring of soft malleable cast iron or wrought iron, or any equivalent substance which possesses the property of readily taking and discharging induced magnetism, whether the circle of spools or coils with their cores so connected be used in connection with rotating magnets, or the circle of spools be made to rotate and used in connection with stationary magnets, or whether the magnets and the circle of spools or coils be both made to rotate.

CLASS 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

1500. J. A. DAUNCEY, *Bury*, "*Apparatus for supplying liquid nourishment to infants and invalids, &c.*"—*Dated* 12*th June*, 1861.

This invention relates, First, to a certain description of apparatus used for supplying liquid nourishment to invalids and infants, and which is now well known, wherein an elastic tube is employed externally, and a rigid internal tube to convey the liquid from the vessel to the consumer. The improvement consists in the employment of a jointed tube for the external tube, in contradistinction to the continuous elastic one now used, so that it may be disunited for the purpose of cleaning, and also in the use of an elastic tube having its lower extremity weighted, instead of a rigid one internally, so that the opening end of the said tube may always be submerged in the liquid in whatever position the vessel may be placed, the two tubes being secured to the stopper of the vessel as usual, in which small tubes or orifices are arranged for the admission of air. If required a number of tubes may be fitted to one vessel, so as to supply many consumers from one vessel. Secondly, the invention relates to the feeding of other animals, such as lambs and calves, and consists in arranging a flexible vessel above the receptacle of the feeding liquid, such flexible vessel being composed of caoutchouc or other suitable material, and either suspended by spring in a framing, or secured by means of a flexible washer on to the lower vessel to give elasticity, instead of having it rigid, as hitherto used. The teats for sucking are placed in the sides of the upper or flexible vessel, and communicate with the liquid by tubes jointed for the purpose of leaning.

1510. J. NAPIER, *Edinburgh*, "*Stereotyping.*"—*Dated* 12*th June*, 1861.

This invention relates to an improved mode of obtaining stereotype plates, which possesses many advantages over the plaster or paper processes. Under one modification a planed cast iron plate is prepared to receive the plaster or stucco impression in the following manner:—A piece of cartridge or other paper is cut to the size of the plate, and pasted on the planed surface of the plate. The upper surface of the paper is also pasted, and a mixture of plaster of Paris and water prepared to the consistence of thick cream is poured on to the paper. The surface of the plaster is levelled to the required thickness by means of a straight-edge or other suitable tool. The form containing the type-blocks or pages to be stereotyped is locked up by quoins in the usual manner to prevent the type from falling out, and the surface of the type is oiled. The form is inverted and the type laid with its face downwards upon the freshly-prepared plaster, and the form is allowed to remain until the plaster has set. The form is lifted off, and the plaster dried completely from the metal side. This may be conveniently done by means of an ordinary type founder's furnace, arranged with a fire-clay or brick flue, fitted with an iron plate to facilitate the drying of the matrix. A flat cast iron plate covered with paper is provided, and this plate has metal gauges to regulate the thickness of the stereotype plate. The matrix plate is screwed or wedged to this plate, and both are well heated; the molten metal is then poured in, and an exact counterpart of the type or form is obtained. After allowing the stereo cast to cool it is removed and finished by planing or chipping if necessary.

1511. D. WALMSLEY *and* J. ROWTHON, *Disley, Cheshire*, "*Hoisting machinery used in mills, warehouses, &c.*"—*Dated* 12*th June*, 1861.

The First part of this invention relates to a system or mode of stopping the motion of hoisting machinery by self-acting arrangements at any predetermined position or floor, so that, if the hoist box is at, say, the bottom, and the attendant wishes it to ascend to any one of the floors above, he has only to arrange a simple stop or handle, and he may leave the hoist after putting the driving gear into motion, and it will stop at the required floor. The Second part of the invention relates to a method of closing the doors leading to the hoist shafts, so as to prevent accidents which frequently happen by persons falling down the hoist shaft. The patentees limit this part of their invention to closing the doors, and not to both closing and opening. The means by which they carry this part of their invention into effect consists in arranging the doors to slide vertically, and so as to open by descending and close by ascending, and in balancing the doors in somewhat similar fashion to that in which the ordinary window sash is hung, making the weights preponderate, so that the door will always ascend or close when left alone.

1513. J. P. GIRARD, *Coutances, France*, "*Coffee-mill.*"—*Dated* 12*th June*, 1861.

This mill is fixed on a box furnished with a drawer for receiving the coffee when ground, and having an upright board which forms the back of the apparatus. The coffee is first placed in a funnel-shaped receptacle of sheet iron, or other suitable material, and, on turning a handle, a toothed grinder of cast iron is made to gear with the teeth of a core also of iron. The grinder is fixed to the upright board above mentioned by two bolts or pins furnished with nut screws. The mill is regulated by means of a thumb screw, and the teeth of the grinder and those of the core are so arranged as never to rub against each other, whereby the mechanism is preserved from all injury.—*Not proceeded with.*

1514. C. SWAN, *College Hill*, "*Travelling bags.*"—*Dated* 13*th June*, 1861.

This invention consists in the peculiar way in which the patentee forms the bag or portmanteau, by means of which he is enabled to obtain large capacity in the article, with great convenience, and comparatively small cost and amount of material. The First part of the invention consists of a frame formed of two rectangular segments jointed at each end in the centre, so as to open and shut by folding on each other. The next part of the invention relates to the form of pieces composing the bag. The end pieces or gussets are made so as to be nearly rectangular in form, and slightly rounded at the upper end. The sides are similarly formed, being nearly rectangular both at top and bottom; the bottom of the bag is of the usual form, and may either have a joint through the middle or not; the whole is attached to the frame in the usual manner, and the result of the combination is such as to give a bag or portmanteau a much larger capacity than can be obtained by those as now formed.

1516. E. CHATONET, *jun., La Rochelle, France*, "*Apparatus for manufacturing the covers of tin or other metal cases.*"—*Dated* 13*th June*, 1861.

This machine (solidly supported on a block of wood) is composed of two cast iron puppets, united by a sockle of considerable strength to ensure the rigidity of the apparatus. A shaft passes from one puppet to another revolving in bronze bearings, and carrying at one end a pinion, maintained in position by a screw, and at the other a mill or roller in cast steel, representing in relief the moulding intended for the covering of the boxes. Immediately below the shaft first mentioned a second shaft traverses the two puppets, and this also revolves in bronze bearings. The upper bearings are movable, and this is obtained by press screws allowing space for a conical graving wheel at one end, the other being furnished with a mill or roller in cast steel. This disposition of the two mills (for milling or rolling the tin) allows them to approach and retire at the will of the operator.—*Not proceeded with.*

1536. L. J. J. PETRE, *Paris*, "*Smoke-consuming grate.*"—*Dated* 12*th June*, 1861.

This invention relates to a new arrangement of furnace grate for the consumption of smoke composed of fire bars, each having two parallel side cheeks or flanges, connected at the upper part at intervals by tie pieces cast on the cheeks. The upper surface of the fire-bar may be of a round, square, elliptical, triangular, or other form; it is also provided at intervals with elongated holes, arranged in various ways, to allow air introduced at the under part of the grate to pass between the cheeks, and through the tubes in the bars into the centre of the fuel, so as to obtain more perfect combustion.—*Not proceeded with.*

1517. H. HOLLAND, *Birmingham*, "*Umbrellas and parasols.*"—*Dated* 13*th June*, 1861.

This invention consists of securing the ivory finish or ornament which is affixed to the end of the tubular ribs of umbrellas and parasols by passing through the said ornament a metal pin treated somewhat like an escutcheon pin, which pin, after having been passed through the ornament to the extent of about a quarter of an inch, is inserted and fastened to the end of the rib by compression of the said rib. That part of the pin on which the end of the rib is closed is of somewhat less diameter than the other part, so that, when the end of the rib is closed thereon, the pin cannot be drawn out of the rib.—*Not proceeded with.*

1520. J. ILLINGWORTH, *Bradford*, "*Arranging sizing-houses, brew-houses, dye-houses, &c.*"—*Dated* 13*th June*, 1861.

The object of part of these improvements is to cause the steam employed in various processes to pass freely away from the apartment or chamber in which it is employed. For this purpose the patentee forms all parts of the roof and flooring where the steam is produced or set free as air-tight as possible, and also by its thickness or otherwise, so as to avoid the conduction of cold within. He admits all the air required from the lower part of the room. He applies pipes, chimneys, or other ventilators rising above the roof to a considerable height, say from two to forty feet, formed to prevent the admission of rain, and yet allow the free escape of the steam, and so that any moisture formed by condensation on the ventilators may be readily conducted away. Iron, lime, and bricks, or stones, or other suitable materials, covered with three coats of gas tar, or other material adapted to prevent the admission of air or cold, are well adapted to form such chambers, roofs, pipes, chimneys, or ventilators. The sizeing troughs, when made of wood, are to be bolted together, so that the bolts can be seen on the parts they hold together, with guides of suitable materials secured without bolts and screws inside, or going into or through the trough sides, and so that the guides will leave or may be removed from their places without breaking the warp. Also rollers of suitable materials to run with shaft and pedestals made of charcoal iron or other cast iron are used. The boxes or other receivers for the wet warps are made of wirework, or are otherwise reticulated, adapted to admit the free passage of air thereto and therethrough.

1523. The Hon. C. DUNCAN, *Cranford House, Hereford-street, London*, "*Machinery for sawing wood, &c.*"—*Dated* 13*th June*, 1861.

This invention cannot be described without reference to the drawings.

1534. H. J. KENNARD, *Great George-street, Westminster*, "*Excavating sand and gravel under water.*"—*Dated* 15*th June*, 1861.

The first part of this invention has for its object the excavation of sand or gravel situated under water, in places where excavations of any description are desirable to be made for foundations or other structures, and consists of an apparatus which is placed on the surface of such sand or gravel, and into which the same is drawn by means of suction. When full of sand or gravel this apparatus is raised out of the water, and is emptied in any convenient place. The apparatus, which may be termed a sand pump, consists of a cylindrical or other shaped water-tight box of wrought or cast iron, or any other suitable material, into the bottom of which is fixed, in a water-tight manner, a tube of convenient diameter, open at both ends and passing upwards inside the box to nearly the top of the same, and continued downwards outside the box to an extent which is governed by the nature of the soil which the pump is to remove. In the top of the box are formed two or more small openings, which are provided with valves opening outwards, and fitting, when closed, in a water-tight manner to the openings; and there is also a larger opening situated in about the centre of the top of the apparatus, over which is fixed, in a water-tight manner, a tube of large diameter containing a weighted piston working therein in a water-tight or nearly water-tight manner, and actuated by a rope or chain from above the surface of the water; or a cylindrical bellows or flexible disc may be attached over the before mentioned opening, and moved up and down, there being also a weight attached to the top of the disc. The Second part of this invention has the same object as the first part, but the apparatus that is to be lowered down upon the sand or gravel below the water consists of a strong circular or other shaped bag, into which the sand or gravel is driven by the water when in an agitated state, and in which bag the sand or gravel subsides by gravity.

1545. D. B. WHITE, *Newcastle-on-Tyne*, "*Plummets and gauges for indicating the depth and the height or level of liquids.*"—*Dated* 17*th June*, 1861.

This invention is more particularly intended to indicate on shipboard the height or depth of water that may have leaked into or otherwise entered the hold, but it is applicable to indicating the depth and the height or level of liquids generally. According to one arrangement this invention consists in the employment of a galvanic battery, a wire from one pole of which leads to a needle or series of needles or indicators, while communication is established to complete the electric circuit by means of a float; or, in the case of salt water, and other good conducting liquids, by the water itself rising and coming in contact with one or other of a set of metal plates, placed one over another, and each having connected to it a separate wire leading to the indicating apparatus. The plates being at different levels, the indicating apparatus shows which plate is in communication, and, consequently, the height of the liquid. According to another arrangement the patentee employs an annular piston working between a cylinder and an internal tube containing the wires which lead to the metal plates before mentioned. These plates are all connected with one pole of the battery, and a wire attached with a tongue to the piston, and which rises and falls therewith, is connected to the other pole. As the column of water presses on the piston (the pressure being proportionately counteracted by a spring or springs), it moves the tongue with the wire to one or other of the metal plates, and the needles or indicators show which plate is in communication, as in the former arrangement.

1546. J. LEWIS, *High-street, Bloomsbury, London*, "*Machinery for cutting and boring wood, &c.*"—*Dated* 17*th June*, 1861.

This invention cannot be described without reference to the drawings.

1549. W. CLARK, *Chancery-lane, London*, "*Letters, designs, and other articles of mica.*"—*A communication.*—*Dated* 17*th June*, 1861.

The patentee claims the new application of mica, as described, superposed and gummed in sheets or pieces of different colours or shades in the manufacture of letters, signs, and other devices for ornamental and useful purposes.

1551. J. PERRY, *Earle-street West, St. Marylebone, London*, "*Washing machines.*"—*Dated* 17*th June*, 1861.

This invention consists, essentially, in disposing and using a screw piece as an agitator to act on the materials being washed, and in forming the ribs or friction surfaces disposed on the interior of washing machines of screwed or spiral form.

1553. A. R. LE M. DE NORMANDY, *Clapham Park, Surrey*, "*Refrigerating the fresh water produced by condensing steam.*"—*Dated* 18*th June*, 1861.

This invention consists in arranging the apparatus in such a way that the condensing tubes, instead of occupying the whole length of the cylinder or vessel used for condensation (as in the apparatus known as "Normandy's marine aerated fresh water apparatus"), occupy only a certain portion of the upper part thereof, and the lower part is provided with a tube or tubes, or suitable refrigerating apparatus, so constructed and placed that the water condensed in the upper portion of the cylinder is refrigerated in the passing through the lower part of the condenser.

1559. W. B. TAYLOR, *Belmes-road, London*, "*Heating by means of lamps.*"—*Dated* 18*th June*, 1861.

This invention is applicable to the heating of various kinds or descriptions of vessels, and generally for heating by the use or employment of the flame of vessels, and generally for heating by the use or employment of the flame produced in lamps of various kinds, constructed for burning oils or other smoke producing materials usually employed for giving light as distinguished from spirit lamps. The mode or method of employing or utilising the heat of flame from lamps in heating the fluid contents of vessels is by forming them with an internal flue or tube of any suitable form, and by removing the glass chimney ordinarily employed for insuring perfect combustion in the production of light and placing the vessel as described upon or over the lamp in such a position as the vertical flue or tube of the vessel will form an equivalent for the glass chimney or flue previously employed.—*Not proceeded with.*

1560. W. FLEMING, *Edinburgh*, "*Apparatus for manufacturing snuff.*"—*Dated* 18*th June*, 1861.

The rollers of the snuff mill, constructed according to these improvements, do not heat during the working; they are always properly lubricated, and kept up to the surface of the grooved cylinder. The rollers are of cast iron, with a longitudinal aperture extending through them; each roller is turned externally, and the aperture is bored at each end to receive two deep tubular brasses. Through these brasses is passed the malleable iron spindle of the roller; a flanged washer is fitted over the spindle at each end of the roller, and the flanges of the washers enter corresponding grooves turned in the ends of the roller, and serve to prevent the escape of the oil used for lubricating. A loose washer is passed over the spindle at each end, and the roller is then fitted in the adjustable socket pieces which project radially from the central vertical shaft. The spindle has four grooves formed in each end, and each socket is furnished with two punching screws to prevent the spindle from turning. A small oil cup or receptacle is formed round the upper socket, and the oil flows down the spindle, and so lubricates both the tubular brasses, which are the only parts moving in contact with the stationary spindle. When the mill is put in motion the rollers by their contact with the grooved cylinder or tube rotate about the spindle, and the tubular brasses which are feathered to cause them to move with the rollers are constantly lubricated, so that no heating of the parts takes place.

1561. S. SHARP, *Birmingham*, "*Printing machines.*"—*Dated* 18*th June*, 1861.

These improvements apply to printing machines where rapidity of action or dispatch is required, and consist in what the inventor terms a fast machine, constructed of a number of small cylinders, deriving their motion from a large cylinder, each small cylinder having its own laying-on board, so that the process is continuous, namely, that of laying on the paper, and its accompanying roller taking it around over the forme, and delivering it. The inventor purposes increasing the number of small cylinders according to the amount of work required to be printed. Secondly, the improvements consist (also in connection with a flat forme) in printing either on one or both sides of a continuous roll of paper, so that as it is unrolled it is passed under a cylinder and over a forme, and taken away by being passed between rollers and cut into lengths as required according to the size of forme; but when the said continuous roll of paper is required to be printed on both sides it is brought back through a pair of rollers, and again passed under a roll and over the second forme, and delivered as before stated by being drawn out between rolls to be cut off. Thirdly, the improvements refer to inking apparatus for printing machines, and consist in a self-acting screw which gives to the roller a lateral as well as a revolving motion, by which means the ink is more uniformly distributed over its surface from inking the forme. And, lastly, the improvements relate to a particular construction of taking-off apparatus, applicable to machines now in use, as well as to the improved machines above described, and consist of flat or circular brushes, working with or without tapes around the cylinder to take and pass the sheets between rollers and tapes or cords, which tapes or cords carry the sheets to any convenient part of the machine.—*Not proceeded with.*

1570. J. DIXON, *Newcastle-on-Tyne*, "*Waterclosets and cocks used therewith.*"—*Dated* 18*th June*, 1861.

The object of this invention is to simplify the construction of waterclosets by dispensing with any connections to cisterns, except by a pipe which is to be brought either from a cistern or from main pipe, without the necessity of wires, cranks, service boxes, valves, &c. The patentee effects this by forming a communication from the bottom of the watercloset pan or basin to a vessel placed behind the closet, in which is a ball or ball-cock; when the handle or seat is at liberty the valve at bottom of basin is shut, the water rises in the basin, and at the same time flows through the pipe to the vessel behind the basin, and raises the ball, which is connected to a lever in communication with a cock or valve, and shuts off the supply to the basin, leaving the water standing in the basin up to the level of the overflow pipe. In this self-acting watercloset the patentee uses a cataract cylinder, or a chamber with a flexible disc for holding the valve at bottom of basin tight, and by regulating the supply of water to the cylinder or chamber the basin can be allowed to wash out during any required time. The construction and arrangement of the ball-cock, which can be used for other purposes, is as follows:—Two fixed elastic rings, with a perforated ring between them, are used, and by this arrangement the pressure of the fluid offers no resistance against the spindle of the valve, as it does not press against a seat, but goes into both rings; there is little or no wear on the spindle as it works against the elastic rings, which can be easily removed.

1571. T. T. JOPLING, *Sunderland*, "*Machinery for the manufacture of bolts, spikes, screw blanks, and rivets.*"—*Dated* 18*th June*, 1861.

For the purposes of this invention the dies are received into the face of a disc, which is mounted on a fixed axis. The disc receives a step-by-step movement at intervals, as hereafter explained, a distance equal to that between the centres of two dies. On the periphery of the disc are formed ratchet teeth, one for each die carried by the disc. On the axis on which the disc is carried is an arm, which moves freely on such axis, and in front of the disc. This arm carries a driver, which, when the arm is moved, takes into the ratchet teeth, and gives motion to the disc; and such arm also carries a cutting edge, which, together with a stationary cutter, causes the bar or rod—when its end has been introduced into a die in the disc—to be cut. The fixed cutter consists of a bar fixed to one side of the machine, so as to admit of its being adjusted in position; at the end of this bar is a hole of a suitable size for the passage of the end of the rod or bar through it into one of the dies carried by the disc, so that, when the disc and the arm carrying the other cutter are moved one step, the end of the bar will be cut off at the point where it comes through the hole or passage in the fixed cutter. The arm which moves the disc and carries a cutting edge receives motion by means of a connecting rod attached to a crank pin on a disc on the end of a shaft, which receives motion from the main shaft by bevel toothed wheels. It will consequently be seen that, by simply moving the arm which carries one of the cutters, the disc carrying the dies will be moved one step, or a distance equal to that between the centres of two dies, and by such movement a portion of metal will be cut off from a bar or rod, and remain in one of the dies. The main or driving shaft receives motion from a steam engine or other power, and by means of a cam formed or fixed thereon it gives motion to the heading die, which is carried by a crosshead which is in front of the face of the disc, and such crosshead is mounted on the ends of two sliding bars or rods. The cam acts on a roller carried by a strong block of wood, which is fixed to the two sliding bars or rods above mentioned, by which the crosshead and heading die are moved towards one of the dies in the face of the disc, and thus forms a head on the length of the bar or rod contained in the die; this cam also moves the crosshead on away from the disc. Another cam on the main shaft gives motion to a rod, which forces the article out of the die if it be a short one, and partly out if it be a long one, and the cam gives motion to another rod with a hook, which takes hold of the head and removes the article. It is preferred that the disc should be arranged to carry six dies, and that the heading should be performed after a length of metal has been cut off, and has been moved a second step with the disc to bring it into a position to be formed with a head, and the cam for forcing out the article from the dies acts after the disc has been made one step or movement after the heading punch has acted. When working with hot metal streams of water are caused to flow through the dies after the article has been forced out, and water is also supplied to the heading die.

1573. C. E. BUTLER, *Birmingham*, "*Riddles or sieves.*"—*Dated* 19*th June*, 1861.

In carrying out this invention the inventor places the wire or other bottom of the sieve over a hoop or lining a little smaller than the outer rim constituting the body of the riddle or sieve. The said hoop or lining is rounded or curved inwards on its upper edge, so that the bottom of the riddle or sieve may be stretched over it without danger of being cut or torn. The outer rim or body of the sieve is forced upon the solid hoop or lining, and pressing the edge of the bottom over the said hoop or lining tightens or strains the said bottom upon the said hoop or lining. The edge of the bottom is then turned up inwards over the lower edge of the hoop or lining, and a small additional lining of iron or sheet metal is put over the edge of the body of the riddle or sieve and the hoop or lining, thereby covering the said edges as well as the turned-in edge of the wire or other bottom. By means of rivets the last named lining is fixed to the hoop or lining on which the bottom is stretched, as well as to the rim constituting the body of the riddle or sieve, and all the parts are thereby secured together.—*Not proceeded with.*

1574. W. CLARK, *Chancery-lane, London*, "*Umbrellas and parasols.*"—*A communication.*—*Dated* 19*th June*, 1861.

This invention relates to arranging the whalebone and other frames of umbrellas, parasols, and sun-shades so as to turn freely on the handle or stem. This improvement is intended chiefly to facilitate the carrying of umbrellas, and also to prevent injury to the umbrella from sudden gusts of wind turning it inside out, as is the case when the frame is a fixture. The principal feature of the invention consists in the methods of mounting the turning sockets to which the frames are attached on the handles or stems. The invention cannot be described without reference to the drawings.

1577. P. PRADEL, *Paris*, "*An improved clasp or fastener.*"—*Dated* 19*th June*, 1861.

This invention consists in the construction of an improved clasp or fastener by which doors, boxes, cases, and articles in general, whatever their size and form, can be secured or closed without the use of a key. The improved fastener is composed of a metal of any desired form or shape, having on the outside a dial divided into hours or minutes similar to a clock dial. In a cavity formed on the inside of the metal plate is fitted a large and small barrel, working within, and independently of one another; the number of such barrels may be increased to make the clasp or fastener more secure, and to make it more difficult to open. To each of these barrels, and in front of the dial plate, are attached hands or pointers similar to the large and small hands of a watch; to each of these barrels are fitted cap pieces or discs, and across the surface of the two discs is a groove forming the arc of a circle, such groove passing through the centre or axle of the caps. Or, instead of using discs, the groove may be cut upon the face of the barrels. In this groove work two studs or pins of a flat lever working on a fulcrum or centre inside the metal plate, the fulcrum being at the centre of the curves formed by the groove above described. The opposite end of the lever passes out through an opening in the side of the plate, and has attached to it the bolt, hook, or whatever kind of fastening may be required. The lever is provided at one end with a knob for working the same; or, instead of the lever forming the clasp or fastener itself, it may be made to act upon a bolt, as described. When the improved clasp is made in the form of a watch or padlock the eye or ring is formed in two segments, which are made to open and close by means of a split or double lever, in combination with the dial and pointer, as before described.

1582. J. F. WILLIAMS, *Queen-square, London*, "*Compounds of india-rubber and gutta-percha, with other substances.*"—*Dated* 19*th June*, 1861.

This invention consists in combining with india-rubber or gutta-percha the black or dark residuum obtained when distilling palm and other vegetable oils by superheated steam. The india-rubber or gutta-percha and the black or dark residuum are masticated or ground together in order to their being intimately mixed, and when it is desired that the india-rubber or gutta-percha compound should be vulcanised, or changed by heat, sulphur is combined with the other materials; it is also preferred, in most cases, to introduce a quantity of chalk into the india-rubber and gutta-percha compounds. Fibres and other matters are also occasionally employed in preparing such compounds of india-rubber and gutta-percha, depending on the nature of the article it is desired to produce.

1581. W. J. HARRIS, *Liverpool*, "*Dry gas meters.*"—*A communication.*—*Dated* 19*th June*, 1861.

The patentee claims the combination of a series of flexible diagrams with a conical valve having an inlet passage at one of its heads, an outlet passage at its other heads, two lateral ports communicating respectively with the inlet and outlet passages, and turning in a conical valve-seat fitted with as many ports as there are chambers in the meter, the whole constructed, arranged, and operating as described. He also claims the combination of the said valve and valve-seat with an enclosed inlet passage or supplementary port in the valve, substantially as described. He also claims the combination of the stems of the flexible diagrams with conical stoppers and stopper-seats.

NEW DISCOVERY OF COAL IN SCOTLAND.—At Newbattle Abbey Colliery a fine seam of parrot coal has recently been cut, at a depth of 297 yards, and from the report and analyses of Dr. Stevenson Macadam it seems probable that the proprietor, the Marquis of Lothian, will be amply recompensed for the time and money he has expended in developing the property. In sinking several good seams have been laid open, but the parrot and the splint, which is a good steam coal, are those to which most importance is attached. Dr. Stevenson Macadam, who enjoys a high reputation as an analyst, reports that the parrot coal yields 51 per cent. of volatile combustible matter, and 45 per cent. of coke. Each ton producing 12,573 cubic feet of gas, 1,140$\frac{5}{6}$ lb. of coke, and 45 gallons of tar and ammoniacal liquor. Generally, he says, the parrot coal from Newbattle engine-pit is a first-class gas coal, and he is of opinion that the large quantity of gas evolved from one ton, and the rich quality of the gas, will commend the use of this coal wherever superior gas is required. As an oil-producing coal the Newbattle parrot is second only to the Boghead; for, although Capeldrae and Auchenheath yield more crude oil per ton, the greater purity of the Newbattle oil gives it the advantage. The quantity of refined oil obtainable from 100 gallons of crude oil from the several coals is—Boghead, 64 gallons; Newbattle, 55$\frac{1}{2}$; Capeldrae, 47$\frac{1}{2}$; Methil Black, 46$\frac{2}{3}$; Wemyss, 44$\frac{1}{2}$; Methil Brown, 40; and Auchenheath, 40 gallons. The specific gravity of the oil from Newbattle coal is ·865, water being 1,000.—*Mining Journal.*

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

QUARTERLY MEETINGS YESTERDAY IN BIRMINGHAM, AND WEDNESDAY IN WOLVERHAMPTON: *Effects of the American News, most favourable* —SALES OF FINISHED PIG IRON—COAL TRADE—GENERAL MANUFACTURING TRADES — NORTH STAFFORDSHIRE IRON AND COAL-MASTERS' ASSOCIATION: *Quarterly Meeting*—THE AFFAIRS OF MESSRS. BEDFORD, BURYS, AND CO.: *Sale of Estates for Dividends*—WANT OF ACCOMMODATION IN BIRMINGHAM FOR THE IRONMASTERS—SEVERE DISTRESS IN KIDDERMINSTER AND COVENTRY—BILSTON GAS COMPANY — GRAVE WRONG TO THE OPERATIVES IN THE "BLACK COUNTRY:" *Defalcations of a Clergyman Manager of a Savings' Bank*—ACCIDENTS FROM THE RECKLESS USE OF BLASTING POWDER —DEATH OF A PLATELAYER IN A TUNNEL IN BIRMINGHAM.

THE past week has been the Quarterly Meeting week. The series opened very languidly on Wednesday in Wolverhampton, where, however, there was a very numerous gathering, and not a few purchasers from Liverpool, and Manchester, and other districts. These had evidently come to "spy out the land," and to give out orders if the news should be favourable. No information being to hand during 'Change hours on that day things passed off very quietly, scarcely anything being done. But, during the evening, the telegraph companies made us aware of the fact, both in Birmingham and Wolverhampton, that the Southern Commissioners were coming across from their felons' cells, once more free men under the protection of the British flag. The news was received by the majority f the trading classes with the] most complete satisfaction. While a few, who had been making up their minds for war, felt nd expressed some disappointment at first, a little reflection led even such men to the conclusion that it would have been a great pity if, in order to "cut the comb" of the American Eagle because of his recent dangerous exploits, we should be compelled to cut the fine bird's throat. No, no; the inviolability of an English deck has been upheld; those people who would lightly esteem it have been taught that to do so would be to incur a fearful risk of terrible retribution; we have satisfied ourselves that thus far at least the national honour that we received unsullied from our forefathers is likely to descend unsullied to our children, and the hardy sons of Vulcan are satisfied—are one and all satisfied! These feelings, so general at the close of Wednesday, were still more apparent yesterday (Thursday). All men were heartily thankful that the appalling evils which are now ravaging the New World were not likely to be increased by any steps which this nation might feel called upon to take. The inactivity at Wolverhampton, therefore, gave way to an animation in Birmingham that was quite cheering. Buyers of finished iron gave out orders to an extent that was not anticipated the day before. The orders were not, however, of the customary magnitude, and evinced the cautiousness of traders and their conviction that, until the dispute between the Americans themselves is ended, there will be no thorough revival of trade. The pig iron makers are effecting sales at an average of last quarter's rates. Some of the sales are for slightly higher and some for slightly lower prices. The makers of mine pigs continue to ask £3 2s. 6d.; and the best houses get that price in many instances as they did in as many last quarter. But the iron of this denomination which is not A1, finished iron houses refuse to pay more for than £3 or £3 1s. 3d. The hematite houses have agreed to demand higher rates than those obtained last quarter; and the announcement that a compact existed between them excited some little amusement in Wolverhampton on Wednesday. The agents of these firms ask a rise of 5s. a ton, and say they will not take a less rise than 2s. 6d. on last quarter's prices. They, however, will not get it till the demand is of a very different character to that which will for some time exist.

The coal trade is not so active as it was last week.

The Quarterly Meeting of the North Staffordshire Coal and Ironmasters' Association has been held at Stoke-upon-Trent. The proceedings have been thus reported:—"Mr. Wragge was appointed chairman for the ensuing year. Mr. Heath-cote (of Apedale) and Mr. Wragge were appointed to represent the association at the Mining Association of Great Britain. Several firms in the district were admitted members of the association. The state of the iron trade was reported to be in much the same condition as for some months past. It was stated that several rather considerable orders for finished iron had come into the district lately. Pigs maintain recent prices, sellers asking an advance of 2s. 6d. per ton; but buyers holding off engagements of any magnitude at present, except at former prices. The coal trade is in a moderately good condition."

At Birmingham stock taking is not yet over, and, as the factors' travellers have not gone out, there are few orders to distribute, so that business is, in many respects, at a standstill, except in a few of the large manufactories, where three or four branches are carried on; slackness in one is compensated in some degree by activity in another. The electro and plating trades are, however, very dull; and as to the jewellers and other fancy trades the reports are much to the same effect. In Wolverhampton manufacturers are fortunate enough to have a few orders in hand prior to the holidays; upon those, then, their men have been kept at work; and in the course of the last two or three days orders have been coming in, though slowly, and they are but small, but still sufficient to enable manufacturers to set their men on, and in two or three weeks we may expect that more activity will spring up. The foreign trade is dull, but not more so than it usually is at this season. There has been a fair trade doing lately with Havannah; and there are now some orders about for Valparaiso.

Hopes are entertained about the Canada trade for the spring, but for another month there will be nothing done on that account. The metal market is dull, and prices of copper and tin indifferently supported, and the state of the money market was in favour of the holders of both metals, and it is not anticipated that any decline in prices will take place. Wednesday and yesterday were factors' quarter days in Wolverhampton and in Birmingham respectively, and the accounts were met with the customary promptitude of those two towns.

In reference to the affairs of Messrs. Bedford, Burys, and Co., of Sheffield, a circular has been issued, notifying that arrangements have been made for the sale of the joint estate, as well as the private estate, of two of the partners, by which a guaranteed dividend of 12s. in the pound will be secured to the creditors. This amount will be paid by instalments—5s. in the pound on the 1st of October, 1862; 3s. on the 1st of April, 1863; and the remaining 4s. on the 1st of July in that year.

We find the following in the *Birmingham Journal* of Saturday last:—"The ironmasters and the numerous persons who attend their meetings are occasionally forced to transact business under circumstances of great discomfort, which might easily be avoided by a little forethought on the part of our local authorities. When they assemble in Birmingham the ironmasters meet in the Town Hall—that is, they should meet there, and do so when they can get the chance. At the last quarterly meeting the hall was engaged, and the ironmasters had to shift as well as they could in the street, between the hall and the institute. The next quarterly meeting takes place on the 9th inst., and again the hall is engaged; so that, for the second time, but for the liberality of the Queen's Hospital authorities, the ironmasters and their customers must stand out in the street, whatever the weather may happen to be. Now, ironmasters' meetings are held in Birmingham only four times a year, and the days are always fixed, so that there could be no difficulty in reserving the Town Hall on the morning of those days for the use of the ironmasters, who only require it until about three o'clock, thus leaving the evening perfectly free. It would be no trouble at all for those who grant the use of the hall to make an entry in the book that it is permanently engaged on the mornings of those four days. Nor would this be an undue concession to the ironmasters, many of whom are intimately associated with Birmingham, and are liberal subscribers to the local charities and public institutions. Our town is not a little proud of being recognised as the capital of the iron district, but it is a poor return for the honour to compel the 'iron kings' to stand out in the rain when we might easily lend them a comfortable room to meet in."

The severe depression of the trade of Kidderminster, and consequent distress among the carpet weavers and others, have attracted public attention, and at a meeting held at the Guildhall of that town, under the presidency of the mayor, it was resolved that, with a view to alleviate the sufferings of the working classes as far as possible, a public subscription be commenced by the inhabitants of the town and neighbourhood; an influential committee was appointed to carry out the views of the meeting, and donations to the amount of upwards of £600 were received.

The reports from Coventry are even more unsatisfactory. The money previously in the possession of the Relief Committee is being rapidly exhausted. The operatives are said to be suffering greater distress than they have ever yet experienced, and it is feared that another appeal will have to be made to the country.

The Bilston Gas Company held their annual meeting on Monday last. The director's report showed that the nett profits of the year were £2,435 17s., to which had to be added £221 8s. 3d. from last year's account, making a total sum of £2,657 5s. 3d. available for dividend. A half-yearly dividend of 4s. per share was paid in anticipation on the 1st of August last, and a similar dividend was proposed to be paid on the 1st of February, which would leave for the reserve fund £200; to write off bad debts £40 9s.; and to be carried forward to next year £416 16s. 3d. towards the law expenses of an arbitration case which the directors had been advised to carry on, during the past year, for some damage believed to be caused by a mining encroachment, the remainder of which the directors propose to pay out of the next year's profits. A number of questions were put to the chairman respecting the present state of the company, as well as in regard to the extra expenses of the past year, which the chairman said he and his brother directors could not have avoided with due regard to the interests of the company, as there was no doubt the injury to the works had been caused, partially at least, from the abstraction of mine under the surface of their property. The number of consumers was 1,405 on the 30th of September, exclusive of market consumers and street lamps, showing an increase of 154 new customers during the past year.

It is with profound sorrow we note that, to the many financial calamities with which Bilston has lately been afflicted, the new year has opened with one that will be fraught with more scandal and pain than any disaster that has preceded it. Some fourteen hundred of the most exemplary of the operatives of Bilston and the surrounding district, who had saved sums averaging from £1 to £150 each, and stored it in the Bilston Savings' Bank, are now informed by the managers that a deficiency has been discovered to the extent of one-third of the assets — in other words, that instead of there being 25,000 sovereigns to repay the £25,000 that the depositors have invested, there are only 16,400 sovereigns, the balance of nearly £9,000 not having been invested by the rev. gentleman whose name as treasurer and actuary had induced the strong feeling of security which the investors felt in the bank. The managers add that they are "taking" measures to secure the deficiency, and that "it is their intention at the earliest opportunity to divide the funds in hand." The assets which the trustees hope to realise consist of a life assurance for £3,500. Mr. Fletcher's age is about fifty-five, and the payments are about £103 a-year. Then the living being worth about £740 per annum, if it should be sequestrated, it is hoped that about £540 a-year may be realised from it. Next, there is Mr. Fletcher's household furniture and the stock, &c., on his farms, which, together, it is expected, will realise £2,000. That sum would divide 1s. 7d. in the pound to be added to the 12s. 6d. that will be obtained from the £16,400 in Government securities. There is, therefore, reason to hope that in a few years, should criminal proceedings not be taken the depositors will obtain the whole of their money. It would seem to be almost beyond doubt that the rev. gentleman first appropriated the money of the bank to pay the expenses of the parish election by which he was appointed to the incumbency. The rev. gentleman's family consist of five sons and one daughter. For one of his sons, who is engaged in the iron trade, he has become security at a local banker's for about £1,500. We trust that such an unpardonable wrong as the operatives and small tradesmen in the district named are now suffering will not induce a recklessness which would make the disaster ten-fold more a calamity than it would otherwise prove, but that, upon receiving their quota of the deposits in hand, they will at once transfer it to the Post-office Savings' Bank, in Bilston, where, as is the case with all other Post-office savings' banks, the depositors have the security of Government for all the money that they invest.

Two serious accidents have happened since our last through carelessness in the use of blasting powder. In the first case a boy has nearly lost his life, and another person has been injured in a pit at Madeley, in Shropshire. The boy had been accustomed to make *petit* cannons out of clay, and load them with the blasting powder. Whilst thus occupied on Friday last the boy set light to about 8 lb. of powder contained in a wooden bottle, and he was not only himself injured, but a companion who was with him was also seriously hurt. A fine horse, worth £30, was also rendered comparatively useless by the same accident. In the second case some well-sinkers were at work in Wolverhampton, and placed about three-quarters of a pound of powder in an oven grate of the house near to which they were employed. This they did on Friday night, and after the fire had gone out of the grate. On the following morning they lighted a fire, forgetting what they had done on the previous night. The powder exploded, shattered the grate, blew out the doors and windows and the like, and left two of the men and a woman seriously injured.

A platelayer has been killed in a tunnel in Birmingham under the circumstances related at the inquest on Friday. It seems that on Monday afternoon the deceased was at work in the Snow-hill tunnel, with three other men, when, hearing the 3.20 train coming, they ran into a man-hole till the train had passed. They were coming from the hole again when they heard another train coming from Snow-hill station, which deceased thought was a third-class engine, and which would pass along the rails near to the man-hole. Deceased then crossed over the line, and stood between the rails and the wall (the other man still remaining in the man-hole) when the 3.20 train came back, knocked him down, and passed over him, mutilating his body in a frightful manner. There being a great fog and steam in the tunnel at the time the deceased could not be readily found, but he was at length discovered lying between the rails, having a compound fracture of each of his legs and thighs, the left arm and fore-arm, the right fore-arm, and one foot torn off. He was then removed to the General Hospital, and expired two hours after his admission into the institution. A verdict of "Accidental death" was returned.

WOOD FOR SHIPBUILDING.—Professor Crace Calvert is now making an investigation for the Admiralty of different kinds of wood used in shipbuilding. It appears that the professor is at no loss to explain why so many of the fleet of recently-built gunboats became rotten and others escaped untouched. He finds the goodness of teak to consist in the fact that it is highly charged with caoutchouc; and that, if the tannin be soaked out of a block of oak, it may then be interpenetrated by a solution of caoutchouc, and thereby rendered as lasting as teak. A few years ago an enterprising individual spent £30,000 in trying to introduce a new wood for shipbuilding purposes from South America, where it is known by the name of Santa Maria; but the dockyard authorities could not be persuaded to take it into use, and the imports were entirely neglected. This is one of the specimens investigated by the Manchester professor; and he finds it to be sound and resinous, and but little interior to teak. Of the durability of teak there can be no question.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

LIVERPOOL MATTERS: *Runcorn an Independent Port: Mersey Docks and Harbour Board: Birkenhead Street Railway Company: Liverpool Polytechnic Society*—STATE OF EMPLOYMENT AT MANCHESTER—PROPOSED NEW RAILWAY STATION AT RETFORD—STATE OF TRADE: *Leeds: Sheffield*—STEAM PLOUGHING: *Fowler's Patent*—THE COTTON SUPPLY QUESTION: *The Future of Lancashire: Casting about for Fresh Resources*—DERBYSHIRE IRON: *New Rolling Mills, completed by Messrs. James Eastwood and Sons: Interesting Speech by Mr. Hedley, Inspector of Mines*—NORTHERN MATTERS: *The Derwent and Consett Ironworks: Map of the Western Coal District of Northumberland and Durham: The Water Supply of Newcastle: The "Red Star" Line of Steamers on the Tyne.*

SEVERAL matters of interest may be noted in the Liverpool district. With the commencement of the new year the Lords of the Treasury have approved of Runcorn as an independent port, and the Commissioners of Customs have appointed the Sloyne in the Mersey as the station at which all vessels arriving at or leaving Runcorn are to bring to for the boarding or landing of the officers of customs.—The Mersey Docks and Harbour Board—in connection with which it may be stated that Mr. Rankin has been elected the new chairman—have come to a final understanding with the Bridgewater trustees as to a proposed new shed at the South Carrier's Dock. The trustees will pay 5 per cent. per annum upon the cost of the works under the surface of the ground and 7½ per cent. upon that of those above. The total estimated cost of the shed is £7,200, and a lease is to be granted to the trustees for seven years.—The Liverpool Corporation finances appear to be thriving, the surplus for the past year being £26,305.—At the Liverpool Assizes the case of "Musgrove *v.* the Birkenhead Street Railway Company" was heard, the plaintiff, Mr. Ralph Noel Musgrove, seeking to recover compensation from the company for alleged wrongful dismissal. The defendants had paid £20 into court. The plaintiff, it appeared, had formerly been purser on board a steamship, and he was sent out to America by Mr. Train to study the working of the street railway system there. Upon his return in November, 1860, he entered into an agreement with the defendants, through their secretary, Mr. Penniston, to become general superintendent of the line at a salary which was to be payable at the rate of 5 per cent. on the gross earnings of the line then in existence at Birkenhead, and any further extensions of it. In October last, however, he was summarily dismissed, and he now sought compensation for such wrongful dismissal. It was agreed to enter a verdict for the plaintiff for £480, subject to arbitration.—At the last meeting of the Liverpool Polytechnic Society Mr. Maxwell Scott, the president, delivered his annual address, in which he gave a *resumé* of the progress made during the year by the society. He also alluded to the proposed new local gallery of science, which, he said, will soon be opened. He expressed a hope that the members of the society would see the necessity of getting together as many models of new inventions, or models of anything that they consider will be useful and instructive, to place in the new gallery; and also that the manufacturers, merchants, and inhabitants of the town would consider it a duty and a pleasure to assist the committee in making this gallery one of the lions of the place.

The state of employment does not appear to have improved at Manchester. Of 84 cotton mills 45 were, last week, working full time with all hands, 8 were on full time with a portion of the hands, 23 on short time, and 8 had stopped altogether. Of 59 silk mills, smallware mills, printworks and dyeworks, 14 were on full time with all hands, 8 were on full time with a portion of the hands, 33 were on short time, and 4 had stopped altogether. With regard to the machinists, of 47 establishments 19 were on full time with all hands, 16 were on full time with a portion of the hands, 9 were on short time, and 3 had stopped altogether. These establishments would have employed, if all had been on full time, 7,206 persons; but only 4,681 were actually working full time and 1,085 short time, while 1,440 were wholly out of employment. Of 23 foundries 8 were on full time with all hands, 10 were on full time with a portion of the hands 4 were on short time, and one had stopped altogether. These foundries would have employed if all had been on full time 4,034 persons; but only 3,062 were actually working full time, and 269 short time, while 703 were wholly out of employment.

Increasing business has rendered necessary the erection of a new railway station at Retford, and the Great Northern Company has resolved to proceed with the work. The cost is estimated at £12,000.

The monthly report of the Leeds Chamber of Commerce observes, with reference to the iron, machine, and tool trades of that town and district:—"The makers of best iron continue well employed; the makers of lower sorts not quite so much so; but all have been enabled to keep their works in full operation to the end of the year. The machine and tool trades are quieter, but in few cases have any makers been obliged to put their hands on short time. The locomotive trade is good, and the makers of railway plant, wrought iron bridges, &c., have been well employed during the past year. In this, as in all branches of the iron and machine trades, a general increase has taken place in the means of production, and, from its excellence of material and skill in manufacture, Leeds bids fair to hold a high place as a seat of iron manufactures." At Sheffield it is reported that there is no revival to notice in the cutlery trades, but that there is some activity in silver plate and Britannia metal. The general tone of the advices received from the Continent is considered satisfactory, and, had as things have been at Sheffield this year, they would no doubt have been worse but for the new outlets obtained in vaious parts of Europe.

The eminent firms of Ransomes and Sims, and Clayton and Shuttleworth, have entered into an arrangement with Mr. John Fowler for the use of his patents for cultivating and steam ploughing. It is expected that a great impetus will thus be given to the cultivation of the land by steam power, while Mr. Fowler will, it is to be hoped, reap also the substantial advantages to which he is entitled.

We ventured last week to take a hopeful view of the cotton supply question, and although, perhaps, we reduced the probable weekly consumption to too low a point, we still cannot look at matters so gloomily as our able contemporary the *Economist*, which has published the following statistical vaticinations as to the progress of affairs during the next six months:—

	Bales.	
Stock on January 1	700,000	
To arrive before July	300,000	
In spinners' hands about	70,000	
		1,070,000
Consumption—6 weeks at 30,000, about	780,000	
Export—2? weeks at 8,000	208,000	
		988,700
Stock July 1, 1862		82,000

On these data the *Economist* assumes that Lancashire will be reduced to poverty during the next half-year, and to starvation afterwards, and a suggestion is made that it will be necessary to make an imperial grant, as was done in the case of the famine in Ireland in 1848. The considerable exports of cotton which have taken place to what is still known by a diplomatic fiction as the United States, have created without doubt a new element in the question; but still, as stocks decline prices will rise, and as quotations advance consumption will probably be still further reduced both here and across the Atlantic. We are inclined to think, under all the circumstances, that the consumption, exports included, will not exceed 30,000 bales per week at the outside, which would carry us on to September 1, instead of July 1, as presumed by the *Economist*, while, of course, in the extra two months farther miscellaneous supplies would come to hand. The worst feature in connection with this very absorbing and important question is the low quality of the Indian supplies

which have so largely accumulated at Liverpool. As to the *Economist's* suggestion for an imperial grant to meet the fearful distress which our contemporary—as, we devoutly hope, erroneously—anticipates, it seems to us, that one point has been overlooked, viz., the attitude of our powerful neighbour across the Channel. The French cotton trade is more extensive and important than many persons appear to imagine, and, of course, if the English operatives are reduced to misery and starvation the French will fare no better. The English workpeople might be aided by an imperial grant, but in the present state of French finance would such an idea be entertained at the Tuileries? We think not. Already the blockade, which has brought poverty to so many thousands of English and French families, is viewed with unmistakeable impatience by France; and, if the grievance continues much longer, we predict that French statesmen will be disposed to cut the Gordian knot with the sword.

The *Liverpool Albion*, whose opinion we may pray in aid of our own, observes:—"We are not altogether without hope, even in this emergency, for while the diminution of supply will be most sensibly felt in the manufacturing districts for awhile, the encouragement to the production of cotton all over the world, and especially in India, cannot fail to be productive eventually of good results, although India has great exertions to make to secure a real position for her staple, which at present is but ephemeral. In the meantime, as all the principal markets of the world are amply stocked with our cotton manufactures, those through whose means these fabrics have been sent abroad will have the opportunity of disposing of them to considerable advantage, instead of their continuing to be a drug, as they would have been, with serious losses, in all probability, to all concerned, had no interruption to the ordinary supply of the raw material taken place. India gives promise of a high state of prosperity this year, for her monsoon, the marrow and fatness of the land, was exceedingly favourable, and China has yet to be developed. The River Plate, under which an enormous territory is comprised, is destined eventually to play an important part in the world's history, but, racked as she has always been heretofore by civil wars, has suffered the penalty of their existence, from which she seems at length to be emerging, and, with a stable Government, offers the very best inducements to emigrants, for labour is dear and provisions cheap; with the United States closed to our emigrants it requires but the organisation of a system to pour a large emigration into the River Plate. Some of the valuable articles of raw material grow wild in that country, the use of which we are alone deprived from high value of labour rendering it impossible to gather them. As to climate, there is none better, and the Government is becoming firm, honest, patriotic, and enlightened, while the more European emigration is encouraged to that quarter the more decided will be the stability of good government. The resources of trade are vast, they extend to all parts of the earth, and, if closed in one quarter, they must, of necessity, bulge out in others, so that we need neither sit with our hands folded because the United States markets are closed to us, nor despair of successful results if energy and enterprise do not fail us, of which there is little apprehension.

Messrs. James Eastwood and Sons, a Derbyshire firm, have completed the erection of large rolling mills rendered necessary by the progress and extension of their business, and have just celebrated the event by what was practically a public dinner in the County Hall, Derby, to which 300 of their workmen sat down, besides Mr. T. B. Horsfall, M.P. for Liverpool; Mr. W. Cox, High Sheriff of the county; Mr. J. Hedley, Inspector of Mines for the Midland District; Lieutenant-Colonel Clay, of the Mersey Steel and Ironworks, Liverpool, and several other gentlemen connected with Liverpool, where the head of the firm formerly resided. In the course of the after dinner proceedings Mr. Hedley, Inspector of Mines, favoured the company with a very interesting speech, to which we cannot do otherwise than refer at some length. Mr. Hedley observed:—I shall not expatiate on the influences of our mineral resources on this great nation of ours; but I say this confidently, that the development of these resources by many of Britain's worthy and energetic sons has had a large share in placing this glorious nation of ours foremost in the rank of the nations of the earth. The following statistics will show the importance of our mining industry. We raise above 80,000,000 tons of coal annually; make upwards of 4,000,000 tons of iron; and consume upwards of 20,000,000 tons of coal in our iron manufactories. Coming home, in Derbyshire, Nottinghamshire, Leicestershire, and Warwickshire, 7,000,000 tons of coals are annually produced; Derbyshire producing 4,500,000 tons of this quantity. Ironmaking in the midland counties is confined to Derbyshire, where 130,000 tons are annually made, and consuming 700,000 tons of coals. Fifty years ago the make of iron was 12,300 tons only. The iron of Derbyshire is used for railway and other purposes where body and tenacity are required; and this iron will bear comparison in quality with iron made of the materials of any other coal-field. Derbyshire iron has been subjected to many severe tests, two or three of which I will mention. Some time ago many makes of pig iron were tested at Woolwich Dockyard, when the iron of Messrs. Whitehouse and Sons, of the West Hallam Works, Derbyshire, bore the greatest breaking strain. It is right to say that these were experiments on iron taken from the bulk. Last month an armour plate, 4½in. thick, manufactured by J. Brown and Co., of the Atlas Steel and Spring Works, Sheffield, of a mixture of cold and hot blast iron, made by Messrs. Fowler and Co., Sheepbridge Works, Chesterfield, was tested at Portsmouth, and stood a test unsurpassed by any armour plate yet submitted to a test. The Butterely Company have long had a character for superior make of bars, plates, sheets, &c., and they are now rolling the largest masses of iron into girders, &c., of any firm, for girders for our large war steamers. Mr. Barrow, of Stavely, makes several hundred tons of castings weekly; from the largest pipes, girders, and columns, down to the smallest. To show the energy of this gentleman, and the extensive mechanical appliances at his command, he has recently completed an order of 4,000 tons of girders and columns, &c., for the Great Exhibition building. The patterns were made, the column ends turned in the lathe, and the castings completed in three months, without interfering with the ordinary work. He has now in hand an order for two miles of railings, for the galleries of the same building. Messrs. Oakes, of Alfreton Iron Works, have for a long time maintained a character for superior material and good workmanship, in their extensive casting business, which embraces castings of every description. All these gentlemen work Derbyshire iron, and there is plenty of material in the ground to make this good class of iron—sufficient to supply the present rate of consumption for at least 500 years. Gentlemen, we meet to-day to celebrate the extension of operations which will naturally aid in the development of the minerals of this country; and the extension of such operations in so important a coal-field cannot fail of being interesting to all parties connected with the county. I will give you a few statistics to show the importance of such operations. To make one ton of bar iron from raw material requires five tons of coals, rather over three tons of ironstone, and about 12 cwt. of limestone. This gives daily employment to fifteen men and boys in mining operations. There is also the mining engineer, with his staff of officers, to direct such operations. The mining engineer must be up in geology, mineralogy, natural philosophy, and mechanical engineering. There is the furnace manager with his staff. The furnace manager must be a practical chemist and a skilled mechanic. Then the rolling mills require the constant attention of a mechanical engineer as well as other practical skill. You see, gentlemen, the importance of our mining industry in the manufacture of one ton of finished iron. The mining operations of Derbyshire afford employment to above 5,000 hands in producing materials for iron-making—but about 18,000 hands are employed in producing all the coals and ironstone of the county—and an aggregate steam power of about 45,000 horses is daily employed in raising these materials and pumping water from the mines. Let us take a glance at our progress in the iron trade and mechanical engineering. Our make of iron is annually 4,000,000 tons; fifty years ago it was one-fourth this quantity. Compare the capacity of our rolling mills twenty years ago with those of the present day, which turn out highly finished armour plates exceeding 4in. in thickness, and upwards of four tons weight, as well as other heavy masses of rolled iron, with as great facility as an ordinary bar of iron. Compare the old atmospheric steam engine of Boulton and Watt with the finished engines of the present day. Compare the first steam-vessel that steamed on the Clyde with our noble fleets of mercantile and war steamers which cross the wide and boisterous seas almost with the punctuality and dispatch that we can travel on land. Look at that noble piece of mechanical and naval architecture, the Great Eastern, which, if not a commercial success, is a great mechanical one. Compare the first locomotive by that venerable father of mechanical engineering, George Stephenson, with the beautiful, powerful, and compact piece of mechanism, the locomotive of the present day. Look at the noble structures raised by the mechanical geniuses of the day—such as the Britannia Tubular Bridge, the St. Lawrence Tubular Bridge, the High Level Bridge, Newcastle-on-Tyne, and our great floating landing stages, and many other works which I cannot refer to in a short speech. These say more than I can tell you of the progress of mechanical engineering. Our mines, iron manufacture, commerce, and manufactories, are all pre-eminently indebted to our mechanical engineers. In short, there is not a difficulty which requires mechanical aid but our mechanical engineers can surmount. Gentlemen, it is pleasing to witness the success of a worthy son of toil connected with this important branch of our national industry, and I say worthy, because our host is known to be a worthy man. Before he located at Derby he was long a servant of that eminent firm, the Mersey Steel and Iron Company. We have here to-day the principal member of that firm to do honour—to an old and faithful servant, and to rejoice in his success. Lieutenant-Colonel Clay, another member of that eminent firm, is also present, with the same gratifying object. The Railway Ironworks, Derby, have been established many years by Messrs. Eastwood and Sons, and they have maintained a high reputation for quality of material and excellent workmanship. They have supplied articles to railway works, steam vessels, and other purposes requiring strength and durability; and, as an evidence that their work has given satisfaction, they have been compelled to extend their operations. We all rejoice in this success, and if good wishes will aid them I am sure they have plenty. They, however, know well that success depends upon energy, enterprise, industry, perseverance, and skill, accompanied with the use of good materials. Now the right sort of materials have been brought together at their works, which have ensured success, viz., good Derbyshire iron and a good workman to use it. There is plenty of room in the county to extend her iron industry, and success will accompany every such extension as we this day celebrate." Lieutenant-Colonel Clay, Mr. Horsfall, M.P., and other gentlemen addressed the meeting, to which, however, we cannot afford further space. The proceedings passed off in the most gratifying manner, and must have been a source of honest pride to the worthy host, heartily enjoyed, as they were, by all who participated in them.

We turn to the north. It appears that nothing definite has yet been settled with respect to the future management of the Derwent and Consett Ironworks. The time for which present lessees hold the works will soon transpire, and some fears are still entertained that the establishment will be "laid in" for a time. The high character, however, of the iron produced at their works, and their great resources, renders it extremely improbable that business would be suspended for any lengthened period under any circumstances, although, of course, great temporary suffering would ensue.—The northern coal trade has been rather flat. Mr. J. T. Bell, engineer, of Newcastle, has published a plan of the western coal district of Durham and Northumberland. The plan has been compiled from actual surveys made chiefly by Mr. Bell himself, and is on a scale of thirty-two chains to an inch, or 2½in. to a mile. It embraces that important coal mining and coke-producing district, extending from Newcastle-upon-Tyne, Urpeth, Witton Gilbert, and Bearpark, on the east, to Bywell, Shotley Bridge, and Wolsingham North Common, on the west, and from Walbottle, Wylam, and Mickley Collieries, on the north, to the Dearness Valley, Esh, Cornsay, &c., on the south, and delineates the boundaries of estates and royalties in the parishes of Newburn, Heddon, Ovingham, Whickham, Ryton, Bywell, Shotley, Ebchester, Medomsley, Tanfield, Lamesley, Lanchester, &c. &c.; also the collieries, ironworks, public and private railways, roads, rivers, and streams, towns and villages, with the names of the owners of the different royalties, the western out-crop of the coal-field, &c. This plan is the sixth of the series of plans of the great northern coal-field prepared by Mr. Bell.—Mr. J. F. Bateman, the eminent waterworks' engineer, has addressed a report, in accordance with instructions, on the state of the Whittle Dene water supply to the company bearing that name. The water during the past summer was the subject of frequent complaint, and proceeding on the assumption that the pressure on the resources of the existing works is already so great as almost to involve the risk of danger, Mr. Bateman proposes to keep pace with the growing demands of the population by having recourse to the Tyne. With the objection which at once presents itself to the use of the water of the river for domestic purposes he endeavours to grapple, and concurs in a suggestion made by the secretary of the company, that water taken from that source should be applied solely to the requirements of trade, careful filtration, under any circumstances, being considered indispensable. With this view Mr. Bateman recommends the establishment of filters at various places, and, to complete the operations necessary to supply the wants of the town, an immediate expenditure of £37,000 will have to be incurred.—The establishment of the "Red Star" line of steamers has been commemorated by the spirited proprietors, Messrs. Rogerson and Co., with a dinner to the various *employés*, who appear to number about seventy. The line of steamers has now been in operation three years, and has proved an undoubted local benefit. At first the service was conducted simply between Newcastle and Shields, but now suitable landing stages have been provided at various points. The enterprise has been carried on in the face of both fluvial and railway competition, and the results have not yet proved particulary remunerative to Messrs. Rogerson and Co., who are still, however, determined to persevere, and the spring will see an increased fleet of steamers plying on the Tyne under the "Red Star."

LIFEBOAT EXPENSES.—During the past two years (1860-61), the National Lifeboat Institution has incurred expenses amounting to £22,650 on various lifeboat establishments on the coasts of England, Scotland, and Ireland. In the same period the lifeboats of the institution have been instrumental in rescuing 500 persons from different shipwrecks on the coasts of the United Kingdom. For these and other lifeboat services, the institution has voted £1,893 as rewards to the crews of the lifeboats. It has also granted rewards amounting to £515 10s. for saving 373 shipwrecked persons by shore-boats and other means, making a total of 871 persons saved from a watery grave during the last two years. The number of lives saved by the life-boats of the society, and other means, since its formation, is 12,293, for which services 82 gold medals, 704 silver medals, and £15,250 in cash, have been paid in rewards. The institution has also expended £57,200 on lifeboats, lifeboat transporting carriages, and boat-houses. The public cannot but sympathise with the vigorous efforts now being made by this institution to save the lives of shipwrecked crews. Their help was never more needed than at the present time, when, through the extraordinary exertions the society has made within the past few years, it has now 121 life-boats under its management, for the maintenance of which, in a state of thorough efficiency, a large permanent annual income is absolutely needed, if its humane mission is to be perpetuated. We may add that contributions are received for this important and truly National Lifeboat Institution, by all the bankers in the United Kingdom; and by the secretary, Richard Lewis, Esq., at the institution, 14, John-street, Adelphi, London.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£ s. d.	Dis. p. ct.
IRON, English Bar and Bolt:—			
in London	pr tn	5 15 0	2
in Wales	„	5 0 0	„
in Liverpool	„	5 10 0	„
Deliv. into boats at works — Staffordshire Bars (Nom. rates last qr. day for favourite brands)	„	7 0 0	1½
Sheet, Singl.	„	8 10 0	„
Dbl.	„	10 0 0	„
Hoop	„	8 0 0	„
Rod, round	„	7 0 0	„
Nail Rod, sq	„	7 5 0	„
SHIPPING IRON, Staffordsh. Bars (Delivered in Liverpool 10s. per ton less)	„	7 0 0	2
Sheet, Single	„	8 15 0	„
Double	„	10 5 0	„
Hoop	„	8 5 0	„
Rod, Round	„	7 0 0	„
Nail Rod, Square	„	7 5 0	„
IRON, Rails, in Wales, cash	„	5 10 0	nett
„ „ 6 months	„	5 10 0	„
Old, to cut up	„	0 0 0	„
Railway Chairs, in Wales	„	4 0 0	„
„ in Clyde	„	3 15 0	„
Pig No. 1, in Clyde	„	2 9 9	„
3-5ths No. 1 & 2-5ths No. 3	„	2 9 9	„
No. 1, in Wales	„	3 8 9	„
No. 1, in Tyne and Tees	„	2 12 6	„
Ditto, Forge	„	9 0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	„	3 10 0	„
Welsh Forge Pig (all Mine), at the Port	„	3 5 0	„
Acadian Pig, Charcoal	„	7 10 0	„
Scotch Pig, No. 1, in London	„	3 0 0	„

		£ s. d.	Dis. p. ct.
IRON, Swedish, Indian assortments	pr tn	11 15 0	2½
Russian C C N D to arrive	„	16 0 0	„
STEEL, Swedish Keg, ham.	„	16 0 0	2
Ditto, rolled	„	15 0 0	„
Fagot	„	17 0 0	„
SPELTER, on the spot	„	17 5 0	net
To arrive	„	17 10 0	„
Hard, remelted	„	16 0 0	„
ZINC, in sheets	„	24 0 0	2
COPPER, Tile, 14 to 28 lb.	„	107 10 0	2
Tough Cake	„	107 10 0	2
Sheathing and Bolts	pr lb.	0 1 0	„
Sheet	„	0 1 0	„
Bottoms	„	0 1 0½	„
Old	„	0 0 10	„
Yellow Metal	„	0 0 10	„
South American, nom.	pr tn	100 0 0	„
Russian do.	„	105 0 0	„
LEAD, British Pig	„	20 10 0	„
Spanish	„	19 10 0	„
W. B.	„	21 0 0	„
Sheet	„	21 10 0	„
TIN, English Block, nom.	„	120 0 0	„
Bar „	„	121 0 0	„
Refined „	„	122 0 0	„
Foreign Banca	„	124 0 0	„
Straits	„	120 0 0	„
TIN PLATES, Charcoal, IC	pr bx	1 9 0	„
Ditto IX	„	1 15 0	„
Coke, IC	„	1 2 0	„
Ditto IX	„	1 8 0	„
Do. at Newport, 1s. pr bx less		—	„
Do. at L'pool, 6d.		—	
CANADA, Plates	pr tn	12 0 0	2
QUICKSILVER	pr bt	7 0 0	3

RAILS continued firm.

SCOTCH PIG IRON.—In consequence of the last news from America the price has advanced from 49s. to 49s. 9d. per ton, Mixed Nos. Warrants, f.o.b. in Glasgow, at which the market closes to-day. No. 1, Gartsherrie, quoted 58s.

SPELTER has advanced from £17 5s. to £18, which is now the nearest price on the spot.

COPPER firm.

LEAD is 10s. per ton dearer. W.B. remains at £21.

TIN.—English has been rather dull. Since the arrival of the American news yesterday, Banca rose to £124, and Straits to £120, nominally.

TINPLATES are also firmer.

Jan. 9th, 1862. MOATE AND CO., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Teak	15 10	17 0	15 0	16 0
Quebec, red pine	3 10	4 10	3 5	4 0
yellow pine	3 0	4 0	3 0	3 15
St. John, N.B., yel.	5 0	5 10	5 0	5 10
Quebec, oak, white	5 0	5 10	5 0	5 10
birch	3 10	4 0	4 0	0 0
Memel	0 0	0 0	0 0	0 0
elm	3 10	4 15	3 10	4 15
Dantsic, oak	3 10	6 0	3 10	6 0
fir	3 15	3 10	3 0	4 0
Memel, fir	3 10	4 0	3 10	4 0
Riga	3 5	3 10	3 10	3 15
Swedish	2 10	2 15	2 15	3 0
Masts, Queb. rd pine	5 0	6 0	5 0	6 0
yl. pine	5 0	6 0	5 0	6 0
rd pine	0 0	0 0	0 0	0 0
Lathwood, Dants, fm	6 0	6 10	6 0	7 0
St. Peters.	8 0	8 10	9 0	9 10
Deals, per C., 12 ft. by 3 by 9 in.				
Quebec, wht. spruce	13 0	18 0	15 0	19 0
St. John, wht. spruce	13 0	16 0	15 0	17 10

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Yel. pine, per reduced C.				
Canada, 1st quality	17 0	18 10	17 10	19 0
2nd do	12 0	12 10	12 0	13
Archangel, yellow	13 0	14 0	14 0	15
St. Petersbg. yel.	12 0	12 10	12 10	13 10
Finland	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	15 0
Gothenburg, yel.	10 0	11 10	10 0	12 10
white	9 10	10 0	9 10	11
Gefle, yellow	10 0	11 0	11 0	12 10
Soderhamn	10 0	10 10	11 0	12 10
Christiania, per C 12 ft. by 3 by 9 in. yellow	22 0	25 0	22 0	24 0
Deck plank, Dants per 40 ft. 3 in.	0 14	1 4	0 14	1 4
Staves, per standard M				
Quebec, pipe	60 0	70 0	50 0	55 0
puncheon	16 0	18 0	16 0	18 0
Baltic, crown pipe	160 0	170 0	170 0	180 0

BENSON'S WATCHES AND CLOCKS.—"Perfection of mechanism."—*Morning Post.* Gold watches 5 to 100 guineas; silver watches, 2 to 50 guineas. Benson's new Illustrated pamphlet, free for two stamps, descriptive of every construction of watch, enables persons in any part of the world to select, with the greatest certainty, the watch best adapted to their use. Watches sent free by post on the receipt of a remittance. J. W. Benson, 33 and 34, Ludgate-hill, and 46 and 47, Cornhill, London, E.C. Established 1749.—ADV.

EAST GLOUCESTERSHIRE RAILWAY.—The estimated cost of constructing this railway from Cheltenham to Faringdon and Bourton-on-the-Water is £600,000, the Great Western and West Midland Railways subscribing thereto.

DISCOVERY OF A NINE-FEET HOUSE AND STEAM COAL IN SOUTH WALES.—This vein was worked extensively about 35 years ago by Mr. Nash Vaughan Edwards, of Rheola, and on whose land the discovery has been made. About 26 years ago it was lost through a fault which ran through the property in an east and west direction; and afterwards thousands of pounds were spent from time to time in looking for it by different companies, all of whom proved unsuccessful; and most of the professional men of the country came to the conclusion that it was a piece of another vein above it, of 4ft. 6in. thick, which had been thrown down by a fault, and in the throw had increased in thickness to 9ft., and that there was no more of it in existence. About eight months ago, however, a gentleman named Mr. John Fraser, from North Wales, came to the neighbourhood in search for coal, and after a most diligent application, and also making inquiries from old colliers of the place, he determined to make another trial more to the south than any that had been made before, and went down with a pit 42 yards in depth, and to the great astonishment of the country in general succeeded to gain the Big Bettws 9ft. coal. On the south side of the fault, where it was lost in former days, a trial was made between the Bettws 9ft. coal and the best first class Newcastle steam coal, and the result was a saving in favour of Bettws of 16 per cent. against the best Newcastle coal. It is of a hard nature, fully 9ft. thick, proved under nearly 500 acres of land, and stands in a very convenient place for both railway and shipping. Great joy is naturally felt through the country, as it will increase the richness of this wealthy part of the world.—*Mining Journal.*

RAILWAY INCLINE PLANES IN AMERICA.—At the south-western end of the summit level of the Mine Hill and Schuylkill Haven Railroad the first inclined plane commences. There are two planes, occupying together, and with the short intervening distance, nearly two miles in length of the road. They descend the gorge occupied by Rattling Run, and bring the road into the Mahonoy Valley. The first plane is 4,493ft. long, and descends 318ft. The next plane is 4,709ft. long, and descends 405ft. In profile both planes are formed of two tangents united by a curve, the steepest rise being at the rate of 1 in 8. These are, we believe, the longest planes of the kind in the world, and but for a necessary change in the direction of the line between them they would have been made in a single plane nearly 1¾ miles in length. It must be borne in mind that the load is carried up and not down these planes, inasmuch as they form the outlet of the coal trade of the Ashland region. They are substantially built, and, so far as the coal trade is concerned, are unquestionably far more economical in working than from 7 to 15 miles of locomotive railroad, overcoming the same elevation, could possibly be. From 5 to 8 loaded coal cars, containing from 25 to 40 tons of coal, are taken up, at a single draught, at from 8 to 12 miles an hour, although a speed of 25 miles is neither impracticable nor unsafe. The planes are calculated for a maximum draught of 15 loaded cars, weighing, say, 110 tons, and are capable of passing 750 cars each way in 12 hours. A wire rope is used on each plane, and safety cars run on an inner track, of narrow gauge, to prevent accidents. The ropes run on friction drums, turned by a pair of steam engines at each plane. The engines have 25-in. cylinders and 6ft. stroke. They are worked at a boiler pressure of 80 lb., and ordinarily work at 20 revolutions a minute, the furnaces of each pair of engines consuming 8 tons of coal in 11 hours. A telegraph is used in working these planes, the engines being started and stopped at an audible signal.—*Philadelphia Engineer.*

INSTITUTION OF CIVIL ENGINEERS.

ADDRESS OF JOHN HAWKSHAW ESQ., F.R.S., PRESIDENT,

ON TAKING THE CHAIR, FOR THE FIRST TIME, AFTER HIS ELECTION,

January 14, 1862.

GENTLEMEN,—I beg to thank you for the honour you have done me in electing me to the office of President of this Institution.

In undertaking the important duties it involves, I can safely promise not to fail in their discharge from any want of interest in your proceedings, nor from any lack of zeal for the advancement of the objects of the Institution.

The profession of which we are members has, from my earliest days, been an object of attachment to me, and, were I actuated by no other motives, the love I bear to it would prevent me becoming lukewarm to its interests. For my deficiencies I trust to your forbearance, and rely on the help of the many friends I see around me.

It is important to notice at the outset that the wide range of subjects which the profession of a civil engineer embraces, renders it imperative on every member of it to avail himself of all the help he can obtain. He requires the assistance of many departments of science and art, and must call into employment important branches of manufacture. He can perform no great work without the aid of a great variety of workmen, and it is on their strength and skill, as well as on their scientific direction, that the perfection of his work will depend. The personal experience of one individual cannot fit him for the exigencies of a profession which is ever extending its range of subjects, and is constantly dealing with new and complex phenomena; phenomena which are all the more difficult to deal with from the fact that they are generally surrounded by such variable circumstances as render them incapable of being submitted to precise measurement and calculation, or of being made amenable to the deductions of exact science. Consequently nothing is more certain than that he who wishes to reach the perfection of his art must avail himself of the experience of others, as well as of his own, and that he will not unfrequently find the sum of the whole little enough to guide him.

And let no inventive genius suppose that his own tendencies or capabilities relieve him from this necessity.

There is, I believe, no such thing as discovery and invention, in the sense which is sometimes attached to the words. Men do not suddenly discover new worlds, or invent new machines, or find new metals. Some indeed may be, and are, better fitted than others for such purposes, but the process of discovery is, and always has been, much the same. There is nothing really worth having that man has obtained that has not been the result of a combined and gradual process of investigation. A gifted individual comes across some old footmark, stumbles on a chain of previous research and inquiry. He meets, for instance, with a machine, the result of much previous labour; he modifies it, pulls it to pieces, constructs and reconstructs it, and by further trial and experiment he arrives at the long-sought-for result.

While, however, it is necessary, if our progress is to be safe, that we should proceed with due caution, it is exhilarating to notice that in the matters to which our profession relates progress is more apparent than it is in most other pursuits.

The great range of objects which it embraces, and which seems ever extending, partly, no doubt, accounts for this.

We are called upon to construct the great highways of nations, and to build the steamboats that bridge the seas. We make the machines by which man seeks to lighten labour and to accumulate force, or to give to that force new directions. We build docks, harbours, and lighthouses to receive, shelter, and warn the mariner; and, as if in contrast to works so useful and so humane, some of us are occupied in the warlike objects of defence and destruction. And at this day young members can look back far enough to distinguish the rapid progress that has been made in those matters to which the civil engineer has to devote his attention.

Thus it is hardly thirty years since travelling began to be transferred from common roads to railways. In the comparatively short period that has since elapsed, in a less space of time than one generation of man, about 70,000 miles of railway have been made in different countries, at an outlay of about £1,100,000,000 sterling, and involving an amount of engineering works exceeding in magnitude and importance all the previous engineering works of the world put together.

In effecting this great change English engineers have taken a prominent part, about one-half of the vast outlay above referred to having been expended under their direction, and they may, I think, feel a pardonable pride in the great works which they have helped to construct, and which are destined to produce an amount of beneficial change and advancement in the habits and culture of mankind, which the most sanguine man of the present day will probably fail fully to estimate.

Simultaneously with this change and tending to the same ends there has been the improvement of steam navigation. I crossed the Atlantic in 1835, in what was then considered one of the swiftest packets, but in those days the Atlantic packets depended wholly on sails, and the voyage occupied twenty days. Many years have not elapsed since it was denied that steamers could cross the Atlantic at all. They do so now in nine days. The progress that has been made in steam navigation in the last few years is truly remarkable. The steamboats plying between Holyhead and Dublin, which were then, as now, among the fastest afloat, had, ten years ago, attained a speed of seventeen miles an hour. Last year those boats were superseded by others—the Leinster, Munster, Connaught, and Ulster, which attained, on their trial trip, a speed of twenty miles and a half an hour.

Great progress has also been made in the application of the screw propeller to steamships, which, for vessels of war, and other purposes, possesses advantages over the paddle, though it has not hitherto accomplished an equal speed.

In 1848 the fastest screw line-of-battle ship in the navy could not steam more than about seven and a half knots, or eight miles and two-thirds per hour, whereas the Warrior, though clothed with an outer coat of iron armour 4½in. thick, at her trial in October last, over the measured mile in Stokes Bay, attained an average speed of 14·356 knots, or 16·533 miles per hour, beating the Howe, which previously had attained the highest trial speed of any of her Majesty's line-of-battle ships, the power, displacement, and speed of the two ships being as follows:—

Name.	Displacement.	Indicated Horse Power.	Speed per hour.	
			Knots.	Miles.
Warrior ..	8,852	5,469	14·356	16·533
Howe ..	4,779	4,523	13·505	15·623

Since 1848 the speed of this class of ships has been nearly doubled. The build and construction of steamboats has also, during the same period, received much attention and been greatly improved.

The doubts which prevailed until very lately, whether iron was the best material for line-of-battle ships, seem now nearly dispelled, although the rapidity with which iron fouls will, unless some remedy can be devised, always be a source of trouble.

The precise and best mode of constructing iron ships of war is still an interesting problem; and many improvements may still be expected in an art which is yet in its infancy.

Hitherto a large amount of wood has been combined with the iron. The Warrior has a thick lining of timber between the inner skin and the outer armour-plates. A material so soft as wood can hardly increase the capability to resist shot; and there seems great difficulty in combining, to any good purpose, two materials differing so much in strength and density. Besides which, wood rots, and is, in ships especially, a perishable material. The probability is that iron will supersede the use of wood in a still greater degree, and that, by the adoption of improved modes of construction, the whole of the iron used in the structure of ships of war will be made to add to the strength of the ship, as well as be useful for its defence. This is not the case in the present mode of construction. The armour-plates of the Warrior add very little to the strength of that ship. There seems to be no good reason why the upper and lower decks, and every portion of the hull of such vessels, should not be of iron. Greater strength would be thereby attained to resist diagonal and cross strains, and much greater longitudinal stiffness would be secured. Ships of war should be constructed practically, as far as it is possible, as if welded out of one piece of iron; and, if they are ever to be used as rams, this mode must be adopted, for it is evident that the present methods of construction would be quite unsuited for such a purpose.

That war-steamers and other steamships can be made stronger, and may be made to steam faster than they yet have been, there is no doubt. No one can have taken the trouble to examine the present methods of building without seeing that it is easy to increase their strength without impairing their efficiency in other respects.

With regard to the speed we ought to obtain, it is with steamers as with locomotive engines, a question just now of what velocity we can afford to pay for, rather than of what rapidity we can physically attain. There is no doubt that the speed of either could be accelerated beyond any point yet reached, and probably beyond any point that the nation at present could afford.

The speed of steamboats and of railroads will have to be determined from time to time, and will vary with circumstances, with place and time, with the accumulation and distribution of wealth.

For cost after all greatly, if not rigidly, regulates progress, whether it relate to civil, to military, or to naval affairs. A hundred years ago no nation could have afforded railways of fifty miles an hour, nor steamboats of twenty miles an hour. The reasons for this are obvious, though often overlooked. Passengers, for instance, can afford a higher rate of speed than goods and minerals; and some descriptions of merchandise require to travel faster than stone, coals, &c. Again, some passengers can better afford to pay for speed than others. Even now it is on certain lines only that there are a sufficient number of those passengers who can afford to pay for them, to justify the appointment of express trains for their especial use. We have not yet, as it respects steamers (except for short distances), secured an equal amount of passenger traffic; and until this be the case they must be built and worked for passengers and cargo. Moreover, wherever time is an element of importance, the exigencies of trade and the convenience of the public require frequent opportunities of travelling and of transport from place to place. This circumstance determines the number of passengers and weight of goods to be conveyed each journey from each place, and, combined with other circumstances, establishes a law which for the time being regulates the load on every railway, in every steamboat, and along each line of communication. Thus, large and powerful as locomotive engines have become, they convey on the London and North-Western and Great Northern Railways an average load of less than 70 tons of merchandise, and, though the Lancashire and Yorkshire Railway has a larger mileage merchandise traffic than either, the average load, owing to the close proximity of towns, and the greater necessity for frequent trains, is only about 45 tons. The same principle applies to steamboat traffic. Again, however superior for naval warfare a steam line-of-battle ship may be to one with sails, yet England, rich as she is, could not at the present day undertake to support a navy which should wholly dispense with the use of sails, which should move to, and from, and among her distant dependencies by the power of steam alone, and which, consequently, would always be dependent upon, and therefore would always require to be supplied with a sufficiency of fuel.

With respect to the speed of railways, there is at present an anomaly which, before long, will require more attention than at present has been bestowed upon it. Thus, to make way for passenger-trains, goods and mineral trains, which might move more slowly, are, in many cases, hurried on, manifestly to the prevention of due economy.

Besides, though I deem it possible that railways ultimately will be made for greater speeds than those at present adopted, I am of opinion that on some lines the companies have attained a rate of travelling which is in advance of their appointments in other respects, —such as with the condition of their road, and with the state of their finances. Railway companies already feel that great speed demands larger expenditure upon their permanent way—their rolling stock—for telegraphic signalling—and for other matters, without which the continuance of such speed becomes positively unsafe; and if the whole of the expenditure which great speed thus entails upon companies were fairly met, it is questionable whether the present speed of railways is not now, in many cases, fully greater than can be afforded.

Goods and minerals, on busy lines, are, there can be no doubt, carried at a speed which is neither demanded by the public nor is economical to the company; but which is often rendered unavoidable from the necessity of keeping out of the way of swift passenger trains, and by the difficulty of interpolating goods and mineral trains among the frequent trains of a large passenger traffic.

But is there no remedy for this? The travelling public demand from railway companies the highest rate of speed they can exact; and that, as I have observed, is sometimes greater than the state of the road and other matters warrant. Would any good result from the introduction of Government interference to regulate speed? I think not. Such a measure might strike at the root of improvement, and the evil is one which will work its own cure, and for which a remedy may be provided in different ways.

It has been urged that the time of travelling between two points may be shortened as well by diminishing stoppages as by an increase of speed. But this mode of dealing with it again becomes a question of cost; for, if local traffic is not to be neglected, diminishing the number of stoppages involves more trains, more expense, therefore; and the difficulty of applying this remedy will increase with the growth of traffic.

It may have to be met, in certain cases, by constructing lines to carry goods and minerals only at a slow speed; and ultimately, perhaps, in other cases, at some future day, by making railways to carry passengers mainly, if not solely.

In grouping engineering works we may class the electric telegraph with railways and steamboats. All three are agents of intercommunication, and tend to the same important ends. And while the vast importance of each cannot be overrated, the electric telegraph is, perhaps, in the peculiarity of its operation, the most wonderful of all.

It was about the same time that the Liverpool and Manchester Railway was started that the minds of a few individuals were first devoted to the subject of using electricity as a medium of communication for messages.

Messrs. Cooke and Wheatstone's patents were taken out in 1837, but the first public telegraph was not established till 1839, when a communication was made by wire on the Great Western Railway between London and Slough.

Since that period, in this country alone, telegraphic communication has been extended over about 14,500 miles; in the rest of Europe over about 100,000 miles; and in the American States over about 48,000 miles; and the total extent of telegraph at this moment cannot be less than 200,000 miles.

On land this most useful discovery has been uniformly successful. Like railways it has grown (in England by public support alone) into a great institution.

Ocean telegraphy has been less fortunate in its results. Short lines across the narrow seas have been laid and maintained, but at a serious amount of cost.

To some extent, no doubt, the failure of deep sea telegraphs may be attributed to ill conceived arrangements, and to faulty designs and workmanship; but the very nature of such an undertaking as laying telegraph wires across the Atlantic precludes the possibility of acting on previously-acquired experience, and makes the requisite experimental trial one of serious cost.

The labours of the late commission appointed to inquire into this subject have made the necessary scientific conditions for forming a good ocean cable better, and, perhaps, sufficiently understood. But they leave the ultimate cost of maintaining a permanent and available communication across three thousand miles of ocean (as, in fact, the great attendant contingencies compelled them to leave it) a question for the future to decide.

A communication with America once well established would call for numerous wires. To meet contingencies, risk of accidents, and stoppages, a single cable would hardly be sufficient. With ample provision in these respects a communication between the two countries could be maintained, but at a cost not at present admitting of calculation. There are some things physically practicable, but which, in a commercial and monetary sense, are for a while unattainable, and the accomplishment of this great object may, therefore, be delayed. It is to be hoped, however, that it will not be finally abandoned.

Simultaneously with the rapid advance which has been made in the works to which I have referred there has also been great progress in another branch of engineering with which civil engineers have latterly become connected.

That new branch is gunnery. In a very few years, mainly in consequence of the labours of Sir William Armstrong and of Mr. Whitworth, the range of artillery has been doubled. The weight of the gun in proportion to that of the projectile has been reduced to one-half, and the capacity for powder of the elongated as compared with the round shell has been more than doubled. This great advance in the destructive power of cannon has rendered most of our old fortifications useless. New fortifications have, therefore, to be built, adapted to the longer range and greater destructive power of the new artillery. These fortifications require to be placed more in advance of the places to be defended, and to be constructed with very superior powers of resistance to those which hitherto have proved sufficient. The old walled towns, which were formidable enough in former days, would to-day, in case of a siege, afford little security to the inhabitants who dwell within them; the old defences, therefore, have to be removed and replaced, where necessary, with those more suitable to modern requirements.

We are clothing our ships of war in iron mail, and it seems probable that iron in some cases will be largely used in modern fortifications. Not that earthwork and stonework will cease to be useful. These are valuable for the staple of most forts, but neither of them make good embrasures, and for that purpose iron offers great advantages. By its use greater strength can be secured at those points where power of resistance is specially wanted. By its use also the size, and consequently the exposure, of the embrasures will be diminished, and much greater facility be given for working the guns and training them through larger angles.

There are some cases, however, in which forts may with advantage be principally, if not wholly, built of iron. I hope to see that material adopted for the superstructure of the large sea-forts at Spithead, the construction of the foundations for which has been intrusted to me. There can, I think, be no insuperable difficulty in constructing iron forts so as to be impregnable to a ship's battery, though in the absence of knowledge as to what may be the ultimate powers of guns, it is not easy at present to arrive at safe conclusions. The difficulty of doing the converse of this, viz., of building ships so as to be impregnable to the fire of such artillery as may and ought to be placed in the new forts will be a problem not so easily solved.

No plated ship yet built could keep afloat under the fire of guns throwing shots of 200 lb. to 300 lb. weight; and it seems difficult, in the case of ships which require buoyancy, sufficiently to increase the thickness of their armour-plates to keep pace with the probable advance in weight and size of the new cannon.

Naval commanders rely a good deal, and, perhaps, up to a certain point correctly so, on the mobility of their ships; but ships cannot be so efficient if, to prevent being struck, they be always kept moving about. If never hit they will, of course, receive no damage; but if ships are to resort to such manœuvres to avoid the enemy's fire, they do not seem adapted to bring great actions to a speedy conclusion. And how are such manœuvres to be managed with damaged rudders and disabled screws? Naval engagements will, in my opinion, be settled hereafter, much as they have been heretofore: the victory will be with the heaviest metal and greatest daring. And, after the various discussions that have been raised on this point, fixed and floating batteries will be found each to have their uses; and it is, I think, a limited view of the question that leads to an undue exaltation of one over the other. If land-batteries are, as some have urged, so innocuous to ships, why was Cronstadt not taken?

A very important question, viz., the use of iron for ships and forts, and war purposes generally, is now undergoing the investigation of a committee specially appointed for the purpose, and it is to be hoped that their labours will lead to some important conclusions.

As it respects the question of armour-plates, or of iron to be used for similar purposes, it would not seem that the hardest iron will prove the most suitable, unless it be combined with the greatest toughness. The force of impact is in a sense infinite. A ball cannot be arrested instanter in its flight. The thing struck, or the ball that strikes, must, one or both, possess some elasticity or ductility, or, if not, one or both must go to pieces. Of course the object to attain, as it regards both ships and forts, will be to devise a structure that will best arrest the shot; but we have not yet arrived at the best mode of doing this.

The use of iron is extending on every side. Its manufacture is, also, I am glad to say, improving. There was great room for its improvement. Several processes for converting it largely into steel, or into a metal approaching steel in character, are also now in use, and promise to afford an article at a moderate price double the strength of ordinary iron. These discoveries will tend still further to extend the use of iron.

Should it turn out that steel, or homogeneous iron as it is sometimes termed, uniform in quality, and of double the strength of ordinary iron, can be manufactured in large quantities at a moderate price, and can be easily manipulated, then, many things that are now with difficulty accomplished will be greatly facilitated, and some things which cannot be done at all will be rendered practicable.

Bridges of greater span could be constructed. Screw shafts, crank-axles, and other parts of steam engines, at present of unwieldy size, would, by its use, be reduced to more moderate dimensions. There seems to be no limit to the size of guns, except that of the strength of the material, and the power of welding, forging, and handling them. Cannon, as we know, have already been greatly increased in power by adopting a superior material in their construction. Could we hit upon an inexpensive mode of doubling the strength of iron, the advantages to all sorts of machinery might be equal to those that would flow from the discovery of a new metal more valuable than iron has hitherto been.

We are, I believe, in the infancy only of discoveries in the improvement of the manufacture of steel and iron. Until lately the nature of the demand for iron rather retarded than encouraged improvements in its manufacture. Railways consumed iron in vast quantities, and railway companies cared nothing about quality. They were driven to seek a tolerably good material for engine and carriage tyres, but as it respected the vast consumption in the shape of rails, they were implicity guided by the lowest prices. As long as this system continued it suited the ironmaster to manufacture a cheap article in large quantities, and they, therefore, gave themselves no concern to establish a better state of things. But heavy engines, high speeds, and an enlarged traffic are gradually working a change. We are beginning to find that iron of the very best quality has hardly endurance enough for rails or locomotive tyres; that there is no economy in putting down rails which require taking up again in a year or two, and, in short, that the increased strains arising from the accelerated motion of railways, steamboats, and machinery generally, are necessitating a better material.

In marine steam engines, which have received much attention, and where great attempts have been made at perfection, paddle-shafts, crank-axles, screws, and other portions have, as before inti-

mated, already attained an unwieldy size, and the *vis inertia* and weight of such masses of metal are of themselves no slight impediment to the improvement of steam navigation, and would be greatly obviated by the use of a stronger material.

Fortunately for this country, just at the time that the use of iron is extending, and improvements in its manufacture are developing, fresh discoveries are made of the raw material, and men seem to stumble, as it were by accident, on new fields of iron ore in places where those mineral riches have laid dormant for centuries, to await a new era and another age, when ships, like knights of old, are to go forth to battle in complete armour, and when the civil engineer has assumed the duties which devolved on the smith and armourer of former times.

Having noticed some of the advantages that may flow from a greatly improved quality of iron or a cheap manufacture of steel, or of a metal approaching steel in character, I may call attention to the great facilities that have arisen from the use of iron cylinders in sinking and securing foundations.

Before this invention masonry built under water had to be performed by divers with helmets, or by means of diving-bells. That mode of construction does not admit of the best work. The stones are laid without mortar, and depend for their security on their large size, and on a good arrangement of bond.

It is true that concrete work (which, however, is inferior to masonry) could be built under water without either divers or diving-bells; by passing the concrete through the water to its destination in boxes, or by means of shoots, and giving it the requisite form by casings of timber or iron.

This mode of building has long been adopted on the shores of the Mediterranean, and the docks and quay walls at Genoa have been built in this manner.

But the use of iron cylinders not only admits of masonry or brickwork being built in mortar under water in any form, and with any bond, but enables the engineer to excavate under water and to examine the ground before he begins to build, and proceed with his work with as much deliberation, method, and security, and almost with as little delay, when 70ft. or 80ft. below the water level, as he can do on dry land.

Hitherto this method has been mainly confined to the use of circular cylinders, sometimes used (as was done by Mr. Brunel in the case of the Saltash Bridge) as a means of building the requisite pier of subaqueous masonry, the iron being afterwards taken away, and sometimes to enable the requisite piers of concrete brickwork and masonry to be executed, and by allowing the iron cylinders to remain afterwards to protect the interior work.

In other cases the cylinders themselves are used to support the incumbent weight, and they then act simply as piles.

But it appears to me that this method of building may be extended with advantage much farther than it has been. It is adapted to almost any form of pier, and might, in certain cases, be usefully applied in building continuous walls, and I know of no system that is likely to afford greater help to the engineer.

I have already said a few words on the progress of invention. This method of building is an illustration of the slow progress of really useful things.

In 1841 a patent was taken out for "improvements in the means of and in the apparatus for building and working under water," and soon after the construction of the Rochester Bridge, where cylinders were sunk under air-pressure, an action was brought against Messrs. Fox and Henderson, the contractors for the bridge, for an infringement of that patent. I happened to be engaged on that trial, and the fact was then brought to light that, many years before, the late Earl Dundonald (then Lord Cochrane) had taken out a patent for a similar purpose very perfect in most of its details, for the drawings attached to Lord Cochrane's patent showed an air-lock almost identical with that now in use, and contained all the requisite arrangements for success. Lord Cochrane proposed to use it for overcoming difficulties similar to those encountered in the execution of such works as the Thames Tunnel; he proposed in fact to excavate such works under air-pressure.

This is another instance of the fertility of mind of that extraordinary man, who, great as he was as a sailor, would probably have been equally eminent as an engineer, and I here offer as a tribute to Lord Dundonald's memory this recognition of his early attempts to introduce the important system to which I have just been referring.

But we live in an age when men's minds turn to mechanical inquiries, and when, probably, they were never more fruitful in mechanical resources.

It is almost needless to give examples of this fact. The locomotive engine is a familiar instance, and railway machinery generally affords many illustrations. The beautiful cotton-combing machine, invented by Joshua Heilman, of Alsace, which was first used in the cotton manufactories to separate the fine from the coarse fibre, and has since been applied to wool, flax, and silk, and which acts almost with the delicacy of touch of the human fingers, is another illustration. Scheutz's calculating machine is another remarkable instance, and many other cases might be named.

There is one subject, however, connected with mechanics which has hitherto been barren of result, but about which men will occasionally occupy themselves, viz., the discovery of a new motive power.

The steam engine, however, remains the only tame giant that is usefully subject to the will of man.

The little that has been done in the way of its improvement, since it left the hands of Watt, speaks volumes to the sagacity, industry, and untiring perseverance of that great man.

The late Mr. Kennedy, of Ardwick House, who was on intimate terms of personal friendship with Watt, on one of his last visits to Soho, asked him if he had discovered anything new in the steam engine. "No," he replied, "I am devoting the remainder of my life to perfecting its details, and to ascertaining whether in any respect I am wrong." What the labours of that life produced we all know, and the patient concentration of will on his great object reminds one of Newton's similar labours in the perfection of his theory of gravitation, and evinces in the one case as in the other the truly great and philosophical mind, which is capable not only of discerning the dawnings of a great truth, and of appreciating its magnitude, but also of patiently pursuing its evidences until the whole is made clear as noon-day.

At present it seems improbable, so long as motive power is to be obtained through the intervention of heat, and until a cheaper fuel than coal can be found, that the steam engine will be superseded by any other machine.

Electric magnetic machines are perhaps the least likely of all inventions to supersede the steam engine. The consumption of a grain of zinc, as Mr. Joule has shown, though much more costly than a grain of coal, does not produce more than about one-eighth of the same mechanical effect.

It would not, however, be at all safe to predict that considerable improvements may not yet be made in the steam engine, or in engines to be worked by coal.

The consumption of fuel in the best steam engines has been reduced to 2½ lb. of coal per horse-power per hour; but such an engine does not utilise one-fifth part of the absolute mechanical value of the coal consumed, and, so long as this is the case, it would be unwise to assume that we have attained the utmost limits of improvement.

On another great branch of engineering, that of docks and harbours, I am not aware that much that is novel can be noticed.

The progress of such works is generally too slow to admit of much change in short periods of time.

An interesting discussion on the subject of harbours took place during a preceding session of this institution. A considerable portion of that debate turned on the question of how far such works should be made permanent in the first instance, and how far they should be constructed so as to bring them into use with the greatest rapidity, and at the smallest amount of cost, reckoning, of course, on rebuilding them at a future period.

This is one of those questions which it would be vain to discuss with any hope of coming to general conclusions.

In its naked form (apart from the question of harbours) it is one of the most simple and elementary questions. For it would not be difficult to show that if money alone be worthy of consideration, then, as it respects public buildings of all sorts, the cheapest system would be to discard solidity and ornament and to adopt structures of a more temporary character—the plan in fact which is always adopted in new countries.

But wealthy nations, like rich individuals, will spend more on themselves and also more on their public works and buildings than the absolute wants of a nation demand, and the fact is that men are not governed by monetary considerations only, but also by a sense of what is or is not appropriate.

We have, however, some exceptions to this rule. There are, for instance, the tattered and ragged margins of the Thames, where, in the greatest metropolis of the world, mud banks swelter and crazy buildings reel and totter against each other, but which it is proposed, at a somewhat late hour, to remedy.

Having thus touched upon the seneral points that occur to me as deserving of notice, I will conclude by remarking that no man can look back on the last twenty or thirty years without feeling that it has been the age of engineers and mechanicians. The profession to which we belong has, in that period of time, done much to change the aspect of human affairs; for what agency during that period, single or combined, can be compared in its effects, or in its tendency towards the amelioration of the condition of mankind, with the establishment of railroads, of the electric telegraph, and to the improvement in steam navigation.

For in constructing railways, telegraphs and steamboats, and their adjuncts, docks and harbours, and moulding and fashioning the face of the material universe to the wants of man, in overcoming its barriers, overleaping its valleys, and spanning its seas, engineers annihilate both space and time, bring into juxtaposition nations and peoples, and accelerate, beyond all human expectation, personal communication, and that interchange of ideas which is all important to the advancement of civilisation and knowledge.

Distance and separation have led and will always lead to misapprehension and prejudice—to ignorance and mistrust—to rebellion and war; and engineers may feel, when labouring on the great public works that facilitate the intercourse of nations, that they are not merely conquering physical difficulties, but that they are also aiding in a great moral and social work.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

January 7th, 1862.

EDWARD SCHUNCK, Ph.D., F.R.S., Vice-President, in the Chair.

A PAPER was read by J. P. Joule, LL.D., President, entitled, "Experiments on some Amalgams."

The weakness of the affinity which holds the constituents of amalgams in combination seemed to the author to offer the means of studying the relationship between chemical and mechanical force. His inquiries were extended to several amalgams, and gave results of which the following is a summary:—

Amalgam of iron was formerly precipitating iron on mercury electrolytically. The solid amalgam containing the largest quantity of mercury appeared to be a binary compound. Iron does not appear to lose any of its magnetic virtue in consequence of its combination with mercury. Its amalgamation has the effect of making it negative with respect to iron in the electro-chemical series. The affinity between mercury and iron is so feeble that the amalgam is speedily decomposed when left undisturbed, and almost immediately when agitated. The application of a pressure of 50 tons to the square inch drives out so much mercury as to leave only 30 per cent. of it in the resulting button.

Amalgam of copper.—By precipitating copper on mercury electrolytically a mass of crystals is gradually formed. After a certain time the crystals begin to get fringed with pink, indicating uncombined copper. In this state the amalgam is found to be nearly a binary compound. On applying strong pressure to an amalgam containing excess of mercury the latter is driven off, leaving a hard mass composed of equivalents of the metals. If, however, the pressure be continued for a long time, the resulting amalgam contains more than one equivalent of copper, indicating a partial decomposition.

The author gave an account of his experiments with amalgams of silver, platinum, lead, zinc, and tin. In the case of the latter amalgam long-continued pressure drives off nearly the whole of the mercury, indicating in a striking manner the efficacy of mechanical means to overcome feeble chemical affinities.

Dr. Angus Smith said it is difficult to tell the exact limits of chemical and mechanical action, because they flow into each other. Let us call the attraction of surfaces a mechanical action, as it is not to our knowledge a chemical combination. Porous bodies exercise this to a very large extent, and yet do not produce chemical compounds. The amount is limited on one side by the pressure of the atmosphere. Chemical compounds are too powerful to be effected by such slight forces. Porous bodies or surfaces do not take up others in chemical equivalents so far as we know; the full capacity of saturation is not satisfied, because of counteracting influences. Water admits air very rapidly, but it is held so slightly that it is affected by atmospheric pressure, and even seems to follow exactly the atmospheric pressure; but a portion is held with such power that it is extremely difficult to remove, and is not ever removable by the mere removal of pressure as far as we know. The small affinity of the great mass or surface of water is equal to a great affinity for a small amount of air. All masses have more or less this mechanical action, but, as in the case of porous bodies, the attraction is feeble, and not raised into the power of a definite grasp of a given quantity such as an equivalent, which is the case with a powerful affinity forming a chemical compound. Large and watery masses lose their water slowly by the mere force of gravitation. Strong mechanical action rises to an equality with feeble chemical affinity. Weak chemical affinity sinks into an equality with mechanical action. Charcoal absorbs gases more eagerly under pressure, but by a removal of pressure they are still absorbed; so that the mechanical force is greater than the weight of the atmosphere can control. There are many cases in which these two forces, if they be two, meet. This of the mercury and other metal is one case. The feeble chemical affinity is, I suppose, overcome by the powerful mechanical force. The alloy with sufficient chemical affinity remains, that with a weak affinity separates. The mercury flows off following the law of liquids; in like cases it flows off like water flowing slowly from a moist porous mass like wet clay. Instances from the feeblest to the most powerful affinity might be given, showing that only when the power reached a definite point did the law of chemical equivalents come in. At the same time there is a definite point where surface action ceases under certain conditions.

These ideas have arisen partly from experiments on the subject, which may some day be published. I believe they explain the difficulties attending the attraction of masses which seem occasionally to oppose the combination by atomic weights.

A paper was read "On the Conductibility of Heat by Amalgams," by Dr. F. Crace Calvert, F.R.S., and Mr. Richard Johnson.

The method followed in the investigations described in this paper is the same as that detailed in their former paper on the conductibility of metals and alloys.

In the first part of their paper the authors treat of the conductibility of mercury, and prove that if the source of heat be applied at the upper part of a column of mercury, so as to prevent any motion of the solid molecules of the mercury, this metal becomes the worst conductor of all known metals; for, silver being 1,000, mercury is 54.

In the second part of their paper the authors examine the conductibility of the solid and semisolid amalgams prepared in equivalent quantities of pure metals with mercury, and they show that amalgams may be divided into two classes—those containing an excess of equivalents of the amalgamated metal, and those which, on the contrary, contain an excess of equivalents of mercury. The first-class conduct heat at the mean rate of the two metals composing the amalgam, and in accordance with the calculated result, as shown by the following table:—

AMALGAM OF TIN.

Mercury = 21·63 or 679
Tin .. = 13·45 or 422

	Found.	Calculated.	Silver = 1,000 Found.	Calculated.
6 Sn. Hg.	10·60	15·24	332	478
5 „ „	10·30	15·63	322	490
4 „ „	9·65	15·88	302	498
3 „ „	9·45	16·30	296	571
2 „ „	8·65	17·19	271	539
Sn. Hg.	5·15	18·56	161	582
„ 2 Hg.	4·75	19·75	149	619
„ 3 Hg.	4·20	20·26	131	635
„ 4 Hg.	3·95	20·55	124	644
„ 5 Hg.	3·65	20·73	114	650

The second-class, comprising those amalgams containing an excess of mercury, conduct heat as if they contained no other metal, although its proportions may vary from 10 per cent. to 34 per cent.

These interesting results were confirmed by observing amalgams of tin, zinc, bismuth, copper, lead, and silver, and applying the source of heat in all cases at the upper part of a perpendicular column of the amalgam.

The third part of their paper has reference to the conductibility of mercury when mixed with 2 per cent. of various metals, and when the heat is applied at one end of a horizontal column; and they have obtained the following interesting series of results:—

	Found.	Calculated.	Found.	Calculated.
Pure Mercury	21·63 ..	— ..	679 ..	—
Mercury with 2 per cent. of—				
Silver	2·30 ..	21·81 ..	72 ..	684
Tin	5·65 ..	21·43 ..	177 ..	672
Copper	13·19 ..	21·62 ..	413 ..	678
Gold	14·50 ..	21·79 ..	454 ..	680
Bismuth	18·75 ..	21·20 ..	588 ..	664
Lead	19·25 ..	21·34 ..	603 ..	668
Cadmium	20·20 ..	21·51 ..	633 ..	676
Zinc..	21·20 ..	21·56 ..	664 ..	676

This table shows that the greater or less conducting power of the metal amalgamated with it has no influence in modifying the conductibility of the amalgam itself; for we find that the amalgam of bismuth (the worst conducting metal) conducts heat eight times better than that of silver (the best conductor), for

Mercury + 2 per cent. of Bismuth 588
„ + 2 „ Silver 72

They were induced to believe at the beginning of these researches that the cause which impeded the conduction of heat in so marked a manner in some of these amalgams was the presence of small crystals of amalgam floating in excess of mercury, as they had observed that, whilst the crystallised amalgams of silver and tin conducted heat badly, that of zinc, which was perfectly fluid and free from crystals, conducted heat very freely. As they pursued their researches they found these views to be incorrect, for the amalgam of bismuth, a very crystalline one, conducted heat with great facility.

Having observed that tin affected the fluidity of mercury in a most remarkable manner, so that even the one hundred thousandth part of that metal would interfere with the property which mercury has of assuming easily a globular form, they prepared the following series of amalgams of tin:—

			Found.	Calculated.	Silver = 1,000 Found.	Calculated.
Mercury	94·50 + Tin	5·50 ..	4·00 ..	21·14 ..	125 ..	663
„	97·00 + „	3·00 ..	4·60 ..	21·35 ..	144 ..	669
„	98·00 + „	2·00 ..	5·85 ..	21·43 ..	177 ..	672
„	98·25 + „	1·75 ..	5·90 ..	21·45 ..	185 ..	673
„	98·50 + „	1·50 ..	10·95 ..	21·47 ..	343 ..	673
„	99·00 + „	1·00 ..	19·30 ..	21·52 ..	605 ..	675
„	99·50 + „	0·50 ..	19·30 ..	21·56 ..	605 ..	675

This table proves that up to 1·75 the conductibility of mercury remains constant, when, by reducing the tin by $\frac{1}{100}$th, the conductibility of the amalgam is doubled; by further abstracting one-third of the tin the conductibility is again doubled.

HARDENING AND TEMPERING TOOLS AND METALS.—Watch springs are both hammered and rolled out of steel wire until they are reduced to fit a gauge which determines their equality in thickness. After being trimmed on the edge and punched at the end they are tied up in a loose open coil with a binding wire and placed upon a revolving iron plate which is situated over a charcoal fire. When they attain to a dull red colour they are lifted off and plunged into a cold oil bath, which hardens them; they are then run through the fire and the oil "blazed off," which operation tempers them. Each spring is now distended upon a long metal frame, like that of a saw blade, and polished with emery and oil placed between two blocks of lead. This polishing operation completely destroys the elasticity of the spring, when it may be bent like a piece of iron, but the elasticity is again restored by hammering it upon a polished anvil. After this the springs are coloured blue by placing them upon a flat plate of iron covered with a hood which is heated by a spirit lamp placed under it. The spring is continually drawn backward and forward, a few inches at once, in this small oven, until it assumes the deep blue colour desired. The colouring of these springs is not really essential, but most people have a different opinion. Each spring, after being coloured, is coiled into spiral form with a small tool which winds it upon an axis. The hair springs for the balance wheels of watches are frequently left very soft, but the best are hardened and tempered in the coil placed round a small cylinder. After this they are curled spirally between the blunt edge of a knife and the thumb of the operative, in the same manner that a strip of paper and the filament of an ostrich feather are frequently curled. The art of manipulating balance springs requires great practice, and a fine touch of the hand. These delicate articles are really triumphs of mechanical skill, as it takes about three thousand of them to weigh one ounce. Bow springs for carriages and railway trucks are hardened by first heating them in a clear hollow fire on a hearth until they are red hot, then they are dipped in water. After this the temper is given by heating them until a piece of wood drawn across the surface emits a sparkle, when they are removed and cooled in the air. An oven heated to 600 deg. may be used as a superior substitute for tempering in the open fire. Much diversity of opinion exists respecting the cause of elasticity or spring in steel and some other metals. The thin blue skin upon the surface of a steel spring is supposed to be the principal part which sustains the elasticity, as when this is rubbed off the elasticity is always impaired. But swords are polished as bright as mirrors, and some of them are so elastic that they may be wound upon a cylinder and will spring back to their original set. It is not the blue skin then which contains the essence of the elasticity in springs. The principles and practice in hardening and tempering steel consist in first heating the metal or tool until it becomes red hot, then plunging it into a cold solution, which hardens it. It is now tempered (rendered softer and made elastic) by reheating it, but not up to the previous heat which was used before hardening. Cold water, salt brine, and various preparations of oils and grease, are used for hardening baths. Almost every cutler and blacksmith has some little hidden secret which he thinks is better than that of every other person. We apprehend that many nonsensical ideas prevail among mechanics and others on the subject. We have records of several experiments in tempering steel, but there exists a necessity for a new set to be undertaken, and we hope some judicious mechanic will undertake them, and furnish the public with the results through our columns.—*Scientific American.*

LOCOMOTIVE BOILER EXPLOSION.

THE following is the report made by Captain Tyler, R.E., on the accident that occurred on the 4th of July, near the Rugby station, from the bursting of the boiler of a locomotive engine.

Whitehall, 30th July, 1861.

SIR,—In compliance with the instructions contained in your minute of the 8th instant, I have the honour to report, for the information of the Lords of the Committee of Privy Council for Trade, the result of my inquiry into the circumstances which attended the accident that occurred on the 4th instant, near the Rugby station of the London and North Western Railway.

The fast train known as the Irish mail train, leaving London at 8.25 p.m., and Rugby at 10.28 p.m., started from Rugby punctually on that evening, composed of an engine and tender, two Post-office vehicles, two composite carriages, two first-class carriages, and two brake vans.

It had proceeded for a little more than four miles, and was approaching a bridge over the railway, called the Easenhall Bridge, when the boiler of the engine suddenly exploded. It had not, at this time, reached its full speed, but is stated to have been running at the rate of 35 or 36 miles an hour, after travelling over gradients, sometimes rising, sometimes falling, but nowhere more severe than 1 in 330 between Rugby and the bridge in question.

This bridge is composed of three brick arches, and carries a road over the railway, at a height of 35ft. above the level of the rails. The two lines of the railway run through the middle arch, and the other arches afford space for the slopes of the cutting through which this part of the line passes.

The *debris* of the engine were almost untouched, and remained nearly in their original position when I visited the site between nine and ten o'clock on the following morning.

It was plain from the appearance of both the sides of the cutting that the explosion had taken place 20 yards or 30 yards to the south of the bridge referred to, and the area of its action on the grass of the slopes was distinctly traceable.

The barrel of the boiler was blown to pieces, while the fire-box remained almost uninjured. Of the three rings of which the barrel was composed the middle ring, containing the steam dome, was thrown off to the right in two pieces, and was separated from the remainder. It struck the south end of the right pier of the bridge with great violence, and knocked away a quantity of the brickwork. The larger portion of it, with the dome attached, after glancing off from the end of the pier (which was built on the skew), fell on the slope in a crumpled condition, at 24ft. from the pier. The smaller portion, about 4ft. by 3ft., lay flattened between the larger portion and the bridge, somewhat lower on the slope, at 8ft. from the pier, and almost under the right or east arch.

A large portion, about 8ft. 6in by 3ft. 6in., was found on the back of the tender after it was brought to a stand. This portion was torn away from the smoke-box, and, in fact, formed the greater part of the foremost ring, of which but little remained attached to the smoke-box. It appeared to have been thrown upwards in the first instance, against the south end of the crown of the middle arch of the bridge, and to have fallen from thence upon the tender. One small piece from the smoke-box end of the barrel was blown away to the left; and a considerable proportion of the fire-box ring, though it was distorted, and forced downwards at its lower part, and though the stays which connected it with the fire-box had given way, was still hanging on to the fire-box. Different sized portions and fragments of tubes, sheeting, lagging, feed-pipes, and hand-rails, &c., were thrown off in different directions. The right, or off driving wheel was blown away, and thrown forward, after striking against the right pier, and knocking some bricks out of it. Not only was the crank-axle fractured, but the framing was also torn away, in front of and behind this wheel; and it lay across the up line, with a part of the framing and machinery still attached to it.

A ragged elongated hole had been made in the bottom of that part of the barrel of the boiler which remained on the fire-box, in consequence, evidently, of its having been penetrated by the left arm of the right crank, either after the fracture of the crank-axle, or at the time when it gave way; but this hole was an isolated one, and was totally unconnected with any of the numerous lines of fracture into which the boiler had been divided.

Those lines of fracture are clearly shown on the diagrams Nos. 1 and 2 enclosed herewith, the former having reference to the right, or off; the latter to the left, or near side of the engine. The different portions, also, into which the barrel of the boiler was divided, are shown in diagrams 3 to 9 inclusive; and the off driving wheel, with the portions that were blown away with it, in Nos. 10 and 11. These diagrams, which are interesting and important, in demonstrating the cause, and illustrating the effects of the explosion, have been kindly furnished to me by Mr. McConnell, the Locomotive Superintendent for the Southern division of the London and North Western Railway, and have been prepared by the officers of his department.

The general results of the explosion may be stated to have been that the middle ring of the barrel, opening on the left side, was torn away from the other two rings in an irregular manner, thrown off to the right, and broken into two pieces; that the greater part of the foremost or smoke-box ring, torn along the left side through the whole plate, in a line almost continuous from the line of fracture of the middle ring, broken off on the right through the seam of rivets, and carrying away with it part of the angle iron of the smoke-box, was thrown upwards against the arch of the bridge, and fell back on the tender; that the hindmost or fire-box ring was torn open on the right side, had its upper part blown upwards, and its lower part blown downwards, and was penetrated by the broken crank (K, K, in diagrams 3 and 4); and that the off driving wheel was blown away to the right, with parts of the framing and machinery; while many of the lighter portions, which covered the boiler, or were connected with it, were thrown off in different directions, and to considerable distances.

The resistance to the explosive force which was offered on the right, by the plates composing the middle ring, and by the driving wheel and framing, caused the engine to diverge to the left, and to strike the left pier of the bridge at its south end. Glancing at that pier without doing any material damage to it, it then ran forward to the left of the down line on which it had been travelling, and finally fell over on that line, an extraordinary wreck, at 72 yards only from the point at which the explosion occurred. It would have been brought to a stand even in a shorter distance if it had not thus fortunately struck and glanced from the brick pier, and the consequences would in that case have been more disastrous. As it happened the whole of the vehicles composing the train pulled up in their proper order behind the tender, on the left of the down line, leaning more or less against the left slope of the cutting, and the principal damage done to them was from the front end of the leading van coming in contact with the tender.

The driver was thrown off to the left at the moment of explosion, and against a telegraph post; but he appears to be in a fair way of recovery from the injuries that he sustained. The fireman was carried forward with the engine, and was so dreadfully crushed about the lower extremities that his case was considered hopeless from the first, and he did not long survive. A Post-office clerk was injured on the head, as well as the guard in the leading van; but the passengers appear to have escaped without further ill effects than resulted from the alarm and the severe shocks that they received.

The engine was one of a class known as the "Bloomer" class, and was rather less than ten years old. It was delivered to the company by Messrs. Sharp, Brothers, and Co., of Manchester, in October, 1851. It had 142 square feet of heating surface in the firebox, and 1,152 square feet in the tubes, of which there were 195. It was a six-wheeled single engine, with 16in. cylinders, a 22in. stroke, and driving wheels 7ft. in diameter. It was provided with two safety valves, 3⅜in. in diameter, set to a pressure of 100 lb. on the square inch, and a Bourdon's pressure gauge. It weighed 9 tons 18 cwt. on the leading, 12 tons 7 cwt. on the driving, and 6 tons 10 cwt. on the trailing wheels. It ran 196,885 miles between October, 1851, and October, 1857, when it was supplied with a new set of tubes, and run 139,483 miles between that date and the period of its explosion. It was the same engine that came into collision with a cattle train at Atherstone, when attached to the limited mail, on the 16th of November last, with such serious consequences.

The barrel of the boiler was 11ft. 9in. long by 4ft. 1in. in diameter in the two outer rings, and 4ft. 1⅛in. in the middle ring, measured in both cases in the interior. The barrel was composed of ⅜in. plate, and the outer shell of the firebox of ⅞ in. plate. Assuming the ultimate strength of the plates at 51,000 lb. to the square inch, and of the rivetted joints at 34,000 lb. to the square inch, and taking the diameter at 49in., the bursting pressure of the barrel would have been, when it was new, 520 lb. per square inch at the longitudinal joints, and 778 lb. to the square inch through other parts of the plates. On the same calculations the bursting pressure through the plates would become 129 lb. to the square inch, if their thickness were reduced to $\frac{1}{12}$in.

In examining the fractured portions of this boiler I observed that corrosion had been actively going on in several parts of it, and particularly above two seams of rivets, the one situated on the left side of the middle ring, and marked A, A, in the diagrams Nos. 2 and 8, and the other on the right side of the fire-box ring, marked B, B, in diagram No. 1. The former was the worst of the two lines, and was the weakest part of the boiler. The metal had been eaten away along this line in an irregular manner, and had been reduced in places to little, if any, more than $\frac{1}{16}$in., which, as I have before shown, would approach closely to the thickness at which rupture might be expected at the ordinary working pressure of the engine.

The engine appears to have been in good order in every other respect; the safety-valves to have been working properly; the supply of water to have been attended to; the pressure of steam to have been rather under than over the prescribed 120 lb. Looking to the way in which this line of greatest weakness is connected with all the other lines of fracture, to the general effects of the explosion, and the subsequent position of the fragments, to the way in which the engine and train were diverted from their course, and to all the circumstances of the case, I have no doubt that the line referred to, marked A, A, in the diagrams, was that on which the boiler first opened, and that it gave way along this line under ordinary pressure solely in consequence of the thin condition to which the plate was reduced.

The interior of the barrel had been last examined in October, 1857, at which time, as I have already stated, a new set of tubes was inserted. It is said to have been in good order, and was expected to out-last another set of tubes.

It is impossible to believe that the corrosive action which has at length led to its explosion had not commenced at that time, though it had not apparently arrived at a stage to excite apprehension in the mind of the foreman who superintended the renewal of the tubes. It is more probable, if, indeed, it may not be considered as certain, that the reduction to about one-sixth of its original thickness, which is apparent in the plate that failed, had been spread over nine years and eight months that the engine had been at work, and that this plate must have been in a condition to require renewal when the boiler was re-tubed three years and eight months ago.

If it is not so—if the plate in question has been reduced in three years and eight months from its original thickness, or from nearly its original thickness, to the condition in which it is now found to be, then it is the more clear that inspection is necessary at shorter intervals to ascertain the condition of the plates.

When no symptoms of leakage or other indications of defect are observed it is not at present the practice in the locomotive works of railway companies to examine the interior surfaces of the barrels of engine boilers, except when the tubes are taken out for renewal. The first set of tubes in the engine now referred to lasted for six years, though its mileage was a heavy one, and it may be said that this practice provides that they shall be inspected once only in every five or six years. Partial inspections, it is true, occasionally take place when some of the tubes are removed, but in order that a thoroughly sufficient examination may be made it is necessary that they should all be taken out, and that a man or a boy should be sent into the interior, to knock away the deposit (when there is any) which has formed from the impurities of the water.

It must be admitted that the taking out and replacing of 195 tubes, as in the case with this engine, or of a greater number, as with some other engines, is a serious operation, and that it is not desirable to take a high-pressure boiler to pieces more frequently than is absolutely necessary; but it is clear that if it be safe to trust the barrel of such a boiler to wear out one set of tubes without an intermediate examination, it cannot at all events be safe to allow it to wear out a second set in the same manner. The present instance is only a illustration of the experience which has been obtained in sufficient abundance in other cases, in which boiler plates have been eaten away in a greater or a less time, according to circumstances.

The peroxide of iron appears to have a peculiar property of propagating itself, as it were, and of eating its way into the metal in particular places, when it is formed in combination with it on its surface, in a manner that is not observable in the case of oxides of any other metal. This action goes on in the interior of boilers as well as in iron employed for other purposes, and it is so treacherous in its character, and so uncertain in its choice of time and place, as well as in the rapidity with which it is carried on, that no reliance ought to be placed for a series of years upon the strength of iron which is exposed to it, in any position where it cannot be examined at proper intervals.

The plates of locomotive boilers, besides being pock-marked, as it is termed, or eaten in holes, are constantly found to be extensively corroded near the seams of the rivets. This is caused, no doubt, by the expansion and contraction of the metals consequent upon the variation of temperature and pressure which promotes mechanical movement, and favours this corrosive action more particularly along the portions where, next to a joint, the metal is most subject to distortion. In order to remedy this tendency to corrosion along the seams of rivets it has latterly become the practice to place the upper plates inside of the lower ones, instead of outside of them, at the joints, a mode of construction which had not been adopted when this boiler was made. It is generally believed that by thus avoiding the ledge which is formed by the edge of the lower plate, when that plate is placed inside the upper one, the deposit caught by such a ledge, which promotes corrosion, is deprived of its resting place. This improved method is no doubt one which it is desirable to adopt, but it is only found, apparently, to be a partial remedy, and the plates continue to be eaten away below the seam in somewhat the same manner as they are gradually rendered unsafe above it.

The only method by which accidents of this description can be properly provided against is by more frequent examination, coupled with an ample margin of strength in proportion to the pressure employed as the boiler deteriorates, as it must always do, more or less, in after years.

The factor of safety originally allowed in this boiler was only 4½, instead of 6, which it ought, in my opinion, to be, inasmuch as the working pressure was 120 lb. and the bursting pressure 520 lb. per square inch, as I have already stated; and the full working pressure was maintained while the plates were getting thinner and thinner, until at length the boiler exploded in the performance of its ordinary duty.

This is an important instance of the danger of trusting for too long a period to iron plates, and of the necessity of more frequent inspection; and it is worthy of serious attention on the part of the locomotive superintendents of the different railway companies. The hydraulic test which some of them are in the habit of applying, and which is, when properly used, a good auxiliary means of security, cannot be considered in any way to supersede this necessity, which undoubtedly exists, for careful examination at stated periods.

H. W. TYLER, Capt. R.E.

The Secretary, Railway Department,
Board of Trade.

MISCELLANEA.

THE 300-pounder Armstrong gun lately received at Woolwich weighs 12 tons 8 cwt. It is a muzzle loader.

A COMMISSION appointed by the Federal Government to examine the Stevens floating battery have reported against it.

THE estimated expense of constructing the proposed new line from Waterford to the town of Passage is £60,000.

THE Federal Government, it appears, have purchased 300,000 stand of arms in this country at an average cost of £3 5s. 10d., or 16 dols. each.

THE old wall of Uriconium at Wroxeter has been at last discovered. It is 6ft. wide, and has been uncovered 34 yards, and traced with the crowbar to a further distance of 100 yards.

THE estimated cost of constructing the proposed new railways from the Sevenoaks Railway to Maidstone and Tunbridge, to join the South-Eastern, and for other purposes, is £750,000.

THE Black Prince is to receive a coating of the patent composition prepared by the Admiralty chemist, Mr. Hay, with which also the bottom of the Resistance, at Chatham, is ordered to be coated.

AN elaborate table has been issued from the Liverpool Custom-house, in which it is shown that a decrease of £13,134,593 in the value of the exports of British and Irish goods has taken place at that port in the course of last year.

THE Great Southern of India Railway was opened from Negapatam to Tanjore, forty-eight miles, on the 2nd of December last. It is expected that the remaining section to Trichinopoly, thirty miles in length, will be opened in February.

THE Kent Coast Railway Company propose to run tramways along the Ramsgate coast, to connect their railway with the quays and the east pier of Ramsgate Harbour, the transfer of which they propose to obtain from the Board of Trade, who now manage it, and for these purposes they will require a further sum of £160,000.

ON the late dispatch of the Europa's mails, from Queenstown to London, the run from Holyhead to Stafford, 130½ miles, was run in 2h. 25m. without a single intermediate stop, Mr. Ramsbottom's apparatus, for supplying the tender with water while in motion, being employed. The average speed was fifty-four miles per hour. The whole distance from Holyhead to London, 264 miles, was run in exactly five hours, or at the rate of 52⅘ miles an hour.

A NUMBER of goods trains have been discontinued on the Lancashire and Yorkshire Railway, in consequence of the depression in the traffic. Some of the passenger trains are also about to be discontinued. These alterations will necessitate a suspension, until better times, of between fifty and sixty engine drivers, &c., in the locomotive department, and a corresponding diminution of hands in the other departments. No reduction in the number of either goods or passenger trains has yet been made on the North Union Railway. The trains are, however, comparatively light. Several of the *employés* in the goods department at the Preston end of this railway are now working only five days per week.

MR. NEWALL, of Bury, has recently applied to several of the passenger trains of the Lancashire and Yorkshire Company his method of lighting railway carriages with gas. The trains to which these lights have been applied include the fast trains between Manchester and Bradford, and Manchester and Blackpool. The London and North-Western Company are about to avail themselves of this mode of lighting some of their fast trains, and among others to the limited express betweed London and Holyhead. Mr. Newell is now fitting up carriages for the last-named train at Bury. By means of compression by hydraulic power the quantity of gas required for one of these trains is contained in a box of small size in the guard's van, and the advantage and comfort derived from these lights by the passengers are spoken of in high terms.

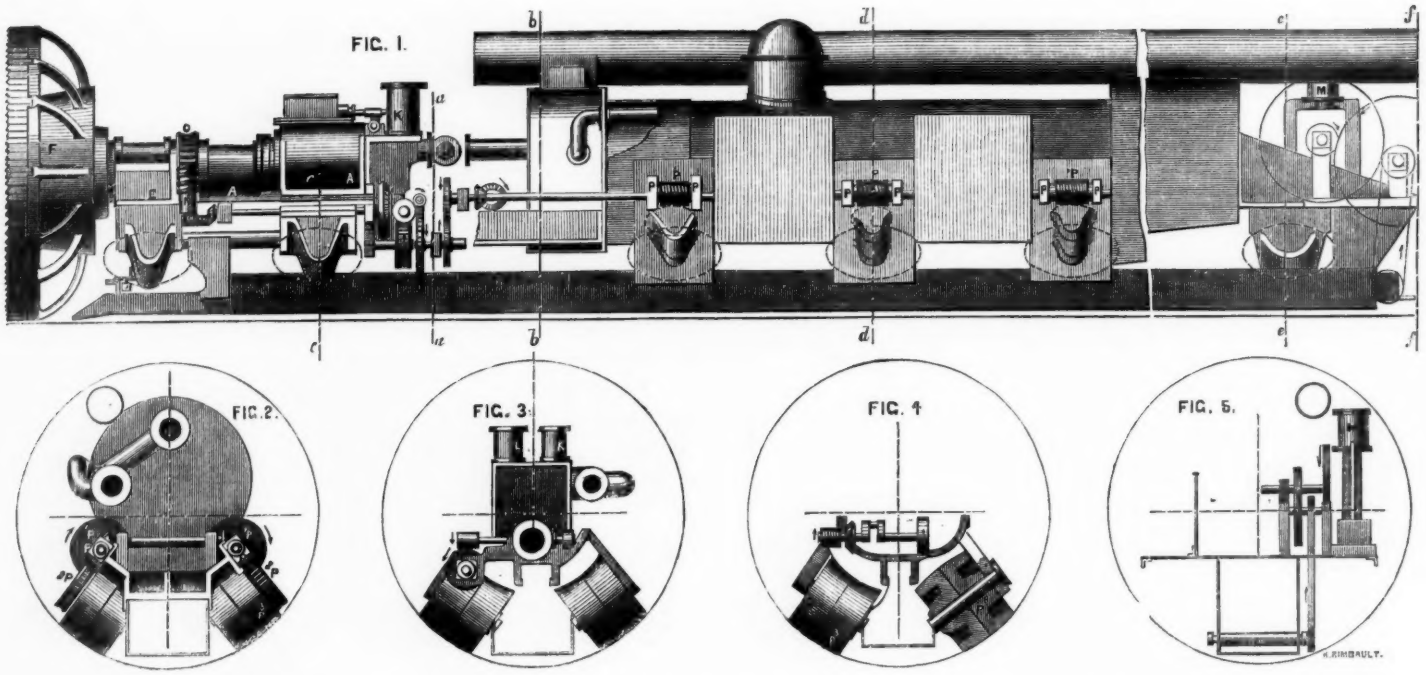
ONE serious defect of an almost, if not quite irremediable character, exists in the construction of iron-cased ships as constructed at present, and is fully exemplified in both the Warrior and Black Prince. This evil is the penetration of water between the teak and armour-plates. This water naturally forces for its exit a passage between the joints of the armour plates, and the opinion at present is that nothing can remedy this under the circumstances of tongued and grooved edged plates hung on a ship's sides by through bolts. Caulking is stated to be useless, and that cannot be wondered at considering the slung weight to be dealt with, and the ship's motion at sea. But the effect of the action of the water in the grooves of the plates, and upon the iron bolts, can only be expected to be such that in four or five years from the time of commission each ship will require re-plating.

IN the famous Windham case, Lord Claude Hamilton, M.P., observed as follows in the course of his evidence:—"I do not consider a taste for driving railway engines a proof of insanity, and such is the opinion of many who hold a distinguished rank in society. Many years ago I joined with half a dozen others in studying the great motive power of modern times. We attended a course of lectures at the Polytechnic, and went into the matter as thoroughly as we could. After a time we were allowed, under proper supervision, to drive engines on railways. I must say, however, that we were not permitted to experiment with passenger trains, but were restricted to ballast and coke trains. I can assure you that it requires a good deal of skill, self-possession, coolness of head, and delicacy of touch to drive a railway engine. It is decidedly an intellectual study."

OUT of forty-seven machine shops in Manchester, Captain Palin, chief constable of police, reports that eight are on short time and that one is stopped. Nevertheless there are not wanting grounds for the supposition that many of the larger and better reputed makers of machines for the cotton trade are now very fully employed. One of them mentioned the other day that in one department of the works of his firm they had already in hand orders which would keep them fully employed till July, and in another till September, and that there was scarcely a spinner or manufacturer of eminence and capital in the town and neighbourhood that was not giving out orders for the replacement of old machinery by more recent inventions, and with a class of machines more adapted to the present requirements of the trade. These orders are partly due to the adaptation of machinery to a different staple of cotton to what they have been accustomed to use, and partly to the fact that they can better afford to stop their mills in times like the present for the purpose of such alterations.

THE traffic receipts of railways in the United Kingdom amounted for the week ending the 4th of January on 10,048 miles to £463,265, and for the corresponding week last year on 9,846 miles to £454,248, showing an increase of 208 miles and £9,017. The gross receipts on the following fifteen railways amounted in the aggregate on 6,641 miles to £354,000, and for the corresponding week of 1861 on 6,521 miles to £352,365, showing an increase of 120 miles and £1,635. The increase on the Eastern Counties Railway amounted to £2,628; on the Great Southern and Western of Ireland to £1,570; on the Great Western and West Midland to £2,196; on the London, Brighton, and South Coast to £1,670; on the London and South-Western to £1,228; on the Manchester, Sheffield, and Lincolnshire to £11; on the North British to £288; and on the North Staffordshire to £1,485, total, £11,076. But from this must be deducted £723, the decrease on the Caledonian, £833 on the Great Northern, £3,514 on the Lancashire and Yorkshire, £585 on the London and North-Western, £227 on the Midland, £2,049 on the North-Eastern, and £1,510 on the South Eastern, together £9,441, leaving the increase, as above, £1,635. The goods and mineral traffic on those lines amounted to £180,793 against £183,607 for the corresponding week of 1861, showing a decrease of £2,814. The receipts for passengers, parcels, &c., amounted to £173,207 against £168,758, showing an increase of £4,449, deducting from this sum the decrease of £2,814 in the goods' traffic, leaves the increase on the fifteen lines, as above, £1,635. The receipts of 65 other railways amounted, on 3,407 miles, to £109,265, and for the corresponding week, on 3,325 miles, to £101,883, showing an increase of 82 miles and £7,382.

PENRICE'S MACHINERY FOR TUNNELLING.



This invention, by H. N. Penrice, of Wilton House, near Norwich, has for its object improvements in machinery for tunnelling and driving galleries through rock and other strata. In the specification of a patent granted to Mr. Penrice, the 6th November, 1858 (No. 2,481), he described certain machinery for tunnelling and driving galleries, which, when worked by steam, was supplied from a boiler at a distance.

Now, according to the present invention, the boiler is connected with the machinery, and the whole is mounted on wheels, so that it may be made to progress as the work proceeds. It is preferred, as in the former invention, that the machinery should be arranged to cut a cylindrical tunnel. The boiler and steam machinery are carried on several pairs of wheels, and the peripheries or tyres of these wheels are formed to a corresponding curve to that of the cylindrical tunnel, and the pairs of wheels revolve in planes inclined to each other, their axles being inclined to each other. On each axle is a screw or worm wheel, and there are two parallel shafts, one on each side of the boiler, with worms or screws thereon, there being one worm for each of the wheels; by this means a slow motion may be given to the wheels, and the machinery may thus be moved towards the face of the work. The speed at which the screw shafts are driven is capable of being readily varied in order to suit the varying strata, and in order to be able readily to adjust the progress of the machine to the quantity of work which the cutters are enabled at different times to penetrate, the cutting machinery is constructed and is put in motion in a similar manner to what was described in the specification of the said former patent. The valves of the steam cylinders, by which the cutter is worked, and the pump or pumps are actuated by suitable gearing worked by a piston of another and smaller steam cylinder, which also drives the screw shafts and the endless chain of scrapers by which the pulverised materials are moved back from the face which is being worked; or more than one steam engine may be employed for these purposes. Provision is made for drawing off the products of combustion and the steam from the tunnel or gallery through a pipe, and provision is also made for supplying the tunnel with fresh air to supply the workman, and also the boiler furnace.

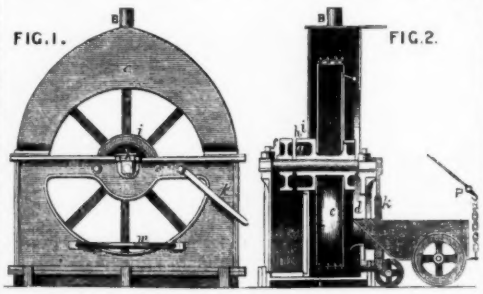
Fig. 1 shows a side elevation of machinery constructed and combined according to this invention; and Figs. 2, 3, 4, and 5, tranverse sections thereof, taken respectively at different parts *a*, *a*, *b*, *b*, *c*, *c*, and *f*, *f*, Fig. 1. The machinery is arranged to cut a cylindrical tunnel, and the size of such tunnel will depend on the diameter of the cutter head or holder used.

A is the bed of the engine or cylinder within which the piston works, which gives a quick to and fro motion to the cutter head or holder F. The cutter head has a number of cutters fixed on arms, which radiate from the centre of the head or holder. These radial cutters are of steel. The cutter head has a slow rotation, so that the cutters are moved after each blow against the face of the rock a short distance round, so that the cutters act at a slight distance from their previous points of action, and so that they are each caused to chip off a small piece of the rock at each forward movement of the cutters. This form of cutter head for cutting tunnels and galleries in rocks is not new, but was described in Mr. Penrice's previous specification, but in the former arrangement of machinery the steam boiler which supplied the engine did not accompany the engine, by which the cutter head or holder was put in motion, neither was the steam machinery mounted on wheels, so as thereby progressively to be caused to move up to the face of the work as the rock in front is progressively cut away; on the contrary the movement of the machinery was by other mechanism. The peculiarity of the present invention consists in arranging the steam machinery which gives motion to the cutter head or holder, and also the other mechanism, in such manner that such machinery may be accompanied by the requisite boiler or boilers, and the whole mounted on wheels, in order that the same may be locomotive. The construction of steam boiler which is preferred is the best class of locomotive boilers of considerable power, in order that the cutter head may be moved to and fro a short distance with high velocity, say, 400 to 500 strokes per minute, and it is preferred that the piston which actuates the cutter head should on one side (where the steam acts on it to bring it and the cutter head or holder back) be of much less area than the other side of the piston where the steam acts on it to drive the cutter head or holder against the face of the rock. That which is required is that the area of the piston on the side next the work should be sufficient to bring back the piston and the cutter head or holder with the requisite speed each time after the cutters have been driven against the face of the rock. In the arrangement shown the cutter head or holder F is mounted on and carried by a hollow piston rod, which is of large diameter as compared with the cylinder within which it works, in order to get strength, and also that one side of the piston may be of larger area than the other. The piston rod is supported and slides in a bearing E. In the arrangement shown there are two small steam cylinders K, L, which are of the ordinary construction, and they are supplied by steam from the steam boiler. By means of these small engines, and the gearing and apparatus put in motion thereby, the slide valve of the main cylinder can be driven with great rapidity; and these small engines also give motion to the two shafts P, one on each side, as will readily be understood by reference to the illustrations. On these shafts P are screws P^1, which give motion to screw wheels P^2 on the axes of the wheels P^3, these wheels carry the steam boiler and the steam machinery, and the peripheries of the wheels are convex, corresponding with the curvature of the tunnel, and they rest on the lower parts of the cutting, the wheels on each side being inclined, as shown. In order that a slow rotating motion may be communicated to the cutter head there is a screw wheel O formed round the piston rod, which receives motion by a screw N put in motion by the small steam engines.

The waste steam from the engines and the products of combustion from the furnace are conveyed away from the engines and boiler furnace by a suitable pipe, supported near the roof of the tunnel, and communicating with the outer air, which arrangement will greatly aid in ventilating the tunnel or gallery, but it is preferred, in addition to the use of the exhaust steam and the products from the furnace for carrying off the air near the engine and boiler (by which air from the exterior of the tunnel is induced to rush through the tunnel towards the further end thereof, where the engine is situated), to employ a fan or fans or exhausting machinery to aid in removing the air in the pipe above mentioned; and it may in some cases be found desirable to provide for drawing air by a fan or fans or suitable mechanism from the outer atmosphere, in order to insure the tunnel or gallery being well ventilated. In order to remove the portions of the rock which are constantly being chipped off by the cutters of the cutter head another small engine M is employed, which gives motion to an endless chain of scrapers working in a trough or rectangular passage below the engines and boiler. The forward end or part of this trough is spread out and formed to a curve to correspond with the lower part of the tunnel; hence, as the engines, boiler, and machinery are moved foward, the chippings of the rock will rise up the incline of the forward end of the trough or rectangular passage, and come within the action of the endless chain of scrapers, and will be by them carried back and delivered at the back end of the machinery, where they are to be collected into suitable trucks or carriages, and conveyed away out of the tunnel or gallery. The small engines K, L, M, or either of them, may, in addition to the work above mentioned, be caused to communicate motion to water pumps for supplying the boiler, and they may also be caused to perform any other duty which may be found desirable. It is not essential that three small engines should be used, as the duties performed by them may be, if desired, performed by a less number of engines.

THOMAS' CENTRIFUGAL MACHINES.

This invention, by D. W. Thomas, of Liverpool, has for its objects the construction of centrifugal machines of greatly increased strength, to admit of their being constructed of a larger size, and driven with safety at a higher rate of speed than now commonly practised, and certain improvements in the apparatus for the more readily feeding the machine with the substance to be operated upon; and consists in constructing the revolving drum on the open or receiving side of the machine, with radial arms or spokes springing



from the boss or nave on the axle, in place of being entirely open as now practised, and in surrounding the opening with a conical receiving lip, the outer edge of which travels round and in close proximity to the inner side of an internal flanch, which runs round the opening of the case which encloses the revolving drum, to prevent any portion of the charge falling between the revolving drum and the inside of the outer casing, and in forming the outer casing with one or more vent openings on the top or side. The revolving drum is charged from trucks having box-like bodies, the front ends of which hang over at an angle of, say, about 45 deg. The sloping front of the truck about one-third down is fitted with two or more bearing hooks, which, upon the truck being run up to the opening in the side of the machine, come in contact with a fixed horizontal transverse bar, upon which the fore end of the truck rests whilst being elevated by a fall tackle hooked on to the back of the truck, and discharges its contents into the machine.

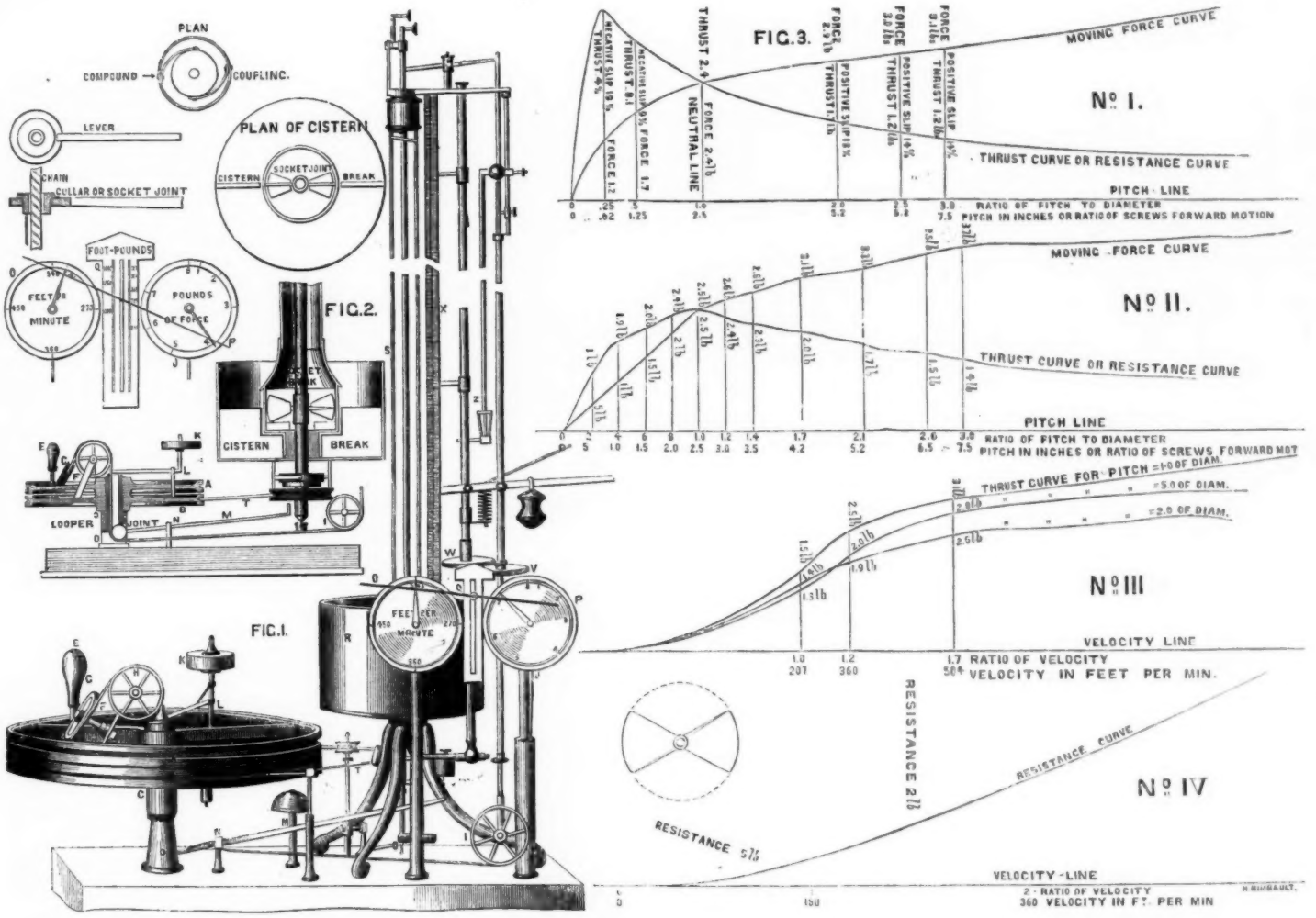
Fig. 1 is an elevation of one of the improved machines; and Fig. 2 is a vertical cross sectional elevation of the same, and a side elevation of one of the trucks used to feed the apparatus.

A is the external casing, provided with B, opening to allow the moist air to escape; C, the revolving drum, for containing the charge to be operated upon; D, a conical flanch surrounding the annular opening, through which the charge is inserted; E, circular opening in the side of external casing, which is surrounded by an annular lip or flanch, which projects over the outer edge of the conical flanch D, to prevent any portion of the charge falling between the inner side of the outer cover and the outside of the revolving drum, by which arrangement the apparatus can be charged during the time it is in motion; F, a loose pulley on axle of the revolving drum; G, a fast pulley on ditto; H, friction pulley on the axle of the machine, against which acts I, the friction strap; K, the lever to actuate the brake gear for stopping the machine; L, division to prevent the syrup falling on the strap; M, a transverse horizontal bar, upon which the truck rests during the time it is being emptied of its contents; O, the improved truck for charging the machine, which is mounted on a pair of wheels, and a single one in front, the bearings of which turn on a vertical axis, to enable the carriage to be re-turned round with facility; P, pulley block and tackle for elevating the rear of the truck.

The Great Explosion at Rhodes.—The effects of the explosion which destroyed so many lives at Rhodes towards the end of the year 1857 are still sufficiently apparent. The place was taken by the Turks in 1522 after a siege of several months, in consequence of the ammunition of its defenders having fallen short. It was known at the time that the chancellor of the Order of St. John had, by some means or other, made away with a large quantity of gunpowder—an act of treachery for which he was summarily condemned and executed. In 1827 this powder, of which there were some thousands of barrels, was discovered in the vaults under the church of St. John by the French prisoners confined there. Little or no use appears to have been made of the discovery, and no precautions were taken to prevent the disaster which afterwards occurred. The powder was ignited by a flash of lightning, and in an instant the massive church, in which were the tombs of all the Grand Masters of the Order, was flying in thousands of pieces over the city and the harbour. A few huge fragments, scattered here and there in the immediate neighbourhood of its former site, and a great round hole in the earth on which it stood, are all that remain of this, the most interesting of the monuments of the Knights of St. John, many of whose houses, however, still stand in a state of good preservation. It is estimated that over 1,500 persons perished in the ruins occasioned by this most terrific explosion.

Dreadful Boiler Explosion.—A most dreadful boiler explosion occurred on Monday last, the 13th inst., at Stonton Wyville, a small agricultural village in the county of Leicester, about six miles from Market Harborough. Mr. Dunmore, a farmer, has a stackyard upon his farm, about half a mile from the village, and on Monday hired a small thrashing-engine, which is owned by a man named Butcher, who resides at Debdale Wharf. This engine was about three or four horse-power, but, from the remains of it, it did not appear in working order. It appears that the pump that feeds the boiler with cold water was in a bad state of repair, and had been repaired on several occasions. About twelve o'clock in the day they were obliged to stop working to again repair the pump pipe, and were wrapping it with string and red lead. The pump was not the only part that was out of repair, for there was no indicator to show the quantity of water in the boiler, the glass being smashed, and Butcher had been saying that he must have a new one the following day, and he had also said that he durst not work the engine much longer, as he began to be afraid of it. The greater part of the men, thirteen in number, were standing round the engine looking at the repairs. There were three killed on the spot. Thomas Lee, about 40 years of age, was blown over 40 yards into a ditch. William Woolman, about 65 years of age, was blown fully 50 yards; one of his legs was blown off, and lay about 12 yards from the engine; his head was blown off and lay some 30 yards away, while his body and a piece of the engine were considerably further away. These men both belonged to Stonton Wyville, and have left families. Samuel Ashby, the other man killed, was the feeder of the engine, and came from Smeeton. He appears to have been hit on the chest by a piece of the boiler, and killed upon the spot. These poor creatures, as soon as assistance could be obtained, were removed to the parish church, and a most sad spectacle their mangled bodies presented. George Woolman, another labourer, from East Langton, was literally doubled up, being cut on the side of the head which caused a concussion of the brain, besides other severe injuries. This poor fellow, who was about 25 years of age, lingered in the greatest agony until about 5 o'clock, when he died. He has left a wife and family. The others hurt are Butcher, the master of the engine, severely, but it is believed not fatally; Abraham Lee, much scalded in the face and hurt in the chest; Joseph Lee, jun., much burnt in the face and otherwise hurt; and John Lee, 13 years of age, and son of Thomas Lee, who is dead. This youth had his arm broken besides other injuries. An inquest is being held upon the bodies of the killed.

LAING'S HELIXOMETER.



SCOTTISH SHIPBUILDERS' ASSOCIATION.

November 4, 1861.

JOHN D. NAPIER, Esq., Vice-President, in the Chair.

EXPERIMENTAL INVESTIGATION INTO THE PROPERTIES OF THE SCREW AS A PROPELLER.

By Mr. JAMES LAING, of Dundee.

THE object of this paper is to explain the nature of the experiments capable of being made by a machine of my own invention, which I have named a Helixometer, and constructed for the purpose of making an experimental inquiry into the properties of the screw as a propeller.

A complete sketch of this "Helixometer" and details, explained in the sequel, will be found in the accompanying Figs. 1 and 2. The results of the experiments are detailed in a series of tables and the set of diagrams forming Fig. 3; and it is an explanation of these tables and diagrams which forms the legitimate object of this paper. For the proper understanding of the action of this machine, and results of the experiments, it is necessary to state that, as we have to do with power, and the effects produced by the application of that power, it will be readily seen that the machine must consist of two parts—the one for determining the power applied, and the other the effect produced by that applied power.

First, as to the arrangement for indicating the power:—

A and B are two grooved wheels supported horizontally on the vertical stud or column C. These wheels move freely on the stud; the lower wheel resting on the collar of the stud, and the upper wheel resting on the nave of the lower. The stud C is hollow from the top down to the point D; at that point a mortice-hole is cut through the stud, which makes a communication with the hollow centre of the stud which reaches to the top. This explanation will allow us to make another step.

On one arm of the upper wheel the handle E is fixed, and on an arm of the lower wheel the bracket F is fixed. On this bracket are supported two small grooved wheels G and H; the plane of the small wheel G being at right angles to the arm of the large wheel B, and the plane of the small wheel H being parallel to the arm of same large wheel B, and so placed on the bracket that the groove is exactly above the hole in the centre of the stud that carries the two large wheels A and B. It will be evident, then, that if a chain is fixed to the lower end of the handle on the arm of the upper wheel A, and passed round the two small wheels G and H, that chain can be led down through the centre of the stud that carries all the wheels, and can be led out through the mortice-hole D, round a pulley, and carried along to the wheel I, from which it ascends to a scroll spring behind the dial J. One end of the chain, then, is fixed to the driving handle E on the arm of the upper wheel A, and the other to the scroll spring attached to the spindle on which the indicating handle of the dial J is fixed. The chain between its two extremes, it will be observed, passes round the small wheels fixed on the lower large wheel; that being the case, if the handle is pulled by any given force, such as 2 lb., the chain will tend to pull round the lower large wheel B with the same force, for the chain passes in a tangential direction from the handle E to the small wheel G. It will also be evident that the chain will tend to pull the scroll spring so as to indicate 2 lb. on the dial J, and thus we have a register of the force or torsion between the upper and lower driving wheels. Any other amount of force can be indicated in the same way, the handle moving to the proper point on the dial. Up to this part of the explanation we have supposed the lower wheel B to be stationary, while the upper one A was pulled with a given force, the chain transmitting that force to the dial as described. But it will be evident, from the arrangements already described, that if a swivel or looper-joint be placed in that part of the chain that passes down through the hollow stud C, so as to break or stop the rotatory motion of the chain at that point when the wheels are actually made to revolve, the now moving force will be indicated on the dial as before; and thus we have the means of registering a force in motion by a fixed index.

The velocity of the moving force can also be registered by a fixed point by the following arrangement:—

K is a weight fixed on the upright arm of a right-angled lever. This lever is supported on a stud L screwed into an arm of the lower driving wheel B, the other arm of the lever reaches from the stud L to the centre of motion, or to the hollow stud that carries all the wheels. This end of the lever is flat, with a round hole in it, exactly above the hole in the stud C, and of course concentric with the axis of rotation of the wheels A and B. This being the case when the wheels A and B are made to revolve, this hole will rotate round the general axis of motion. Into this hole is fitted a collar, with a shoulder for resting on the upper edge of the hole. This collar has also a hole in it of sufficient size to allow the chain to pass freely through it as it leaves the wheel H in its passage down through the hollow column C. From this arrangement it will be clear that the collar so described may be kept at rest, while its supporting parts are revolving; this collar, in fact, is for breaking the rotatory motion of the lever, as was necessary to break the rotatory motion of the chain by means of the looper joint To this collar, then, is fixed the rod shown in the sectional drawing, that passes down through the hole in column C to the end of the lever M, which is supported by the stud N, the other end of this lever M reaching to below the dial O. From this end a chain is attached which passes upwards to a scroll spring behind the dial O, which spring is fastened to the same spindle as the handle of that dial.

From this arrangement it will be evident that when the wheels A and B are made to revolve, carrying along with them the weight K, the centrifugal force generated by that weight will be proportional to the velocity of the wheels, and will tend, to a greater or less degree, to move the handle or dial O.

Now, if the centrifugal force and the spring are adjusted so as to indicate by the handle of dial O the number of revolutions or the number of feet the driving handle passes through per minute, we will have at any time the exact velocity of the moving force indicated by a fixed point.

From these arrangements it will be seen that the force and its velocity can be accurately indicated, the handle of dial J pointing to the force, and the handle of dial O pointing to the velocity of that force.

Having got the length of being able to exhibit the force and its velocity by fixed points or handles on the two dials, our next object is to mechanically combine these two elements that go to constitute power; and the method is simple: for, by passing a wire P through the handles of each dial, in such a manner that the handles will be free to move, the centre of that wire indicates on the straight scale Q between the two dials, the actual power or foot-pounds in action at any time; and thus we have arrived at the means of accurately registering power, as compounded of a force and its velocity, by means of a point at rest.

This mechanical arrangement, however, of determining the power only answers for certain fixed velocities; for general experimenting we must have recourse to time, and the aid of a time beater, such as the metronome, is essential, and the method is simple: for, if we can determine the number of feet the driving handle E passes through per minute, and multiply by the indicated pounds of force in action on the dial J, we will have the power applied at the time. The number of feet the driving handle E passes through per minute is ascertained by multiplying its revolutions per minute by three, for the handle exactly passes through 3ft. each revolution. And in the act of experimenting, if the beat of the metronome and the ring of the Helixometer bell are simultaneous, we are sure all is going on right; for time is the base on which all such experiments rest.

Second, as to the arrangements for determining the effect produced by propelling the screw:—

R is a cistern for containing water. In the centre of this cistern is screwed the glass tube S, with a brass socket for the screw working in at its lower end (section on large scale shown). There are breaks in this socket to prevent the rotation of the water; also, there is a break across the cistern for same purpose. The screw is propelled by a band T passing round the large wheel B and the pulley connected to the vertical spindle of the screw. The journal of this pulley sustains all the lateral strain caused by the band, and the connection of the pulley with the screw spindle is effected by a combination of the compass-joint and a four-journaled coupling. This arrangement is for the purpose of allowing the screw spindle to move freely up and down in the act of weighing the column of water suspended in the tube, by means of the dynamometer U.

The pitch of the screw is altered at pleasure by turning the wheel V, the pitch being pointed out on the horizontal dial W.

X is a scale of inches to determine the height of the column of water, and on its edge is a scale of pounds to determine its weight.

Y is an equal armed beam for weighing the column of water by means of the dynamometer U.

Z is a facsimile of the working screw in the tube, and partakes of exactly the same degree of pitch, being moved by the same mechanical arrangement; but it does not revolve, and thus we have the means of seeing the degree of pitch the working screw is at during any particular experiment.

Now, since power is compounded of force and its velocity, the arrangements must be such that these two components, namely, force and velocity, must be registered on their respective indices; and such are the arrangements on the machine that, however varied the force and its velocity may be, the handles indicate their respective degree; and, by a simple multiplication, the absolute power in action is obtained. This is the arithmetical method of determining the power. A second method of at once showing this power is by mechanically combining the force and its motion as explained; and, through the medium of a third index, we have their product in foot-pounds indicated by a pointer; that is to say, the motive force is again brought to rest, and the power in action determined by the position of a pointer on a stationary scale.

Thus far, then, as to the method of determining the moving power; and by an inspection of the tables it will be seen, in the columns in which the moving force and its velocity are noted, how nearly the moving force and its velocity can be determined through all their varying magnitudes, according to the kind of experiment to be performed; and thus we have the means of determining and registering, in the proper columns of the tables, the power in action at any given time. These tables, numbered I., II., III., and IV. respectively, immediately follow, and represent the mean results of a great number of experiments of the nature indicated by their respective titles, while the headings of the respective columns, with some little explanation, sufficiently explain the nature of the various elements and deduced calculations therefrom. Also, in addition, at the end of the paper, in No. III. is given a corresponding set of diagrams, in which those various elements are graphically represented by curved lines, the like numbered tables and diagrams corresponding to each other.

In illustration of the nature and mode of construction of these tables, referring to Table No. I., in the last line of the first portion of that table we have, in the column of force, 3·11lb., which, being multiplied by its velocity, 276ft. per minute, gives the effective power in action at 855 foot-pounds per minute, and similarly throughout the other tables. Again, as to the mode of determining the resisting force overcome by the moving power, the arrangement of the machine is such that, as explained, the screw is made to generate and sustain a vertical column of water, the weight of which column is assumed to be the thrust or resisting force. This weight is ascertained from the vertical scale attached to the machine; and by referring to the same experiment it will be found that 1·2 lb. is the resisting force in this particular experiment, and so on with the like columns of thrust throughout the tables. At this stage of our explanation we notice a fundamental fact which ramifies the whole subject of comparative dynamical action, namely, that if any moving power compounded of force and its velocity be applied to overcome a resistance, or, in other words, to perform work—whatever element of the work is determined, whether it be the resisting force overcome or the velocity with which it is overcome—if we divide the moving power by the determined element of the work done the quotient will be the remaining element. Thus, for example, 10 lb. acting through 10ft. per minute gives 100 foot-pounds per minute as the moving power; and again, applying that power under circumstances in which it overcomes a resisting force of 5 lb., if we divide 100 foot-

pounds by 5 lb. we obtain 20ft. per minute as the velocity with which that resistance is overcome. On the other hand, from the nature of the circumstances, had the velocity been given at 20ft. per minute, then dividing 100 foot-pounds by 20ft. we obtain 5 lb. as the resting force overcome at that velocity.

To apply this truth: on reference to the same experiment we have 855 foot-pounds, the motive power, which, divided by 1·2 lb., the observed weight of the sustained column, gives 712ft. per minute as the velocity of the thrust or resisting force; and in like manner we obtain the calculated numbers in the corresponding columns of the other tables.

Again, it will be quite evident that, if we multiply the pitch in inches by the number of revolutions of the screw per minute, the product will be the forward or pitch speed of the screw. Hence, applying to the same experiment, we have 7·5in. by 1,334 revolutions per minute, or 833ft. per minute as the forward or pitch speed of the screw. Lastly, subtracting the velocity of the thrust from the velocity or pitch speed of the screw, as calculated in the preceding paragraph, their difference, positive or negative, as the case may be, is the slip of the screw. In the experiment referred to, 833—712, or 121ft. per minute, as given in the table, is this difference; and the corresponding results in other cases is noted in this and similar columns of the other tables.

Having thus shown how these tables are constructed from the various data obtained from the indices of the machine, under the altered conditions of the different experiments, it will also be apparent how diagrams may be constructed from the several columns of these tables, since by a scale of equal parts the perpendiculars proportional to the moving parts and thrust can be drawn to the base line at points corresponding to the various pitches of the screw, and thus we have a visible rendering of the most important elements of these experiments.

No. I.

Table of Results from Experiments made by Applying the same Power in Propelling a Screw of varying Pitch.

Ratio of pitch to diameter.	Moving force in pounds.	Velocity of moving force in feet per minute.	Free moving power used.	Thrust obtained in pounds.	Acquired velocity of thrust in feet per minute.	Power developed.	Pitch in inches.	Revolutions of screw per minute.	Forward pitch speed of screw in ft. per min.	Difference between thrust and screw speed.	Revolutions of helixometer wheel per minute.
	lbs.			lbs.							
·25	1·2	726	870	4·0	216	870	·62	3509	181	— 35	242
·50	1·7	504	857	3·1	276	857	1·25	2436	253	— 23	168
1·00	2·4	360	864	2·4	360	864	2·50	1740	360	0	120
2·10	2·9	297	861	1·7	507	861	5·20	1435	622	+ 115	99
2·60	3·0	288	864	1·4	617	864	6·50	1392	754	+ 139	96
3·00	3·1	276	855	1·2	712	855	7·50	1334	833	+ 121	92

FROM THE ABOVE WE HAVE

Ratio of pitch to diameter.	Thrust speed or ship's speed.	Speed of screw.	Difference of ship and screw speed.	Value of negative and positive slip.
·25	216	181	35	19 per cent. negative.
·50	276	253	23	9 do. do.
1·00	360	360	0	0 neutral.
2·60	507	622	115	18 do. positive.
2·50	617	754	137	15 do. do.
3·00	712	833	121	14 do. do.

No. II.

Table of Results from Experiments made by Propelling a Screw at same Velocity, but with varying Pitch.

Ratio of pitch to diameter.	Moving force in pounds.	Uniform velocity of moving force in feet per min.	Free moving power used.	Thrust obtained in pounds.	Acquired velocity of thrust in feet per minute.	Power developed.	Pitch in inches.	Revolutions of screw per minute.	Forward pitch speed of screw in ft. per min.	Difference between thrust and screw speed.	Revolutions of helixometer wheel per minute
	lbs.			lbs.							
·2	·5	360	180	1·0	180	180	·5	1740	72·5	— 107·5	120
·4	1·0	360	360	1·0	180	360	1·0	1740	145·0	— 45·0	120
·6	1·5	360	540	2·0	270	540	1·5	1740	217·0	— 53·0	120
·8	2·0	360	720	2·4	300	720	2·0	1740	290·0	— 10·0	120
1·0	2·5	360	900	2·5	360	900	2·5	1740	360·0	——	120
1·2	2·6	360	936	2·4	390	936	3·0	1740	435·0	+ 45·0	120
1·4	2·8	360	1008	2·3	438	1008	3·5	1740	507·0	+ 69·0	120
1·7	3·1	360	1116	2·0	558	1116	4·2	1740	609·0	+ 51·0	120
2·1	3·2	360	1152	1·7	679	1152	5·2	1740	754·0	+ 75·0	120
2·5	3·5	360	1260	1·5	840	1260	6·5	1740	942·0	+ 102·0	120
3·0	3·7	360	1332	1·4	951	1332	7·5	1740	1087·0	+ 126·0	120

No. III.

Table of Results from Experiments made by Propelling a Screw of same Pitch at different Velocities.

Ratio of pitch to diameter.	Moving force in pounds.	Velocity of moving force per minute.	Free moving power used.	Thrust obtained in pounds.	Acquired velocity of thrust in feet per minute.	Power developed.	Pitch in inches.	Revolutions of screw per minute.	Forward pitch speed of screw in ft. per min.	Difference between thrust and screw speed.	Revolution of helixometer wheel per minute.
	lbs.			lbs.							
·5	·4	297	207·0	1·3	160	207·0	1·25	1435	149	— 11	99
·5	1·25	360	450·0	2·0	225	450·0	1·25	1740	182	— 43	120
·5	1·70	504	857·0	2·8	306	857·0	1·25	2436	253	— 53	168
1·0	1·50	297	445·0	1·5	296	445·0	2·50	1435	302	+ 4	99
1·0	2·50	360	900·0	2·5	360	900·0	2·50	1740	362	+ 2	120
1·0	3·10	504	1562·0	3·1	504	1562·0	2·50	2436	507	+ 3	168
2·0	2·50	297	742	1·4	532	742·0	5·20	1435	622	+ 90	99
2·0	3·40	360	1224	1·9	644	1224·0	5·20	1740	754	+ 110	120
2·0	4·60	504	2016	2·5	807	2016·0	5·20	2436	1039	+ 232	168

No. IV.

Table of Results from Experiments made by the Propulsion of a Screw at increased Velocities.

Ratio of pitch to diameter.	Ratio of velocity.	Velocity of moving force per minute.	Moving force in pounds.	Free power used to overcome resistance.	Ratio of Power.	Revolutions of wheel per minute.
·8	1	180	·5	90	1	60
·8	2	360	2·0	720	8	120

On referring to Table II. another feature of the screw presents itself. In this table a uniform velocity is maintained in the screw under a varying pitch; and it seems that a screw may have a pitch that developes the greatest thrust under that uniform velocity, this is when the pitch is equal to the diameter of the screw. And it is also remarkable that the same phenomena as to slip is exhibited in this series of experiments as was observed in the first series, Table No. I.

Again, on referring to Table No. III., where the same pitch is maintained under increasing speeds, the remarkable fact again comes out, that, when the pitch is equal to the diameter, the greatest thrust is obtained at all speeds, as is evident from the greater remoteness of the thrust curve from the horizontal or pitch-line belonging to that pitch. Also, the same phenomena as to slip take place at all the velocities.

Admitting, as shown by the experiments, that the pitch of a screw should be equal to its diameter, there is, in the case of actual propulsion, an adaptation that requires to be made between the vessel to be propelled and the engines and screw propelling her: the vessel must be adapted to the engine and screw, as well as the engine and screw to the vessel; and this adaptation is effected when the velocity of the resisting zone of the vessel is the same as the acquired velocity of the thrust, generated by the transmission of the free or effective power of engines into the screw; or, in other words, the vessel must be of such resisting properties as will allow the engines to attain the same speed as if they were generating and sustaining a vertical column of water by the action of the screw; in fact, the vessel just takes the place of the vertical column of water; but as that column can offer no resistance, except that of its own weight, so the vessel should offer an equal resistance when the speed is attained.

It will be admitted as a theoretical fact that if a power be applied to overcome a resistance, and if the velocity of the moving force be the same as the velocity of the resisting force, the forces themselves must also be equal.

Now, when the pitch of the screw on the machine is set to be equal to its diameter, under such circumstances the pitch speed is the same as the speed of the driving handle of the machine; that is to say, there is no slip, as has already been shown. Here, then, we have two things equal to the same thing; therefore, according to the axiom, these must also be equal to each other; for we have the velocity of the handle or moving force equal to the pitch speed, and also the calculated velocity of the thrust equal to the pitch speed; therefore the velocity of the moving force is equal to the velocity of the resisting force, and if the velocities are equal the forces themselves must also be equal; and so the experiment shows, for the indices of the moving and resisting forces both keep steadily at the same intensity of force on the two scales. This, we think, is satisfactory of the general accuracy of the machine, as well as proving that the mode of investigation adopted is sound.

Table and diagram No. IV. is intended to illustrate the resistance which a screw suffers at increased speeds.

On propelling the screw at any velocity, call it 1, we find the various indices show a given resistance, as is noted in the table. For instance, the moving force employed as shown in the index is ·5 lb., with a velocity of 180ft. per minute, which shows a propelling power in action of 90ft.-lb. Now, if we double the speed, the moving force, as shown on the index, is 2 lb., with a velocity of 360ft. per minute, which shows a propelling power in action of 720ft.-lb., or eight times the power used in the first experiment, for $90 \times 8 = 720$.

It thus experimentally appears that, before we can double a speed eight times, the power must be in action. There is no evading of this; for, if we attempt to propel the screw in the second experiment with less power, a diminution of speed soon shows itself on the speed index, and we can only regain our double speed by again expending our eight-fold power.

But, although there is an eight-fold power required to be in action before a double speed can be attained, it must not be understood that eight times the power is required to be expended to propel a vessel at double speed from one port to another. Only four times the power is required for that purpose, because the run is accomplished in half the former time.

It appears, then, that, in consideration of time, the power required to propel during that time varies as the cube of the velocities, but in consideration of distance the power required to propel through that distance varies only as the square of the velocities, though in both cases eight times the power requires to be in action during the accomplishment of the distance, as well as during the period of time.

We think the overlook of this simple fact has led to great misunderstanding, and has tended to mystify the subject in the hands of many able persons.

These are the only remarks that require to be made on the subject of the law of resistance. On seeing the machine in action all will be clear, though, I am afraid, some indistinctness in the first place will be the result of perusing this paper.

P.S.—Any one of the experiments in any of the tables can at once be shown by merely adjusting the indices, and regulating the beat of the time-keeper.

IRON FURNACES IN AND OUT OF BLAST

IN THE UNITED KINGDOM OF GREAT BRITAIN

ARRANGED UNDER THE DIFFERENT DISTRICTS.

FIRST WEEK IN JANUARY, 1862.

(*From Mr. Samuel Griffith's Staffordshire Iron Trade Circular.*)

MANUFACTURE OF PIG IRON IN GREAT BRITAIN.

We present our readers with statistics, carefully compiled, of the number of blast furnaces in the kingdom, showing how many were in and how many out of operation at the commencement of this year. In examining these lists two questions will at once occur to the reader. The first is, the increase or decrease as compared with previous years.

To facilitate this inquiry we have compiled a table, showing the number of furnaces in blast in each of the last six years, and reaching a period—the beginning of 1857—when the iron trade was active, and when none of the depressing influences existed which have since come into operation—the commercial crisis of the autumn of that year, the Indian mutiny, and lastly, but greatest of all, the American civil war. One element must be kept in view in drawing any inferences from these tables. It must be remembered that they represent, not the actual make of iron, but the number of furnaces in which it has been made. The production of each furnace is a most variable and uncertain element, but we may safely say that the tendency of improvements in the manufacture of pig iron is to increase the make of each furnace; and that when new furnaces are built they are, in most cases, constructed so as to be capable of producing a greater amount of iron than those previously in existence. Hence a decrease in the number of blast furnaces does not represent an equally large decrease in the yield.

Taking the figures *cum hoc grano salis* we find that there are now fewer blast furnaces in operation than during any of the five preceding years. As compared with last year there are 32 less, 79 fewer than in January, 1860; a decrease of 84 from the number in 1859, of 94 as compared with 1858, and 89 less than 1857. This is, undoubtedly, a great falling off, and though from the increased make per furnace the diminution in the pig iron made is of less amount than the decrease in the number of furnaces in blast, the production of iron must still be considerably less than in previous years.

Looking at the districts from which the decrease arose we find that it is mainly due to two—South Staffordshire and Worcestershire and South Wales. Comparing 1862, the year of the least, with 1858, that of the greatest number of furnaces in operation, we find a decline in the case of South Staffordshire and Worcestershire of 45 furnaces, or 30 per cent. In South Wales the decline in the same periods was 40 furnaces, or more than 24 per cent. In Scotland there is a decline as compared with 1859 and 1861, but of not nearly so large an amount; and Shropshire, Derbyshire, and the Forest of Dean also show a slight diminution.

The decreased production of South Staffordshire is easily accounted for. The scarcity, and consequent cost of its iron ores, and its distance from any port, incapacitate this district from competing successively with other iron-producing localities in the production of the cheaper kinds of iron in which the raw material—the pig iron—forms a very large proportional element as compared with the cost of manufacture. Hence its mills and forges being mainly employed to produce iron of better quality and more expensive manufacture, the quantity of pig iron used, in proportion to the value of the finished iron produced, is less. Again, the hæmatite pig iron of the Lancashire and Cumberland district forms a most valuable mixture with South Staffordshire iron, and is very largely consumed in the district. The table shows a very large increase in the number of furnaces making this iron, and the new furnaces in that district are of extraordinary capacity, some yielding as much as 400 tons per week.

The decrease in the make of South Wales is mainly due to the growing competition of the Cleveland district in the production of railway and other kinds of iron. It is true that the number of blast furnaces in the north-eastern counties does not show an increase, but these include the smaller furnaces in Yorkshire; and there has been an undoubted increase in the production of iron on the Tees, whilst its improved quality has made that district a very powerful rival to South Wales.

The yield of pig iron for the year 1861, and the quantity of coal, iron, ore, and limestone employed in its production, forms another question of considerable interest. Applying to the figures given below—the most trustworthy estimates we are able to form—we make the pig iron produced last year in Great Britain 3,972,280 tons; or, in round numbers, 4,000,000 of tons. Of this aggregate yield England produced 2,046,720 tons; Wales, 958,360 tons; and Scotland, 967,200 tons. Taking the separate districts, we estimate the year's make in Staffordshire and Worcestershire at 919,620 tons, of which North Staffordshire contributed 161,460 tons; Northumberland, Durham, and the Stockton and Darlington district, 527,100 tons; Cumberland and Lancashire, or the hæmatite district, 167,440 tons; Shropshire, 148,720 tons; Derbyshire, 114,440 tons; Forest of Dean, 23,400 tons; Northamptonshire, 27,300 tons; and Wiltshire, 14,040 tons.

To make this prodigious quantity of iron there would be consumed by the blast furnaces about 12,000,000 tons of coal, 9,000,000 tons of ironstone, and about 3,000,000 tons of limestone.

Supposing the whole of the furnaces now in existence to have been in blast the produce for a year would be nearly 6,500,000 tons of pig iron, which would require for its production nearly 20,000,000 tons of coal, 14,000,000 tons of ironstone, and nearly 5,000,000 tons of limestone.

If the streams of molten iron which flow from all the blast furnaces in the kingdom were united they would equal the flow of a great river; and, if discharged from a crater, they would rival the volcanic torrents of lava which are belched forth from the fiery mouths of Vesuvius.

Proprietor's Names.	Names of the Works.	Gross No. of Furnaces.	In Blast.	Out of Blast.
Wolverhampton and Buston District.				
Addenbrookes, Smith, and Pidcock	Rough Hay	3	2	1
Aston, Isaiah and Co. ..	Wolverhampton	3	1	2
Bagnall, John and Sons ..	Capponfield	3	2	1
,, ,, ..	Gold's Green	3	2	1
Baldwin, William, and Co.	Boveneux	3	0	3
Bennitt, William, Esq. ..	Oldbury	4	4	0
Blackwell and Co.	Bilston New	5	0	5
Chillington Company ..	Chillington	4	2	2
,, ,, ..	Moseley	3	0	3
,, ,, ..	Bentley	2	2	0
Colbourn, J. and Sons ..	Horsley	4	3	1
Cresswell, E. and Sons ..	Tipton	2	2	0
Davies, Bloomer, and Co.	Pelsall	3	2	1
Fryer, William F., Esq. ..	Hatherton	2	1	1
Fletcher, Solly, and Urwick	Willenhall	3	3	0
Griffiths, Samuel	Bilston Brook	3	2	1
Gibbons, Benjamin	Millfields	4	4	0
Groucutt and Sons ..	Broadwaters	3	3	0
Hopkins, John and Son ..	Dudley Port	2	2	0
Haines, J. and H.	Willingsworth	3	2	1
Hickman, G. H. & A. (late)	Stonefield	1	0	1
Jones, David	Herbert's Park	1	0	1
Jones and Murcott	Bilston	5	4	1
Jones, John	Birchills	5	2	3
Lloyds, Fosters, and Co.	Wednesbury Old Park	3	3	0
Mills, Samuel	Darlaston Green	3	3	0
Morris, Thomas	Park Lane	2	1	1
Osier Bed Iron Company	Osier Bed	3	2	1
Onions, W. J and G. ..	Stour Valley	2	2	0
Parkfield Company	Parkfield	5	4	1

PROPRIETOR'S NAMES.	NAMES OF THE WORKS.	Gross No. of Furnaces.	In Blast.	Out of blast.
Pemberton, Samuel	Deepfields	3	0	3
Perry, F. C. (late)	Roughwood	3	0	3
Roberts and Co.	Tipton Green	4	3	1
Shale and Fowler	Barbor's Field	2	0	2
Sparrow and Co.	Stow Heath	2	2	0
Thorneycroft, G. B. Co.	Bradley New	4	0	4
Thompson, G. and Co.	Crook Hay	2	2	0
Turley, J. and T.	Coseley	3	2	1
Williams P. and Sons	Wednesbury Oak	3	2	1
,, ,,	Union Westbromwich	3	2	1
Williams Brothers	Birchills	2	0	2
Ward, William and Sons	Priestfields	3	2	1
,, ,,	New Priestfields	2	1	1
Whitehouse, H. B.	Priorfields	3	2	1
		128	75	53
Dudley District.				
Blackwell and Co.	Russell's Hall	5	1	4
Bradley, John and Co.	Shut End	4	2	2
Badger, T. and I.	Old Hill	2	0	2
Cochrane and Co.	Woodside	3	2	1
Dudley, Earl of	Coneygre	3	2	1
,, ,,	Level	3	3	0
Dawes, W. H.	Withymoor	2	2	0
Evers and Martin	Park Head	2	1	0
Firmstone, W. and G.	Oak Farm	2	1	1
,, ,,	Lays	3	2	1
Griffiths, Samuel	Old Windmill End	3	2	1
Grazebrook, M. and W.	Netherton	2	1	1
Gibbons, B.	Ketleys	3	0	3
,, ,,	Corbyn's Hall, New	4	2	2
Hall, Holcroft, & Pearson	Brettle Lane	2	1	1
,, ,,	Old Level	2	1	1
Haden, William	Dixon's Green	1	0	1
Hingley, Noah and Sons	Netherton and Dudley Wood	6	3	3
Mathews, William	Corbyn's Hall	4	2	2
New British Iron Company	Corngreaves	6	3	3
		62	33	29
Shropshire.				
Botfield, Beriah, Esq., M.P.	Dark Lane	2	1	1
,, ,,	Hinkshay	2	1	1
,, ,,	Langley Field	1	0	1
Coalbrookdale Company	Dawley Castle	2	2	0
,, ,,	Horsehay	2	0	2
,, ,,	Lawley	1	1	0
,, ,,	Lightmoor	2	1	1
Foster, W. O., Esq., M.P.	Madeley Court	3	2	1
Ketley Iron Company	Ketley	2	1	1
Lilleshall Iron Company	Lilleshall	8	7	1
Madeley Wood Company	Madeley Wood	3	3	0
Old Park Iron Company	Old Park and Stirchley	4	3	1
		32	22	10
Forest of Dean.				
Cinderford Iron Company	Newnham	4	2	2
Forest of Dean Iron Co.	Park End	2	1	1
Gibbons, Benjamin	Soudley	2	0	2
Ebbw Vale Company	Oakwood	1	0	1
		9	3	6
North Staffordshire District.				
Fenton Park Iron Co.	Fenton Park	2	2	0
Granville, Earl of	Shelton	8	7	1
Heathcote, J. Edensor	Apedale	4	3	1
Heath, Robert, Esq.	Biddulph Valley	3	3	0
Kinnersley, T., Esq., Trustees of late	Clough Hall (One other about to blow in.)	4	2	2
North Staffordshire Coal & Iron Company, limited	Talk-o'-the-Hill	2	0	2
Sparrow, W. H. and Son	Longton, Lane End	3	2	1
Silverdale Company	Silverdale	4	2	2
Williamson, Brothers	Goldendale	4	2	2
Stockton and Darlington District.		34	25	11
Bolckow and Vaughan	Cleveland	9	9	0
,, ,,	Middlesboro'-on-Tees	3	2	1
,, ,,	Witton Park	4	3	1
Bell, Brothers	Port-Clarence-on-Tees	6	5	1
Bronkburn Iron and Coal Company	Morpeth, Northumberland	1	0	1
Beasley, Joseph, jun.	Haltwhistle	1	0	1
Cochrane and Company	Ormesby Ironworks, Middlesborough-on-Tees	4	3	1
Clay Lane Iron Company	Clay Lane, Eston	3	2	1
Derwent and Consett Iron Company, limited	Consett (One of these partly down.)	18	4	14
Gilkes, Wilson, Pease and Company	Tees Ironworks	5	3	2
Holdsworth, Bennington, and Company	Stockton-on-Tees	3	2	1
Hopkins and Company	Tees Side	2	2	0
Irwin, Thos. R., Esq.	Bedlington, Sunderland	2	0	2
Jones, Dunning, and Co.	Normanby	2	2	0
The Most Hon. Frances Anne, Marchioness of Londonderry	Vane and Seaham Ironworks	2	0	2
Samuelson, B. & Company	South Bank Furnaces	3	3	0
South Durham Company	South Durham	3	2	1
Union Bank, Harecastle	Hareshaw	3	0	3
Weardale Iron Company	Tow Law, Weardale	5	3	2
,, ,,	Stanhope, Weardale	1	0	1
Warners, Lucas, & Barrett	Norton Furnaces	3	2	1
Whitwell, Wm., & Company	Thornaby	3	0	3
	Albert Works, Hinderwell	1	0	1
Newcastle-on-Tyne District.		87	47	40
Birtley Iron Company	Birtley Ironworks	3	2	1
Bell, Brothers	Wylam	1	1	0
Bell, Hawkes, and Co.	Wear	1	1	0
Jarrow Iron Company	Jarrow	4	2	2
,, ,,	Wallsend	2	1	1
Losh, Wilson, and Bell	Walker	5	2	3
Morrison, James	Ferry Hill	3	2	1
Pattinson, H. L. and Co.	Felling	2	0	2
Washington Chemical Co.	Washington	1	0	1
Lancashire and Cumberland District.		22	11	11
Harrison, Ainslie, and Co.	Newland, Bushbarrow, Duddon, Lorn (Charcoal iron.)	4	1	3
Kirkless Hall Hæmatite Company	Kirkless Hall*	4	3	1
Lonsdale, Earl of	Seaton*	1	0	1
Lewis, Edwin	Harrington*	1	0	1
Schneider, Hannay, & Co.	Ulvers one Hæmatite Ironworks, Barrow (One not yet lighted.)	6	5	1
Whitehaven, Hæmatite Iron Company	Whitehaven Hæmatite Ironworks (One ready for lighting.)	4	3	1
Workington Hæmatite Iron Company	Workington Hæmatite Works	6	2	4
West Cumberland Hæmatite Iron Co., limited	West Cumberland Hæmatite Ironworks	4	0	4
Yorkshire District.		30	14	16
Bowling Iron Company	Bowling	6	5	1
Beale, S. and Co.	Holmes	2	2	0
,, ,,	Parkgate	1	1	0
Coopers and Co.	Worsbro' Dale	1	0	1
Dawes, W. H. and G.	Elsecar, near Barnsley	3	2	1
,, ,,	Milton, near Barnsley	2	2	0
Farnley Iron Company	Farnley	4	3	1
Hird, Dawson, and Hardy	Low Moor	9	6	3
A. Harding and Co.	Beeston Manor (Cold blast.)	2	2	0
Newton, Chambers, & Co.	Chapeltown	2	0	2
,, ,,	Thorncliffe	2	2	0
Whitby Iron Company	Beck Hole	2	0	2
		36	25	11

* These Works have been used of late years for the rolling of iron and the manufacture of tin plates.

PROPRIETOR'S NAMES.	NAMES OF THE WORKS.	Gross No. of Furnaces.	In Blast.	Out of blast.
Northamptonshire.				
Butlin, Thos. and Co.	East End, Wellingbro'	1	1	0
S. Griffiths	Heyford	3	2	1
		4	3	1
Wiltshire, &c.				
Chick, George	Pennywell Road, Bristol	1	0	1
Knight, Edwin and Co.	Ashton Vale, Bristol	1	0	1
Sarl and Co.	Seend	2	0	2
Westbury Iron Company, limited	Westbury	2	2	0
		6	2	4
Derbyshire District.				
Appleby and Company	Renishaw	2	1	1
Barrow, Richard, Esq.	Staveley	2	2	0
Butterley Iron Company	Butterley	7	5	2
Beale, Samuel and Co.	Newbold	1	1	0
Clay Cross Company	Clay Cross	3	1	2
Dunston and Barlow Co.	Near Chesterfield	4	2	2
Knowles, John	Brimmington	1	0	1
Mold, W. H.	Alderwasley and Morley Park (Cold blast.)	2	2	0
Oakerthorpe Iron Company	Near Alfreton	2	0	2
Oakes, James and Co.	Alfreton	3	2	1
Rangeley, Henry	Unstone	1	0	1
Stanton Iron Company	Stanton	3	2	1
Whitehouse, H. B. & Sons	West Hallam (One cold blast.)	3	2	1
Wingerworth Iron Co.	Wingerworth	3	1	2
		37	22	15
South Wales District.				
Aberdare Iron Company	Abernant, Glamorgan	3	0	3
,, ,,	Glyn Neath (Average make 300 tons each furnace per week.)	3	0	3
,, ,,	Aberdare	6	5	1
Bailey, Crawshay	Aberamman	3	3	0
Briton Ferry Iron Co.	Briton Ferry	2	2	0
Booker, T. W. and Co.	Pentyrch	2	2	0
Brodgen and Sons	Tondu	2	2	0
Crawshay, William	Cyfarthfa and Ynisfach	11	11	0
Crawshay, Francis	Treforest Iron and Tin Works	3	0	3
Dowlais Iron Company	Dowlais, Glamorgan	18	13	5
Forman, W. H.	Pennydarran	7	0	7
Gadlys Iron Company	Gadlys	4	4	0
Hill, Anthony	Plymouth	10	10	0
Llewellyn and Co.	Banwen	2	0	2
Llynvi Vale Iron Company	Llynvi Vale	4	3	1
Lemon, R. P. and Co.	Maesteg	4	0	4
Parsons, W.	Onllwyn	2	1	1
The English Copper Co.	Cwn Avon, Oakwood	7	3	4
Talbot, T. M.	Cefn Cuse	2	0	2
Vaughan, N.	Venalt	2	0	2
Ystalyfera Iron Company	Ystalyfera	11	5	6
Bailey, Crawshay, Esq., M.P.	Varteg, Monmouthshire	2	0	2
Morgan, W.	Golonos	3	0	3
Bailey, J. and C.	Nantyglo	12	12	0
Blaenavon Iron Company	Blaenavon (A small one for smelting into wrought iron.)	6	5	1
Ebbw Vale Iron Company	Abersychan	6	2	4
	Ebbw Vale	4	2	2
	Pentwyn	5	2	3
	Sirhowy	4	2	2
	Victoria	2	2	0
Levick and Simpson	Blaina	2	2	0
	Cwn Celyn	2	2	0
	Coalbrookvale	2	2	0
Pontypool Iron Company	Pontypool, Monmouthshire (All cold blast.)	4	4	0
Rhymney Iron Company	Rhymney	9	6	3
Roper, R. S. and Co.	Cwnbran	1	1	0
Tredegar Iron Company	Tredegar	9	7	2
Striker, Henry, Esq.	Bryn Amman, Caermarthen	2	1	1
Harrison, Frederick	Trimsaran	2	1	1
Watney, Daniel	Gwendraeth	2	0	2
Bailey, J. and C.	Beaufort, Breckmockshire	7	6	1
Crawshay, Francis	Hirwain	4	0	4
Clydach Iron Company	Clydach	4	0	4
Parsons, William	Abercrave	1	1	0
Ynisceedwyn Iron Company	Ynisceedwyn	6	1	5
Vickerman and Oliver	Kilgetty Ironworks, Pembrokeshire	2	0	2
		210	124	86
North Wales District.				
Brymbo Company	Brymbo, Denbighshire	2	2	0
Cooke, Mr.	Ponkey	1	0	1
Dicken, Dr.	Plas Kynaston	1	0	1
Giller, Samuel	Plas Issa	1	0	1
New British Iron Company	Ruabon	3	1	2
Sparrow and Poole	Frood	2	1	1
Cresswell, Mr.	Rhos Hall, Flintshire (Partly built.)	2	0	2
Coed Talon Company	Coed Talon	1	0	1
Sharpe, T. B. and Co.	Leeswood	2	1	1
		15	5	10

SYNOPSIS OF BLAST FURNACES IN THE UNITED KINGDOM OF GREAT BRITAIN.

DISTRICTS.	Gross No. of Furnaces.	In Blast.	Out of Blast.
Wolverhampton and Bilston District	128	75	53
Dudley District	62	33	29
Shropshire	32	22	10
Forest of Dean	9	3	6
North Staffordshire	34	23	11
Stockton and Darlington	87	47	40
Newcastle-on-Tyne	22	11	11
Lancashire and Cumberland	30	14	16
Yorkshire	36	25	11
Northamptonshire	4	3	1
Wiltshire, &c.	6	2	4
Derbyshire	37	22	15
Total England	487	280	207
South Wales	210	124	86
North Wales	15	5	10
Scotland	175	124	51
Total Great Britain	887	533	354

YIELD OF BLAST FURNACES IN GREAT BRITAIN, 1861.

	No. of Furnaces in Blast.	Make of each Furnace Per Week.	Total Yield Per Annum.
		Tons.	Tons.
Staffordshire	131	135	919,620
Shropshire	22	130	148,720
Forest of Dean	3	150	23,400
Northumberland, Durham, and Cleveland	58	175	527,800
West Riding of Yorkshire	25	80	104,000
Lancashire and Cumberland	14	230	167,440
Northamptonshire	3	175	27,300
Wiltshire	2	135	14,040
Derbyshire	22	100	114,400
Total England	280		2,046,720
South Wales	124	145	934,960
North Wales	5	90	23,400
Scotland	124	150	967,200
Total Great Britain	533		3,972,280

NUMBER OF FURNACES IN BLAST IN GREAT BRITAIN,

At the Commencement of each of the following Years.

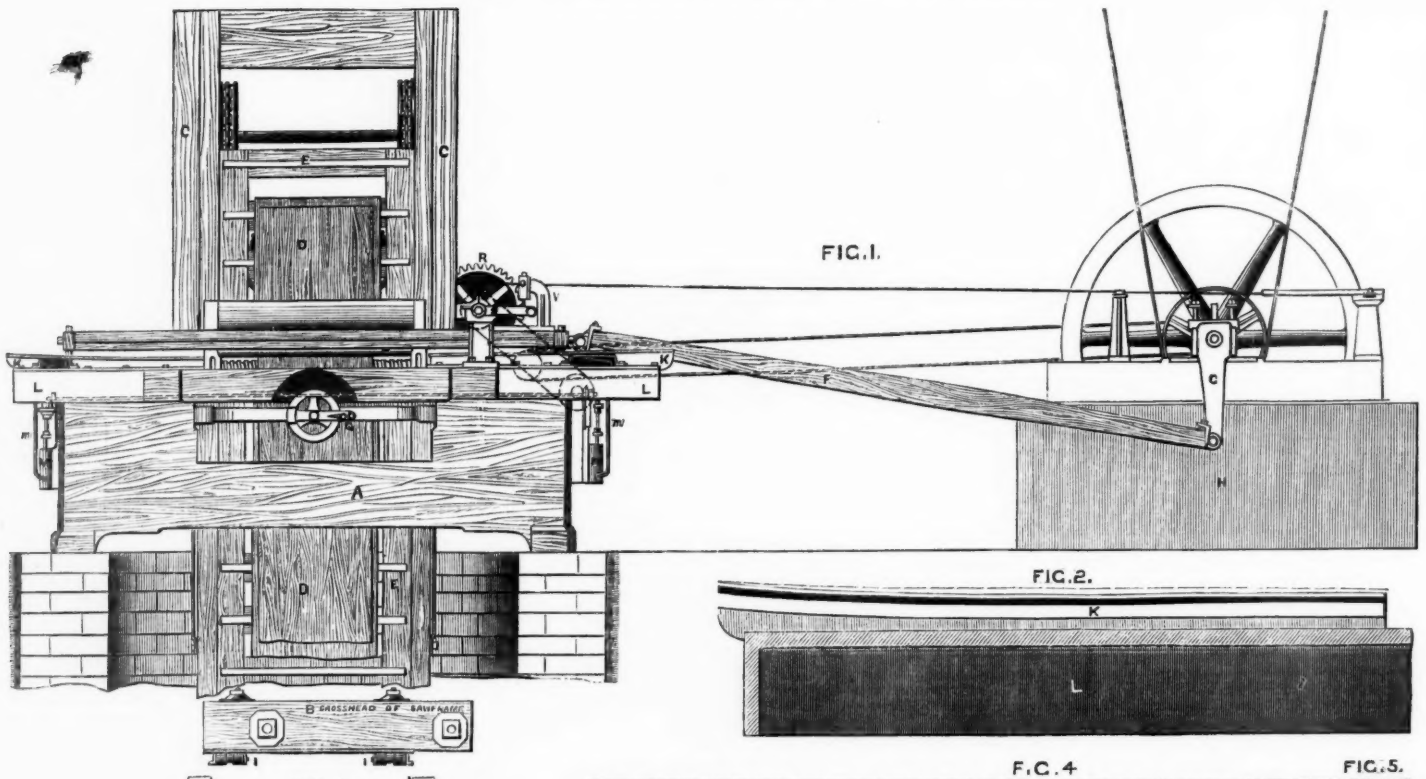
DISTRICTS.	1857.	1858.	1859.	1860.	1861.	1862.
South Staffordshire & Worcestersh.	147	153	147	135	114	108
North Staffordshire	20	23	22	23	25	23
Shropshire	27	26	25	25	25	22
Forest of Dean	5	5	4	5	4	3
Derbyshire	26	25	28	27	17	22
Northumberland, Durham, & York-	94	89	94	99	78	83
Northamptonshire [shire		3	3	3	3	3
Wiltshire		1	2	3	4	2
Total England	324	333	332	334	289	280
South Wales	162	164	147	147	139	124
North Wales	9	6	6	6	6	5
Scotland	127	124	125	132	131	124
Total Great Britain	622	627	617	612	565	533

BLAST FURNACES IN SCOTLAND.

NAMES OF PROPRIETORS.	NAMES OF WORKS.	COUNTY WHERE SITUATED.	Gross No. of Furnaces.	In Blast.	Out of Blast.	PORT OF SHIPMENT.
Addie, Robert, Esq.	Langloan	Lanark	6	6	0	Glasgow
Baird, W., Esq.	Gartsherrie	,,	16	13	3	,,
,, ,,	Eglington	Ayr	8	8	0	Ardrossan
,, ,,	Blair	,,	5	4	1	,,
,, ,,	Lugar	,,	4	0	4	,, and Troon
,, ,,	Muirkirk	,,	3	3	0	,, ,,
Bell, Robert, Esq.	Wishaw	Lanark	2	0	2	Glasgow
Coltness Iron Co.	Coltness	,,	9	9	0	,, and Leith
Christie, Alexander, &	Lumphinnans	Fife	1	0	1	Burntisland
Carron Iron Co. [Co.	Carron	Stirling	4	4	0	Grangemouth
Christie, C. and A.	Gladsmuir	Haddingn.	1	0	1	Cockenzie
Dalmellington IrnCo	Dalmellington	Ayr	5	4	1	Ayr
Dunlop, Colin, & Co.	Clyde	Lanark	8	7	1	Glasgow
,, ,,	Quarter	,,	2	2	0	,,
Dixon, Wm. Esq.	Govan	,,	5	3	2	,,
,, ,,	Calder	,,	8	6	2	,,
Forth Iron Company	Forth	Fife	7	4	3	Alloa
Lochgelly Iron Co.	Lochgelly	,,	4	0	4	Burntisland
Merry and Cunning-	Glengarnock	Ayr	9	8	1	Ardrossan & Glas-
,, ,, [hame	Ardeer	,,	5	4	1	,, [gow
,, ,,	Carnbroe	Lanark	6	4	2	Glasgow
Alloa Coal Co. [Co	Devon	,,	3	0	3	Clackmannan
Monkland Iron & Steel	Monkland	Lanark	9	8	1	Glasgow [Troon
Portland Iron Co.	Portland	Ayr	5	4	1	Ardrossan and
Russell, James, & Son	Almond	Linlithgo'	3	2	1	Bo'ness
Shotts Iron Company	Shotts	Lanark	5	3	2	Glasgow & Leith
,, ,,	Castlehill	,,	3	0	3	,, ,,
Stewart, Robert, Esq.	Omoa	,,	4	3	1	,, and Alloa
Wilson, Wm., & Co.	Kinniel	Linlithgo'	4	4	0	Boness
Wilson, J., Trustees	Dundyvan	Lanark	8	3	5	Glasgow
Wilsons and Co.	Summerlee	,,	8	8	0	,, [Troon
	Nithsdale	Ayr	3	0	3	Ardrossan and
	Garscube	Lanark	2	0	2	Glasgow & Bow- [ling
			175	124	51	

UTILISATION OF METROPOLITAN SEWAGE. — Some details were published in last week's ENGINEER with reference to a proposal addressed to the Metropolitan Board of Works on the part of the Metropolis Sewage and Essex Land Reclamation Company. At a meeting of the board on Friday Mr. Wilkinson moved—"That this board assents to the proposal of the Hon. W. Napier and Mr. Hope, representing the Metropolis Sewage and Essex Reclamation Company, in the terms of the communication to the board, provided the grant from the Crown and the requisite authority of Parliament be obtained in the ensuing session, and that the solicitor of the board do see that all the necessary clauses are inserted in the bill to convey the necessary authority to the board."—Mr. Carpmael seconded the resolution, and said the persons making the proposition proposed to use the sewage in the irrigation of the land, provided the assent of Parliament and this board was previously obtained. They believed that the sewage of the metropolis was a valuable property, and if they succeeded they would pay them a percentage for it; but if they failed this board would not be called upon to pay a single farthing towards the construction of the works. Therefore he did hope that the board would at once give the company this concession, and so enable them to go to Parliament and ask for powers to carry their scheme into effect.—Mr. Doulton said his opinion on the general question would be in accordance with those of the mover and seconder of the resolution; but, at the same time, he thought it would at present be impolitic on the part of the board to take the course now proposed, which might bear the appearance of favouritism. Other parties had applied to this board for similar powers to those now sought to be given, and it was only on the 16th of November last that Mr. Pollard, the clerk to the board, sent a letter to other parties requesting them to be good enough to supply a map and sections, showing the intended operations, the level of the surface, and the lines, levels, and sizes of the intended aqueducts, indicating the various kinds of surface soil with which it is prepared to deal, and showing in detail what mode of subsoil drainage it was intended to adopt, with the size, depth, and inclination of the several proposed lines of drainage, together with particulars of the pumping power to be employed, and the nature of the outfall; also a statement of the manner in which it was proposed to work the scheme, what kind of powers will be taken for dealing with the land to be operated upon, how owners and occupiers are to be treated with, what quantity of sewage will be taken daily, over what area of land it will be distributed, and many other particulars in reference thereto. The letter was sent only two months ago, and all he asked them to do was that, as persons were engaged in preparing that information, they should wait until that was laid before them, which they themselves by their own officer had asked for. He was not in favour of any particular scheme; but he was opposed to the board committing itself to any particular plan until the fullest information as to other plans was obtained. He moved as an amendment that all the documents and report of the committee be printed and placed in the hands of members, and that the subject be adjourned for a month.—Mr. Alderman Lawrence seconded the amendment.—Mr. Robinson supported the amendment, believing that the irrigation of 20,000 acres of land with sewage could not fail to create a nuisance; and he hoped that they would confine themselves to so much of the subject as referred to the metropolis, with which alone they had to deal.—Mr. Bidgood said he did not see what the board had to do with the scheme at all, for, if they were to assent to it, it would at once be put prominently forward that the Metropolitan Board of Works had agreed to it, and persons might be induced to part with their money in consequence. He therefore urged the board to be very cautious in giving their assent to any scheme, but let the whole of them go to Parliament and ask for compulsory powers on the Metropolitan Board of Works to let them have the sewage.—Mr. Bennett said there was an opinion among the public that this sewage was valuable, and, if that was so, it was impossible that they could give away what was the property of the ratepayers, and could be used for their advantage. Mr. Hughes gave it as his opinion that if ever there was a scheme calculated to create a nuisance more than another, this was one, as it was proposed to spread over a sandy soil a thickness of sewage which would pollute the air with malaria, and would affect such towns as Maldon, Chelmsford, Southend, Gravesend, Dartford, and many other places, until it finally reached the metropolis. Sand would not imbibe ammonia, and indeed it was intended to form a soil on the top of the sand of the sewage of the metropolis until it should reach a depth of 10in. which must be most pernicious to the surrounding neighbourhood. As to the scheme, he believed it was altogether impracticable; it was an interference with nature and the boundary of the coast, and, if submitted to Parliament, would be immediately rejected. The amendment was carried by 87 to 18.

GERMAN VENEER-CUTTING MACHINE.



INSTITUTION OF ENGINEERS IN SCOTLAND.

December 11th, 1861.

DESCRIPTION OF A GERMAN VENEER-CUTTING MACHINE.*

For upwards of thirty years veneer-cutting machines, somewhat resembling that about to be described, have been in use at Hamburgh, and in other continental localities; but, as might be expected, that interval has not passed without numerous improvements in details having been gradually embodied in its construction and working. At different times single machines have been introduced into this country, the state of perfection of each corresponding more or less with the period of its introduction. During the summer of last year a veneer-cutting establishment was opened at St. James's Road, Glasgow, by the Hamburgh firm of Prale and Balheimer.

One of these machines is represented in Fig. 1, being a front elevation, and Figs. 2 to 6 enlarged views of separate details. A massive rectangular wooden bench, A, forms the main framework or basis of the machine, and the saw frame, B, works immediately over and along the front of this bench. A rectangular opening is formed in the centre of the top of the main bench to receive the log frame, C, which consists of an upright wooden framework, having fixed to it a horizontal rectangular frame of iron, by which it rests upon guides at the sides of the bench opening; means to be afterwards described being provided for shifting it backwards or forwards. The wood log, D, to be cut into veneers, is attached to a slide, E, arranged to work vertically in guides in the lateral uprights of the log frame, C; and this slide is counterbalanced by means of chains passing over pulleys in the head of the log frame to suitable weights. The log slide, E, is raised as the sawing proceeds, by means of a rack and pinion driven from the feed movements. A straight saw blade is used, being stretched in a frame, B, of the ordinary construction, consisting of a stile with cross-heads at each end and a back tension rod; and the frame is made to reciprocate by a crank, G, and connecting rod, F, the crank shaft being carried upon a separate block, H, situated to one side. The saw frame, B, is peculiarly guided; each of its cross-heads has attached to its under side, as shown in Fig. 3 two small swivelling sliders, I. These project horizontally in, opposite directions into small square grooves, J, formed in the inside vertical faces of the guides, K, which are bolted down to a cast-iron plate, L, fixed along the front of the bench, A. The guiding grooves, J, are not straight, but curved slightly upwards from their inner ends towards the opposite outer ends, and by this ingenious contrivance a twofold advantage is obtained. The saw is made to do an equal amount of work in both directions of its motion, whilst the upward feed of the log is continuous, and the saw cuts inwards towards the centre from both edges of the log, and has in consequence much less tendency to break through the veneer near the edges when the wood is brittle. Another important feature of the saw-frame guides, K, is the provision for lubricating them. Lubrication by hand or by ordinary appliances must be somewhat in excess to insure efficiency; and, as a consequence, the oil is thrown about by the rapid motion and injures the veneers. In this machine the lubricating oil is put into small brass cylinders or pumps, M, one for each guide, and communicating with about the middle of it by a small tube, *m*. Each cylinder or pump, M, is provided with a piston which is gradually screwed down by a movement derived from the feed motion of the machine, and this feeding action of course only takes effect whilst the saw-frame, B, is in motion. The supply of oil is by these means accurately adjusted to the requirements, and there is no waste, nor is any thrown about. The inner guides, K, sustain the severer strain and consequently require freer lubrication, to meet which the cylinders, M, communicating with these guides, were made somewhat larger than the others. The saw blade, *b*, Fig. 4, is placed vertically with its teeth directed downwards. It will be understood that the teeth are shaped to act similary in both directions; in side view they resemble lancet points projecting at short intervals from a straight edge; they are very slightly set, alternately to opposite sides.

The thinness and elasticity of the saw-blade require that it should be very firmly guided; and to this end it is made to work upon the inner vertical face of a guide, N, shown in inside elevation in Fig. 4, which is knife-shaped in cross section as shown in Fig. 5. The knife edge of this guide, N, is directed downwards, and the saw teeth project just sufficiently below its bottom edge to take the cut, whilst the veneer which is being cut comes away on the outside of the guide, just as though it was being cut by the guide, which from its shape, position, and apparent office, is in fact termed the knife. Perhaps the most elegant contrivance in the entire machine is a recent improvement in the shape of this knife, N, and which has yet to be described. Instead of the guiding surface upon which the saw blade runs being straight, a slight convexity inwards is imparted to it. It is practically impossible to stretch a thin steel band so tightly that it will not buckle or bend out of the straight line when subjected to varying strains. A very little lateral strain will make it move slightly out of the straight line; but, if it is by any means kept slightly out of that line, it will require a much larger proportionate strain to make it recede still further from it. Thus the saw-blade, being already stretched over a curved surface, cannot be made to spring from that surface with anything like the ease with which it would spring from a flat surface, being equally stretched in both cases. In a knife 33in. long the convexity is about $\frac{1}{16}$ths of an inch, the length of the saw-blade being 6ft.; but the amount of convexity varies in different cases.

These various contrivances permit of a very thin saw-blade being used, and as the saw removes from between each veneer, and wastes a thickness of wood at least equal to its own thickness, a reduction in the thickness of the saw-blade involves a direct diminution of the waste. Specimens of the veneers cut by these machines are on the table. It is common for them to obtain from fourteen to twenty veneers of a moderate thickness from the inch of wood, but as many as thirty-six can be got from the inch if required; the veneer is, however, in this last case rather too thin for satisfactory use. To show how refinement in one part of a machine leads to, and, in fact, necessitates an equal refinement in other parts, it may be mentioned that the full advantages of these machines cannot be realised with the saw-blades in the state in which they are received from the makers. In appearance the blades are well made and finished, and the surface seems smooth and the thickness uniform. It is, however, found to be absolutely necessary to pass them through a special machine, whereby their surfaces and thickness are, by a planing process, rendered sufficiently true and uniform. In the case of resinous woods the heat caused by the sawing action is apt to soften the resinous matter, and very much increase the frictional resistance to the saw-blade. To overcome or lessen this difficulty when it occurs a lubricant is applied to the saw-blade, and the one found most suitable is a solution of salts of lemon or oxalic acid.

The thickness of the veneer is determined by what may be termed the wood guide, P, Figs. 4, 5, and 6, and which is situated immediately below the knife or saw guide, N. This wood guide, P, consists of a wooden block having its inner face slightly inclined, and formed with dovetail grooves to receive a series of wedges, *p*, the inner faces of which serve as guides for the front of the wood-log, D. Prior to each cut the log is lowered until its upper end is just below the saw, and it is then drawn forward against the guide just described, by means of a screw spindle worked by a handle, Q, in front. This screw spindle is tapped through a front horizontal bar, connecting the two sides of the iron frame, by which the log frame, C, rests on the bench; and of course the entire log frame, with its vertical slide, E, and the log, D, upon it are brought forward. The upward feeding motion applied to the log slide is contrived so as not to be interfered with by the backward or forward shift, the pinion in gear with the rack of the slide, E, being on a spindle carried by the log-frame, C, and this spindle having fast on it a large spur-wheel in gear, with a pinion, R, on a shaft, S, mounted in fixed bearings at the side, whilst this last pinion is moved along its shaft by an arm attached to the log-frame. The shaft has fast at one end a worm-wheel, T, which is driven by a worm carried in a frame or arm, V, contrived so that it can be turned out of gear from the worm-wheel without disengaging any other part. When a cut is completed the attendant, after removing the veneer, has simply to throw the feed-worm out of gear, to wind down the log, D, by means of a handle on the other end of the worm-wheel shaft, S, to screw forward the log up to the wood guide by means of the handle, Q, and throw the feed-worm into gear again. It is quite unnecessary to stop the motion of the saw itself. The feed-worm is driven from the crank shaft by means of a pair of stepped pulleys and belt, permitting of the rate of feed being varied. The motion for screwing down the lubricating pumps is taken from the worm wheel shaft, so that, when this shaft is thrown out of gear, the supply of oil ceases.

The ordinary rate of working of these machines is 300 revolutions of the crank shaft per minute, but in consequence of the great attention paid to the securing of firm and massive foundations and frame-work, and to the accurate adjustment of the working parts, the tremor produced is barely perceptible.

* From the Transactions of the Institution of Engineers in Scotland.

The Great Eastern and Mr. Towle.—The passengers who were on the Great Eastern on her last disastrous passage, have transmitted a valuable gold watch to Mr. Towle, the American engineer, who rendered such invaluable assistance in arranging temporary steering gear on that occasion. But for his services the ship might have been lost. The Great Ship Company have not recognised his services in any manner.

TO CORRESPONDENTS.

Vol. xi. of THE ENGINEER *can now be had from the office, price* 18s.

*** *Covers for binding the volume can be had from the publisher, price* 2s. 6d. *each.*

*** *We must request those of our correspondents who desire to be referred to makers of machinery, apparatus, &c., to send their names and addresses, on which, after publishing their inquiries, we will forward any letters we may receive in answer. Such answers, published to catch the eye of an anonymous querist, are in most cases merely advertisements, which, we are sure our readers will agree with us, should be excluded as much as possible from this column.*

ANTIPODES.—*We have answered a similar query below.*

R. S.—*We know of none. Your best course is to advertise.*

J. M. A. R. (Manchester).—*We cannot call to mind any such improvements.*

ALEXANDER.—*We find no patent taken out at any time by Mr. Kidd for gas burners.*

W. B. AND G.—*We think there is no reason to doubt that the sun is fixed in space.*

T. Q.—*We are unable to answer either of your questions. You should apply direct to the Secretary.*

J. B. S. and BROTHER.—*We have no information as to the competition for the Brisbane bridge beyond that already given.*

W. C. T.—*Messrs. Napier, of York-road, Lambeth, make the machinery of which you inquire, and you can apply to them.*

H. G. C.—*The length of the Warrior is generally given as 380ft. Have you referred to our description of the vessel, published a year ago?*

Y. Z.—*Premiums for a youth in a draughtsman's office vary all the way from nothing to 200 guineas. We cannot answer you more definitely.*

X. Y. Z.—*We really know of no forms to which we can refer you. We doubt if there are any at the Institution except those published in various works, which you can as well consult at the free library of the Patent Office, Southampton-buildings, Chancery-lane.*

C. D.—*Had you tried the experiment by accurately measuring your own height on rising and on going to bed, you would have found that you were somewhat taller in the morning than at night. We have often made such measurements, and find the difference in our own height to average half-an-inch.*

A. M. (Brighton).—*Apply to Henry Cole, Esq., of the Science and Art Department, South Kensington. Write for Mr. Weale's rudimentary treatise on Logarithms. As to the effect of cannon fired when firmly fastened to an unyielding support, it is unquestionably greater than when the cannon is allowed to recoil. We have not yet thought sufficiently over the other matter. Was the feat actually accomplished?*

FALLING BODIES AS AFFECTED BY THE EARTH'S ROTATION.

(*To the Editor of The Engineer.*)

SIR,—If a weight were let fall from the summit of a high tower whose centre line is exactly plumb, the centre of gravity of the weight being in that centre line upon being let loose, would the weight, during its descent, depart from that centre line, supposing it to be free from accidental disturbing causes, such as atmospheric currents, or attraction by any proximate object? M——N.

Perth, 15th January, 1862.

THE FLOW OF WATER.

(*To the Editor of The Engineer.*)

SIR,—Will you or any of your readers answer me the following question, and likewise give the most accurate rule for calculating the "head" of water in feet required to produce a given quantity of water in gallons per minute, through pipes of various diameters and lengths, and of different inclinations?

Required, a head of water in feet necessary to produce 280 gallons per minute, through pipes 7in. diameter and 1,000 yards long, having a total rise of 55ft. T. B——W.

January 9th, 1862.

THE FORCE OF IMPACT.

(*To the Editor of The Engineer.*)

SIR,—A firm of correspondents in your last week's number, signing themselves C. and N., wish to be favoured with the rule by which may be known the force of impact of a body, when having fallen through any given height. The rule is as follows:—Multiply the space in feet by 64·4 and the square root of the product will be the velocity acquired in feet, which, multiplied by the weight of the falling body, will give the force of impact.

Taking his question, viz.:—66·25 lb. falling through a space of 35·625in. or equal to 2·96875ft., we have—$\sqrt{2{\cdot}96875 \times 64{\cdot}4} = 13{\cdot}826$, the velocity acquired $\times$ 66·25 = 915·9725 lb. the force of impact. W. R.

Manchester, Jan. 14, 1862.

[*We do not think that impact is comparable with pressure. Our correspondent's rule only gives the momentum of the falling body, and it may occur to him that a weight of 66¼ lb. falling almost exactly 3ft. would produce an effect different from that of 915 lb. or so, at rest.*

MEETINGS NEXT WEEK.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, January 21st, at 8 p.m., renewed discussion "On the Discharge from Underdrainage, &c.;" and, if time permits, "On the Form and Materials for Iron-plated Ships, and the Points Requiring Attention in their Construction." By Mr. JOSEPH D'A. SAMUDA.

SOCIETY OF ARTS.—Wednesday, at 8 p.m., "On the Present Aspect of the Fine and Decorative Arts in Italy, with Special Reference to the Recent Exhibition in Florence." By Mr. DIGBY WYATT.

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THE ENGINEER.

FRIDAY, JANUARY 17, 1862.

THE INSTITUTION OF CIVIL ENGINEERS.

MR. HAWKSHAW has placed the profession under obligations for the excellent address which he delivered, on Tuesday evening last, on taking the chair, for the first time, as President of the Institution of Civil Engineers. So much good sense, coupled with such liberality of opinion and encouraging avowal, is not always heard on like occasions. The tone of the address was one of mingled congratulation upon the past success of our profession, and hopeful augury for the future, the whole tempered by a judicious consideration of the circumstances of, and necessities for, both past and future improvement. Mr. Hawkshaw's own conservative practice, and his established reputation as a safe engineer, preclude all suspicion of un-professional enthusiasm, as well as of hasty admission, on his part, and thus his observations have the additional value—of which they bear their own evidence—that of great breadth of safe application, the result of critical and comprehensive thought, and extensive and successful experience. It was pleasant to listen to the warm expressions of professional devotion, and alike gratifying to hear the engineer, who, it is but right to admit, is now the foremost among us, acknowledging the great extent to which he is constantly becoming indebted, in his practice, to the assistance of others. The increasing scope of the profession was touched upon in suitable terms, and, had we a mind to do so, it would be easy to show how, whether intentionally or no, this increase was shown to be almost wholly in the direction of mechanical engineering.

After touching upon the great progress made in the capabilities of steam vessels, Mr. Hawkshaw noted the present confidence in iron, as a material for line-of-battle ships, the certainty that iron hulls will become foul, and the room yet open for improvement in the construction of armour plated ships. Wooden backing, he thought, would be altogether abandoned, and the armour plates furthermore rendered useful in strengthening the ship, which they do not now do. The present mode of construction, he added, would never answer in the case of vessels intended to act as rams, which should, as nearly as possible, approach the condition of a ship welded up in a single piece.

As to the speed of steam vessels and railway trains, the question was dealt with in its commercial and political bearings, Mr. Hawkshaw expressing his confidence that any speed for which the public could afford to pay could be readily and safely attained. He pointed out that lines of railway might yet be required exclusively for passengers and goods respectively. Land and submarine telegraphy received a share of consideration, and a hopeful view was taken of the ultimate success of long ocean lines. In connection with improvements in ordnance, Mr. Hawkshaw expressed his unqualified opinion that "no plated "ship yet built could keep afloat under the fire of guns "throwing shots of 200 lb. to 300 lb. weight," it being understood, of course, that the weight of gun and charge of powder were in proportion. He doubted, therefore, the possibility of increasing the protection of ships by plating in anything like the proportion of the probable increase in the weight and effect of guns. The modern processes for the cheap production of homogeneous metal and steel, on the large scale, were liberally and hopefully treated. Enough was said, certainly, to induce engineers to keep themselves fully informed of the great progress being made in this branch of manufacture, and to prepare themselves for extensive changes in the application of iron in works of construction. Modern improvements in putting in foundations under water were not overlooked, and the mode of employing iron cylinders, charged with compressed air, was attributed to the late Lord Dundonald. Mr. Hawkshaw had but little encouragement to give to the contrivers who are endeavouring to render us independent of steam, and, upon this point, hardly one in a hundred of the many who will read his address will be likely to differ from him.

The character of modern engineering works, as affected by the wants and means of different communities, was briefly but sensibly dealt with; there was a word of congratulation upon the movement at last to be made to put the banks of the Thames into decent condition, and the address closed with a few sentences, not less truthful than eloquent, touching the higher functions of the engineer—expressions which must have found a hearty response in the minds of all who listened to them, and which will be set down as something more than empty platitudes, to the credit of the gentleman who gave them forth. As a valuable summary of engineering retrospect and prospects, leavened with healthy and kindly sentiment, and clothed in felicitous phrase, Mr. Hawkshaw's opening address will be prized and remembered.

THE FOUNDATIONS OF LONDON.

WITHOUT going down 1,000ft. or so to the gault clay, or even from 200ft. to 300ft. to the chalk, an incision of a few feet in depth, almost anywhere in the semi-plastic crust so well honeycombed by the cellars of the metropolis, is sufficient to show varied and extensive geological phenomena. Stable enough, perhaps, if left as nature has left it, the metropolitan sub-soil is treacherous ground when gashed for the works of the engineer and builder. We do not know that the "faults," the interstratial slipping surfaces, the quicksands, "potholes," and other weak spots of sub-London, have ever been approximately mapped out, as on a geological chart, but we should think that, by this time, *data* sufficient for such a representation had been collected. The engineers and architects of former times must have had their share of trouble in putting in foundations in London, and even almost upon the spot where,

"Though you walk the city round
"This is still the highest ground,"

Sir Christopher Wren found a pit or "pot hole," in which he was compelled to sink a brick well to carry one corner of the chancel of St. Paul's Cathedral. In our own times it was but a few years since, in carrying out the London Dock extension, a large part of the neighbourhood in Shadwell came near slipping into the new basin, in a manner which might have led Mr. Brunel to look forward, at the time, to an easy job in launching the Great Eastern. The surface of the London clay was found to rise suddenly at a slope of 1 in 10 from the basin to the High-street, Shadwell, and on this greasy incline a prism 800ft. long, and of considerable width, had started, like the rocks at the undercliff in the Isle of Wight, and, on a miniature scale, like the rocks of the Rossberg, which, more than fifty years ago, carried swift death and ruin into the valley of Goldau in Switzerland. Mr. Rendel soon stopped his excavations, and, after driving a forest of piles into the clay in front of the churchyard of St. Paul's, Shadwell, and connecting these piles by walings at right angles to the basin wall, he started that work on piers of concrete filled into pits of great width and depth, and having the bottoms so stepped as to resist any further tendency to slipping. The ground actually within the dock works was by no means good—8ft. of "made" ground, resting on 6ft. or 7ft. of brown clay, which bore, in turn, upon a bed of peat 6ft. thick, with a thin seam of blue clay between this and a layer of sand, which rested, finally, on the solid London clay, 30ft. below Trinity high-water. On this foundation the house containing the pumping engine settled bodily more than 2ft., and at one time the appearance of the premises suggested the recent occurrence of an earthquake.

Some of our readers will recollect the extensive slip which took place, now twenty years ago, in the New Cross cutting of the then London and Croydon Railway. It was all the fault of the same old London soil—the yellow clay slipping on the blue clay, and great, indeed, was the slip—250,000 cubic yards of clay having to be removed, and the line being obstructed for most of the time from the beginning of November to the middle of the next February. The passenger to Brighton, Dover, or even to the Crystal Palace, may still see the irregular surfaces upon which this avalanche of clay took place. The fall in the tunnel of the Hampstead Junction Railway, and that of the bridges on the North London Railway, were due, we believe, to the same infirmity of the clay. The tunnel, also, of the Metropolitan Railway, under the Euston-road, has cut some of the inclined planes upon which the upper yellow clay is so apt to slip, and not long since the houses between Judd and Wilstead streets came near tumbling towards the subterranean passage. Sir Joseph Paxton startled the metropolis, two years ago, by an intimation that, if the low-level sewer were taken under the Strand, Somerset House and St. Paul's (and, he might have added, THE ENGINEER office) would be endangered, and we cannot say how far the early subsequent appointment of the Thames Embankment Commission was due to this warning. The author of a tract, entitled "Facts and Fallacies of the Main Drainage," had, two years before, pointed out the same danger to Piccadilly and Oxford-street, from the construction of a sewer tunnel 60ft. or so below their respective levels. These warnings were given chiefly, however, with reference to faults and dips in the clay, whereas, if quicksands were encountered, the case would be (none can say how much) worse. In the case of the Victoria-street sewer, the original contract price for which was £14,000, the intersection of quicksands carried the final cost to £70,000. It was stated, two years ago, when the parliamentary committee on the cleansing of the Serpentine was sitting, that the pumping on Duck Island was disturbing the foundations of the Westminster Palace Hotel, and fears were expressed lest Carlton House, and, we believe, the whole of Pall Mall, should be undermined, and fall in the direction of the water in St. James's Park! Whether this fear was aroused by the probability of the drainage of the quicksand in question, or of the lower Thanet sands, underlying the London clay (at least from Lewisham to Watford), we do not know, but it shows how little confidence some persons are disposed to place in the stability of the foundations of the capital. Upwards of thirty years ago Mr. Clegg erected a building, on a quicksand foundation, at Fulham. After excavating 15ft. an iron rod sunk, of itself, 15ft. further. A concrete foundation was put in, which sunk 16½in. in twelve days, and without a crack, and it has, we do not doubt, remained secure ever since.

The surface of London, too, is bad enough to build upon. In the lower grounds it is exceedingly unstable. If a steam forge were set up in the Borough, the concussion of the hammers would, we fancy, affect the stability of the neighbouring houses. The visitor to the pumping station of the Southwark and Vauxhall Water Company, in Battersea-fields may perceive how even the impulses of the pump pole upon the water shake the ground all about. The engines themselves have to be placed on foundations of remarkable strength. One of them, the great 112-inch cylinder, made by Harvey, of Hayle, and altogether the largest pumping engine in the kingdom, is set upon the 30-ton block of granite which commanded the respectful observation, if not the admiration of the visitors to the Great Exhibition of 1851. In making the pit, 204ft. in diameter, for the great gas holder of the Imperial Gas Company at Hackney, Mr. Joseph Clark found it necessary to place a great load upon the neighbouring ground in order to prevent its rising, and the consequent disappearance of his brickwork and iron columns. The borings to the solid clay were upwards of 35ft. deep. The large pit in the floor of Mr. Scott Russell's foundry, at Millwall, was only made water-tight after much trouble, but upon the Isle of Dogs this, of course, is not to be wondered at. The aboriginal dogs which gave the "island" its name must have been web-footed. At Maudslay's, the foundry floor is raised above the general level and approached by a flight of steps, to keep out water from the moulding floor, we suppose. In putting in the foundations of the old Albion Mills, Mr. Rennie found it necessary not only to drive piles into the "made ground" at the southern abutment of Blackfriars bridge, and to lay several courses of large, flat stones over these, but he turned inverted arches over the whole surface between the walls, footing the lower courses of their foundations upon the skewbacks of these inverts. By these means the building was firmly set, and it has been even said that, had it rested upon mud, it would have floated, and gone down equally at every point in the area of its base. It will be a matter of some interest to ascertain whether the long, over-house viaducts of the Charing Cross and London, Chatham, and Dover Railways, now in progress, will rest without settlement in the Borough soil.

We have had evidence, in the case of old Westminster and Blackfriars bridges, of the insecurity of the foundations put down, in the Thames, by the old engineers. The later bridges have been founded so as to endure, we hope, for many centuries. We have almost everything in the river now—timber piles and granite piers, iron piles and concrete filling, brick piers with stone casings, iron cylinders sunk by scooping, &c. &c. Even in London soil and in the bed of the Thames there are now, however, no such things as engineering "difficulties," but this does not alter the fact that long foresight, careful regard to plan, details, and workmanship, and a liberal provision of cash, are indispensable to the permanence of any structural foundations in the metropolis.

THE LONDON FIRE ENGINE ESTABLISHMENT.

AT a recent date the London Fire Engine Establishment comprised thirty-nine hand-worked engines, and one land and two floating steam fire-engines, the "Brigade" numbering 120 men. The land engines, as our readers are aware, are drawn by horses to fires, where they are worked by men hired, by the hour, from the crowd which is always sure to collect on such occasions. An allowance of one shilling for the first hour, or part of an hour, and sixpence

for every subsequent hour, or part of an hour, with unlimited beer, makes the working of the engines a favourite occupation with the strong-limbed throng of porters, 'long-shore men, and such others as are always to be found ready for an odd job, and this arrangement relieves the general committee from the necessity of maintaining a permanent, large, and expensive force for the work in question. The whole police of the metropolis may be said, too, to be in the pay of the fire companies. The policeman who, by the help of his feet and good lungs, telegraphs the coming of the engine, and clears the way for its approach, is sure of his five shillings, and a sovereign is ready for the other policeman who, on the arrival of the engines at a fire, is found upon the spot, guarding the door, and protecting the property endangered. In New York, a city which, although of but little more than one-third the size of the metropolis, has our full annual number of fires, the "fire department" numbers about fifty engines and 4,500 volunteers, regularly organised, and who, in consideration of their arduous and gratuitous services, are exempt from military duty and from serving on juries. If we take, therefore, say 3,500, as the number of men which would be actually required to work the fire apparatus of London, we can readily perceive what the maintenance of such a force would cost, unless, as in New York, we could command gratuitous service. In New York, however, the insurance companies have nothing to do with the fire-engines, which belong to the city, and we may be sure that, neither there, nor here, would men be likely to serve private associations for nothing. It must be borne in mind, however, that the committee for managing the London Fire Engine Establishment make no distinction, on an alarm of fire, between insured and uninsured property. It is adopted as a maxim that the insurance companies cannot afford to permit any fire to spread within the whole circle of their operations, and the freeholder who insures in Liverpool or Glasgow, and he who neglects to insure at all, alike enjoy the protection of the London offices in respect of the most strenuous efforts to preserve their property from destruction by fire.

The late Mr. Braidwood never gave much encouragement to the introduction of land steam fire engines, and to this day the London Establishment has but one of these in use. The brigade engines, with their 7in. pumps of 8in. stroke, throw, at the utmost, but 88 gallons per minute when worked at their usual speed of 40 strokes per minute. The steamer in question, although having but a single steam cylinder 8½in. in diameter, with a single pump (double acting) 7in. in diameter, and 9in. stroke, is capable of throwing as much water per minute as four or five of the hand engines, and to continue its work incessantly for a week together if necessary. This engine, which weighs, we believe, less than 3 tons, and which costs £650, will throw a 1¼in. stream 225ft. horizontally, and costs only one shilling an hour in working. Steam of 90 lb. pressure may be raised in it in a quarter of an hour, when cold water is used, but it is now the practice to keep a gas jet constantly burning in the fire-box while the engine is housed in Watling-street, and thus, with a well clothed boiler, the water is kept constantly on the boil, and steam of 90 lb. pressure can be raised within five minutes after lighting a fire on the grate bars. Three horses draw this engine through the streets at a speed of ten miles an hour when the way is clear. Messrs. Shand and Mason, the well-known fire engine builders in the Blackfriars-road, and the builders of the steam fire engine, have thus attained excellent results already in this new branch of their business, and we are pleased to know that three more of their steam engines are in progress for the Fire Engine Establishment. In his report, just issued, to the managing committee, Captain Shaw expresses his confidence that the new engines will be found more effective and at the same time more economical than those worked by manual power. Of this we have no doubt.

The floating steam engines, and, especially, the larger of the two, are capable of rendering excellent service at fires on the river and river side, where only they can be brought to work. The larger "float" almost always lying just above Southwark bridge, and always having its steam up to 60 lb., cost £6,000. The hull, which is nearly as large as that of a river steam ferry boat, was built by Mr. Mare, while the engines and machinery were constructed by Messrs. Shand and Mason. There are two locomotive boilers, and two steam cylinders, 14in. in diameter, each working a pump 9in. diameter, the stroke of both being 18in. Each steam cylinder may be made also to drive, at will, a large Appold's pump, which propels the boat by forcing out water through a 10-in. opening, one for each pump, the reaction of the two 10-in. jets driving the boat at a fair speed, sometimes, we are told, as fast as nine miles an hour. The jets are discharged at the stern, and the boat is generally so trimmed as to bring them just under water, although in this mode of propulsion, which is Mr. Ruthven's, the discharge has been in other instances kept above the load water line. The engines and pumps are arranged horizontally, under deck. The work is of great strength, and the valves and passages are very large. The 9-in. double acting pumps, which form the fire engine proper, are made to discharge through four nozzles of 1¾in. diameter each, the capacity of these pumps being between 200 and 300 tons, or upwards of 50,000 gallons of water per hour. At the great fire on Cotton's wharf the float played incessantly for nearly *three weeks*, discharging probably 75,000 tons of water upon the ruins.

Captain Shaw's report upon the fires which occurred in the metropolis in 1861 appears in another column. We have not found space, however, for a lengthy appendix which accompanied it, classifying the occupation, as trades, &c., of the buildings partly or wholly burned, and stating the causes, as far as known, of these fires. Of 1,183 cases of fire, 796, or upwards of two thirds, were in and on premises where gas was used. The causes of these fires, as far as known, were in many cases curious, and in all cases worthy of study. 145 were set down to candles, 50 of these being in private houses; 56 were set down to "gas," only 3 of these being in private houses; 27 other cases were attributed to "escape of gas," of which 1 was in lodgings and 4 only in private houses; 4 more cases come under the head of "lighting gas," 2 that of "gas-fitters," 4 "gas stoves," and one fire was caused by the explosion of gas. Of the fires attributed to "gas," none are set down under that head which are not directly chargeable to the use of that illuminating agent. Thus the great fire which destroyed the sugar bakery in East Smithfield is entered as "throwing down paper on gas-burner." Five fires were occasioned by paraffine lamps, and one by drawing off "paraffine" (or some stuff, we suppose, sold as such) with a naked light. One fire was caused by a naphtha lamp. No less than 10 cases of spontaneous ignition occurred, respectively at a carpenter's, chemist's, coal-merchant's, printer's ink makers, lodging house, manure yard, provision merchant's, rag shop, tobacco shop, and warehouse. Two fires are attributed to "steam pipes," the steam, we suspect, being superheated; 3 were caused by the slacking of lime, in one case by rain falling upon the lime; 2 occurred on railways in consequence of sparks from the engines; 2 more are set down to "friction," in one case in a steam saw mill, and in the other in a wagon on the road.

The past year has been memorable for the number and magnitude of the fires occurring in the metropolis. The number of alarms was 1,409, of which 1,183 were for actual fires, a number exceeding by 127 that in 1860, and 391 greater than the annual average for the past 28 years, the period during which the Fire Engine Establishment has been in existence. It will be borne in mind that the numbers given do not include chimneys on fire, of which Captain Shaw estimates that there were as many as 3,000 last year, besides 4,000 cases of fires not sufficiently important to require the attendance of firemen.

BOILER EXPLOSIONS.

We have given place, in another column, to a report by Captain Tyler, R.E., upon the explosion, last summer, of a locomotive boiler, on the London and North Western Railway, near Rugby. The cause of the explosion was traced, correctly no doubt, to a groove or furrow which had been gradually eaten into one side of the middle ring of plates in the barrel of the boiler, the thickness of the iron having been reduced, by this corrosion, to about one-sixteenth of an inch. There are many, probably a majority of, engineers who would at once say that, thus weakened, the explosion of the boiler was inevitable. Yet there is a class of accidents frequently happening to steam boilers, to wit: the mere rupture of corroded or otherwise weakened plates, or entire seams of rivets, and which accidents are generally harmless. It is to be remarked, however, that such harmless ruptures generally take place in the lower plates or seams of the boilers well under water. But, we may ask, if the local weakness of a plate produce an explosion in some cases, why should it not do so in all or nearly all, the pressure of steam, and, generally, the other circumstances being the same, with the single exception already noted? On the other hand, why should the rupture of any seam or plate produce a violent explosion at all? Captain Tyler leaves his case at a point where this question arises and ought to be answered. He knows, certainly, that the pressure of a jack screw within the boiler, pushing outwardly with the same force as the steam, would produce no explosion, and that hydrostatic pressure, to the same extent, would have merely opened the plate and allowed the water to escape without further injury. So, too, he must be sufficiently aware that a boiler-full of steam only, whether of 100 lb. or 500 lb. pressure per square inch would never have produced the wreck which came near overthrowing Easenhall bridge. 150 cubic feet of high pressure steam has not (as every one conversant with the properties of steam is well aware) sufficient power to account for the effects manifested in the case in question. Before such a quantity of dry steam could have imparted momentum to the heavy masses actually projected to considerable distances, it would have escaped, probably harmlessly, into the air. There might have been a smart crack, possibly a disturbance of the engine, but not the tremendous projection of great weights over many yards of distance. But Captain Tyler does not inquire into the cause of the actual violence exhibited.

Without recourse to the explanation of boiler explosions first given in The Engineer, and afterwards re-published over Mr. Colburn's own name, the Rugby explosion would be almost inexplicable. Mr. Fairbairn's disquisitions, extending over twenty years, take no account of the effects due to the sudden removal of the steam pressure, under which, alone, a large quantity of heated water has been heated far above the boiling point. Dr. Joule, too, has, we believe, admitted that he was not aware that ruptures of boilers ever took place without violent explosion. And so we might go through nearly all that has been written upon this subject, and though we fell back upon the untenable hypotheses of electrical action, decomposition of steam into explosive gases, &c. &c., we should be as far off as ever from any comprehensible, not to say demonstrable, explanation of the cause of the explosion near Rugby. When, however, we bear in mind that, upon the occurrence of a local rupture above the water line (a rupture which, if it permitted only the escape of the steam in the upper part of the boiler, without any other consequences, could do but little if any harm), must instantaneously liberate the steam pressure under which, alone, the highly heated water in the lower portion of the boiler is restrained from the violent disengagement of a vast quantity of additional steam, we may perceive what are the intermediate steps in a boiler explosion. Rapidly as water, previously heated above the boiling point, will give off its steam on being suddenly placed in communication with the open air, it cannot give off its steam with the same rapidity as that with which the superincumbent steam will escape through an already opened rent, and thus an exceedingly brief interval of time may be conceived in which little if any steam pressure is exerted upon the heated water. It is in this momentary absence of pressure that the disengaging steam gains headway, and striking with the velocity due to its elasticity, upon the upper portions of the boiler — aided, too, as it must be, by the water which it carries, in a more or less divided state, along with it, inflicts a tremendous blow upon the, as yet, unruptured portions of the boiler. It is, we think, within the means of calculation to show that this cause alone is sufficient to account for the utmost violence of effect exhibited in boiler explosions, and we are glad to see that, in various recent publications, including the last edition of the *Encyclopædia Britannica*, Mr. Colburn's explanation has been adopted, in some cases with ample acknowledgment.

LIMES AND MORTARS.

Smeaton ascertained, more than a century ago, that all the "water limes" or hydraulic limes with which he experimented contained clay in combination. But he could not form hydraulic limes by adding clay alone to pure limes, and as the only substances which, added by him to fat lime, caused it to set under water, were more or less ferruginous, he concluded that the presence of iron was essential to a hydraulic lime. In like manner, manganese, magnesia, &c., having since been found in hydraulic lime, its peculiar property has been attributed to their presence respectively. And to this day many engineers and others assign special virtues to these substances in combination with argillaceous limestones, and yet there are well authenticated instances of the rapid and permanent setting of limes containing, in turn, neither iron, manganese, nor magnesia.

Vicat's experiments, made nearly fifty years ago, appeared to establish, conclusively, the fact that silicate of alumina (clay) only, in combination with the uncalcined carbonate of lime, was sufficient to insure setting under water. So little care, however, has been paid in England to the whole subject that Mr. Robertson, who has, within the last two or three years, re-directed professional attention to it, might be supposed to be urging the acceptance of altogether new theories. The drift of his essays upon hydraulic lime appears to be that rapid and permanent setting under water is insured by the presence in the stone of pure clay alone, the clay having definite proportions of silica and alumina. In a long course of practice in connection with extensive and important works of construction, Mr. Robertson has paid unusual attention to the nature and properties of limes, and has made many experiments, both in the laboratory and on the large scale. He had especially doubted the hydraulic value of iron, either in limestone or pozzuolana, and to satisfy himself he powdered some of the latter substance and boiled it for three days in chlorohydric (muriatic) acid, so as almost completely to remove the iron, the remaining powder being quite white. Yet this powder, on mixture with rich lime, caused it to set as rapidly under water as before. The addition of iron filings to lime, always expensive, was furthermore found to be positively injurious, inasmuch as these filings became oxidised, increasing the bulk of the mortar, and rendering it friable, or, rather, rotten. When forge scales, or the black oxide of iron, were added to lime, little increase of bulk was observed, because these substances do not readily combine with more oxygen; but while, in this form, the iron may be used to form sharp, insoluble *nuclei* for the setting of the lime, there appeared to be no evidence of any hydraulic effect whatever. "Minion," or the scales obtained in roasting argillaceous iron ore, assists setting under water; but not at all, there is reason to believe, on account of the presence of iron, the combination of silica and alumina sufficiently accounting for the result. Mr. Robertson observed, also, that on the addition of iron slags to lime stone, the slight gain in hydraulicity was not in proportion to the metal in them, but to the quantity of silica abstracted by the flux from the ore. "Slag from the puddling furnace, "with little silica, but plenty of iron in it, proved to be "of no use in setting rich lime under water." Mr. Robertson further observes that "The vitrified state in which "silica exists in slag, a fused silicate of lime being already "formed, greatly hinders any further action of the silica; "therefore, slag is very inferior to pozzuolana."

The naturally hydraulic blue lias lime from Lyme Regis contains no iron, and, before burning, but little more than 17 per cent. of silica and alumina. Yet, as most engineers must be aware, it requires no mixture of minion, pozzuolana, forge scales, or filings, to enable it to set permanently under water. The accepted theory of setting, moreover, leaves no purpose for iron in any form, in combination with lime. With a carbonate of lime containing only a certain quantity of clay, it is supposed that, during calcination, double silicates are formed, of lime and alumina respectively. In ordinary practice, even with an abundance of silica, burning is not carried so far as to silicatise the whole of the lime. The double silicates absorb water in slacking, and solidify as hydrates, both of which are insoluble in water, and which, therefore, remain permanently when immersed in water, the compound not giving up more than the free lime left uncombined after calcination. Upon this theory no share is left for foreign matters. Even Vicat, however, was of opinion that in the dolomites, or magnesian limestones, the magnesia assisted setting under water, forming, he conjectured, a third hydrate. The action of magnesia and certain other foreign matters we shall reserve for another occasion.

Population of the American States.—Before the secession of South Carolina there were 34 states in the Union, viz., 19 free and 15 slave states. Of the slave states 11 have seceded, while 4 remain with the 19 free states under the Federal Government. The population of the free states was, in 1860, 18,950,759, and the number of free persons in the 4 still loyal slave states 2,869,543, or 21,820,302 free persons in the 23 Federal States. The free population in the 11 seceded states was, at the same time, 5,617,725, or 26 per cent. of the population in the Federal States, the preponderance of the Federal over the Confederate free population being thus almost exactly 4 to 1. In addition to the numbers given there are in all the states about 4,000,000 slaves, and of these nearly 3,500,000 are in the seceded states. The total population of the United States in 1860 was, including slaves, 31,600,000 nearly

THE LONDON FIRE ENGINE ESTABLISHMENT.

CAPTAIN EYRE M. SHAW, the successor to Mr. Braidwood, has made the following report to the committee for managing the Fire Engine Establishment in London :—

"In pursuance of instructions received on the 30th December I have the honour to present the following report of fires which have taken place in London and its environs during the year 1861: —The total number of calls received during the year 1861 has been 1,409, of these 89 were false alarms, 137 proved to be only chimney alarms, and 1,183 were fires, of which 53 resulted in the total destruction of buildings, &c., 332 in considerable damage, and 798 in slight damage. The fires of 1861, compared with those of 1860, show an increase of 127, and compared with an average of the twenty-eight years during which the establishment has been in existence the increase is 391. This list does not include trifling damages by fires not sufficiently important to require the attendance of firemen. Of these no record is anywhere kept, but they may be estimated in round numbers at 4,000; neither does it include the ordinary calls for chimneys on fire, which may be roughly estimated at 3,000. The totally destroyed list, 53, is 25 in excess of the same list for 1860, and 13 in excess of the average proportion for the twenty-eight past years. Of the premises burned, 20 were from two to seven miles distant from the nearest station; 25 were used for the carrying on of hazardous trades—such as cabinet-makers, carpenters, hay and straw salesmen, steam saw mills, &c. Three were completely on fire before the arrival of the engines, and of the remaining number some through imperfect construction, and one from its great magnitude and inflammable contents, baffled all the efforts of the firemen. In the last mentioned case, which occurred in Tooley-street, on the 22nd of June last, and resulted in the almost total destruction of thirty-three buildings, there is every reason to believe that, but for a serious delay and deficiency of water and some violent explosions which took place at the commencement, the fire would have been confined to the building in which it originated. In six of the cases mentioned in the totally destroyed list the supply of water was either late or insufficient. The manual fire engines and appliances connected with them are in excellent condition. The land and floating steam fire engines are also in complete working order. The land steam fire engine continues to render valuable service. In this engine a great difficulty has hitherto been experienced in getting up steam in a sufficiently short space of time; this difficulty is now obviated by the introduction inside the fire-box of a small jet of gas which keeps the water constantly boiling. By this simple and inexpensive method two advantages are gained —one is, that it entirely does away with the great risk to the boiler and machinery caused by the sudden expansion which takes place when steam is raised in fifteen minutes from cold water, and the other is, that it ensures the raising of sufficient steam in less than five minutes, which is all that is ever required for practical purposes. The three new land steam fire engines recently ordered of the same makers—Messrs. Shand and Mason—will be finished in about six weeks from this date, and, as they will always be kept ready for immediate use by the expedient already mentioned, I confidently anticipate that they will be found more effective and at the same time more economical than those worked by manual power. The internal condition of the establishment with regard to discipline, zeal, intelligence, personal intrepidity, and general good conduct, is entirely satisfactory, and all ranks vie with each other in performing their arduous duties to the utmost extent of their several abilities. The establishment has sustained a severe loss in the death of the late superintendent, Mr. James Braidwood, who was killed by the falling of a wall at the fire which occurred in Tooley-street on the 22nd June last. With this serious and melancholy exception the list of casualities for 1861 has been small and unimportant. I have appended a list, with remarks, of all the fires, classified according to trades; also a separate list, with remarks, of those which resulted in the total destruction of buildings, &c. It would probably be a hopeless task to attempt to put a stop to the steadily increasing use of gas, which is the most economical and convenient of all modes of lighting; but it appears absolutely necessary that some steps should be taken to caution owners of property, particularly in large wharves and warehouses, as to the position and protection of these dangerous lights. These remarks may not be considered unnecessary when it is remembered that in many of the most valuable buildings in the metropolis movable gas brackets are placed within 20in of the ceiling without the slightest protection whatever. It may be laid down as a rule that the jet on the outer arm of the bracket should never be less than 36in. from the ceiling over it, and that it should be protected on the top by a hanging shade, and on the sides by stops on the swivel-joints, which should prevent the brackets moving beyond a safe distance. Attention might, perhaps, also be called to the very common and dangerous practice of nailing tin or iron on the adjoining timbers. This has long proved to be no protection, and it has the disadvantage of allowing the timber to be charred completely through before it is known."

SOCIETY OF ENGINEERS.

January 16, 1862.

E. RILEY in the Chair.

THE chairman, in announcing the award of the premiums for the best papers, read during the year 1861, at the meeting held on Monday evening last stated that the committee considered the papers read by E. Riley "On Iron," P. F. Nursey "On Superheated Steam," J. Louch "On Surface Condensers," and W. H. Stephenson "On Fire-Clay Manufactures," were of great merit, and deserved the special thanks of the society; and that as Messrs. Riley and Louch were members of the committee they were disqualified, by the rules of the Society, from competing for the premiums, which were awarded to Messrs. Nursey and Stephenson.

THE EXPLOSION AT BYER MOOR, DURHAM. — The adjourned inquiry concerning the boiler explosion, which took place at Byer Moor Colliery on the 7th inst., and which caused the death of a man named John Watson, was resumed on Wednesday at Crookgate before Mr. Favill, the coroner. It was proved that at the time of the explosion there was plenty of water in the boiler, and that both its workmanship and the iron of which it was built were good. It appears from the evidence that an inferior quality of water had been drawn from the pit during the last fortnight, which deposited on the surface of the lower plates a substance of peculiar character and composition, never seen in any of the boilers at Byer Moor before. This water has been analysed by Messrs. Richardson and Browell, at Newcastle, who state in a report that, from the quantity and character of the matters it contained, it is calculated to form a thick and injurious deposit on boilers in which it may be employed. It is without any acid reaction. The boilers had been cleaned four days before the accident, yet the furring taken from the torn plates was $\frac{1}{16}$ths of an inch in thickness. It was the opinion of various witnesses that this deposit had kept the water off the plate until the iron became very hot, and was bulged out by the expansion of the steam and water. In this process the brittle layer of furring must have broken off, and thus placed the hot iron over the flue in contact with the water, which the jury supposed would perfectly account for the explosion. At the conclusion of the evidence the coroner briefly summed up, and the jury, without retiring, returned as their verdict, "That John Watson came to his death on the 7th inst. by injuries to his head, caused by the explosion of a boiler at Byer Moor Colliery; that the explosion was caused by a deposit having taken place in the boiler during the last four days; and we consider the workmanship, materials, and fittings of the boiler were good, and sufficient for the safe working of the boiler."

LAW INTELLIGENCE.

VICE-CHANCELLOR'S COURT, JAN. 14.

(*Before Vice-Chancellor Sir* W. P. WOOD.)

BIDDER *v.* RICHARDS (CLERK TO THE LOCAL BOARD OF HEALTH FOR THE TOWN OF CROYDON).

THE object of this suit was to restrain the Local Board of Health for Croydon from continuing to discharge sewage, filth, or other offensive or injurious matter, either solid or liquid, into the river Wandle, to the injury of the plaintiff and his property. The plaintiff was the owner of property near Croydon, with gardens and pleasure grounds running down to the river Wandle, which was originally a clear, pure stream, noted for its trout. In 1853 the Local Board of Health constructed a sewer for discharging the drainage of Croydon into the Wandle, at a point between two and three miles above the plaintiff's property. The upper portion of the river was so polluted by the discharge from this sewer that proceedings were taken against the board for creating a nuisance by a Mr. Lambert. These proceedings resulted in an injunction against the board, and payment by them of £200 to Mr. Lambert for damages. The board thereupon constructed a fresh sewer through Beddington Park, for which leave was obtained from the tenant of the park, Mr. Bridges. The river having become polluted and the fish destroyed by this sewer, Mr. Bridges in March, 1859, obtained an injunction restraining the board from discharging any offensive matters into the river. After this injunction had been granted the board dug a ditch, the effect of which was to divert the sewage from the Beddington Park channel, and convey it through small tributary channels into the Wandle, where it flows through the plaintiff's property. The sewage before its discharge into the river had been deodorised by M'Dougall's disenfecting fluid,* but the bill stated that this fluid contained a large quantity of carbolic acid, which was highly injurious to animal life. After the sewage had been mixed with this fluid it was transmitted through the sewers into tributary channels of the Wandle, or was spread upon the ground and allowed to percolate through the ground, or run off into the river. In December, 1860, the plaintiff first discovered the pollution of the stream, and complained to the Board of Health. The nuisance was for some time diminished, but in May, 1861, it again increased, and legal proceedings were threatened by the plaintiff, and the stream was less perceptibly polluted during June and July. In August the nuisance was very great, and several dead and dying fish were found in the river. The nuisance from time to time varied very much in extent, but at the beginning of October had again become very serious. Under these circumstances the plaintiff had filed his bill to restrain the Local Board of Health from discharging the sewage into the river to the injury of his property.

For the defence it was contended that the particular nuisance complained of as having happened in August last was occasioned by the accidental discharge of the refuse of some gasworks into the river, for which the Board of Health were in no way responsible, and that the mischief had been greatly exaggerated in the evidence of the plaintiff, while the defendants had done everything in their power to purify and deodorise the sewage before its escape into the river.

Mr. Rolt, Mr. J. Pearson, and Mr. G. P. Bidder appeared for the plaintiff; and Mr. Giffard and Mr. Miller for the defendants.

The Vice-Chancellor (without calling for a reply) said that the plaintiff was entitled to an injunction. As early as December, 1860, the plaintiff had complained of the state of the river. In the interval between December and May a considerable change had been introduced by the defendants. They deodorised the sewage by means of M'Dougall's disinfecting fluid, and they had acquired an additional 200 acres of land for the purpose of absorbing the organic particles of the sewage. An improvement, no doubt, was effected, but there were fresh complaints in May, and again at the end of June. As the sewage water, after passing over the fields, came into the river one mile above the plaintiff's property, he was bound to show some special injury as occasioned to the water running through his grounds. In August the nuisance, beyond dispute, became excessive. Even assuming that it arose from the accidental circumstance of the discharge of the refuse from the gasworks into the river, it was to be observed that the defendants had not in the first instance raised this case of the nuisance being accidental. The result of the accident was that a great number of fish were killed, and whether or not the fish had been killed above and floated down to the plaintiff's portion of the river, was really not material, as he was entitled to have the fish as they circulated from one part of the river to another. Complaint was immediately made by the plaintiff, and if the matter had rested there there might have been a case to send to law before coming to any conclusion upon the particular instance complained of. Even assuming that the pollution in August was from an accidental cause, there was evidence beyond all question of a very considerable nuisance in October. There could be no doubt that, if sewage was poured into the river without the precaution of filtering it through the fields, &c., very great damage would result. This was established by the scientific evidence adduced by the defendants, to the effect that if care was taken in the combined preparation and filtration of the sewage matter no damage would be occasioned to the river, which was in other words saying that, unless there was great care and attention in the filtering process, evil consequences would certainly result. His Honour then proceeded to comment upon the evidence as to the nuisance occasioned in the early part of October, and said that a plain and distinct case was shown of sewage having been poured into the river in an offensive state, and so as to pollute the water and render it unfit for use. Two plain cases of negligence were thus established against the defendants, and it was a proper case for putting them under an injunction. His Honour, after some further observations upon the arguments on behalf of the defendants, granted an injunction restraining the defendants from causing or permitting to pass any sewage, filth, or other offensive or injurious matter, either solid or liquid, down, through, or from any sewer, or drain, or otherwise, into the river Wandle to the injury of the plaintiff.

* M'Dougall's disinfecting fluid is made in the proportion of 2 lb. of sulphurous acid to 1 oz. of carbolic acid.—ED. E.

COMMUNICATION BETWEEN ENGLAND AND IRELAND.—It is not generally known that, in order to receive the news brought by the American packets as they touch at Queenstown, it is necessary that the despatches should be forwarded by telegraph a distance of nearly eight hundred miles, or about one half of the entire length of the cable which, for a short time, stretched across the Atlantic. When the steamer calls at Queenstown its news has to be transmitted from Cork to Dublin, thence to Belfast, thence to Donaghadee, across the Channel to Portpatrick; from thence to Dumfries, then to Carlisle and Liverpool, and finally to London. This involves great delay, and numerous breaks in the communication, and mistakes constantly arise from these repeated transmissions. This, however, is by no means all the delay. The steamers call off what is called Roche's Point, and a steamer is now required to convey the despatches up the harbour to Queenstown, the time occupied being an hour and a half. Important as is the news required there is no telegraph from Roche's Point to Queenstown. It is now proposed to establish a new telegraphic line, which will place Queenstown not only in direct communication with the telegraph station at the entrance to the harbour, but also with the Old Head of Kinsale, from whence the Atlantic steamer may be sighted several hours earlier than is at present the case. Lord Fermoy has given permission to lay a telegraphic wire over his property from Roche's Point, which will be carried on to Queenstown, and join a main line which will connect Cork and Queenstown with Waterford and Wexford, and thence run to Carnsore Point, projecting a considerable distance into St. George's Channel. At this point the line will be submerged to St. David's head, on the Welsh coast, and be continued through Milford, Gloucester, and Bristol, direct to London.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

2899. ANTHONY JOHN MUNDELLA and WILLIAM ONION, Nottingham, "Improvements in machinery or apparatus for the manufacture of looped fabrics."—*Petition recorded 18th November*, 1861.

2917. FRANCIS PULS, Francis-terrace, Hackney-wick, London, "Improvements in treating fatty and oily matters."—*Petition recorded 20th November*, 1861.

2981. FRANCOIS FREDERICK DUMARCHEY, Boulevart de Strasbourg, Paris, "Improvements in machines for crushing and pounding stones, ore, and other materials."—*Petition recorded 27th November*, 1861.

3027. ANDRE MARIE AUGUSTIN PICHERY and PIERRE LOUIS DANAIS, Nantes, Loire Inférieure, France, "Improvements in hermetically stoppering or covering jars, pots, vases, and other like articles."—*Petition recorded 3rd December*, 1861.

3007. THOMAS LAWES, City-road, London, "Improvements in the manufacture of quilts and coverlets."

3076. BALTHASAR WILHELM GERLAND, Newton-le-Willows, Lancashire, "Improvements in the manufacture of sulphate of copper and other salts of the same metal."—*Petitions recorded 7th December*, 1861.

3123. STEPHEN BARBER HEWETT, Railway-cottage, Fairfield-road, Bow, Middlesex, "Improvements in the construction of boilers or generators for steam engines and other uses, applicable also to evaporators, and in pumps used therewith or otherwise used, some of which improvements in pumps are applicable to pistons and piston-rods generally."

3129. JOHN WALTER FRIEND, Freemantle, Southampton, "Improvements in apparatus for registering the depth and flow of liquids, and the distances run by ships at sea."

3131. THOMAS BOW GIBSON, Glasgow, Lanarkshire, N.B., "A new or improved method of ornamenting certain fabrics."

3132. SYLVANUS PADLEY, Swansea, Glamorganshire, "Improvements in paddle-wheels."

3133. PIERRE QUANTIN, Bouscat, near Bordeaux, France, "Manufacturing moulded earthen or stoneware cross sleepers for superseding wooden ones in the construction of railways."

3140. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in apparatus for the production and application of motive power in locomotive and other steam engines."—A communication from Felix Alexandre Testud de Beauregard, Paris.—*Petitions recorded 13th December*, 1861.

3142. EDUARD CLAUDE BARBOTTE DE BEAULIEU, Avallon, Yonne, France, "Improvements in apparatus for extracting gold dust from auriferous sands."

3145. COLIN MCDOUGALL and JOSEPH CRANE, Manchester, "Improvements in raising and supporting ladies' dresses."

3150. EMILE CAJOT, St. Servais, Belgium, "Improvements in the treatment of pyrites for the manufacture of iron."—*Petitions recorded 14th November*, 1861.

3159. WALTER HENRY TUCKER, Fleet-street, London, "Improvements in locks."—*Petition recorded 17th December*, 1861.

3167. SAMUEL SHEPPARD, Birmingham, "A new or improved tap or stop-cock."

3169. MATTHEW CARTWRIGHT, Carlisle, Cumberland, "Improvements in the manufacture of beds or palates for the reception of artificial teeth."

3173. JOHN PIDDINGTON, Gracechurch-street, London, "Improved condensing apparatus for steam engines."—A communication from Wilhelm Winter, Charlottenburg, Berlin.

3179. CHARLES PONTIFEX, St. Paul's-road, Islington, London, "Improvements in refrigerators for cooling worts or other liquors."—*Petitions recorded 18th December*, 1861.

3181. THEODORE BOURNE, Charlotte-street, Bedford-square, London, "Improvements in cotton gins."—A communication from Hiram Wilson Brown, Melville, Cumberland, New Jersey, U.S.—*Petition recorded 19th December*, 1861.

3186. WILLIAM MAKIN, Attercliffe, Sheffield, Yorkshire, "Improvements in apparatus for the manufacture of cast steel, mill chisels, and other taper tools and files."

3187. JAMES STANDFIELD, Aylsford, Kent, and JOHN STANDFIELD, Stratford, Essex, "Improvements in machinery or apparatus for giving motion to ships and machinery, and for raising water."

3189. CHARLES EDMUND WILSON, Monkwell-street, Falcon-square, London, "Improvements in collars for gentlemen's, ladies', and children's wear."

3191. JOSEPH WESTWOOD, London-yard, Poplar, Middlesex, "An improvement in the construction of hydraulic pipes."

3193. GEORGE WALKLAND, St. Pierre-les-Calais, France, "An improved machine for winding lace or other similar fabrics or tissues on cards or other materials."

3194. WILLIAM TIPPLE, Clarence-place, Gravesend, Kent, "Improvements in paddle-wheels for the propulsion of ships and other navigable vessels."

3195. VASCO D'ALMEIDA, Nottingham-street, Marylebone, London, "An improved mode of obtaining colouring matter applicable to dyeing skins, silk, wool, and other fibrous materials."—A communication from Edward Smith, Place Cruzquebrada, Lisbon.

3198. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "A new improved method of preparing silk fabrics to be employed in the manufacture of hats, caps, and bonnets."—A communication from Louis Bayard, Paris.

3200. ROBERT WAILES, Brighton, Sussex, "An improved tool or apparatus for cleaning windows and glasses."

3201. THOMAS GREEN, Smithfield Ironworks, WILLOUGHBY GREEN, Brunswick-place, and ROBERT MATHERS, Trafalgar-street, Leeds, Yorkshire, "Improvements in lawn mowing, rolling, and collecting machines."—*Petitions recorded 20th December*, 1861.

3204. JOHN WAKEFIELD, Birmingham, "Improvements in sewing machines."

3209. WILLIAM LOADER ALLCHIN and WILLIAM ALLCHIN, Globe Works, Northampton, "Improvements in apparatus applicable to the superheating of steam."

3211. FRASER SELBY, Surbiton, Surrey, "Improvements in boilers for the generation of steam in engines for applying steam for motive power purposes, and in wheels and ways for steam carriages to run on."

3212. WILLIAM KEMPE, Holbeck Mills, Leeds, Yorkshire, "Improvements in scrays or tables applicable to gig-mills, brushing mills, and other like machinery."

3213. CHARLES OSMAN, Chryssall-road, Brixton, Surrey, "Improvements in the manufacture and application of elastic or yielding surfaces for sitting, lying, or reclining upon."—*Petitions recorded 21st December*, 1861.

3214. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in apparatus for cleaning wheat and other grain."—A communication from Jean Pierre Fill, Paris.

3215. LOUIS RUDOLPH BODMER, Thavies-inn, Holborn, London, "Improvements in looms for the manufacture of sacks, knapsacks, mattress cases, and other goods."—A communication from Charles Hippolyte Tessier, Paris.

3217. JOHN ROSINDELL, Mile-end, London, "An improved method of and apparatus for separating solid from liquid substances."

3218. EDWARD EDE, Abercorn-mews, Violet-hill, St. John's-wood, London, "Improvements in the construction of horse-shoes."

3220. JOHN FRANCIS HARVEY, Strand, London, "Improvements in umbrellas and parasols."

3223. EDWARD BARNARD SAMPSON, Ham Mills, Stroud, Gloucestershire, "Improvements in the apparatus for drying wool and other fibres and substances."

3224. JOHN BLAND WOOD, Broughton, near Manchester, "Improvements in the manufacture of driving-straps or bands, the backs of wire cards, and cop-tubes."

3225. FRANCOIS LAURENT and JOHN CASTHELAZ, Rue St. Croix de la Bretonnerie, Paris, "Improvements in the manufacture of colouring matters."

3226. JOHN COCHRANE, Woodside Ironworks, Dudley, Staffordshire, "Improvements in apparatus employed in sinking cylinders and open coffers for forming foundations under water."

3227. GEORGE HENRY BIRKBECK, Southampton-buildings, Chancery-lane, London, "Improvements in the arrangement of traction and connecting apparatus for railway carriages and trains."—A communication from M. Claude Arnoux, Paris.—*Petitions recorded 24th December*, 1861.

3230. THOMAS STANDING, Preston, Lancashire, "Improvements in cinder-sifters and ash receptacles applicable to domestic fire-grates."

3232. JOSEPH SCHLOSS, Cannon-street, London, "Improvements in envelopes for containing photographic portraits and pictures."—A communication from Simeon Schloss, Paris.

3234. JAMES SHEPHERD, Manchester, "Improvements in apparatus for cleansing steam-boilers."

3235. RICHARD NEEDHAM, Dukinfield, Cheshire, "Improvements in apparatus for cleansing steam boilers and lubricating the pistons of steam engines, and for an improved steam-trap."

3237. JOSEPH NOTTINGHAM PALMER, Fenchurch-street, London, "Improvements in cooking stoves and ships' ranges."—A communication from John Russell, Sydney, New South Wales.—*Petitions recorded 26th December*, 1861.

3238. WILLIAM HAWKSWORTH, Oldham, Lancashire, "Certain improvements in carding engines."

3239. THOMAS SILVER, Philadelphia, U.S., "Improvements in apparatus for governing or regulating the speed of steam and other engines."

3242. THOMAS BRIGHT, Old Foundry, Carmarthenshire, "Improvements in machinery for cutting hay, straw, and other vegetable substances."

3244. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements

in steam generators."—A communication from Rafael Rafael, New York, U.S.

3245. JAMES MCINTYRE, New York, U.S., "Improvements in bomb-shells and similar projectiles."

3247. JEAN JOSEPH HECTOR FAJOLE and PASCAL ACHILLE AGOSTINI, Courbevoie, France, "An improved composition or improved compositions suitable for painting, varnishing, and coating."—*Petitions recorded 27th December*, 1861.

3248. JOHN WHITFIELD HARLAND, Chorlton-on-Medlock, Manchester, "An improvement or improvements in the manufacture of wood and other types or substitutes therefor or furniture used by letter-press printers."

3249. EDWARD LORD, Todmorden, Yorkshire, "Certain improvements in machinery for preparing cotton and other fibrous substances."—*Petitions recorded 28th December*, 1861.

3252. JOHN PETER DORMAY, JAMES SHIRLEY AIKENHEAD, and THOMAS JOHNSON, Wandsworth, Surrey, "Improvements in the construction of boats for sailing or rowing."

3253. JOHN EDWARDS, Aldermanbury, London, "Improvements in the permanent way of railways."

3256. GEORGE HENRY BIRKBECK, Southampton-buildings, Chancery-lane, London, "Improvements in apparatus for raising or forcing water or other fluids."—A communication from Mr. Edward Bruce Boughton Barker, H.B.M. Consul at Samsoun and Sinope, Black Sea.

3257. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in the manufacture of cube sugar."—A communication from Gustavus Finken, Brooklyn, King's County, New York, U.S.

3259. ALEXANDER ISAAC AUSTEN, Millwall, Middlesex, "Improvements in the manufacture of night-lights."—*Petitions recorded 30th December*, 1861.

3261. ANDREW MACNAIR, Southampton-buildings, Chancery-lane, London, "Improvements in axle-boxes for railway carriages."—A communication from Davis H. Dotterer, Chicago, Illinois, U.S.

3263. THOMAS GREEN and WILLOUGHBY GREEN, Smithfield Ironworks, and ROBERT MATHERS, Trafalgar-street, Leeds, Yorkshire, "Improvements in chains for giving motion to chain-wheels, and in giving motion to machinery."

3267. WILLIAM SPENCE, Chancery-lane, London, "Improvements in deflectors for lamps."—A communication from Lemuel Beers, Newtown, Fairfield, Connecticut, U.S.

3269. WILLIAM HENRY BAILEY, Salford, Lancashire, "Certain improvements in sewing machines."

3271. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improved apparatus for boring rocks and other mineral substances."—A communication from Emanuel Lisbet, Rue St. Sebastien, Paris.—*Petitions recorded 31st December*, 1861.

Invention Protected for Six Months by the Deposit of a Complete Specification.

36. GEORGE TOMLINSON BOUSFIELD, Loughborough Park, Brixton, Surrey, "Certain new and useful improvements in machinery for propelling water craft."—A communication from Edward Sabine Renwick, Broadway, New York, U.S.—*Deposited and recorded 4th January*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

88. FREDERICK VERSMANN and ALPHONS OPPENHEIM, Bury-court, St. Mary-axe, London.—Dated 11th January, 1859.

95. JOSEPH GIBBONS, Oxford-street, London.—Dated 12th January, 1859.

126. JOHN DAUGLISH, Tunbridge Wells, Kent.—Dated 14th January, 1859.

198. BERNARD LAUTH, Surrey street, Westminster, Middlesex.—Dated 21st January, 1859.

69. JOHN THOMAS FORSTER, Holland-road, Kensington, London.—Dated 8th January, 1859.

132. ROBERT MUSHET, Coleford, Gloucestershire.—Dated 15th January, 1859.

141. WILLIAM EDWARD NEWTON, Chancery-lane, London.—A communication.—Dated 17th January, 1859.

74. THOMAS JAMES CLAXTON, Montreal, Canada.—A communication.—Dated 10th January, 1859.

80. CHARLES MIDDLETON KERNOT, Gloucester-house, West Cowes, Isle of Wight, Southampton.—Dated 11th January, 1859.

89. NICHOLAS PROCTER BURGH, Sheerness, Kent.—Dated 11th January, 1859.

98. WILLIAM MCNAUGHT, Manchester, and WILLIAM MCNAUGHT, Rochdale, Lancashire.—Dated 12th January, 1859.

121. THOMAS SAMPSON, Calle Cartaños, Barcelona, Spain.—Dated 13th January, 1859.

81. JOHN BIERS, jun., Rochester-road, Kentish-town, St. Pancras, London.—Dated 11th January, 1859.

103. CHARLES BESLAY, Rue St. Sébastian, Paris.—Dated 12th January, 1859.

108. HENRY CRITCHLEY and SOLOMON ELSTON, Bury, Lancashire.—Dated 13th January, 1859.

1134. JAMES JOHN STEVENS, Darlington Works, Southwark, Surrey.—Dated 13th January, 1859.

11. FRANCOIS JULES MANCEAUZ and EUGENE NAPOLEON VIEILLARD, Paris.—Dated 13th January, 1859.

Patent on which the Stamp Duty of £100 has been paid.

72. ALEXANDER ROBERTSON, Upper Holloway, London.—Dated 11th January 1855.

Notices to Proceed.

2190. ALPHONSE NICOLAS SALERES, Rue de Charonne, Paris, "Improvements in printing and colouring paper, chintz, and other fabrics, and machinery or apparatus for that purpose."—*Petition recorded 2nd September*, 1861.

2196. PATRICK ROBERTSON, Sun-court, Cornhill, London, "Improvements in treating yeast, and in the manufacture of ammoniacal salts, and a substitute for animal charcoal."—*Petition recorded 3rd September*, 1861.

2208. CHARLES EDKINS, Birmingham, "Certain improvements in ladies' dress-suspenders."

2209. JOHN EDWARD RIDGES, Wolverhampton, and JAMES BARKER, Birmingham, "Certain improvements in composite carriages for funeral and other purposes."

2210. DANIEL HEYWORTH, Featherstall Mill, Littleborough, Lancashire, and JOHN HEYWORTH, Manchester, "Certain improvements in looms for weaving."

2219. CHARLES WRIGHTMAN HARRISON, Holland-grove, Brixton, Surrey. "Improvements in the construction of casters."—*Petitions recorded 5th September*, 1861.

2223. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improvements in ribbon looms."—A communication from Messrs. Benoit Durand and Claude Crozet, Rue de la Bourse, St. Etienne, Loire, France.

2224. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improvements in the application of the Archimedian screw to the production and transmission of motive power, and in the apparatus connected therewith."—A communication from Julius Sturms Mannheim, Grand Duchy of Baden.

2225. WILLIAM SPENCE, Chancery-lane, London, "Improvements in apparatus for dividing and softening vegetable fibres."—A communication from Felix Lorin, Rue des Fossés, Montmartre, Paris.

2229. CHARLES FELTON KIRKMAN, Palace New-road, Lambeth, Surrey, "Improvements in obtaining manure from sewerage, and in the apparatus employed therein."

2231. JOHN BROWN, Burnley, Lancashire, "Certain improvements in power-looms for weaving."—*Petitions recorded 6th September*, 1861.

2237. WILLIAM AINSWORTH, ELLIS HEAP, WILLIAM FIELDING, and ELI OPENSHAW, "Certain improvements in power-looms for weaving."

2238. NICHOLAS DORAN PROBY MAILLARD, Dublin, "Improvements in the material and preparation of the material and apparatus for making potash, pearlash, and caustic potash of commerce."

2239. JOHN CARPENDALE and THOMAS MIDDLETON, Sheffield, Yorkshire, "Improvements in means of producing raised chasing on copper, silver, and Britannia metal by the application of pressure."

2241. JOSEPH HOLLAND, Manchester, and GEORGE ORELL, Ashton-under-Lyne, Lancashire, "Improvements in apparatus by which an engine or train is made to give an alarm or signal at any required place on arriving at or passing any given point on the railway."—*Petitions recorded 7th September*, 1861.

2245. GEORGE MALCOLM, Dundee, Forfarshire, N.B., "Improvements in machinery or apparatus for softening or treating jute, hemp, flax, or other similar fibrous substances."

2246. WILLIAM SIMONS, Renfrew, N.B., "Improvements in constructing ships or vessels."

2253. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in fire-grates and furnaces for domestic and other purposes."—A communication from Paul Baudet, Paris.—*Petitions recorded 9th September*, 1861.

2255. JOHN ANTHONY, Oxford-terrace, Poplar, Middlesex, "Improvements in steam boilers and generators."—*Petition recorded 10th September*, 1861.

2258. LEON PIERRE BARRE, South-street, Finsbury, London, "Improvements in tubular steam boilers."

2260. WILLIAM LYNALL THOMAS, Hill-street, Berkeley-square, London, "Improvements in projectiles."—*Petitions recorded 11th September*, 1861.

2262. GEORGE HENRY BIRKBECK, Southampton-buildings, Chancery-lane, London, "Improvements in needles."—A communication from Thomson Hankey Alexander, Washington, Columbia, U.S.—*Petition recorded 12th September*, 1861.

2275. PAUL DUBRULE, Tourcoing, France, "Improvements in apparatus for manufacturing figured or ornamental stuffs with headle power-looms."

2278. RICHARD FELL, Kingsland, London, "Improvements in compressing and rarifying atmospheric air with machinery, for applying the same to obtain a motive power, part of which is applicable for cooking purposes."

2280. THOMAS LAURIE MURRAY, Paris, "Improved applications of mica previously coloured or metallised, for letters and signs, decorating churches, rooms, shops, frames, and other ornamental and useful purposes."—A communication from Mr. Frederic Holthausen, Paris.

2211. JOSEPH BENNETT HOWELL, Sheffield, Yorkshire, "Improvements in the manufacture of chains and chain-cables."—*Petitions recorded 13th September*, 1861.

2286. JOHN ADAMS KNIGHT, Symond's-inn, Chancery-lane, London, "An improved apparatus for rendering fatty or oleaginous matter and delivering the same."—A communication from Wellington Lee, Esq., East 19th-street, New York, U.S.

2291. JAMES KING and JOHN SUTCLIFFE, Rochdale, Lancashire, "Certain improvements in or applicable to machines for spinning and doubling."—*Petitions recorded 14th September*, 1861.

2308. WILLIAM STEWART, Peckham, Surrey, "Improvements in apparatuses for supporting persons in, and for enabling them to progress through, the water."—*Petition recorded 16th September*, 1861.

2344. JOHN GRAHAM, Ann-street, Devonport-street, Commercial-road East, London, "An improved double-acting force or lift-pump for ships' fire-engines and other purposes."—*Petition recorded 19th September*, 1861.

2357. WILLIAM GODLEY CREAMER, Woburn-place, London, "Improvements in railway-brakes, and in apparatus for actuating the same."—*Petition recorded 20th September*, 1861.

2380. ANGELO JAMES SEDLEY, Regent-street, London, "Improvements in constructing bridges and viaducts."—*Petition recorded 24th September*, 1861.

2388. CARL GUSTAV LENK, Maddox-street, Regent-street, London, "Improved pens."—*Petition recorded 25th September*, 1861.

2423. WILLIAM NEWTON WILSON, High Holborn, London, "Improvements in sewing machines and apparatus connected therewith."—*Petition recorded 28th September*, 1861.

2466. THOMAS WARWICK, Birmingham, "An improvement in the manufacture of umbrellas and parasols, and improvements in machinery to be used in the manufacture of umbrellas and parasols."—Partly a communication from Charles Augustus Van Kirk, Philadelphia, U.S.—*Petition recorded 3rd October*, 1861.

2476. EDWARD THOMAS HUGHES, Chancery-lane, London, "Improvements in the permanent way of railways."—A communication from Laurent Rigolier, Lyons, France.—*Petition recorded 4th October*, 1861.

2522. FREDERICK CURTIS, Newton, Middlesex, Massachusetts, U.S., "A new and useful improvement in fire-arms."—*Petition recorded 9th October*, 1861.

2640. HOWARD BUSBY FOX, Liverpool, "Improvements applicable to iron and other metallic bedsteads."—*Petition recorded 2nd October*, 1861.

2745. MYER MYERS, MAURICE MYERS, and WILLIAM HILL, Birmingham, "Certain improvements in metallic clips or joints for holding, connecting, and adjusting crinolines, and other purposes."—*Petition recorded 1st November*, 1861.

2809. WILLIAM ALBERT SHEPARD, Pall-mall, London, "Improvements in preparing and treating gutta-percha and india-rubber."—*Petition recorded 7th November*, 1861.

2848. JOHN HODGKINSON and DANIEL GREENHALGH, Bolton, Lancashire, "Improvements in machinery or apparatus for preparing cotton, cotton-waste, or other fibrous materials to be spun."—*Petition recorded 13th November*, 1861.

2902. JAMES HEMINGWAY, Robert-town, Yorkshire, "Improvements in machinery or apparatus to be used in the working 'winning,' or mining of coal, clay, shale, and other minerals or earthy matters."—*Petition recorded 19th November*, 1861.

2961. ALFRED VINCENT NEWTON, Chancery-lane, London, "An improved method of removing and preventing the formation of calcareous and saline deposits in steam boilers."—A communication from Lewis Baird, Cambridge, Massachusetts, U.S.—*Petition recorded 25th November*, 1861.

2997. HENRY WILDE, Manchester, "Improvements in magneto-electric telegraphs, and in apparatus connected therewith."—*Petition recorded 28th November*, 1861.

3047. ALLEN THOMAS CARR, Carlisle-street, Soho, London, "The addition to horses' shoes of certain material to prevent slipping."—*Petition recorded 5th December*, 1861.

3142. EDUARD CLAUDE BARBOTTE DE BEAULIEU, Avallon, Yonne, France, "Improvements in apparatus for extracting gold-dust from auriferous sands."

3148. WILLIAM HUSBAND, Hale, Cornwall, "An improved water safety-valve."—*Petitions recorded 14th December*, 1861.

3154. WILLIAM BARTRAM and WILLIAM SHELDON HARWOOD, Sheffield, Yorkshire, "An improved apparatus for filling and ramming cartridges for breech-loading and other fire-arms."—*Petition recorded 16th December*, 1861.

3159. WALTER HENRY TUCKER, Fleet-street, London, "Improvements in locks."—*Petition recorded 17th December*, 1861.

3201. THOMAS GREEN, Smithfield Ironworks, WILLOUGHBY GREEN, Brunswick-place, and ROBERT MATHERS, Trafalgar-street, Leeds, Yorkshire, "Improvements in lawn mowing, rolling, and collecting machines."—*Petition recorded 20th December*, 1861.

3225. FRANCOIS LAURENT and JOHN CASTILLAZ, Rue St. Croix de la Bretonnerie, Paris, "Improvements in the manufacture of colouring matters."—*Petition recorded 24th December*, 1861.

36. GEORGE TOMLINSON BOUSFIELD, Sussex-place, Loughborough Park, Brixton, Surrey, "Certain new and useful improvements in machinery for propelling water craft."—A communication from Edward Sabine Renwick, Broadway, New York, U.S.—*Petition recorded 4th January*, 1862.

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 11th January, 1862.

1277, 3d.; 1347, 6d.; 1348, 3d.; 1349, 3d.; 1350, 1s. 2d.; 1351, 6d; 1352, 7d.; 1353, 4d.; 1354, 10d.; 1355, 7d.; 1356, 1s. 3d.; 1357, 3d.; 1358, 10d.; 1359, 9d.; 1360, 3d.; 1361, 3d.; 1362, 6d.; 1363, 5d.; 1364, 3d.; 1365, 3d.; 1366, 11d.; 1367, 3d.; 1368, 3d.; 1369, 5d.; 1370, 7d.; 1371, 10d.; 1372, 7d.; 1373, 3d.; 1374, 9d.; 1375, 7d.; 1376, 3d.; 1377, 3d.; 1378, 1s. 11d.; 1379, 1s. 4d.; 1380, 3d.; 1381, 3d.; 1382, 5d.; 1383, 3d.; 1384, 3d.; 1385, 8d.; 1386, 1s. 10d.; 1387, 4d.; 1388, 10d.; 1389, 10d.; 1390, 3d.; 1391, 3d.; 1392, 3d.; 1393, 7d.; 1394, 9d.; 1395, 6d.; 1396, 3d.; 1397, 10d.; 1398, 3d.; 1399, 7d.; 1400, 6d.; 1401, 3d.; 1402, 1s. 4d.; 1403, 6d.; 1404, 3d.; 1405, 3d.; 1406, 3d.; 1407, 3d.; 1408, 1s. 4d.; 1409, 10d.; 1410, 3d.; 1411, 4d.; 1412, 3d.; 1413, 3d.; 1414, 3d.; 1415, 10d.

*** Specifications will be forwarded by Mr. Bennett Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

(Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.)

1633. M. A. F. MENNONS, *Paris*, "*Caloric engines.*"—*A communication.*—*Dated 26th June*, 1861.

This invention consists in a new or improved combination of known machinery applied to the construction of locomotive, stationary, marine, and other engines. The essential elements of this combination—in which heated air is the motive agent—are, First, a ventilating apparatus, by means of which cold air is thrown into the body of the engine. Secondly, a furnace composed of a metallic cylinder, provided with a horizontal grate carrying the fuel with vertical grated apertures giving passage to the air supplied by the ventilator. Thirdly, a turbine mounted on a horizontal shaft, and driven by the dilated air mingled with the gaseous products of the combustion. Fourthly, a regenerating apparatus, by means of which the cold air supplied by the ventilator is progressively heated to a given point, while the temperature of the hot air escaping from the turbine is reduced in the same proportion.

CLASS 2.—TRANSPORT.—NONE.

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

1609. R. ORMEROD, *Manchester*, "*Manufacture of ornamental or fancy ribbons.*"—*Dated 22nd June*, 1861.

This invention consists in printing patterns or devices in the form of ribbons upon calico or other fabrics in the piece by means of the well-known method of engraved cylinders, the cylinders being engraved with the required ribbon designs, and the colouring apparatus adapted as usual. When the entire piece is printed the ribbons so produced are to be severed or divided by an arrangement of cutters, and wound upon spools as ordinary ribbons, and are to be employed for trimmings and other suitable purposes.

1615. J. FERRABEE, *Phœnix Ironworks, Stroud*, "*Machines for fulling woollen and other fabrics.*"—*Dated 24th June*, 1861.

This invention cannot be described without reference to the drawings.

1617. H. B. BARLOW, *Manchester*, "*Knitting machinery.*"—*A communication.*—*Dated 25th June*, 1861.

The object of this invention is to produce knitted fabrics of varying widths by means of certain improved arrangements of self-acting machinery, which are applicable to rectilinear and to circular frames. The improvements consist in the general arrangement of the whole of the parts, and in the peculiar construction of some of the parts, and in the mechanism for actuating the jacks or sinkers, and parts in connection therewith to form the stitches or meshes. The needles are stationary, but the jacks or sinkers, by which the thread or yarn is guided, are actuated to and fro and up and down by means of three cam bars furnished with the requisite elevations and depressions. Another part of this invention consists in the mechanism for reducing the number of needles according to the width of the stocking or other article to be knitted. The reduction or narrowing is effected by a division wheel, to which one or more toothed segments are attached, and these segments act in combination with a vertical and two horizontal racks, which are in communication with the needles; or a compound sliding rack with suitable levers may be used in lieu of the division wheel above referred to.

1618. W. E. GEDGE, *Wellington-street, Strand, London*, "*Doubling and twisting the threads of any textile matter with any material susceptible of being carded or combed.*"—*A communication.*—*Dated 25th June*, 1861.

This invention is very simple; its object is to utilise waste wool and old woollens which have been carded afresh, but which cannot advantageously be again spun alone. This is effected in the following manner:—To an ordinary throttle-frame is adapted a cylinder carrying the material which has undergone the usual carding preparations, and a creel or bobbin holder on which is rolled the cotton or other threads intended to serve as standing warp for the materials it is desired to spin; the threads on the bobbins are so arranged that, in their rotation (which may be accelerated at will), they slightly graze or touch the carded material placed on the before-mentioned cylinder, so that these cotton threads cover or coat themselves with wool, and thus a thread or yarn is obtained the exterior of which is wool and the interior cotton.—*Not proceeded with.*

1623. F. WARREN, *Birmingham*, "*Churka or roller-gin.*"—*Dated 25th June*, 1861.

This invention consists, First, in making both the rollers of metal, when desired. Secondly, in cutting spiral grooves in one roller, and rounding or in any way blunting the edges of such grooves to prevent their cutting the fibre of the cotton. Thirdly, in pressing the one roller upon the other, when practicable, so as to produce raised lines upon the one roller that shall correspond to and work in the grooves of the other. Fourthly, in using rollers with grooves cut lengthwise, and placing a piece of metal or other suitable material in a position relative to the rollers, so as to prevent the seed from being drawn through with the fibre, as would otherwise be the case when such rollers are used. Fifthly, in grooving both rollers in any way desirable. Sixthly, in inserting material, other than that of which the rollers or either of them is made, into or on such roller for the purpose of roughing the surface thereof. Seventhly, in placing the heads containing one pair or one set of rollers in each head on a suitable framework, and passing a shaft along in a proper position, having thereon gear or friction wheels arranged to work in gear or friction wheels on the rollers contained in the heads aforesaid, so that, by applying steam or other power to the said shaft, the rollers are set in motion. Eighthly, in putting a fast and loose pulley on one of the rollers, and placing a shaft, with suitable pulleys thereon, in any desired position to be driven by steam or other power, and by means of a band or strap from such shaft to convey the power to the rollers. By this method any one of the heads or sets of rollers can be stopped at pleasure, without interfering with the working of any other of the heads on the frame. Ninthly, in making these machines self-feeding.—*Not proceeded with.*

1626. A. SACRE, *Brussels*, "*Preparing and spinning flax, &c.*"—*Dated 25th June*, 1861.

This invention consists, First, in dividing and spreading flax mechanically by a machine which the inventor calls a "divider-spreader." Secondly, in the application in duplicate of the spiral or screw gill arrangement to the first preparatory machine, the object being to do away with the pressing rollers which condense the flax thereon. The fibrous matter having been laid by the divider-spreader, without having been condensed, is conducted between two rows of gill bars. The drawing operation will therefore be effected without breaking or injuring the flax, as it is entirely free in the pins or gills. Thirdly, in the application of a second drawing roller to the said machine, in order to extend over two points the enormous pressure exerted upon the flax. By this means a portion of the waste pressure is utilised. Fourthly, in the application of a fixed pinion upon the drawing cylinder, made to gear into a wheel which is mounted fast upon the shaft upon which the wooden pressing rollers are mounted, so that the working of these latter will be regular, and never stopped by the resistance which might be offered by the flax. This method possesses the advantage of still further diminishing the pressure exerted upon the matter operated upon for the drawing operation. Fifthly, in the machine for spinning flax in the half wet state of different lengths the improvement consists in the inclination to be given to the strick, according to the fineness of thread required to be obtained. In any case the ends of the stricks of flax rub constantly against the drawing cylinder until they are taken hold of between the pressing rollers. The machine is so constructed as to give these various inclinations.

1637. J. HIGGINS *and* T. S. WHITWORTH, *Salford*, "*Apparatus for spinning and doubling cotton, &c.*"—*Dated 26th June*, 1861.

This invention refers, Firstly, to those machines in which a revolving ring flyer is employed, bearing by its periphery against supporting rollers, and through which ring flyer the cop or bobbin of material passes, and consists in supporting such ring flyer by extending it downward, and there adapting a bearing; and for this bearing the patentees use a tube attached to the copping rail, which tube also supports the spindle by which the bobbin is carried, or upon which the cop is formed. Or, instead of the tube above referred to, they form a bearing for the ring flyer by means of a stationary rail, through which the said tube passes; or they place a similar bearing above the ring, instead of beneath it, as above mentioned.

1668. A. V. NEWTON, *Chancery-lane, London*, "*Lapping used in machines for printing textile fabrics.*"—*A communication.*—*Dated 29th June*, 1861.

The patentee claims, First, the use in printing machines of a lapping made in the form of an endless band or belt, and composed of one or more layers or thicknesses of woven material, either with or without a surface or coating of india-rubber or gutta-percha, as described. Secondly, uniting the ends of woven driving bands whereby an even lap or junction will be produced in the manner described.

1676. S. H. GERSTLE, *Paris*, "*Manufacture of needle or tapestry work and coloured embroiderings.*"—*Dated 2nd July*, 1861.

These improvements in the manufacture of needle or tapestry work and coloured embroiderings relate to a mode of working which allows any ordinary needlewoman to produce any number of copies of tapestry work or embroiderings with as much accuracy as would have been possible hitherto only to perfectly trained operatives, and whether the tapestry or embroidery is to be made in worsted, silk, or other yarn, in any required pattern, and in any suitable number of colours, this method being applicable as well to the mode of working in high as in low warp (*haute et basse lisse*). For this purpose the design or outlines of the pattern to be obtained in tapestry work or coloured embroidery is printed, or delineated in any other suitable manner on the canvas or other suitable material that is to serve as a ground or back for the embroidery or tapestry work; a copy of the same design is printed on paper, parchment, or other suitable material, and the various colours and shades indicated thereon by means of numbers, letters, or other marks, each colour or shade being indicated all over the design by its own mark. Along one of the sides of the canvas or other material is fixed a strip of paper, provided with the same series of numbers, letters, or other marks as are inscribed on the design paper, and close to each number is fixed a small sample or tuft of yarn of the colour to which this number or other mark refers; by this means, for executing the tapestry or coloured embroidery on the canvas or other material, the operative will only be required to look at the number inscribed in that part of the design paper which is to be imitated, and will thus find at once the colour of the yarn to be made use of for that part, which yarn is then stitched or worked up on the canvas ground or back in the ordinary manner. Instead of employing canvas for the ground or back, silk, woollen, or other suitable cloth, tissue, fabric, or material might be taken, in which case a suitable number or series of squares, imitating those of a piece of canvas, are to be delineated, imprinted, or in any other suitable manner worked thereon, so as to replace the squares or meshes of the canvas.

1677. J. P. E. PAIGNON, J. M. VAUDAUX, *and* G. GAGNIERE, *Paris*, "*Jacquard machines.*"—*Dated 2nd July*, 1861.

The patentees claim, First, the general arrangement and mode of working of the improved jacquard machine, allowing the use of perforated endless paper in lieu of the ordinary pasteboard pattern cards hitherto made use of in such machines, the said arrangement being combined in such manner that the pressure of the paper against the horizontal needles takes place only when their hooks, wires, or vertical skewers are resting with their lower ends on the harness board, and thus, being in proper equilibrium, allow the said needles to yield with the utmost facility to the pressure exerted on them by the paper. Secondly, providing the endless paper to be made use of in the improved jacquard apparatus with proper division folds, for the purpose of causing the paper suitably to apply itself against flat sides or surfaces of the cylinder or perforated square axis.

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

1623. J. FOWLER, jun., *Leeds*, "*Machines for tilling land by ploughing or steam power.*"—*Dated 25th June*, 1861.

In ploughing or tilling land by steam power it is common to mount the pulleys round which the hauling rope passes on carriages carried by disc wheels, which cut into the land, and thus prevent the carriage being drawn sideways by the strain on the rope, but allow of its travelling endways with considerable facility. In some cases, also, in place of disc wheels, metal plates or shares, also cutting into the land, have been employed; the pulley carriages thus arranged can only with facility be made to travel forward in a straight line. According to this invention the patentee so arranges the disc wheels or coulters that they may be set at an inclination to the carriage either to the one side or to the other, so as to cause the carriage to travel in any required direction. This power of steering the pulley carriage is very necessary when the headland along which it is required to travel is curved.

1637. J. DRAGO, *Hemingham, Whitchaven*, "*Reaping and mowing machines.*"—*Dated 28th June*, 1861.

This invention relates to an improvement in the cutting parts of reaping and mowing machines, the object of which is to prevent the grass from collecting on the points of the fingers or guards, and also to preserve the knives from choking. To this end, instead of constructing the fingers against which the blades cut, after the ordinary manner, the patentee makes each finger or guard in two parts, which he attaches respectively to the upper and under side of the finger bar. For the purpose of keeping the spaces between the fingers clear he places the knives alternately on opposite sides of the knife or cutter bar. The space thus left allows the knives to keep the fingers clear.

CLASS 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

1607. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Floor cloths and paving blocks.*"—*A communication.*—*Dated 22nd June*, 1861.

This invention relates to a peculiar manufacture of tiles or blocks for paving floors or covering other surfaces where hard and durable materials are required, and consists in manufacturing such tiles or paving blocks from a composition of hydraulic lime and sand, suitably prepared and pressed into the desired form by mechanical pressure.

1620 L. PIERRE, *Niort, France*, "*Iron windows or casements.*"—*Dated 25th June*, 1861.

In carrying this invention into effect the inventor fixes the framing on the opening to be closed in a small rabbet on both sides, letting it in at the top, its two sides being adjusted to the sill. The sashes are fitted to the framing by plates or fastenings which fit on to round rods intended to cover the joints. The two sides of the framing carry in their entire height a return or small joint, which, penetrating into a dovetail lined with a band of caoutchouc on which it presses, prevents any air or water penetrating by the two sides. At the upper part of the framing, as also at the lower part of the sill, is also fitted a dovetail lined with caoutchouc, which, receiving a certain pressure by the fastening or bolt (the hooks of which take into the rods) hermetically closes the window.—*Not proceeded with.*

1625. C. STEVENS, *Charing-cross, London*, "*Brickmaking machine.*"—*A communication.*—*Dated 25th June*, 1861.

This invention cannot be described without reference to the drawings.

1630. W. HOLLAND, *Warwick*, "*Suspending and raising and lowering window sashes.*"—*Dated 26th June*, 1861.

This invention cannot be described without reference to the drawings.

PORTSMOUTH NAVY YARD.—No official notice has yet been given at Portsmouth respecting any discharge of hired mechanics or labourers consequent on our renewed peaceful relations with America; it is, however, understood, both by the officials and the men themselves, and is further confirmed by an Admiralty order, that the services of these men will not be required in the present phase of affairs beyond April next. Three of the iron-cased ships now building are to have engines of 1,350 horse power.

AURIFEROUS ROCKS OF VICTORIA.—The area of the quartz-bearing rocks at Victoria, in Australia, is estimated at 25,000 square miles. The total area of the extent of land at present mined upon in that colony is 561 square miles. Thus 89,920 square acres have produced gold to the amount of £92,787,236, on an average of about £1,032 per acre, and there yet remains upwards of 15,000,000 acres almost everywhere intersected by quartz veins of greater or less thickness, which are as yet intact by the pick of the miner.

ANOTHER TYPE-SETTER.—Mr. Felt, of Boston, Massachusetts, has invented a type-setting machine, which will be for compositors what the sewing machine has been for seamstresses. It has capacity, if required, for a thousand different characters, and for any quantity of each character; it will set up two copies at the same time, and in different type, properly "spaced," "leaded," and "justified," at the rate of 15,000 letters an hour. It will also distribute the type after the work is printed; and, what is more, it keeps a register, by punching holes in stips of paper, during the composition: and if at any time a reprint of the work should be asked for the compositor has only to introduce the register into the machine, when, by an ingenious contrivance, the setting of the type goes on precisely the same as for the first edition. Printers may be excused for scepticism concerning this new wonder; but Mr. Felt is to have one at work in the Exhibition.

POPULATION OF FRANCE.—The Minister of the Interior has addressed to the Emperor a report on the late census of the empire. It states that the last census, that of 1856, gave as the population of the eighty-six departments the number of 36,039,364. On the 1st of January, 1862, the population of the eighty-nine departments amounted to 37,382,225 souls, from which arises for the quinquennial period from 1857 to 1861 an increase of 1,342,861, or 3·72 per cent. In taking the part of the new territory annexed to the empire, which comprises 669,059 inhabitants, the effective increase is 673,802, or 1·86 per cent. That result is satisfactory compared with those given by the two quinquennial periods preceding. Thus, from 1846 to 1851 the increase has been 382,684, or 1·08 per cent. From 1851 to 1856 it remained a little below that figure. The census of 1861 gives an increase almost double.

FRENCH RAILWAY RECEIPTS.—The total traffic receipts on the Lyons and Mediterranean Railway for the fifty-two weeks in 1861 amounted to 121,672,710f. (£4,866,911), against 101,931,597f. (£4,077,264) in 1860, showing an increase of 19,741,183f. (£789,647). The total receipts on the Eastern of France amounted for 1861 to 69,632,617f. (£2,785,304), against 63,408,308f. (£2,536,332) for 1860, showing an increase of 6,224,309f. (£368,972). The total receipts on the Paris and Orleans for 1861 amounted to 69,498,794f. (£2,779,952), against 66,055,680f. (£2,642,277) for 1860, showing an increase of 3,443,117f. (£137,724). The total receipts on the Northern of France amounted for 1861 to 64,199,775f. (£2,567,991), against 60,759,398f. (£2,430,398) in 1860, showing an increase of 3,439,825f. (£137,593). The total receipts on the Western of France for 1861 amounted to 55,213,550f. (£2,208,542), and for the year 1860 to 50,940,247f. (£2,037,610), showing an increase of 4,273,308f. (£170,932). The total receipts on the Southern of France amounted to 31,607,412f. (£1,264,279) in 1861, against 25,765,454f. (£1,030,618) in 1860, showing an increase of 5,841,967f. (£233,679). The total receipts on the Paris and Mediterranean new lines amounted to 22,800,822f. (£912,053) in 1861, against 18,644,945f. (£745,798) in 1860, showing an increase of 4,155,877f. (£166,235). The total receipts on the Lyons and Geneva amounted to 7,226,237f. (£289,049) in 1861, against 6,764,852f. (£270,594) in 1860, showing an increase of 461,385f. (£18,455); and the total receipts on the Ardennes line for the year 1861 amounted to 4,115,521f. (£164,621), against 3,641,783f. (£145,671) in 1860, showing an increase of 473,738f. (£18,950). The total receipts on the above-mentioned nine railways for the fifty-two weeks ending the 31st December, 1861, amounted, in the aggregate, on 5,797 miles, to £17,838,701; and for the same number of weeks in 1860, on 5,542 miles, to £15,916,513, showing an increase of 255 miles, and £1,922,188, or about 12 per cent., in the receipts. The traffic receipts per mile in 1861 amounted to £3,077, against £2,872 per mile in 1860, showing an increase of £205 per mile.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

TERMINATION OF THE QUARTERLY MEETINGS—YESTERDAY IN BIRMINGHAM AND WEDNESDAY IN WOLVERHAMPTON—ANTICIPATIONS IN REGARD TO AMERICA—INQUIRIES FROM FRANCE: *The Conditions Imposed: Hopes of the Future with France:* PIG IRON TRADE—THE PRODUCTION OF THIS DISTRICT—COAL TRADE—GENERAL HARDWARE TRADES: *Orders in Movement: The French Inquiry: Singular Sample Lots: Great Depression in the South American Trade*—WILLENHALL TRADE IMPROVED—TIN-PLATE TRADE DEPRESSED—THE BIRMINGHAM CANAL: *Reduction of Traffic: The Management Strictured*—THE GROWTH OF BIRMINGHAM: *Interesting Particulars.*

THE series of Quarterly Meetings terminated on Friday last, at Dudley, where, however, hardly any business was done, and the meeting was scarcely more than a show. All the business was done on the previous day in Birmingham. As stated in our last, that business was more than had been expected, but it was not equal to that usually transacted at a Birmingham quarter day. The orders that were given out for finished iron were of comparatively little value, and so barren of orders was the entire district that they were speedily swallowed up without producing any appreciable effect upon the condition of partial employment in which most works have for some time past been. There continues to be a tolerably good demand at certain leading houses for London, Liverpool, and Manchester, principally—and in regard to the last-named districts almost entirely—iron for ship-building purposes.

Neither yesterday in Birmingham, nor the day before in Wolverhampton, was there any business worthy of note transacted. The different makers of finished iron reported themselves to be pretty much in the same condition as they were before quarter day. Very low prices, it was stated, continue to be taken for bars and hoops. On that account those descriptions are being made, almost exclusively, at the second-class works; but, in sheets and plates, some of the first-class houses are still doing a tolerable trade, and at remunerative rates. The partial suspension of specie payments in America was looked upon as indicating the near approach of a very serious state of things. The speakers, however, congratulated themselves that there was not, now, "out" in America anything like the amount of money that is usually due to us by our customers in that country.

Inquiries for tolerably valuable lots of iron have been made in South Staffordshire in the past few days. They come from France, but are accompanied with so many conditions that it is doubtful whether any ironmasters of note will pay that attention to them that the purchasers require. The iron would seem to be intended for the general smith's purposes of a dockyard. The notions of our French neighbours—as, indeed, of a large number of our continental customers—would seem to be somewhat different to those of English customers. This may be inferred from the conditions with which they accompany their orders. The terms that they are to indicate the quality of iron they require are not sufficiently specific, and are so general as that they might be fully complied with according to the opinion of one man, but, in the estimation of another, fall far short of the required quality. The makers to whom these inquiries have been submitted would have no objection to take the orders if they could fully understand what it is their would-be customers require. They ask for a specific test to be named, and desire that that test should be applied in this country, or they are willing to supply iron which shall bear the test to which the iron is being subjected that is sent from this district to be used by Government contractors, and to which the Government tests are applied When masters are told that the iron must bear a strain of twenty-two tons in one direction and nineteen in another they understand what is meant, and are prepared to supply such iron; but when they are told that the iron must be ductile, they have no specific test, but they know that iron which is "ductile" in the estimation of one man is not so in that of another. It is hoped that by and by, when the Frenchmen learn somewhat better business habits, they, as buyers, and the ironmasters of this country as sellers, will be able to understand each other, and that we shall be able to do an amount of business with them that will make it worth our while to look after their orders; at present, however, in regard to finished iron, as also to hardware goods, referred to below, the Frenchmen are "more trouble than profit."

With these exceptions there is scarcely any appearance of movement in the foreign trade, and the demand seems to be almost entirely for home consumption, and is for particular descriptions. In the patterns which are usually denominated general merchant iron there is scarcely anything doing. Rafters and girders continue to be largely made here, and one maker is very busy upon iron required in carrying out the London sewerage.

Pig iron continues to be offered at prices which the buyers maintain are not in advance of the rates current three months ago, but there is a slight advance in certain descriptions of hematite iron.

In another part of THE ENGINEER we give a statement of the furnaces in blast in this district, which Mr. Griffiths has just compiled and published in his Circular. It appears that in this locality the number of furnaces in blast has decreased 32 since this period last year. Since 1857 the fall off has been general; there having been, in September of that year, 147 furnaces in; at the present time there are 108 only. There has also, in the meantime, been a small increase in Shropshire. The total number of furnaces in blast in Great Britain, in the first week of this month, was 533; out of blast, 354. Mr. Griffiths estimates the make of pig iron in Staffordshire, last year, to have been 919,620 tons; in Shropshire, 148,728 tons; and the total of Great Britain, 3,972,280 tons. He further estimates that, in order to produce this quantity of pig iron, there would be consumed twelve millions of tons of coal, nine millions of tons of ironstone, and nearly three millions of tons of limestone.

The coal of the valuable thick measure continues to meet a ready sale at our last quotation.

With reference to the general hardware trades we may remark that some excellent orders are now being rapidly given out by factors engaged in the Canadian trade, with which colony a splendid trade will be done this spring by houses who have laid themselves out for that particular market. From South America the accounts are in the most gloomy tone. A large trade in hardwares is usually done between this district and that part of the world. In consequence not a few agencies have been opened there by Wolverhampton and Birmingham firms. Such, however, is now the utter disorganisation of that country that some agents maintain that the interests of their employers would be better served by the realising of their stocks at a sacrifice of even seventy five per cent. than by their remaining any longer with the goods unsold. France continues to present hopeful features. Agents in Paris assure their principals in Wolverhampton that if they will only bear awhile with the "nibbling" of the French ironmongers, an excellent trade will by and by be done with our Gallic neighbours. The orders that come across are of considerable length, but they are comparatively worthless. In fact, their execution involves a loss. But seeing that, with very few exceptions, the goods ordered are of English pattern, it is clear that the buyers are cautiously "feeling their way." They know that they are introducing to their customers articles which will seem entirely new, and in many cases quite novel; and, until they know how their customers will receive them, they will not order a larger quantity than is absolutely necessary to indicate the character of the British hardwares. The French manufacturers are striding before us into several foreign markets. But agents in the markets referred to assure their principals in this town and Birmingham that a little imitative ingenuity by the English manufacturer would enable him to beat the Frenchman in several important articles, and, at the same time, realise a good profit. The home trade in hardwares continues to be greatly superior to the foreign. Every morning factors and merchants receive a large number of letters from almost every part of the kingdom. They contain specifications of little value, 'tis true, but they are numerous, and require immediate execution. Thereby they indicate that stocks are everywhere very low, and that only an improvement is needed in certain of the leading foreign markets, by which the general trade of the country would be stimulated, to occasion a demand that would materially benefit the miscellaneous trades of Wolverhampton and Birmingham. The trade of Willenhall, which in the past few weeks has been subsiding into even smaller dimensions than before characterised it, is experiencing a slight revival. The improvement is especially felt in the lock trade, in which more orders were given out one day last week, even before the arrival of the City of Washington, than have been received on any one day for a considerable period. The tin plate trade is in a depressed condition, so much so that some of the Welsh houses have had temporarily to close their works.

The half yearly meeting of the proprietors of the Birmingham and Worcester Canal has been held in Birmingham. The report stated that, owing to the depression of trade, the revenue of the canal for the half year ending Christmas exhibited a decrease of £752 10s. 3d. when compared with the corresponding period of 1860. From the financial statement it appears that the balance of profit and loss to the 30th of November amounted to £4,037, which balance the committee recommended should be appropriated as follows:—1st, in payment of the guaranteed dividend on the Droitwich Junction Canal shares, £600; 2nd, in liquidation of the sum standing to the debit of the dredging account for the last half year, £173 1s. 9d.; 3rd, in payment of a dividend of 10s. per share on the shares in this canal, £3,000; making a total of £3,773 1s. 9d., leaving a balance of £264 11s. 5½d. to be carried to the credit of the ensuing half year. It was stated that the works of the canal continue in good order, and the stock of water now in the reservoirs was amply sufficient to supply the trade during the ensuing half year. In reference to this company a writer has said, "This concern, like others, cannot stand still, it must keep pace with the requirements of the time, or the value of the property will still further retrogade, not that there is such margin, the market prices being no more than £13 to £14, upon which £78 8s. has been paid." We need scarcely say that it is with no desire to reflect in any improper way upon the committee that we say that the management is altogether too "slow" for these times, that there are too many traces of the rust of antiquity for the Worcester and Birmingham Canal shareholders to participate to the extent they might do in this property. The business has been so far carried on upon what we may call the "genteel principle," with the results detailed in the above report. From what took place at the meeting it is evident that some of the proprietors are alive to this; that there is a determination if possible to stir up the management with the view to infuse a little more action into their cumbrous machinery.

Notwithstanding the disturbing influences of the American war, which have seriously affected the condition of trade during the past year, it is satisfactory (says the *Birmingham Journal*) to find that the town continues to extend in a way that indicates a considerable amount of prosperity. Its material progress, in fact, as indicated by this criterion, is greater than at any period since 1855. A glance at the actual state of the case will illustrate our meaning, and we cannot convey it better than by the following returns of the building plans lodged with the borough surveyor, according to the Improvement Act, from the 1st of January to the 31st of December in each year:—

	Houses entered.		Houses entered.
1852	3,000	1857	612
1853	2,784	1858	605
1854	2,219	1859	689
1855	1,253	1860	778
1856	803	1861	811

This return, however, without some explanations, would be illusory. In the four or five years just named building was in an exceptional state. Whole streets had been swept away by the construction of the various railways, rendering necessary the re-erection of buildings on a somewhat extensive scale. Still the decline up to 1859 was very marked, and is to be accounted for in various ways—periods of depressed trade and over speculation being amongst the number. We believe that the chief cause is to be found in the growing desire to build in the suburbs and beyond the limits of the borough. On every side beyond the borough boundaries considerable towns have sprung into existence, with their villa residences, workshops, and manufactories, which do not appear in the borough surveyor's return, but which, if included, would, perhaps, go far to double the apparent results. As the details are somewhat interesting, we give them for the last five years:—

	1857.	1858.	1859.	1860.	1861.
Houses	612	605	689	778	881
Churches..	1	0	1	0	0
Chapels	0	3	1	2	2
Schools	1	2	4	10	1
Manufactories	7	4	7	10	9
Warehouses	16	5	12	16	20
Workshops	33	24	32	46	29
Stables	0	8	8	8	12
Miscellaneous	21	5	0	9	11
Alterations and additions	83	69	68	54	56

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

NORTHERN MATTERS: *General Aspect of Affairs: Trade of the North-East Ports: Shipbuilding on the Wear: Whittle Dean Water Company*—RIVER TYNE COMMISSION: *Growth of the Shipping Trade of the Tyne: Proposition for Street Railways in Newcastle*—LIVERPOOL: *Birkenhead Ferry Receipts: Mersey Docks and Harbour Board: The New Spanish Line of Steamers: Monster Anvil Block: Coast Defences, &c.*—STATE OF TRADE: *Sheffield, Leeds*—LANCASHIRE WATERING PLACES: *Blackpool, &c.*—EASTERN COUNTIES RAILWAY: *Opposition to the Amalgamation Bill: Extraordinary Accident.*

WE commence with the north. The aspect of commercial affairs seems, on the whole, rather more hopeful. True, things in America look almost as bad as ever, and the cotton supply question has been aggravated by the unprecedented shipments to instead of from the States; but one must take a general view of matters, and the tendency of the advices from India is decidedly favourable, while Europe is at rest, and even the Emperor Napoleon professes to be praying for a year of "consolation and peace." It is stated that the stocks of coal, iron, and general merchandise in central and southern Europe are low, and that persons are desirous of doing business—especially in France. If this is the case we may expect that industry, so long torpid and idle, will to some extent revive, and that 1862 will prove a better year than its gloomy predecessor. The resources of commerce are vast; the sphere of commercial operations becomes more and more extended day by day; and, if one outlet is closed, it will be hard if we cannot find some compensation in another direction. Returns just made up for December show a decline in the shipment of coals from Newcastle, Middlesboro', and Stockton, but an increase in the shipments from Sunderland, the Hartlepools, Blyth, and Shields. In coke there has been a decline in the shipments at all the Northern ports except the Hartlepools. In the shipment of general merchandise there has been a decrease at Newcastle, but an increase at all the other ports in the North Eastern district. The collieries on the Wear have not been working very briskly lately; but the local shipbuilding trade seems to have made a pretty good twelvemonth of it last year. Thus, in 1861, 126 vessels were launched on the Wear, being 14 more than in 1860, and 26 more than in 1859. The 126 represent an aggregate tonnage of 46,778, the largest amount since the year 1857, when 143 vessels were built, with a tonnage of 54,780. Of the vessels built last year 56 were sold to Sunderland owners, 26 to London, 22 to the Tyne, and 7 to Liverpool. The average tonnage was 371¼, lower than that of many years, the highest for some period being 454¼, in 1853. Messrs. Scott and Reed, of Newcastle, have obtained a contract for new filter beds at Benwell in

connection with Whittle Dean Waterworks. The cost of these works will be somewhere about £5,000, according to the calculations of Mr. Bateman, the engineer consulted by the company. At a meeting of the shareholders of the company last week the chairman stated that it would be necessary to obtain greater conveying power. When the company was originally established to bring water from Whittle Dean a main pipe, 24in. in diameter, was laid down from Whittle Dean to Newcastle-upon-Tyne. At the time the pipe was laid he believed it was the largest then cast; the requirements of the town were 900,000 gallons per day, and the pipe was supposed to be abundantly sufficient not only for that time but for a great many more years than it had proved to be sufficient for. A 24-in. pipe was now barely large enough to bring down the water required, and the directors proposed to remedy this by laying down two pipes. They would be made larger, inasmuch as the prices of iron were at present favourable to the company, and would be 30in. in diameter. There was an advantage in having two pipes instead of one; for, according to the statement of Mr. Bateman, two 24-in. pipes were really better than one bringing the same amount of water, because, in case of accident happening to one, the other could still bring a supply of water. Another advantage of a second pipe would be that the amount of friction caused by over-pressure on one pipe would be lessened, and greater delivering power would consequently be obtained. In November there was something like 100,000,000 to 200,000,000 gallons in the reservoirs. Still Mr. Bateman thought they had run it rather too closely in a dry season to be safely dependent merely upon the supply they at present possessed, and that was the reason they were now asking for a greater water supply. The supply they at present possessed was more than sufficient for the requirements of house consumption; but they had scarcely sufficient to supply the requirements of the town and trades. To supply the manufactories they proposed to pump water from the Tyne at Newburn. They had two engines there, and one second pipe was proposed to be laid down, which was a necessary step, and whether they went to the Tyne or not they must have a new pipe for house consumption. The directors did not at present propose to supply the Tyne water for domestic use; it was, first of all, stained with mud; filtration would take that out, but so long as the peat stain remained in the Tyne water, at certain seasons of the year, it would be unfit for house consumption. They required an engine at Gateshead at a cost of £5,000, and Mr. Bateman thought—the directors concurring with him—that their engine power for high service was not sufficient, and that they ought to increase it. Mr. Bateman was preparing a minute and extended report on the general feature of the company's works, and proposed to recommend the construction of a reservoir at Hallington, in the western district. In 1846 the company's revenue had been stationary at £6,000, but in 1862 it would reach something about £22,000; being an increase of about £1,000 per annum. The consumption at that time was 900,000 gallons, and at this 4,700,000 gallons. The shareholders were asked for an expenditure of £7,000 upon filters—that was £5,500 at Benwell, and £1,500 down the Tyne; upon pipes the sum of £25,000; the engine at Gateshead £5,000; making in all £37,000. To raise that they would have to go to Parliament for a money bill, and the question would be whether, in going to Parliament, they should not, at the same time, apply for powers to make the Hallington reservoir. The chairman concluded by moving that the directors be authorised to proceed immediately with the works recommended for increasing and improving the supply of water. Mr. Hawthorn said he thought they were going into the matter in an unsatisfactory manner, and he considered that, as Mr. Bateman had devoted his attention to gravitating more than to pumping waterworks, it might be necessary to have an engineer who had paid some attention to the latter before they proceeded with the work. Mr. Hawthorn moved as an amendment that the full report of Mr. Bateman should be laid before the shareholders before any steps were taken. After discussion, however, Mr. Hawthorn withdrew his motion, and the proposition of the chairman was put and adopted.—We pass on to the doings of the Tyne Improvement Commissioners, who held their monthly meeting yesterday week. The Dredger and River Works Committee reported that they had accepted the tender of Messrs. J. W. Richardson and Co., for the construction of a steam hopper-barge for the sum of £4,175, on condition that the engines and boilers should be supplied by Messrs. Hawthorn, and that the latter be parties to such contract so far as respects the engines and boilers. The Piers Committee, in accordance with a wish expressed at the last meeting of the commissioners, have had under their consideration the financial means at the disposal of the commissioners applicable to the piers works, and to what extent the piers can be carried on with such means. With regard to the shorter line of piers, estimated by Mr. Walker to cost £550,000, it is found that that line can be completed, with the present borrowing powers, in twelve years, leaving, at the expiration of that period, a surplus of £16,000 per annum for a sinking fund. If the borrowing powers be increased to £400,000 from their present amount, £300,000, the pier could easily be completed within five years, the time named by Mr. Walker, leaving, at the end of that time, a free revenue of £6,910 after payment of interest on the mortgage debt. With respect to the middle line of piers, costing £660,000, it is found that this cannot be completed, with the present borrowing powers, within a reasonable period; nor within the time named by Mr. Walker, namely, six years, without exhausting nearly the entire income for interest, and leaving scarcely any surplus for redemption. The committee, however, append a table, showing that, with extended borrowing powers, this line of piers can be completed in ten years, leaving at the end of that time a mortgage debt of £450,000, and an annual free revenue of £9,700 applicable hereafter to the redemption of capital. Those statements were based upon the assumption of the commissioners putting in force the full powers of taxation on an estimated annual increase in the revenue of the trust, and also on an assumption that the capital required would be borrowed at 4½ per cent. per annum. A committee was appointed to investigate the engineering expenditure on the piers works, with instructions to report at the next monthly meeting. The effect of this is to again defer the consideration of Mr. Walker's further plans.

The great advance made by the trade of the Tyne during the last ten years—notwithstanding the steadily-sustained grumbling which prevailed last year—is seen in the fact that, while in 1857 2,846 vessels entered the river, the number were in 1867 no less than 7,262. Our Tyneside friends must be working at much reduced profits to justify the constant complaints which they have been making, for there can be no doubt that they have been doing an enormously extended business. At the last meeting of the Newcastle Town Council a communication was read from Messrs. Samuel and Bruce, of London, proposing to introduce into Newcastle a system of street railways at their own cost—the lines of rails to be laid to the satisfaction of the town surveyor, flush with the surface of the road so as not to interfere with the ordinary traffic; the paving or metalling between the rails, and for one foot on the outside of each rail to be maintained by them so long as the rails remain down; the working of the line to be subject to such regulations as the council might see fit to enforce; the charge for the conveyance of each passenger not to exceed 1d. per mile; and the work to be completed within six months from the date on which permission was granted for its commencement. In consideration of the expense which these terms would involve Messrs. Samuel and Bruce solicited a concession to lay down and work the line for seven, fourteen, or twenty-one years, with six months' notice, should the local authorities wish to become possessed of the property, and any arrangement for sale to be based on the profits of the previous three years, the assumed value of money being five per cent. The communication was referred to the Town Improvement Committee, who will doubtless give it their serious consideration, as it emanates from gentlemen who have satisfactorily carried out similar projects in other large towns.

We glean several items of interest from the Liverpool district. The Birkenhead ferry receipts continue to roll on prosperously, having been £22,447 in the eight months ending Dec. 31, 1861, as compared with £20,033 in the corresponding eight months of 1860. The Mersey Docks and Harbour Board, at its last meeting, accepted the tender of Messrs. Home and Nicol for the construction of slides, &c., between the Wapping and King's docks. It was decided not to enforce the penalty incurred by Messrs. Jones and Pump for the non-completion, within the prescribed time, of sheds on Victoria Wharf, Birkenhead, a prolonged frost and a strike among the workmen having impeded the works. It was rather agreed to accede to an application from Admiral Evans for permission to place the five or six gunboats now stationed in the Mersey in the Great Float at Birkenhead. A memorial was read from certain shipowners in Liverpool, asking for extended graving dock accommodation on the Liverpool side of the Mersey, the present accommodation being quite inadequate to the requirements of the memorialists, who sustained inconvenience from their vessels having frequently to wait thirty or thirty-five days before they could be accommodated. Mr. Fernie said the members of the board were aware of the difficulties under which shipowners laboured with regard to this important question. During the last year ships, sailing ships especially, were regularly detained from three to five, and frequently more weeks for their turn in the graving dock. Ten years had elapsed since the Sandon graving docks were formed, at which period they were something in advance of the requirements of the port, and for a year or two these docks were not so greatly in demand; but the increasing requirements of the port caused them soon afterwards to be constantly used; and although graving docks had also been made on the other side of the Mersey by private parties, even they had also gradually come into use during the last two or three years. The want was a growing one, and would become more and more felt. It was, he understood, proposed to construct graving docks at the north end, somewhere about the site of Bootle land-mark; but this it was said could not be effected in less than three, or it might be five years. The board should not leave shipowners for three or five years waiting for such accommodation. The shipowners had looked to the south end, seeing that at the north so long a time must elapse before the docks could be finished. The land lying south of the Toxteth Dock, which belonged to the board, appeared very little used at present, and would become most easily available for graving dock purposes. If the board would turn their attention to this piece of ground the shipowners believed their dock engineer could soon produce a plan which could be carried out with great rapidity and at a moderate cost, and thus the pressing wants of the port would be provided for. The chairman said the matter referred in the memorial and by Mr. Fernie was very important, and it was receiving the best consideration of the Works Committee. If anything could be done to forward the proposed graving docks at Liverpool in a less time than three years it would be the object of the board to carry it out, provided it did not interfere with the great works in progress at Birkenhead, and which it was the desire of the board to complete as speedily as possible. Details were recently given in THE ENGINEER of the Prince Albert screw steamer, the first of a line destined to ply between Cadiz and the Spanish settlements in the West Indies, Havana being the head port of call. The line will consist of eight vessels, and will be in the hands of the Spanish Government, which has of late been giving such general proofs of activity and vitality. Two of the other steamers have left England for Cadiz during the last few days, viz., the Scotland from London and the Vigo from Liverpool. The Scotland is an exact copy of the Prince Albert, but the Vigo has considerably more power, while her tonnage is rather less. On a trial trip her speed was found to be 12½ knots an hour. These vessels will be followed by two others, by the end of this month, of equal tonnage, speed, and accommodation; and by the 10th of March next the whole of the eight vessels will be completed and delivered at Cadiz. The steamers have been completed and fitted out under the management of Mr. James Hodgson, consulting engineer, of Liverpool. Messrs. Fawcett, Preston, and Co., cast on Friday afternoon the sole or anvil block of a gigantic steam hammer about to be erected on the premises of the Mersey Steel and Ironworks. The casting was a somewhat irregular mass of metal measuring 9ft. square on the base, which is 12in. thick. From the middle of this base there rises a vertical projection 5ft. high, 7ft. wide from side to side, and 20in. thick. This, which forms the bed of a steel anvil, is supported by four diagonally shaped ribs, tapering from the base to the top of the vertical ridge; these ribs being each 12in. thick. Midway between the ribs there are two blocks, one on each side of the vertical ridge, and connected with it, each measuring 2ft. high by 2ft. 6in. wide. The whole of this irregular series of concentric cubes forms one homogeneous mass of metal of the weight of between 35 tons and 38 tons. To complete this stupendous casting no less than 40 tons of metal were melted; yet such are the efficient means of operation possessed by Messrs. Fawcett, Preston, and Co., that the whole was fused and run without any addition to their ordinary appliances or staff of operatives. The casting was, in every respect, successful.—A plan for erecting coast batteries has been communicated to the *Liverpool Albion*, by Dr. Eddy, whose paper on iron-plated vessels attracted attention at the last British Association meeting. Boiler-plate iron, with sand and clay, are the materials principally employed; these are surmounted by a streak or two of massive iron plate to form a breastwork, behind which the guns would be worked, and over which, moreover, a hundred rifles would be levelled at the pilot of the hostile vessel. The proposer of the above plan claims for his invention the merit of great indestructibility. He asserts that it may be riddled with shot and shell without sustaining such injury as would silence it, and that it also affords better protection to the artillerymen than any similar battery formed of other materials. Dr. Eddy also proposes a plan for partially closing or narrowing the entrance to harbours, by means of a strong net of coir rope, which floats and spreads out horizontally, and is so fastened that, if a vessel should carry it away, it would very materially clog her movements, while, at the same time, no such permanent injury is done to a harbour, as has been inflicted by diabolical Yankee cunning at Charleston.

From Sheffield we learn that some of the large steel houses in that town have good orders on hand from Government for steel required for articles of war, although, in other respects, they are not busy. The demand for railway springs is only moderate, and there has been a disagreement in this trade between some masters and their men, which has not improved matters, although the difference is not likely to be of long duration. The silver plate and Britannia metal trades have slightly improved, but the cutlery trades continue depressed. A few orders received on American account have been executed in consequence of the recent favourable advices. The iron trade of Leeds continues good, the supply of best iron being always anticipated by the demand, while the machine and tool trades are not badly employed, all things considered.

At Blackpool, a pleasant north of England watering-place, a pier is in contemplation, about 450 yards in length. At a recent meeting of the promoters of the scheme it was stated that the average number of visitors to Blackpool during the six months forming the season, and staying about a fortnight, was between 90,000 and 100,000. The erection will be carried out by a limited liability company, with a capital of £10,000. It was estimated that the revenues of the company would amount to £3,000 per annum, and that the disbursements could not exceed £1,000. From the nature of the coast the pier will have to be 50 feet in height at its extremity. Improvements, which are being also carried out at Lytham with the new line of railway to Blackpool, are progressing satisfactorily, the permanent rails being laid from the road near the parish church to the Cross Slack, beyond the lighthouse. Several of the bridges are in a forward state, and there appears no obstacle to prevent the line being opened for traffic during the coming season.

The bill for amalgamating the Eastern Counties system of lines with the Norfolk, Eastern Union, and East Anglian will, it appears, be not permitted to pass unopposed. The Eastern Union and East Anglian complain that the terms offered them are not sufficiently liberal; and the latter company, which never yet acquired a dividend on its stock, although it has now entered on its fifteenth year, seems to consider itself especially aggrieved. As far as we have been able to investigate the subject the terms offered by the Eastern Counties direction appear reasonable, but the whole matter is one which must be elaborately and expensively fought out before a Parliamentary committee. The East Anglian has become obstreperous because it probably considers that it could make a better bargain with the Great Northern, but this again and again proved a delusive phantasm. *Apropos* of the Eastern Counties, an extraordinary accident occured to one of the express trains on Saturday night. The high wind blew down one of the telegraph posts, carrying some of the wire across the rails; this was caught by the express when going at full speed, and an immense length of wire was quickly torn down—report says as much as two miles. Such a casualty is probably without precedent in railway annals.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

	£ s. d.	Dis. p. ct.
IRON, English Bar and Bolt:—		
in London ..... pr tn	5 15 0	3
in Wales ..... "	5 0 0	"
in Liverpool ..... "	5 10 0	"
Staffordshire Bars ... "	7 0 0	1½
Sheet, Single ..... "	8 10 0	"
Double ..... "	10 0 0	"
Hoop ..... "	8 0 0	"
Rod, round ..... "	7 0 0	"
Nail Rod, sq. "	7 5 0	"
SHIPPING IRON,		
Staffordsh. Bars "	7 0 0	2
Sheet, Single .... "	8 15 0	"
Double..... "	10 5 0	"
Hoop ..... "	8 5 0	"
Rod, Round..... "	7 0 0	"
Nail Rod, square.. "	7 5 0	"
IRON, Rails, in Wales, cash "	5 7 6	nett
" 6 months "	5 10 0	"
Old, to cut up "	0 0 0	"
Railway Chairs, in Wales "	4 0 0	"
" in Clyde "	3 15 0	"
Pig No. 1, in Clyde ..... "	3 8 6	"
3-5ths No. 1 & 2-5ths No. 3.	2 8 6	"
No. 1, in Wales..... "	3 8 9	"
No. 1, in Tyne and Tees "	2 13 0	"
Ditto, Forge ..... "	0 0	"
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom. "	3 10 0	"
Welsh Forge Pig (all Mine), at the Ports .. "	3 5 0	"
Acadian Pig, Charcoal.. "	7 10 0	"
Scotch Pig, No. 1, in London ..... "	3 0 0	"

	£ s. d.	Dis. p. ct.
IRON, Swedish, Indian assortments..... pr tn	11 15 0	2
Russian CC N D to arrive "	16 0 0	"
STEEL, Swedish Keg, hom. "	16 0 0	2½
Ditto, rolled..... "	18 0 0	"
Faggot..... "	17 0 0	"
SPELTER, on the spot .. "	18 10 0	net
To arrive ..... "	18 15 0	"
Hard, remelted ..... "	17 0 0	"
ZINC, in sheets ..... "	24 0 0	"
COPPER, Tile, 14 to 25 lb. "	107 10 0	2
Tough Cake..... "	107 10 0	2
Sheathing and Bolts ..pr lb.	0 1 0	"
Sheet..... "	0 1 0	"
Bottoms..... "	0 1 0½	"
Old ..... "	0 0 10	"
Yellow Metal ..... "	0 0 10	"
Burra..... "	103 0 0	"
Russian..... do. "	105 0 0	"
LEAD, British Pig ..... "	20 10 0	"
Spanish ..... "	19 10 0	"
W. B. .. .. "	21 0 0	"
Sheet..... "	21 10 0	"
TIN, English Block, nom. "	120 0 0	"
Bar " ..	121 0 0	"
Refined " ..	122 0 0	"
Foreign Banca ..... "	124 0 0	"
Straits ..... "	120 0 0	"
TIN PLATES, Charcoal, IC..... pr bx	1 9 0	"
Ditto 1X ..... "	1 15 0	"
Coke, IC ..... "	1 5 6	"
Ditto 1X ..... "	1 8 6	"
Do. at Newport, 1s. pr bx less	—	"
Do. at L'pool, 6d. "	—	"
CANADA, Plates ..... pr tn	12 0 0	2
QUICKSILVER ..... pr lb	7 0 0	2

RAILS.—The market remains steady, with more inquiry.

SCOTCH PIG IRON has declined about 1s 3d. per ton during the past week, and the market now closes flat at 43s. 4½d., for Mixed Nos. Warrants f.o.b. Glasgow, No. 1 Gartsherrie 55s.

SPELTER advanced to £19, but this has not been maintained, and the nearest price on the spot is now £18 10s.

COPPER in fair demand at current rates.

LEAD continues firm, and there is a fair business doing at improved prices.

TIN.—English remains unaltered, but the market is somewhat firmer. Some business has been done in Foreign at £124, and Straits £120 to £121.

TIN PLATES are firmer at prices quoted.

Jan. 16th, 1862. MOATE AND CO., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s. £ s.	1862. £ s. £ s.
Teak.....	15 10 17 0	15 0 16 0
Quebec, red pine ..	3 10 4 10	3 5 4 0
yellow pine..	3 0 4 0	3 0 3 15
St. John, N.B., yel.	5 0 5 10	5 0 5 10
Quebec, oak, white	5 0 5 10	5 0 5 10
birch	3 10 4 0	4 0 0 0
Memel..	0 0 0 0	0 0 0 0
elm	3 10 4 15	3 10 4 15
Dantzic, oak	3 10 6 0	3 10 6 0
fir.....	2 15 3 10	3 0 4 0
Memel, fir	3 10 4 0	3 10 4 0
Riga.....	3 5 3 10	3 10 3 15
Swedish	2 10 2 15	2 15 3 0
Masts, Queb. red pine	5 0 6 0	5 0 6 0
yl. pine	5 0 6 0	5 0 6 0
rd pine	0 0 0 0	0 0 0 0
Lathwood, Dantz, fm	6 0 6 10	6 0 7 0
St. Petersb.	8 0 8 10	9 0 9 10
Deals, per C, 12 ft. by 3 by 9 in.		
Quebec, wht. spruce	13 0 18 0	15 0 19 0
St. John, wht. spruce	14 0 16 0	15 0 17 10

	1861. £ s. £ s.	1862. £ s. £ s.
Yel. pine, per reduced C.		
Canada, 1st quality	17 0 18 10	17 10 19 0
2nd do ..	12 0 12 10	12 0 13 0
Archangel, yellow.	13 0 14 0	14 0 15 0
St. Petersbg, yel...	12 0 13 10	12 10 13 10
Finland.....	9 0 10 0	9 10 10 10
Memel	10 0 15 0	10 0 15 0
Gothenburg, yel...	10 0 11 10	10 0 13 10
white	9 10 10 0	9 10 11 0
Gefle, yellow	10 0 11 0	11 0 13 10
Soderhamn	10 0 10 10	11 0 12 10
Christiania, per C		
12 ft by 3 by 9 in.....yellow	22 0 25 0	22 0 24 0
Deck plank, Dnts per 40 ft. 3 in.	0 14 1 4	0 14 1 4
Staves, per standard M		
Quebec, pipe	60 0 70 0	50 0 55 0
puncheon	16 0 18 0	16 0 18 0
Baltic, crown pipe ...	160 0 170 0	170 0 190 0

SCOTCH PIG IRON REPORT.

		s.	d.	
No. 1	Gartsherrie	55	0	f.o.b Glasgow.
" 1	G.M.B.	48	0	" do.
" 3	Do.	47	0	" do.
M. Nos.	Do.	47	6	" do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths " 3 .. G.M.B.	Cash prompt, ...	48	6	per ton.
	1 mo. open, ...	48	9	do.
	2 mos., "	49	0	do.
	3 " "	49	3	do.

MANUFACTURED IRON.

	£	s.	d.	
Bars, Govan	7	0	0	
" Common	6	17	6	
Drumpellar, Common	6	17	6	
Do. Best	7	17	6	
Plates and Sheets	9	0	0	to £10.
Rails	7	5	0	
Pipes	5	0	0	
Chairs	5	0	0	

GLASGOW, 15th January, 1862.

Our market has been drooping since this day week, and large quantities of iron have been pressed for sale both by makers and speculators.

The demand for shipment is improving, and local consumption may also be said to be better.

Exports last week were 8,882 tons against 7,280 tons in the corresponding week of last year.

SHAW, THOMSON, AND MOORE, Metal Brokers.

BENSON'S WATCHES AND CLOCKS.—"Perfection of mechanism."—*Morning Post.* Gold watches 5 to 100 guineas; silver watches, 2 to 50 guineas. Benson's new Illustrated pamphlet, free for two stamps, descriptive of every construction of watch, enables persons in any part of the world to select, with the greatest certainty, the watch best adapted to their use. Watches sent free by post on the receipt of a remittance. J. W. Benson, 33 and 34, Ludgate-hill, and 46 and 47, Cornhill, London, E.C. Established 1749.—ADV.

THE TREASURES OF OSTIA.—The excavations at Ostia, renewed by order of his Holiness, continue to furnish objects interesting alike to the artist and the archæologist. Amongst other marbles brought to light recently is a cippus, bearing a singular inscription, commemorating the offering of two crowns, one of which was of gold, and specifying the weight of them both, to Isis Bubastis Venus Argiva, according to the will of Caltilia Diodora, who was a Bubastician. This appellation with regard to the divinity of Isis opens a fresh field for antiquarian investigations and mythological discussions. Nearer Rome, in the estate of Tor Sapienza, on the ancient Via Prenestina, belonging to Prince Massimo, excavations have been also made with good success. The prince has already increased the collection of ancient marbles in his palace by the addition of a recently discovered bust, judged by the Commendatore Visconti to be the portrait of Didia Clara, daughter of the Emperor Marcus Didius Severus Julianus, from its resemblance to the rare medals of that princess coined during the brief reign of her father in the year 193. Another extremely rare bust, considered, on the authority of ancient medals, to be the portrait of Pupienus, who reigned jointly with Balbinus, in 237, and was murdered, together with his colleague, by the Pretorian Guards, has been purchased by the Minister of Public Works for the Vatican Museum. This bust is of excellent workmanship. The great antiquary and art critic, Ennio Quirino Visconti, declared that the portrait of Pupienus was the last specimen of good sculpture in the series of the Roman Emperors.—*Roman correspondent of the Morning Post.*

SOCIETY OF ENGINEERS.

January 13th, 1862.

ON THE ENCLOSURE OF LANDS FROM THE SEA, AND THE CONSTRUCTION OF SEA AND OTHER BANKS.

By E. OLANDER

I SHALL endeavour to lay before you the details of construction for sea banks, &c., taken from my own experience during the time I was engaged on works relating to this subject.

New methods in the protective work at that time were conveyed from Holland, where the practice of enclosure of lands is carried on to a great extent, and my object will be to explain the uses of some, and whether the respective methods are improvements or not.

Dividing the subject under various heads will, I think, be more comprehensive, and I shall, therefore, class them in the following order, viz.:—The sea enclosure bank; secondly, the shelter and nursing bank; thirdly, the nursing bank; fourthly, the guide or channel bank; and, lastly, the sinking of cradles in the filling up of gaps, &c. &c. &c.

The most important of all is the enclosure bank, constructed to take land from the sea. Land, when reclaimed, can be sold for £40, £50, and £60 per acre.

In the construction of such a work the transverse section will greatly depend upon its situation. If in an exposed position, fronting the north-east, south, and west, are preliminary matters, best decided on the ground.

Any one acquainted with the subject, I think, will agree with me that a slope of not less than 4 to 1 should be the sea slope; the inner or land slope, as steep as it will nicely stand, at, say, 1½ to 1.

I want to show that some of the kinds of slope protection used by the Dutch engineers are not so good, effective, and much more costly than we have applied to secure our sea banks for a number of years past. Granted that protection is better adapted for that country, for there large plains of warp land miles before deep water is to be found; add to this a much less rise and fall in the tide than we have to deal with here, thereby rendering the force of the sea less dangerous to the maintenance of their banks.

Consequently we require more strength, in overcoming the resistance of the "springs" in Holland, which in most parts are very small, whereas, in various parts of our coast, we have an every day difference of 25ft. to 30ft., and on the river Wye, on the Severn, as much as 60ft. difference between the ebb and the flood has been recorded.

The drawing No. 1 is a transverse section of what I consider the best form of enclosure bank. The hearting coloured yellow is generally composed of sand or good warp—the latter being far preferable of the two—got from floor "pits," fronting the proposed bank by barrow roads. Sea marsh sods would be better if a quantity could be obtained, but an acre of such material 1ft. deep would soon be taken away, and extra expense in the increasing distance, and hence the necessity of being obliged to use such material that can be got by "short leads" in the front and sometimes the back of the bank.

When the hearting is of sufficient height, and the slopes trimmed, the clay protection can be cast on trimmed also, and well punned; this is 1 to 6; care must be taken in procuring the best kind of clay. The blue "butter" clay is not at all suited for this purpose. Got generally from the slopes of creeks, where, in its natural bed, receives its periodical soakings every tide, and when exposed to the action of the atmosphere cracks and forms openings dangerous to an extent; and I would add there is also a difficulty of working to an uniform slope through its soft nature, and it will run down to the toe. Good clay can be obtained generally in the bay of Green Marsh, and is very good for this purpose.

After the clay is nicely trimmed on a complete layer of green marsh, sods or "flags" should be placed on the clay, 6in. deep, or more, if possible, well jammed together. On top of these a layer of clunch stone (chalk stone is good) 1ft. deep, care taken that good packers are employed, as the strength of the stonework depends a good deal in the manner each stone bites the other, also in producing a flat top, rendering less resistance to the action of the wave.

Such a bank I would adopt where strength is required, and I think you will see that, if made strictly according to specification, it would require a powerful sea to do any amount of damage. It may appear a strong work where only a head of water of 8ft. has to be met, but the sea is very strong at times, and would, in an exposed part, cleave those stones away. When once the water touches the "hearting," which has become dry, a gap will soon form, and the water rush through. I do not know that a better idea can be given than by supposing the inside of the bank to be composed of moist sugar, and you all know how that collapses when water comes in contact with it. I have seen a hole clear through the top of a bank above high-water line 3ft. to 4ft., and about 3ft. diameter, where the lip of the wave has nipped away a weak part of the protection, and got to the sand.

Drawing No. 2 shows a Dutch mode of making sea banks, and method of protecting slopes. The clay upon the hearting will be the same as already described, and on top of this (instead of sods) straw matting, called "crammatting." The process of covering the slope is as follows:—Supposing that we look up slope. A layer of straw lose 1½in. thick, evenly distributed up and down slope, after which is laid horizontally along slope straw bands, when at every 4in or 5in. the crammatter, a man who understands the work, by the aid of a tool, shown on drawing No. 3, thrusts the band, in the form of a stitch, into the clay through the loose straw; before the second stitch is performed the workman will give the band a twist, so as to keep it round, and the thrust is repeated (sixty-four stitches go to the square yard).

When a slope of this protection, as I have seen it, a mile long and 30ft. deep, is complete, it appears to me more ornamental than useful. The fact is, I substitute flags in place, which is a permanent material, and the older it gets the more consolidated, whereas the crammatting will rot in two and at the most three years.

Over this, in lieu of my stone, a costly work of "fascinework" protection, which is supposed to be an improvement on the old "faggots," and in this case I think I may safely say that its beauty excels its utility. The process is as follows:—The fascines are 7ft. 6in. long, and 6in. diameter and 1ft. diameter at the broom end, so that when compressed forms a layer of about 6in. thick. At every 1ft. 6in. up and down slope, and 1ft. 2in. along slope, pointed stakes are driven into the clay through the crammatting 5ft. in length, and at an average of 1½in diameter, after which long twigs of about 2in. diameter, technically called "binders," and about 8ft. to 10ft. in length. These wound in and out of each stake along slope (say five on top of each other) after which keys will be driven through the top of the stakes, and each stake driven down tight on the binders, and, of course, tight on the loose fascines, fastens all down on top of the crammatting. This is one of the Dutch methods of protecting the slopes of their sea banks.

A great deal of money has been lost by a non-knowledge of the ground that an enclosure bank may be built upon.

I maintain that an undertaking of this kind should not be made on "silty" or "warpy" ground, and not even on samphire or crab marsh ground, which comes next in height to green marsh, but that the only site that can possibly pay the proprietor or a company, and particularly the contractor, is at the edge of green marsh, so far in as to leave a cess or foreland of 40ft. to 50ft., and when commenced should be ordinarily ploughed, causing a jagged surface to receive the "seat" of proposed bank. If, on the contrary, it is attempted when sea marsh does not exist, and seawards of green marsh, and in an exposed position, where a deal of back water must necessarily ebb out, the difficulties will be great, not so much in the construction of the proposed work as in keeping the original ground the bank is to be built upon. For should a gap occur the cost of refilling is so much increased the deeper the gap becomes, by the increased length of the slopes, and referring again to the safety on the green marsh is obvious, from the fact that it all forms at a certain height above low water line, and where there is not sufficient head of water to render it dangerous to its working; also the material being of a very strong and tenacious nature, meets the increased resistance of the tides. The exposed position on the low grounds will give rise to several causes of failure, and it requires the greatest care on the part of the engineer to foresee the effect that the power of wind and wave have over the works of man. The apparent strong facing, with rigid thick stone protection, and a good flat slope, has been shattered and carried away in less time than I could estimate its cost. The 6ft. wave, with the wind obliquely on the slope, will clear away the stones. Another dash will scope out a quantity of clay work, and get it to the inside, and the effect then I have already explained, and a loss of sometimes £500 to £1,000 will be the consequence, and perhaps a deal more, if the land within the bank, *i.e.*, the enclosed portion, is tilled and worked up for agricultural purposes.

When I state the safety and profit of constructing sea banks at the edge of the green marsh my meaning must be taken for the enclosure of lands, and not to exclude the practice of carrying forward such a work two or three miles if circumstances admit of such a requirement. A strong sea wall may be required to shut out the sea for the construction of waterworks, as docks, slips, &c. &c., but then the cost is part of the works to be carried on within. This is absolutely another question, and is in itself a matter of cost for sea walls for any special undertaking.

The bank already described as being one of great strength, and which would require small outlay in the maintenance (a great consideration) would cost about £80 per chain forward; therefore, requiring about 300 chains to enclose 1,000 acres, would amount to £24,000; when enclosed the land ought to fetch £45 per acre = £45,000, leaving a residue of £31,000 as profit.

Comparing the cost of the two methods of constructing the bank already described, will show that the one in drawing No. 1 possesses advantage over that shown in No. 2. The hearting will cost the same—clay same. The green marsh sods can be done for 2d. the super yard. The Dutch crammatting costs 6d.; the stone packing, in place, would be well paid at 2s. 6d. per super yard 1ft. deep, that being the price of the fascinework, showing a small reduction in favour of No. 1 drawing, but this is not the main consideration. The first design is strong and permanent, which would resist any sea in the position already named for its site; whereas, in the second case, the sea slope is but a temporary protection, and easily damaged by the wave.

SHELTER AND NURSING BANK.

The bank under this title, and which I saw constructed, was intended to answer two purposes: First, that of sheltering and preventing damage to an existing enclosure bank; and secondly, in assisting nature in the laying up of land for future enclosure. Now, I hope to show the one desirability, viz., that of "nursing" (as it is technically called) and assisting nature in her sea deposit of debris, probably from the inland rivers, drains, and coast of the estuary, is not attained, and that such an undertaking has no claim to the title of "nursing."

To make quite clear my meaning, I shall suppose *a b* the boundary of an old enclosure work, and that further claims are required seawards: *c d* is the proposed sheltered nursing bank.

Supposing, for example, the tide is in direction of arrow, and the wind in direction of dotted arrow, there cannot exist a doubt that *c d* would materially shelter the old bank *a b*, and for this purpose it has its advantages when run out to a certain length, when the old sea bank is too weak and requires continually repairing, and, at times, in danger. This would occur when too small an outlay is given in the protection, showing that an enclosure bank ought to be made at the onset sufficiently strong, and the requirements of a shelter bank unnecessary. But at the same time the bank *a b* could, by circumstances, be weak, and hence the necessity of an outer protection bank. The most prominent advantage to be gained, in my opinion is that, if maintained, it would ultimately become one side of a new enclosure.

The bank *c d* having been constructed, let us see the result of the second requirement, viz., that of assisting nature in depositing or the laying up of warp for future enclosure. The simple fact will be borne in mind. The narrower you make your river the quicker the rate of the tide, and by the same principle that a "cut" is made in an estuary to improve navigation and to obtain a greater fall by an increased score due to the extra rate of the tide, so by jutting out banks from a coast, the same theory will hold good; certainly to a small extent, but to an extent sufficient in interfering with the process of "laying up" already mentioned. In the vicinity of the inside of the bank *x, x, x*, the flood and ebb tides are considerably increased. Now, therefore, as the warp already deposited is entirely subservient to the rate of the water passing over it, consequently this increased rate will take away that that would have remained had it not been for the bank that caused the extra power. I have seen a rich deposit that has taken place during low "neaps," when a good wind in the "springs," causing a high tide and an increased rate of ebb, and taking all away again quite clear to the original surface. "Warp" deposit, collecting in an estuary is, seen in its theory by considering the water leaving the deep sea beyond, and coming up a flat plain of little depth, and, when reaching this point, passes on slowly, coming at last to a stand at the edges of all the green marshes. The matter carried along by the tide, and which did not sink through the troubled water, but becoming quiet, those particles which produce good land leave themselves lightly upon the surface. Now, by raising such impediments as bars or cradge banks, commotion takes place, and, ultimately, an increased rate of tide. Hence the very particles lightly settled upon the top of its preceding deposit is carried away; as I observed before, the deposit is on sufferance to the rate of water flowing over it.

To make clear again my meaning I shall suppose a fall of snow, one flake gradually building upon the other. When a layer of 2in. on the day it fell remains peaceful and quiet, but the next day a high wind sweeps all away, and leaves that portion the wind cannot affect. The snow is the "warp" and the high wind is the extra rate of water due to the nursing bank.

I took careful levels on three lines after the bank was completed, and the results, when plotted, confirmed my previous statement. The most prominent, and which actuated me to investigate the matter more closely on the line E F, a good depth of material had scoured away in the form of a wedge, the thin end at E, where the bank could not practically affect the land. The same result showed itself on the line G H, but not to such an extent; and on the line J K, instead of new deposit where there ought to have been at least 1ft. of new warp, an average of 4in. in depth was washed away. The ultimate result was that small cradge banks had to be run out at right angles from the inner slope to prevent small slips that had occurred, and small holes repaired with clay and made even with original slope again.

It is very necessary, in carrying forward such a work, to keep the "floor pits" as distant as possible from the "toe" of the slopes. Of course the nearer the less cost per floor, and consequently the barrow roads a less "lead." By excavating too near only adds to draw the ebb water to the bank, and forming a permanent channel for the ingress and egress of the tides. If the pits are 3ft. deep at the total length of the bank they must, of course, tend to form flat rivers each side, and as the work proceeds seawards great difficulty is occasioned. The last water drawing into the made river is carried along by its fall, and rushes round the end and scours the original surface. It is, therefore, very necessary to make an apron of good clay, driving it forward as the bank works are pushed forward 1ft. deep the entire length and width of the bank which will meet the rush of water in the flood and ebb tides.

Having seen a bank of this description constructed a mile long, with its progress day by day, meeting its increased resistance as it is increased in length, showing, as it gets to the lower ground, the compound difficulties it has to encounter. Small rivulets for the first quarter mile will form at the end, increasing at the end of the half mile about 5ft. to 8ft. deep, and filling these up increases the cost considerably, until the sea, with its usual determined character, made a breach at the end of unusual dimensions, just to show we were infringing.

If it were required, for the bank just described, to be carried forward another mile, the cost would increase in the construction every yard forward. For the first twenty chains a layer of clay in the front as an apron 1ft. 6in. deep, with flags if possible, if not, with the best clay conveyed to the spot by flat bottom barges and discharged at high-water, trimmed when the water had left. This material costs more than the hearting, twice as much, but it is not lost by reason of its becoming part and parcel of the seat of the bank and reducing the sectional area. This clay apron ought to be in advance about three chains. Proceeding from twenty to forty chains the same care should be taken, but increasing the clay to 2ft. in depth. From forty to sixty chains 2ft. deep of clay, covered with temporary fascining, *i.e.*, faggot or furze bushes staked down about every 5ft. in line with the bank, great care and examination, an uniform thickness of clay, as by this time considerable difficulties will arise. The last twenty chains completing the mile would require a very strong apron, at least five chains in length, and about 20ft. beyond each side of the toe of slopes. This pushed forward with 2ft. 6in. of clay sods, or the very best clay if the sods cannot be got, covered with complete fascinework, made as well as if for a slope protection, after this an average foot of clunch stone, packed as closely as possible. This done the sand hearting work may proceed seawards. Every time the rising tide prevents the works proceeding the navvies should be employed the last thing in trimming the end slope with clay up to high water line, and when commenced again this clay may be left and included as hearting; not so with the apron. The temporary fascines, stakes, and binders, with the stones on top, may be removed and re-used for the same purposes, and only leaving the clay to make up as part of the sectional area. When the mile is finished—and I have no doubt that the way I have described would be accomplished without a gap forming—the apron with the stone on top should be made about two chains longer at the end of the bank left, to keep the toe of slope safe and secure. It will, therefore, be seen that the further the bank juts from the coast more difficulties present themselves, even if the low water line may be ten miles distant, and the fall in the ground does not exceed 12in. the mile. The back water, held up by the greatest length of bank, produces the greatest rush of water round the end. If these banks can be made pointing as near as possible to the direction of tide it would save a deal of trouble and cost.

NURSING OR WARPING UP BANK.

The sectional area is simple, built about 5ft. in height above the original ground. The hearting of sand, covered with clay, then fascining, and, lastly, stones on the top, made round so that the sea can pass gently over it when arriving at the top (see Drawing No. 5). In every respect, with one exception, do my preceding remarks relating to the shelter and nursing bank, with reference to the laying up of "warp," apply in this case. Being only a few feet from the sand the sea every tide covers it, and when rising falls over the top, not if there is a good fall in the land it is built upon. This rushing over is objectionable for its maintenance, causing holes and slips on the inner side. Careful consideration on this subject leads me to the conclusion of little profits arising by making these banks; and, whatever benefits may accrue unknown to myself, they cannot be made to produce one-tenth of their cost, and I have no hesitation in condemning them as unnecessary.

Having thus freely given my opinion on works of this nature that I have seen executed by others (and I hope not presumptuously), I may be expected to suggest something myself in lieu of what I condemned, but am sorry that, although I have considered an improvement, still, were my opinion asked, I would waver between two, viz., whether to let nature take its own course or produce means to assist.

My improvement would consist of constructing impermeable shallow enclosure banks, to receive the water every tide, and to leave the inclosed portion to fall when it had receded. Let the bank be made 4ft. to 5ft. high above the ground; the water docked up remaining still, and the alluvial matter suspended would settle, and by the time the next tide came, bringing its fresh supply, the water remaining would be displaced, or, intermixed with the larger supply, would leave an entire basin to do its work again in the process of raising the land ultimately to the level of top of cradge bank I propose. By these means all scour is avoided, and a good time is given for each periodical supply to get rid of all the alluvial soil it contains.

GUIDE OR CHANNEL BANKS

are very difficult to construct, owing to their being entirely submerged at high-water, and besides can only be constructed at low-water. Owing to this the cost is considerably increased, as the men must be paid by the tide. I am aware that in recommending clay sods of their not always being obtained plentifully, as the marsh lands in the vicinity of an estuary belong generally to private individuals. If they can be procured no material is preferable for the hearting, no material (coming next to stone) resists the rush of water so well; besides, when cast in, they will, when trimmed, stand at a steeper slope than ordinary clay; indeed, ordinary clay, if not of a very tight description, will run away into a flat slope; and any other lighter material than clay, such as warp-silt, &c., ought not to be used, and, although it may seem at the onset cheap, but when the bank is proceeded with any height a gap would soon form, and cover in a short time the extra cost of the sods in the first place.

On works of this kind, where so much risk is to be apprehended, it is no doubt advisable to adopt strength at first rather than wait to see the result of loss that must be made good again. Also it will be seen that the maintenance is decreased after completion by making the work substantial at first.

Referring to Drawing No. 6 it would be well to make the hearting of sods on the very best clay, and with this material a slope of two and a half to one when cast in and above low-water line the work may proceed in a better manner, *i.e.*, properly trimmed, carrying up at the same time 1ft. of clay sods, jammed together, and the stone protection may rise also.

The toe of the slopes would be of loose stone, cast in as careful to line of bank as possible, and doing this tends to form a stay for the soft material inside, and to keep it in place. Between the clay sods and the stones a layer of loose straw, upon which the stones can be packed. This straw is to prevent the stones sinking into the clay, and forming an uneven surface on the slope.

There are two methods of commencing these works. First, by boats casting in the material at any point in line of proposed bank, and raising it bodily; but great objections arise by this system on account of raising so great an area at one time, and hence it will be seen an irregular surface would but encourage the tides (continually passing backwards and forwards) in forming gaps through the new material to the seat of bank, and that, being generally of sand, is soon scoured away. Now, it would not be proper to raise any portion of the work until the gap had been repaired, as the higher the bank the greater head of water held up, and hence the scour and the gap become larger. The second system would be to take a length, say three to four chains, and raise such length horizontally, and when above low-water line to commence the next length, always casting in about 2ft. of clay forward of coming bank to meet the extra rate round the end. As the bank lengthened, the top being about 4ft. wide, a small tramway, carrying one-yard wagons, might be used to convey straw. Clay sods, and even stones, to facilitate its progress, and being the highest point, could work up, and the latest time the tide would allow.

I saw the advancement of such a bank from day to day. Before this it had been raised about an average 2ft. above low water line by large stones and loose clay, deposited by large hopper barges, carrying thirty yards to forty yards each, and at low water the longitudinal surface presented a very jagged appearance with several gaps, one of which was very large. Nothing else might be anticipated than proceeding with the work in this manner, the irregular surface, and

more especially the stones, presenting great obstacles to the progress of the work.

On top of this uneven surface the work was commenced, sometimes with clay but chiefly with sods; all this material brought by flat-bottomed barges, cast on and trimmed to a slope, with a horizontal top about 6ft. above low water. This bank at such a height is but the commencement of a larger one, for the purpose of continuing the cut of the estuary, and to form, ultimately, a bank for enclosure of land. These matters depend, of course, on the first designs.

The position of this guide bank renders it, when complete, in danger of a breach being cut through it, owing to the great area of several breaches existed, one of which exceeded greatly the others. It was 460ft. long and 24ft. sounding at low water. The tides rushed through with great velocity, and while the spring tides existed it was almost impossible for a boat to pass along the upper side without being carried through. To fill this up, and complete the bank evenly with the other portion, was rather a formidable undertaking. It was considered by professional men a difficult work, but it was done effectually and completely.

The bottom of this large gap was composed entirely of sand, thereby giving itself away as much as the rate of the water running through desired. Various methods might be thought of in filling up this large hole, and I think, in England, there has been but one way—

FIG. 1.

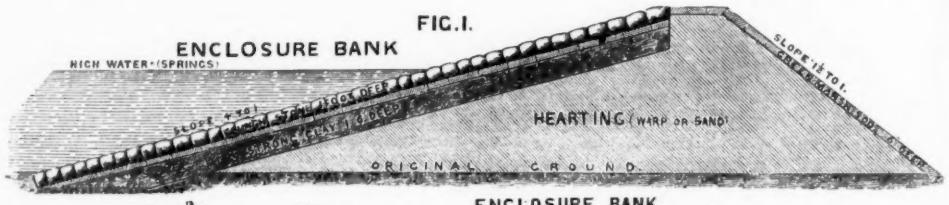


FIG. 2.

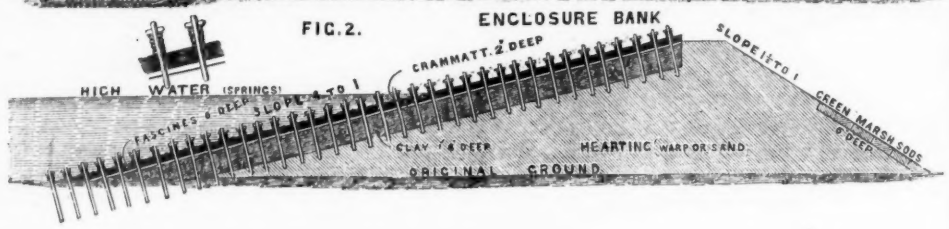


FIG. 3.

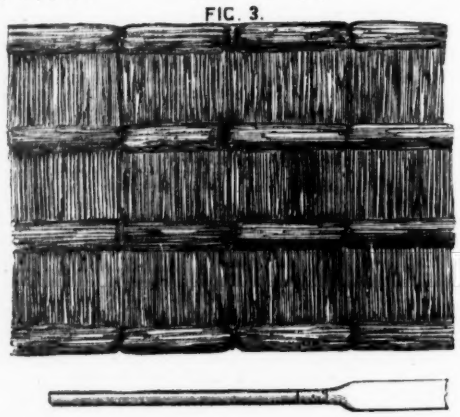
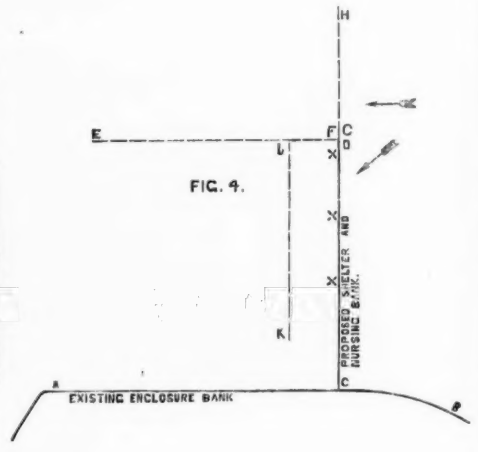


FIG. 4.



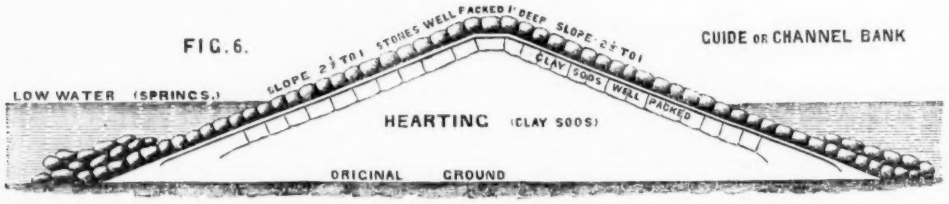
NURSING BANK

FIG. 5.



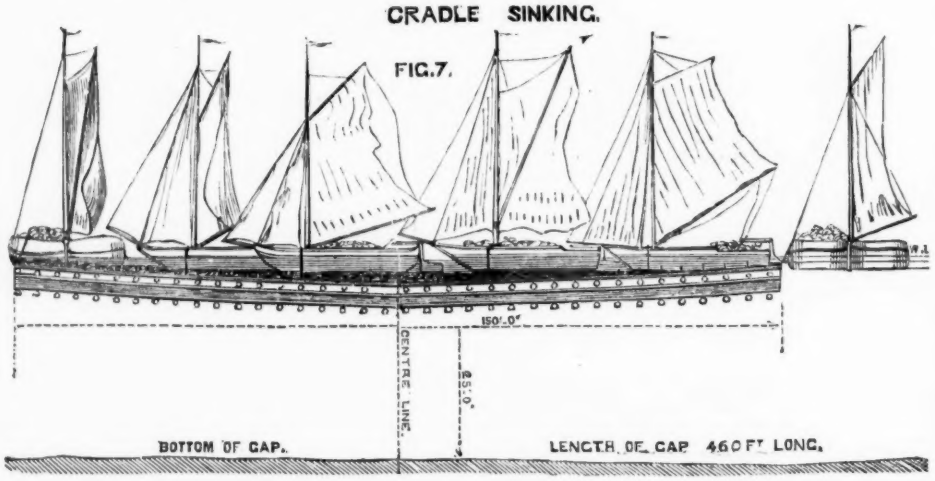
FIG. 6.

GUIDE OR CHANNEL BANK



CRADLE SINKING.

FIG. 7.



back water held up, and this, at last, ebbing out always around the end when below the level of top, leaving a basin on the inner side, the flood tide again coming in at the outer side and pouring over, causing a fall and running down the inner slope.

But the protective materials being of the best quality, as already mentioned, damage has not yet taken place.

These banks, constructed to guide the tide into the channel and to discharge the descending tide through the low sands, the river slope is also subject to the full rate of the tide. Consequently it is important that a good toe of loose stones and firm material underneath should be used.

I have stated before that, at the commencement of this work, that of casting in, indiscriminately, all sorts of material at any point, and sometimes to be carried away again without system or defined quantity. Adopt this plan, and let us see the result. It is a sandy bottom, and the area of gap just due to the quantity and rate of water passing through it. At one end of the gap a quantity of material is tipped in, say clay; and being stronger to meet the current remains; the sectional area is reduced, but the rate and quantity of water the same; the sand being the weakest, and at the mercy of the water, must be displaced, and practically as much in quantity as the clay tipped in; this is very likely to occur at the toe of the clay material, and the consequence is, that it slips and only fills up the hole where the sand is taken away. Provided even that the clay is raised to a good height there would be very little chance of it remaining in such a breach as I am now dwelling on. The material requires binding together to form one entire consolidated body. This has been accomplished by the system of cradle-sinking, and I shall now endeavour to explain the entire operation.

In reference to Drawing No. 7 I must now mention that great credit is due to Mr. Muller, a gentleman who had the management of the works, for his indefatigable exertions in bringing the system of cradle sinking in the filling up of gaps to perfection in this country. About twenty-five of these were sunk in different parts of the works, and not one failure is to be recorded in the whole. It will also be understood this part of the work is a Dutch engineering importation, about two years old, and its success is entirely owing to the exertions of this gentleman.

As a cradle so large as the breach could not be worked effectively it was necessary to give the bottom a coating of clay sods. This was done all over with a good width and also a good depth; instead, therefore, of a sandy bottom it was composed of green marsh sods. Before describing the operations of sinking it will be necessary to detail the materials and construction of the cradles. The first one used and the largest was 150ft. long by 45ft. wide, and about one hundred workmen were engaged in the sinking. The whole of it is made of fascines, stakes, and binders. The fascines before described, 7ft. 6in. long, are lapped and intersected into one another to form a rope of about 6in. diameter, the intersected parts bound strongly together with osier twigs. This rope, made of birch (but I think willows preferable), is manufactured on a raised rack, made of two uprights and a horizontal bar to rest the rope on, so that the workmen may get their arms underneath for binding them together. A sufficient number of these ropes is all the preliminary work before commencing to constructing the cradle.

A flat of sand in the vicinity of the gap is chosen and at such a height that the tide will float in when completed.

Transverse ropes of fascines, laid about 3ft. apart, on top of these longitudinally, and the same distance apart at right angles, the same thickness of rope, all these were fastened at their crossings by cheap hempen rope. This properly done, three layers of loose fascines, breaking joints with one another. On top of these loose fascines (see Drawing), precisely the same as the underneath, two layers were repeated, but reversed, *i.e.*, the transverse ropes on top making in all four depths of ropes and three layers of loose fascines. Again on top of these, in various divisions on plan binders, were staked down, making it as rigid as possible; besides this several mooring posts were made of stakes, the stakes coming out at the bottom, and giving a jagged surface to bite into the clay.

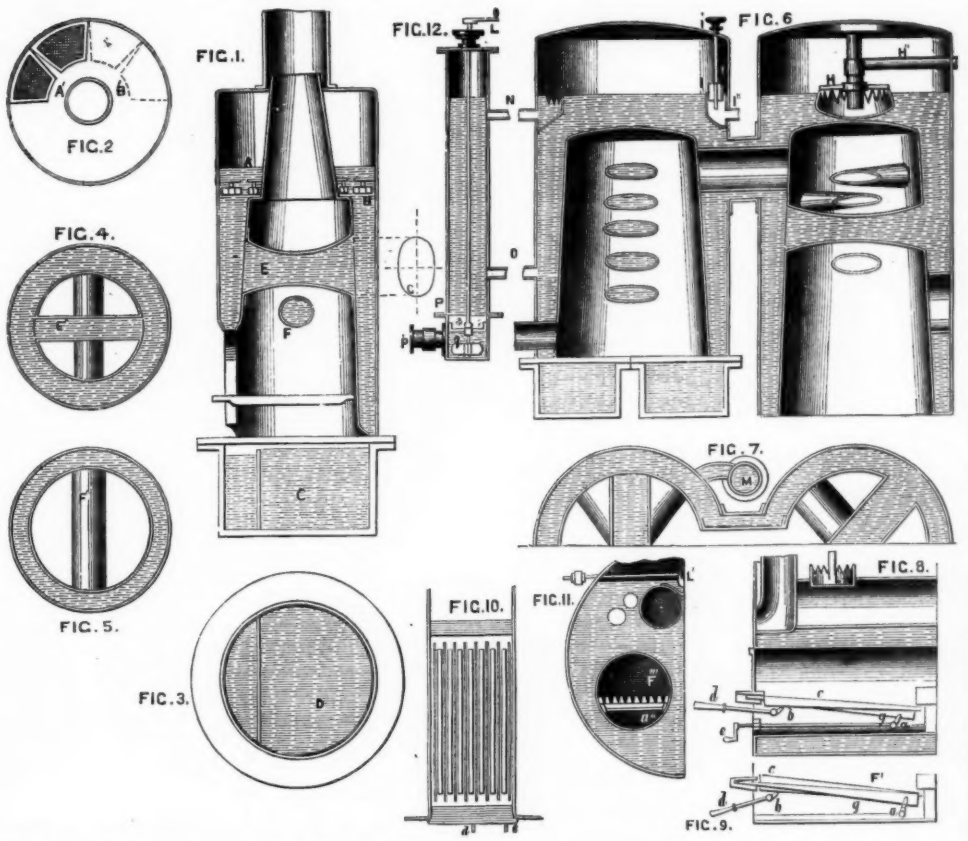
When manufactured, the spot where it was to be sunk being properly beaconed out, the floating and mooring was the next object. This was accomplished slowly by anchors. Boats carry them at a distance, and dropped, and then hauled upon, to be repeated again, until it was brought into the exact position, and this is a short time before high-water. The flat bottomed barges, loaded with sods and stones, following in the rear, about eighteen of these and three lighters of clunch stone surrounded the cradle, and care was taken that they moored or and anchored independently of the cradle.

All these boats surrounded, slip ropes from each were passed through small ropes, with smooth iron eyes attached to the edges of cradle. The ropes of the barges passed through these eyes, and brought up again with a slip knot. After this orders were given to cast in the sods and a few stones, and as evenly as possible, so as to prevent distortion. This has to be feared, and great care must be taken in evenly distributing the materials on the surface, until it disappears below the surface water. The discharge of sods and stones still proceeded until about 3ft. to 4ft. below, and at this time the fleet of barges take the strain, and the cradle is prevented sinking by the ropes. At this time it was necessary to let go, and the drawing shows the cradle in that position. To do this effectually all the ropes must be released simultaneously, and a previously systematic arrangement among the workmen had been made.

For it will be seen that any mistake on this score on the part of one man in neglecting the release at the proper time, the strain on the one or two ropes would tend to topple and crumple up the flat sinking bulk that ought to sink horizontally. Nothing of this kind occurred when the order was given. The ropes were released, the barges upheaved, and the cradle went down satisfactorily. It was also an understood work among the men immediately the ropes were loosed with all possible speed to cast in sods and stones, and particularly the large pieces of clunch stone, so that, whatever tendency the cradle might have to collapse, the large quantity of material contained in the twenty-one barges, delivered by about one hundred workmen, would prevent anything of the kind, but the extra quantities discharged facilitated the operations complete. This job occupied two and a half hours, about 170 cube yards of sods, 120 tons of cliff stone, and cost about £170.

The Stevens Battery.—The *New York Times* of the 6th inst. states that, on the preceding Saturday, Mr. Edwin A. Stevens conducted, at Hoboken, "a series of experiments relative to the whole subject of naval warfare, under the inspection of a number of distinguished naval and military officers. The target used represented a section 4ft. wide and 4ft. long, of the casemate of the Stevens Battery, as proposed to and indorsed by the committee lately appointed to examine that vessel. It consisted of a series of wrought iron plates of the aggregate thickness of 6⅝in. backed by 14in. of locust timber, in which were embedded 6in. girders 2ft. apart, the whole being lined with ½-in. iron plate, and inclined at an angle of one vertical to two horizontal, to the line of fire. The missiles first employed were 10-in. solid 124-lb. shot, with the full service charge of eleven pounds of powder at a range of 660ft.—the heaviest solid shot used in our service, and a vastly more destructive missile than any known in European practice. The first of these shot simply indented the target 1½in.; the second indented it 1⅝in. In neither case was even the top-plate—⅝in. thick—cracked; and in both cases the shots were smashed into an iron rain which fell around and beyond the target. The third shot was an elongated 100 lb. missile, fired, with the service charge, from a 6.4in. Parrott gun at the same range. The shot was broken, the target was indented $\frac{11}{16}$ths of an inch, and the top-plate was not cracked. The precise effect of the various shots upon the inner plates and upon the wood will, we persume, be examined, and the result laid before the public. That there is one way, then, of making a ship of war impregnable, not only as against a shower of the heaviest missiles in use, but as against vastly more destructive projectiles yet to be invented, is no longer a matter of speculation. The other experiments were of a most important character. Taking up the recoil of the heaviest ordnance by india-rubber springs, within a short space, although illustrated yesterday by a hastily improvised apparatus, was unanimously pronounced, by the experts present, entirely practicable. But its feasibility is not indorsed by this test alone; for it has been the subject of such elaborate private experiments that the capacity of springs to resist recoil has been actually tabulated for each weight of gun projectile and charge. The recoil of the 10in. gun referred to was stopped by six columns of car-spring rubber, each column 6in. in diameter and 20in. long, in a space of 8½in., and the gun always returned to practically the same point from which it started. Loading the heaviest ordnance by a steam cylinder, of which the piston-rod is the ramrod of the gun, was successfully illustrated by a hastily constructed apparatus. The shot and cartridge, attached to a *sabot* which prevented their sliding out of the gun when rammed home, were laid on a scoop at the end of a lever, lifted by it to the depressed muzzle of the gun, and rammed to the chamber by a stroke of the piston, with a degree of celerity only limited by the skill of the operator. The remarkable ability of a vessel having two screw propellers, to turn on her centre and manœuvre in action, and the feasibility of settling a properly constructed vessel rapidly into the water till her upper deck was submerged; of locomotion when thus settled, and of rapidly rising to the load line again, were illustrated by the gunboat Naugatuck, presented by Mr. Stevens to the Government."

ARMSTRONG'S MARINE STEAM BOILERS.



THIS invention, by Robert Armstrong, of North Woolwich, relates, firstly, to certain improvements in steam boilers, principally applicable to those of the vertical kind, having cross water tubes in their fire-boxes.

Secondly, to a combination of two or more such or similar boilers placed side by side, and attached to each other by suitable channels or short flues passing through their outer shells and water spaces, by which their respective fire-boxes or combustion chambers are connected, thus forming a duplex or compound vertical boiler of less elevation, though of equal strength and greater portability, and thereby better adapted to marine and other locomotive purposes.

Thirdly, it relates to various apparatus and adjuncts applicable to steam boilers generally. With respect to the single vertical boiler above referred to, in order to prevent the "priming" of the water of the boiler into the cylinder of the engine, there is fixed therein, near the surface level of the water, a perforated circular shelf or continuous bracket which is called a "priming shelf," projecting from the interior side of the shell of the boiler, and extending over the width of the water spaces between the shell and the fire-box. This priming shelf is to be continued around or nearly all around the circumference of the interior of the boiler, and constructed in removable portions or segments as at A, B, and A^1, B^1, Figs. 1 and 2. For the still further and more complete prevention of priming, by purifying the feed water, and also for heating the same, a cast-iron box or tank is used, which serves as a foundation for the boiler to stand upon, and is to be divided into two unequal divisions by a partition across its interior reaching to within half-an-inch of its cover or lid, which lid is to be cast with a thick projecting convexity on its under side so as to dip to at least an inch below the surface of the feed water when the larger division of the tank is fully charged therewith. The resulting effect is, that the heat thus communicated to the water is sufficient to cause the latter to expand at the surface, and gradually pass over the top of the partition from the larger to the smaller division of the tank. From which division the boiler may be supplied with comparatively clean as well as heated feed water, while the sedimentary deposits will settle in the larger division to be removed from time to time. This feed water heater and cleaner is represented in vertical section and plan at C and D, Figs. 1 and 3.

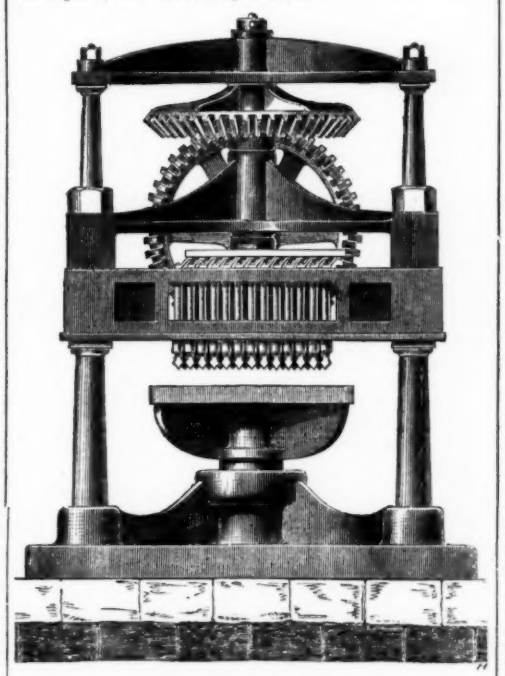
The next improvement is in the form of the tubes themselves, by making the latter oval or elliptical in cross section in the central portion, and also at the ends of each tube, while the central portion and the ends have the axes of their respective ovals at right angles to each other, the longer axis of the central oval being horizontal, while that of the end oval is vertical, thus forming the strongest and most durable shape of water tube or tubular stay for a boiler. Such stays are represented in section at E and F, and by the diagram G in Fig. 1, and also in horizontal section and plan in Figs. 4 and 5.

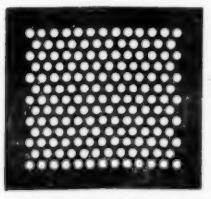
In order to effect the smokeless combustion of bituminous coals economically, without detriment to the superheating qualities of the boiler funnel, a continuous or frequent slight movement should be given to the fuel on the grate, which is accomplished by having each grate or length of fire-bars supported by a rocking transverse bearing bar at one end, and an adjustable or regulating bearing bar at the other. The fire-bars are also made thicker as well as deeper at one end than the other, and these taper fire-bars are placed with their thick and thin ends side by side with each other alternately, in order that the withdrawal of the adjustable bearing bar may have the effect of widening the spaces between the fire-bars, or the converse, thereby promoting either quick or slow combustion, as may be desirable. At the same time time a rapid up-and-down movement is to be imparted to the other ends of the alternate bars by means of a hand lever attached to the rocking bearing bar; which operation will have the effect of shaking and expelling all dust and ashes from the air spaces down into the ash-pit. Thus the tendency to flux any siliceous or other earthy impurities in the fuel, and consequent formation of clinkers, will be prevented; while at the same time the draught through the grate will be accelerated, thereby increasing the temperature of the furnace and the efficiency of the boiler. A furnace with these movable fire-bars and apparatus is shown in longitudinal sections F, F^1, plan, and cross sections F^{II}, F^{III}, in Figs. 8, 9, 10, and 11. *a*, *a*, *a*, is the adjustable bearing bar, with its connecting rod and handle *e*, *e*. The rocking bearing bar *b*, *b*, *b*, with its rocker and hand lever *d*, *d*, *d*, is shown in Figs. 8, 9, and 11; *c*, *c*, in Figs. 8 and 9 show the thick end of a rocking fire-bar in the position for being moved; while *g*, *g*, shows one of the adjustable fire-bars in the position for being screwed backward or forward by the regulating handle *e*, *e*.

Another improvement is an apparatus for promoting the circulation of the water and a sediment collector or mud receiver combined. This apparatus is shown as detached from the boiler by Fig. 12; it consists of a vertical pipe or narrow vessel M, placed in any convenient situation near the side of the boiler as at M^1 in the plan, Fig. 7, and connected thereto by two pipes with stopcocks or valves at N and O, through which, when open, the water circulates in the direction of the arrows, and any sedimentary matters held in suspension will be gradually deposited at the bottom of the box P, and may be at any time discharged at the blow-off cock P^1, after being stirred up with the agitator, *q*, by means of its shaft and handle Q. In order to clear the surface of the water of all floating sediment, and thereby do away with the principal cause of priming, the two cocks N and O must be occasionally shut off, and the mud receiver emptied, immediately after which, and while the blow-off cock is still open, the top cock N, which is in communication with one of the scum pans, must also be suddenly opened, when the surface of the water will be instantly skimmed of all floating substances whatever.

SHANKS' DRILLING MACHINES.

THIS machine, the invention of Andrew Shanks, of 6, Robert-street, Adelphi, is for drilling locomotive tube plates, marine condenser plates, boiler work, bridge work, &c





Any number of drills, whether in straight lines, curves, or at irregular distances from each other, can be driven simultaneously by this method, avoiding all complications of toothed, gearing, or wheels of any kind; each drill has its own separate crank to drive it, and the whole of the cranks are connected by a plate with as many holes as there are spindles to drive, this connecting plate being driven by the main shaft.

The boring table, on which the work is placed, is forced against the drills by hydraulic pressure.

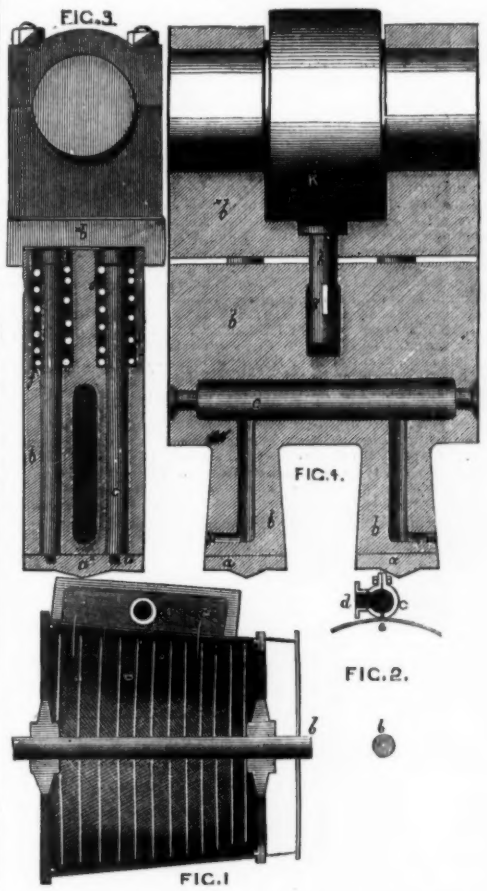
PLATT AND RICHARDSON'S MACHINERY FOR MAKING BRICKS.

THIS invention, by John Platt and William Richardson, of Oldham, relates, firstly, to sifters for screens for clay intended to be moulded into bricks, and consists in directing a blast of air from a narrow opening against the outward surface of the sifter or screen so as to keep the meshes clear.

Secondly, the invention relates to that part of the mould of brick-making machines by which the pressure is given to the material, and consists in forming such part in two or more pieces adapted to move independently of each other, so as to effect a slight opening for the escape of air, such pieces, however, being so arranged as to be capable of being forced forward simultaneously when desired.

Fig. 1 is a transverse section of a rotatory screen with the improvement adopted, and Fig. 2 a cross section of part thereof. The screen is at *a*, mounted upon a shaft *b*, which is caused to revolve. At *c* is a tube supplied with a blast of air by means of a pipe *d*. The tube *c* is furnished at its side next to the screen with a slit *e*; as therefore the screen is caused to revolve, a stream of air is directed with force against the meshes, and any material clinging thereto is propelled inward.

The next part of the invention is shown at Figs. 3 and 4, which are vertical sections taken at right angles to each other, of a ram carrying the top mould or die of a brick-making machine.



In describing this apparatus we shall suppose that the moulding is effected by two operations; firstly, the ram is allowed to descend so as to strike the clay in the bottom mould by percussive force; and, secondly, a positive pressure is given by the direct action of a cam or similar apparatus. The bottom die is not shown, as it forms no part of the invention. The top die is at *a*, a^*, the part *a* being fixed permanently to the ram *b*, b^*, but the part a^* is loose within the part *a*, and is therefore capable of moving upward or downward (to a certain extent) therein. This central part a^* is attached to rods *c*, which at their upper ends are provided with collars *d*, beneath which are springs *e*, resting at their lower ends upon shoulders *f*, formed by projecting parts within the ram. The ram *b*, b^*, is also formed in two parts, the lower part *b* being connected to the upper part b^*, by means of a key *g* passing through a pin *h*, by which key therefore the lower part is capable of being lifted when the upper is raised; the latter of these, however, at liberty to move downward independently of the former, there being a slight space left between them when the whole ram is lifted. The operation is as follows:—According to the position shown the ram is raised, that operation having been accomplished by any ordinary mechanical means, and by which it is allowed to fall when the proper elevation has been attained; this falling will cause the mould or die *a*, a^*, to strike the clay within the bottom mould by percussive force, and as an impetus will be given to the whole mass the part b^* will be jerked forward, and will by that impetus strike the upper ends of the rods *c*, so as to drive them downward until the upper part b^* of the ram meets the lower part *b*. The result of this will be that the loose part a^* of the top die will be forced slightly downward into the clay beyond the fast part *a*. This having been accomplished, a cam or other ordinary pressing mechanism will arrive in contact with the bowl *k*, and will complete the moulding of the brick or set of bricks. The ram being now lifted by the ordinary mechanism connected to the part b^*, that part will rise first, and will thus liberate the rods *c*, *c*, from pressure, and the springs *e*, *e*, will then be free to act so as to raise the loose portion a^* of the die or mould, and restore it to the position shown in the illustration, and when this has been accomplished the key *g* will have arrived in contact with the bottom portion *b* of the ram, and the whole will move upward together, and it will thus be seen that the central part a^* of the die or mould is moved from contact with the clay before the outward part *a* thereof commences to rise.

THE grand total of coal received in London for the past year is 5,232,082 tons, or a decrease of 6,375 tons in sea-borne, and 1,322½ tons in canal receipts, and an increase of 164,956 tons 11 cwts. by railway as compared with the preceding twelve months.

NOTES FROM NEW SOUTH WALES.

WE have advices from Sydney to November 21. The articles which New South Wales will contribute to the Exhibition are now *en route*, having previously been grouped together in a colonial display at Sydney. Several models of various kinds were exhibited, the most noticeable of which were improvements in railway construction. The principal of these was the model of a structure, called a "key bridge" designed by T. Woore, and executed by Messrs. James and Davis. The distinguishing feature of the key bridge is stated to be "a new disposition of timber struts arranged in a series of triangles to form a trussed beam in such a manner that the strain rests solely on the longitudinal fibre of the timber, and that the whole is incapable of longitudinal expansion." The main design of the inventor was to construct a strong timber bridge adapted for crossing the creeks and ravines of this colony, and capable of being carried over a considerable span without any intermediate supports. The piers of the proposed bridge are of stone, and upon either of these rests the ends of three diagonal struts, the lower one of which meets at about a right angle the corresponding strut from the other pier: the other two extend at different angles, and are joined at their opposite ends to smaller struts, so as to form triangles, the upper angles of which are right angles, and fit into grooves prepared for their reception in the girders. These press consequently against the fibre of the struts, and the whole weight of the bridge falls perpendicularly on the piers. The struts and the girders are secured to each other by duplex vertical braces, fastened at their ends with iron straps. The planking for the roadway rests upon the girders as in ordinary bridges; and, in addition to the piers for the struts, there are to be upper piers, or some other kinds of support for the ends of the superstructure. The model is made of rosewood, very cleverly executed; it represents a bridge of 100ft. span, the scale being three-quarters of an inch to the foot In order to test the strength of the bridge weights amounting to 5½ cwt. were placed upon it, which were occasionally increased, with scarcely any perceptible deflection. The weight of the model is less than 19 lb.; it consequently sustains more than thirty times its own weight, and, by comparing the position of the ends of the struts before and after the weights are put on it is evident there is no lateral thrust. Mr. Woore also contributed a model showing a new mode of supporting iron rails, for the invention of which he has obtained a patent. The object of the invention is to get rid of the expense of macadamising or otherwise preparing the road previous to laying down the rails, and at the same time of giving greater stability to the rails. This is to be effected by embedding rough trunks of trees in the ground in two parallel lines, corresponding with the gauge of the intended railway, the top surface only of the logs being levelled, and light iron rails being secured upon them. It is considered that these logs would afford such a continuous support to the rails that a very light rail would answer the purpose. No cross pieces are to be used, the idea being that the heavy logs when firmly fixed in the ground would not be liable to shift; should the soil, however, be loose, piles might be driven on either side of the logs. It is proposed also to construct small channels at every six feet, in order to carry off the water accumulated on the line. It is estimated by Mr. Woore that upon this principle rails might be laid down at one-sixth of the cost at present incurred. A model of a horse railroad and carriage was exhibited by the inventor, Mr. Peter Brawen. The method proposed in the construction of both the tramway and the carriage is extremely simple. There are to be three rails instead of two; the outer rails are to be logs of hardwood timber, fitted into notches cut in lower cross sleepers and fastened at the joints; only the upper edge of the logs to be flattened. Along the centre rail there is to be a scantling, and upon this again an iron plate. The carriage is to be constructed with a central wheel at either end, having double flanges, to traverse like a pulley the iron rail. The other two wheels at the sides of the carriage are to be of wood with iron tires, but without flanges; their use is to balance the carriage, the whole weight of which will fall on the central wheels. A model of the Sofala diggings—the first gold-field discovered in Australia—was constructed under the direction of the commissioners, by Mr. J. C. Low, the author of a large and elaborate model of Ballarat, exhibited in Melbourne last year. The model is on a scale of forty feet to the inch, its size being ten feet by six, and the area comprised a mile by half a mile.

The colonial iron mines are represented at the Sydney Exhibition by several interesting specimens. The mine best known is the Fitzroy mine, at Mittagong, on the Southern-road, 75 miles from Sydney; some fine specimens of the iron are exhibited by Mr. J. H. Thomas, of the Railway Department. The iron at Mittagong lies in a compact mass, and extends to a considerable depth, covering, as visible on the surface, an area of about sixteen acres. The vicinity of workable seams of coal, of beds of fire-clay suitable for making fire-bricks and crucibles, and of lime for flux, besides the proposed extension of the railway from Sydney close to the spot, promise to give great value to the mine when worked. The iron of the Fitzroy mine is pronounced to be "not an iron stone, such as is ordinarily met with in mines of iron, but an iron ore, combined with the oxide of several other metals, as nickel, rhodium, manganese, advantageous as alloys of iron." Pieces of cast iron and wrought iron from the Fitzroy mine are exhibited. Another sample of iron ore is thus labelled:—"From the surface of the ground on the property of Mr. H. B. Lockyer, on the Great Southern-road, near the Wollondilly River, contributed by Mr. J. H. Thomas, of the Railway Department." The vein at this mine, which is about ninety miles from Sydney, is, as visible to the eye, about 400 yards in length, and fourteen feet in width. A shaft has been sunk alongside it, and a level driven at a depth of twenty feet to the ore. The ore in both of these mines contains above 60 per cent. of iron. The samples will, upon the closing of the International Exhibition, be forwarded to Mr. Bessemer, the well-known inventor of a process of steel manufacture, by whom they will be subjected to a series of tests to ascertain their value. Great confidence is entertained as to the result of the experiment.

A collection of mineral specimens illustrating the various coal formations, was contributed by Mr. W. Keene, Examiner of Coal Mines. The specimens are between two and three hundred in number, and represent the several beds that have been gone through in the search for coal, commencing with the sandstone and ending with the granite, each of the beds being represented by characteristic specimens. The following explanation of the collection was supplied by Mr. Keene:—"Specimens of rocks, fossils, and minerals, collected and arranged stratagraphically, or in the order of their succession, so far as this order has as yet been ascertained by the exhibitor. These specimens show the super and sub-carboniferous rocks and the coal measures, comprising eleven different seams, all of which are more or less worked at various levels, from 450ft. below to 1500ft. above the sea. The first, second, and third seams are worked in the Illawarra district, at Mount Keira, Bellambi, and Bulli. The third, fourth, fifth, sixth, seventh, and eight are worked at Newcastle, and Wallsend, and at Minmi and Tomago on the Hunter River; the ninth, tenth, and eleventh seams at East and West Maitland."

We shall give some further Australian notes next week.

A NEW POCKET PISTOL.—While our great engineers are occupied in making the largest gun a *Sharpe* Yankee has been perfecting the smallest pistol. Yes! the smallest pistol with the greatest range that ever pistol or even fowling-piece of the last century acquired. It is already in the shops of the English gunmakers; but, as it requires a range of 400 yards! to try it with safety, some notion of its especial merits may be guessed at. It is a most perfect thing of its kind; and we are glad to hear that those manufactured by Messrs. Tipping and Sawden, of Birmingham, the patentees for Great Britain, exceed in their capabilities even the model specimens made in America.

LAW INTELLIGENCE.

COURT OF CHANCERY, LINCOLN'S-INN, JAN. 16TH to 21ST.
(*Before the* LORD CHANCELLOR.)

HILLS *v.* EVANS.

THIS was an appeal from an order of Vice-Chancellor Wood, and related to an alleged infringement of letters patent granted to the plaintiff on the 28th of November, 1849, for an invention which (as modified by subsequent disclaimer) is entitled "an improved method of manufacturing gas." The infringement was alleged to have been committed by the defendant, Frederick John Evans, in the process patented by him on the 27th of August, 1858, for an invention entitled "an improvement applicable to gas purifying." This process has been in use by the London Gaslight Company, and other companies, and has given rise to repeated litigation, which has been duly reported in THE ENGINEER. The plaintiff, Frank Clark Hills, of Deptford, the well-known manufacturing chemist, by the specification in his letters patent claims, first, the purifying coal gas from sulphuretted hydrogen, cyanogen, and more or less perfectly from ammonia, by passing it through the precipitated or hydrated oxides of iron, or the subsulphates or oxy-chlorides of iron, from whatever source obtained, and either by themselves or made into a more porous material; and, secondly, the repeatedly renovating or reoxidising the purifying materials by the action of the air, whenever they cease to absorb sulphuretted hydrogen, so that they may be used over and over again to purify the gas; with a third claim, which is not material. In the months of June, 1856, Mr. Hills commenced an action in the Court of Exchequer against the London Gas Light Company for an infringement of his letters patent. This action came on for trial at the sittings after Michaelmas term in the same year, when at the end of the second day of trial the plaintiff was nonsuited. A rule *nisi*, however, was obtained for a new trial, which was ultimately in November, 1857, made absolute. A new trial was accordingly had at the Guildford Summer Assizes, 1858. This trial lasted five days, and resulted in a verdict for the plaintiff upon all the issues, leave being reserved to the defendants to move on several points of law. The defendants afterwards moved for and obtained a rule *nisi* calling upon the plaintiff to show cause why the verdict should not be set aside and a verdict for the defendants or a nonsuit entered, or why a new trial should not be had. The argument of this rule occupied the attention of the Court of Exchequer seven days, and ultimately, on the 25th of February, 1860, the court gave judgment, discharging the rule. The effect was to establish Mr. Hills' patent against the defendants so far as the Court of Exchequer was concerned, and the plaintiff signed final judgment in the action. The defendants, however, proposed to appeal on the points of law involved to the Court of Exchequer Chamber, under the right of appeal given by the Common Law Procedure Act, 1854, upon which the plaintiff instituted the present suit to restrain the defendants, by injunction, from infringing his letters patent, and for other relief. The London Gas Light Company admitted that they had infringed Mr. Hills' letters patent if valid, but contended that for some time past they had used the process patented by the defendant, Frederick John Evans, and which they insisted was essentially different from the invention of the plaintiff. The Vice-Chancellor made an order, declaring that the process in use by the defendants, the London Gas Light Company, and the purification of gas by the material described in the patent of Frederick John Evans, was an infringement of the letters patent of the plaintiff; and the plaintiff undertaking to abide by any order of the court as to damages, it awarded an injunction restraining the defendants from the manufacture and purifying of gas according to or in imitation of the patent of the plaintiff, or for other purposes. In the month of March last the case came on by way of appeal before the Lords Justices. On that occasion their lordships interposed, and the following order was agreed to:—"The plaintiff to serve a notice of motion for a decree forthwith, and the defendant to have six weeks before the injunction commences; and the plaintiff to give an undertaking to be answerable in damages as from the expiration of that period." The case came on for hearing before their lordships in the month of July last, upon a motion for dissolving the injunction, when an important point was raised whether Mr. Hills was entitled to have the injunction granted by the Vice-Chancellor made perpetual at once, considering the amount of litigation that had passed during the last ten years, in which the validity of his patent had been in contest, or whether the condition of the affirmance of the Vice-Chancellor's judgment ought not to depend upon the establishment by Mr. Hills of the validity of his patent by a new action at law. Their lordships took time to consider their judgment, but, as they differed in opinion, a suggestion was made that the case should be reheard before the Lord Chancellor, and it accordingly came on for hearing before his lordship last term. The arguments had not proceeded far when his lordship expressed a wish to have the points of law, which were intended to be raised on appeal in the Exchequer Chamber, argued before him.

Mr. Bovill and Mr. Denman (with whom were Sir H. Cairns and Mr. Druce), argued this case for the defendant, Mr. Evans, who was in the position, for the purposes of the argument, of an appellant to the Court of Exchequer Chamber from the judgment of the Court of Exchequer in the action of "Hills *v.* the London Gaslight Company," reported in its various stages in THE ENGINEER, and finally in the 5th volume of Messrs. Hurlstone and Norman's *Exchequer Reports*, page 312. Mr. Grove and Mr. Hindmarch (with whom were Mr. Rolt and Mr. Marten) argued the case for the plaintiff, Mr. F. C. Hills, who, for the purposes of the argument, was in the position of a respondent, supporting the judgment of the Court of Exchequer.

The short question now argued was whether Mr. Hills' invention for improvements in the manufacture of gas was anticipated—that is to say, not new—by reason of the specifications of Mr. Croll and Mr. Laming, under letters patent previously granted to them respectively. The judgment of the Court of Exchequer determined this question in favour of the plaintiff, and established the novelty of his invention, as against the London Gaslight Company, subject to an appeal to the Court of Exchequer Chamber. No appeal was prosecuted in that action; and upon the present case being opened in the month of December last, the Lord Chancellor directed the case to stand over for further hearing, upon which Mr. Evans was first to bring before the court all such questions and points of law as the London Gaslight Company might have brought before the Court of Error on the appeal at law in the action of "Hills v. the London Gaslight Company," if such appeal had been prosecuted

The Lord Chancellor said that the object of the suit in Chancery was to obtain an injunction to restrain the defendants from any infringement of the patent of the plaintiff for the purifying of gas. Now this court never granted a perpetual injunction until the title of the plaintiff had been finally established at law. It was said in the present case that by a decision at law, and an agreement between the plaintiff and some of the defendants, the title of the plaintiff had been permanently established, and that such right had been admitted and allowed by the defendant Evans, but he (the Lord Chancellor) was of opinion that Evans was not bound by the agreement, and would therefore under ordinary circumstances have been entitled to prosecute the appeal to the Exchequer Chamber or to bring a new action. This court, however, now having authority to try the question itself, had determined so to do, and the parties had assented to such a course. The arguments had proceeded in this court in precisely the same manner as if the validity of the plaintiff's patent were being tried in an action at law. After having considered the matter very much during the four days' argument he (the Lord Chancellor) had come to the conclusion that the plaintiff's patent was good and valid at law. Such was his judgment, but the reasons for it he would give at length on some future occasion, as it would be now necessary to have the question argued whether there had been an infringement of such patent. It might be necessary upon the hearing to have witnesses examined *viva voce*, and, therefore, perhaps the defendants might like to have some time to consider whether they would proceed further in the matter. The case was then ordered to be mentioned on Friday (to-day).

THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

THE seventh annual meeting of this association was held on Tuesday in the Town Hall, Manchester, Mr. W. Fairbairn, LL.D., F.R.S., the president, in the chair. There were present Messrs. Bazley, M.P., Hugh Mason, Edmund Ashworth, J. M'Connell, T. Schofield, H. W. Harman, T. Taylor (Wigan), J. B. Booth, (Preston), W. Booth, — Bowman (Halifax), Walker (Bolton), Mr L. E. Fletcher, chief engineer, &c. &c.

The report, of which the following is an abstract, was taken as read:—

"The number of members, as well as the number of boilers under in-pection, have increased during the past year; and at the close of 1861 the association numbered 430 members, and had under inspection, at 535 factories and other works, 1,454 boilers and 1,030 engines, representing approximately a total of 127,065 indicated horses' power. The ordinary subscriptions, with the special service fees, amounted in the gross to £1,266 6s. No explosion had occurred to any boiler under the inspection of this association during the past year, while no less than 20 explosions were known to have happened in various parts of the kingdom, from which 27 persons had been killed, 47 wounded, and considerable damage done to property. 5,612 boiler inspections had been made, 52 boilers being found in a dangerous state; while, with regard to 226 others, it was necessary, in 145, that the furnaces should be strengthened by hooping; in 52 that the shells should be strengthened by additional stays; and in 29 that the load on the safety valves should be reduced. The association have been in the habit, on the occurrence of any explosion within a reasonable distance of Manchester, of having a special examination and report made upon the boiler in question, so that the members should have the advantage of the information; and after alluding to the whole of the cases which have been examined in the course of the year, it was stated that it had been found that due care and periodical inspection, with the application where necessary of the hydraulic test, would have prevented every one of these explosions, and thus the word accident could not correctly be applied to any one of them. The report then went on to the consideration of engines and "economy in the raising and use of steam," and pointed out the desirability of adopting a more satisfactory system than that now in use, which it is hoped the association will be the means of introducing ere long, stating that it would be extremely valuable if a complete table could be obtained of the actual net amount of fuel consumed, per indicated horse-power, by each engine under the inspection of this association. Such a table would form a true record of comparative economy, which would not only be useful to steam users, but also to manufacturing engineers, while it would establish a wholesome competition between all parties for the attainment of the highest degree of economic efficiency. The report recommended the application of steam casings or jackets to cylinders, and the adoption of superheated steam, stating the commercial advantages derived from these arrangements in other parts of the country, and concluded by stating that it was the desire of the association constantly to diffuse among the entire body of members reliable information on all points relating either to the safety of boilers or the economic use of steam, carefully avoiding the recommendation of anything untried or experimental. In this way it was thought that the association would continue to be a source of wealth to its members, as well as to the surrounding district, and the earnest desire was expressed that no year should pass without a decided mark of engineering progress being clearly stamped upon it by the association.

The president moved the adoption of the report. Mr. Hugh Mason (Ashton-under-Lyne) seconded the resolution, which was unanimously adopted.

Mr. Edmund Ashworth moved a vote of thanks to the committee of management. The resolution, which was passed, was seconded by Mr. T. Taylor (Wigan).

Mr. J. B. Booth (Preston) proposed, and Mr. Bowman (of the firm of Huntriss, of Halifax) seconded, the appointment of officers for the ensuing year, Mr. William Fairbairn being again named as president. The resolution was adopted.

Mr. Bazley, M.P., moved the following resolution:—

That the meeting considers the system of voluntary periodical inspection to be worthy of the confidence of all steam users, and that this view is borne out by the fact that no explosion has occurred to any boiler under the inspection of this association during the past year, while no less than twenty explosions are known to have happened in various parts of the kingdom. Also this meeting wishes prominently to call attention to the fact that, in every case where exploded boilers have been examined and reported on directly to this association, it has been found that the explosion resulted from the simplest causes, and might have been prevented by the exercise of due care. This meeting therefore considers that the labours of this association have established the following principle, namely, that the causes of explosion have been shrouded in unnecessary uncertainty and mystery, and takes this opportunity of expressing its conviction that explosions are considered far too frequently to be accidental, and that by due attention to correct principles in the construction of boilers in the first place, added to care in their working in the second, the recurrence of explosions would be prevented.

Mr. J. M'Connell seconded the resolution (which was passed), remarking upon the advantages derivable to the members from the vast amount of information as to boilers collected by the chief engineer.

Mr. H. W. Harman moved, and Mr. William Booth seconded the next resolution:—

"That this meeting calls attention to the fact that the association by no means confines its attention to the safety of boilers, but includes all questions relative both to their efficient working and to the economic use of steam generally, and this meeting considers that the association, by the assistance it renders to engineering progress, is commercially valuable, not only to its own body of members, but also to the district at large."

This resolution having also been passed a vote of thanks to the president terminated the business.—In acknowledging the vote Mr. Fairbairn alluded to the Hartley Colliery accident, and said that had the beam, instead of being made of cast iron, been constructed of rivetted plates, as bridges were now made, the accident might never have happened.

THE GREAT EXHIBITION.

We are glad to say that at last some steps have been taken, or rather are ordered to be taken, towards getting ready the Annexe for the reception of machinery in motion. An engine-house for six boilers is to be built at the northern end of the shed, with a chimney 12ft. in diameter and 100ft. high. The engine is to work up to 300-horse power at 30lb. pressure, and culverts under ground will convey the steam and exhaust pipes. Even in these matters alone there is so much work to be done that it seems scarcely possible all can be ready for the opening.

Her Majesty's Commissioners have adopted the following regulations with respect to the admission of visitors to the Exhibition:—

1. The Exhibition will open, as previously announced, on Thursday the 1st of May, and will be open daily (Sundays excepted) during such hours as the commissioners shall, from time to time, appoint.

2. The Royal Horticultural Society having arranged a new entrance to their gardens from Kensington-road, the commissioners

have agreed with the council of the society to establish an entrance to the Exhibition from the gardens, and to issue a joint ticket, giving the owner the privilege of admission both to the gardens and to the Exhibition on all occasions when they are open to visitors, including the flower shows and fêtes held in the gardens, up to the 18th of October, 1862.

3. There will, therefore, be four principal entrances for visitors:—1. From the Horticultural Gardens for the owners of the joint tickets, Fellows of the society, and other visitors to the Gardens. 2. In Cromwell-road. 3. In Prince Albert's-road. 4. In Exhibition-road.

4. The regulations necessary for preventing obstructions and danger at the several entrances will be issued prior to the opening.

5. Admittance to the Exhibition will be given only to the owners of season tickets and to visitors paying at the doors.

SEASON TICKETS.

6. There will be two classes of season tickets. The first, price £3 3s., will entitle the owner to admission to the opening and all other ceremonials, as well as at all times when the building is open to the public. The second price, £5 5s., will confer the same privileges of admission to the Exhibition, and will further entitle the owner to admission to the gardens of the Royal Horticultural Society at South Kensington and Chiswick (including the flower-shows and fêtes at these gardens) during the continuance of the Exhibition.

PRICES OF ADMISSION.

7. On the 1st of May, on the occasion of the opening ceremonial, the admissions will be restricted to the owners of season tickets.

8. On the 2nd and 3rd of May the price of admission will be £1 for each person; and the commissioners reserve to themselves the power of appointing three other days, when the same charge will be made.

9. From the 5th to the 17th of May, 5s.

10. From the 19th to the 31st of May, 2s. 6d., except on one day in each week, when the charge will be 5s.

11. After the 31st of May the price of admission on four days in each week will be 1s.

SALE OF SEASON TICKETS.

12. Season tickets are now for sale, between the hours of 10 and 5 daily, at the offices of her Majesty's Commissioners, 454, West Strand, London, W.C.

13. Applications through the post (stating Christian name and surname) must be addressed to the secretary, and must be accompanied by Post-office orders, payable to Mr. J. J. Mayo, at the Post-office, Charing-cross.

14. No checks, or country notes, will be received.

15. Cases for preserving the season tickets may be obtained at the office for 1s. each.

By Order, F. R. SANDFORD, Secretary.

STEAM BOILER ASSURANCE COMPANY.

AT a recent meeting of the directors of this company, held at their offices in New Brown-street, Manchester, Mr. R. B. Longridge, the chief engineer, presented his report, from which the following are extracts.

In the course of the past year proposals have been received for the insurance of 1,812 boilers, of which 1,722 have been accepted by the board and 34 declined, the latter not being in a condition to warrant their acceptance. The insurance of 175 boilers has been deferred for repairs or additional mountings, but of these 83 have since been insured on completion of the necessary alterations.

Notwithstanding the depressed state of trade, which has considerably affected the business of the company, it is gratifying to be able to report that the number of boilers accepted in the year 1861 has exceeded that of the previous year by 86 boilers.

The total number of boilers for which policies have been issued from the formation of the company in the year 1859, to the 31st December 1861, is 4,244. During this period there have been, in Great Britain, not fewer than 138 boiler explosions, causing the loss of 232 lives, and serious injuries to a still larger number of individuals, besides great destruction of property—of these boilers only one was insured. These, however, form but a portion of the boiler accidents that have occurred, those not attended with fatal consequences being seldom reported in the public journals. To give a more correct idea of the frequency of such accidents, I may state that within the last twelve months forty-five of the boilers insured have been injured in consequence of the deficiency of water, and the sum of £687 has been paid by the company for the several claims. But, in addition to these, thirty-nine other boilers only escaped similar injuries, from having been provided with mountings specially recommended by the company to guard against such casualties.

The total number of boiler inspections made by the officers of the company in the course of the year is 13,071, of which 368 were internal, and 897 other examinations. These inspections revealed not less than 861 serious defects, many of which, but for their timely detection, would, in all probability, have resulted in explosion. As these will, however, be fully detailed in a future report it is unnecessary to enter further upon the subject at present.

A THRIFTY SCOTCH WORKMAN.—On the 6th instant died, at the Carron Ironworks, Scotland, aged 78, Mr. John Andrew. John was a remarkable specimen of a hardworking, frugal-living, canny Scotchman. For upwards of sixty years he had been connected with the Carron Ironworks, during which time he had succeeded in amassing a princely fortune for a working man. For about the last five years he had retired from labour. His department in the works was that of a foreman iron-dresser and letter-cutter of loam goods, which, in the days of the late Mr. Joseph Stainton, and in those of the late Mr. J. Dawson, was very lucrative. This may be inferred from the fact that the deceased, in the course of his life, massed about £10,000. His habits of living were unusually moderate. He was never known to spend a single farthing on luxuries, preferring, to everything,

"The halesome parritch,
Wale o' Scotia's food,"

and such primitive fare; and it was deficient neither in bone-forming, flesh-forming, or health-giving qualities. It was said, however, when John was alive that his frugality extended to niggardliness. We have it on excellent authority that about eight years ago, when his wife died, he asked permission of his employers to attend her funeral, and although at that time worth £6,000, he actually returned to work immediately after having paid the last respects to the remains of his partner in life. His anxiety to pursue his daily avocations was in order to secure the full day's pay. It is further said that, despite his wealth, he once craved one of his relations for a halfpenny which was owing him, so scrupulously exact was he in his monetary transactions. When buying herrings he used to weigh one in each hand so that he might buy the heaviest. The most remarkable anecdote we have heard of him is the following:—About twenty years ago he chanced to take ill, and, as he seriously thought he was dying, bethought himself how matters stood with reference to futurity. Evidently wishing to atone for his earthly deficiencies, he made a handsome donation (something about £250) to the Rev. Mr. Welch, late of the West U. P. Church, for the purpose of establishing a native teacher in Caffraria. Regaining health, he demanded back the sum. It is not known exactly how his wealth will ultimately be distributed. His heir-at-law is a younger brother. According to report a large sum has been made over to Bible societies and colonial missions. He had such a wonderful reverence for the first sixpence he ever earned that he kept it for sixty years.—*Falkirk Herald.*

RISE OF JETS OF WATER FROM FOUNTAINS.

A BODY falling in a vacuum from the force of the earth's attraction falls 16ft. in the first second, at the end of which it is falling at the rate of 32ft. per second; the velocity being constantly accelerated. If a flume or tank of water is pierced at its side the water will issue with a velocity just equal to the velocity which a body falling from the level of the surface of the water would acquire when it reached the level of the orifice. If the jet is turned vertically upward it will rise in a vacuum just to the level of the surface of the water; but in the atmosphere the height to which it rises is reduced by the resistance of the air. Small jets are reduced in height more than large ones, and it is only by an elaborate series of experiments that the ratio between the theoretical height of the jet due to its velocity, and the actual height to which it rises in the atmosphere, can be ascertained. A German engineer has recently made such a series of experiments, and the *Scientific American* has translated the following account of them from Dingler's *Polytechnic Journal*:—

Until quite recently the experiments made by the French philosophers, Mariotte and Bossut, over a hundred years ago, have been the sole guide for determining the height of the jets of fountains or of fire engines. It is well known that the results obtained from these experiments have been insufficient, owing partly to the small pressures or heads employed, and partly to the poor instruments of that time. It is, therefore, of great importance to the scientific world that a comprehensive series of experiments have lately been made by a German engineer, Mr. Weisbach.

The following tables give the result from experiments made with two different mouthpieces. The first mouthpiece was $\frac{3}{4}$in. in diameter $5\frac{1}{2}$in. long, and the convergence of its sides was $5\frac{1}{2}$deg.

Head in feet.	Height of jet in feet.	Head in feet.	Height of jet in feet.
3	2·865	33	28·611
6	5·712	36	30·708
9	8·541	39	32·643
12	11·304	42	34·440
15	14·010	45	36·189
18	16·704	48	37·776
21	19·278	51	39·219
24	21·768	54	40·608
27	24·138	57	41·838
30	26·430	60	42·960

The second mouthpiece was $\frac{3}{4}$in. diameter, $9\frac{1}{2}$in. long.

Head in feet.	Height of jet in feet.	Head in feet.	Height of jet in feet.
3	2·844	33	30·338
6	5·709	36	32·724
9	8·559	39	35·022
12	11·424	42	37·254
15	14·250	45	39·429
18	17·082	48	41·424
21	19·845	51	43·209
24	22·569	54	45·090
27	25·218	57	46·740
30	27·810	60	48·360

The following are some of the results arrived at by M. Weisbach:—

1. The resistance of the air for small velocities of discharge of from 5ft. to 25ft., or for jets of from 1ft. to 10ft. height, is so small that the height of the jet can be taken as equal to the height corresponding to the velocity of discharge, without a perceptible error.

2. Under the same head or pressure the height of the jet increases with the area or size of the orifice. The resistance of the air is smaller with thick than with thin jets: in order to obtain a greater height, therefore, not only a greater pressure but also a larger orifice is required.

3. Under otherwise equal circumstances jets from circular orifices reach higher than jets from square or differently shaped orifices.

4. With equal velocity of discharge, and with the same area of the orifice, jets discharged without contraction rise higher than those with contraction. The resistance of the air is greater with the former than with the latter. Under otherwise equal circumstances, and if the head or pressure is not very small, jets from small conoidal or conical and internally-rounded mouthpieces rise to a greater height than jets from orifices in a thin plate.

5. With jets discharged from orifices in a thin plate the coefficient a may be taken equal to 1, and the difference between j and h is perceptible only when the velocity of discharge exceeds several feet.

6. The height of the jet j does not increase in a simple ratio to the theoretical height h, corresponding to the velocity; if h is not very large the height of the jet is approximately.

$$j = \frac{h}{a + bh + ch^2}$$

where a b c are coefficients, to be determined for each orifice by experiment.

MR. GRIFFITHS has published a list of the iron mills and forges in the South Staffordshire district, with the number of their puddling furnaces. 100 mills and forges, with 1,782 puddling furnaces, are working, and twelve mills and forges, with 208 furnaces, are standing.

THE prospectus has been issued of the Victoria (London) Mining Company (limited), and formed for the purpose of carrying on the business of mining and reducing ores in Victoria. The company has acquired an interest in valuable mines in that colony, the amount hitherto expended upon which does not exceed £2,000. The capital of the company is fixed at £25,000.

RAILWAY BRIDGE OVER THE EBRO, SPAIN.—This bridge is one of the most remarkable specimens of the recently-introduced system of wrought-iron lattice-girder bridges. It has been lately completed by Messrs. Kennard, of London, for his Excellency Don Jose De Salamanca, the eminent Spanish contractor. It crosses the river Ebro near Viedola, on the Pamplona and Zaragoza Railway, and consists of twenty-one spans of lattice-girders, each about 102ft. in length; the length of the bridge being about 2,014ft. The piers are formed of iron cylinders 6ft. and 8ft. in diameter, sunk through the bed of the river to an average depth of 30ft. by means of dredging, assisted by divers, who worked in their diving dresses, patented by Messrs. Heinke, to the rock through and below which they were sunk by the compressed air process. This bridge was erected to a great extent in the winter—the first cylinder having been completed on September, 1860, and the whole work finished and opened for traffic on the 23rd of May following, less than eight months from its commencement. We doubt if any work of similar magnitude was ever executed in so short a time: the period of the year during which the work was done was much against it; the winter floods of the Ebro, always great, were that year more extensive than they had been known to be for many years—the whole body of the river running down at times at the extraordinary velocity of fifteen miles per hour. During these freshets on two occasions considerable portions of the works were carried away. The limit of time in which a railway or similar work can be executed is the amount of time necessary for completing the heaviest work upon it. In former times some great bridge generally fixed this, and the public remained for years without the much-desired accommodation, and the shareholders without interest for their expended capital. The introduction of wrought iron for civil engineering purposes entirely removed this difficulty, for not only are the largest rivers spanned, as we see in this instance, with a rapidity that would a few years ago have been thought impossible by the most enlightened engineers, but deep valleys and gorges that formerly were crossed by solid earth banks or stone viaducts, that took years to execute, are now passed over in less time than it formerly took to build a turnpike-road bridge. Messrs. Kennard have executed a large number of works of this description in England and elsewhere, and are justly celebrated for them. The great capital, skill, and energy expended on such works, and the rapidity and certainty with which they are carried out, cause English contractors to be sought for to execute them in whatever part of the world they may be required.

MISCELLANEA.

A RAILWAY, at a cost of £75,000, is proposed from Newport to Brading, Isle of Wight.

THE proposed railway extensions from Rickmansworth to Amersham and Chesham are estimated to cost £95,000.

WORKMEN are engaged in repairing the spire of Salisbury Cathedral, 404ft. high, and which is 22in. out of the perpendicular.

A LARGE meeting has been held in Dublin to promote the rebuilding of Carlisle Bridge, the estimated cost being under £60,000.

THE Brighton Railway dividend is to be at the rate of 7 per cent. per annum, making the dividend for the year 1861 6 per cent.

THE Somerset and Dorset Central Railway was opened on Saturday from Glastonbury to Temple Combe, a distance of 21¼ miles.

THE East Indian Railway is now open for 320½ miles in Bengal, and for 209¼ miles in the north-west provinces, or 529¾ miles in all.

THE prospectus has been issued of the British Paper Manufacturing Company, with a capital of £60,000, and contemplating the erection of a freehold mill large enough to turn out 30 tons of paper weekly.

THE Defence is stated to have attained a rate of steaming of 13 knots an hour with only two boilers at work. This frigate has shipped her guns, viz., six 100 pounder Armstrongs and ten 95 cwt. guns of 68 lb. bore, besides smaller guns.

THE traffic receipts of railways in the kingdom amounted for the week ending the 11th of January, on 10,059 miles, to £458,730, and for the corresponding week of last year, on 9,846 miles, to £452,240, showing an increase of 213 miles and £6,490.

THE prospectus has been issued of the Warmley Colliery and Spelter Works Company, an undertaking with a capital of £70,000 formed to purchase and work conjointly some colliery works and spelter mines in Gloucestershire and Cardiganshire.

THE Bessemer process has, we learn, been successfully applied to the production of armour plates, for which the metal can be made of any required toughness. The present price of rolled iron armour slabs is £35 per ton. Bessemer plates ought not to cost half of this.

A MASSIVE and perfectly sound crane chain snapped suddenly at the Ordnance Wharf, Chatham, on Saturday last, while a 95 cwt. gun was being hoisted. The failure was attributed to frost, although it is nothing unusual for crane chains to break in consequence of crystallisation.

DR. LETHEBY, the medical officer to the City Commission of Sewers, states in his quarterly report that no application has been made to him during the quarter for the analysis of food or drink, and he adds that "it is to be feared, from the experience of the last six months, that the Adulteration of Food Act will become a dead letter."

THE following appointments of naval engineers have been made since our last:—John H. Marshall, chief engineer, to the Asia, for charge of the machinery of the Cæsar when paid off; W. Birks, first-class assistant-engineer to the Asia, for the Earnest; and G. F. Williams, first-class assistant-engineer to the Asia, for the Cracker.

AT the half-yearly meeting of the Panama Railway Company, at New York, on the 24th of December, the report stated the gross earnings for the last half of the year 1861 to have been £316,000, and the net earnings £193,000. A dividend of 6 per cent. was declared (making 12 per cent. for the year), and £50,000 was added to the surplus fund. The net profits of the entire year have been a fraction over 19 per cent.

THE Telegraph to India Company have given notice that the Alexandria and Suez land line will be restored to working order early in March. It is further stated that the cost of a message between any part of England and any of the following places at which the company have agents will not exceed £3 for a single message—viz., Aden, Bombay, Galle, Madras, Calcutta, Penang, Singapore, Hong-kong, Shanghai, King George's Sound, Melbourne, Sydney, Mauritius, and Reunion.

IN case the Black Prince is fitted with hydraulic steering gear it is proposed to inclose the cylinder and pistons in a box of 3½ in. and 4½ in. iron abaft the rudder head, under the beams of the upper deck, and the application of the power to be brought to bear upon the rudder head by a right and left threaded screw, similar to the one fitted on board the American frigate Niagara. It is also proposed to supply the Black Prince with a 90-horse power engine, and steam capstan for heaving up the anchor, raising the screw, &c., and thus keep the hydraulic power intact for steering purposes.

A PROSPECTUS has been issued for establishing a new steam line to India, to be called the British and Eastern Steam Navigation Company, with a capital of £750,000, in £10 shares. The intention is to construct a fleet with extensive accommodation for passengers, such as will admit of facilities for those of second-class as well as first, and also for the conveyance of troops, railway operatives, and the large number of persons who are likely, henceforth, to be brought into that line of travel by the rapid development of India, and who are, at present, compelled by the necessarily high scale of existing fares, to take the long sea route.

THE number of cotton mills in Manchester on short time last week was 23, out of a total of 84; nine were working with a reduced number of hands, and eight were stopped altogether. Of cotton, smallware, and silk mills, printworks, dyeworks, machine shops, and foundries, 59 out of a total of 213 were on short time, 12 were standing idle, and 54 were working with a reduced number of hands. The number of work people out of employ was 6,220, and the number on short time was 12,586, out of a total of 47,183 usually employed. This shows a slight increase on the previous week in the number totally out of employ, and an increase of 717 in the number on short time.

M. GUILLAUME, in a paper recently read before *La Société des Ingenieurs Civils*, gives the total cost of the Kehl Bridge as 7,000,000f., or £280,000, the foundations and preparatory works costing 5,250,000f., or £210,000, and the superstructure 1,570,000f. or £70,000. This cost was the result of several restrictions imposed by the two governments of France and Baden. But for that requiring two turning bridges the whole cost, it was said, would not have exceeded 4,250,000f., or £170,000. The Kehl Bridge, we may observe, has three lattice spans of 183ft. 9in. opening each, and two turning bridges, each 196ft. 11in. long, and giving two openings 85ft. 3½in. each in width.

A "FIRM OF SOLICITORS" write to the *Times* to say that, while one of their clerks was reading by a paraffine lamp, it suddenly, and without any apparent cause, exploded, throwing the paraffine all over the poor fellow, and enveloping him in a sheet of flame. "He, fearing his sister's clothes would be ignited, rushed into the street, where the flames were put out by two passers by, not, however, before the man had been most cruelly burnt, and he now lies in a very precarious state." An inquest was held last week upon the body of a little girl who had been burnt to death by the inflammation of paraffine in a lamp, while being trimmed. The "paraffine," probably, was, in both cases, some spurious stuff sold as paraffine. The latter, it is asserted, will not ignite in the open air even when warmed to 130 deg.

IT is understood that the Messageries Imperiales Company have just concluded a contract with an English firm for the construction, for £1,000,000 sterling, of eight first-class iron steam vessels for packet service, three to be built on the Clyde and five in ports of France, under the superintendence of the firm. The first English built one is to be completed within 19 months, and the others at successive intervals of two months from the expiration of that term. With respect to the company's operations in connection with India, the three vessels intended for that service are now lying in the harbour of Marseilles completely ready for sea, in regard to equipment and furniture. They are the Impératrice, the Donau, and the Camboge, all screw vessels of 3,300 tons burden each, and 500-horse power, and fitted entirely for first-class passengers and their servants. These ships are to leave Marseilles for Calcutta within two months from the present date, and are intended to run between that port and Suez.

WALKER'S HYDRAULIC STAGE FOR RAISING VESSELS.

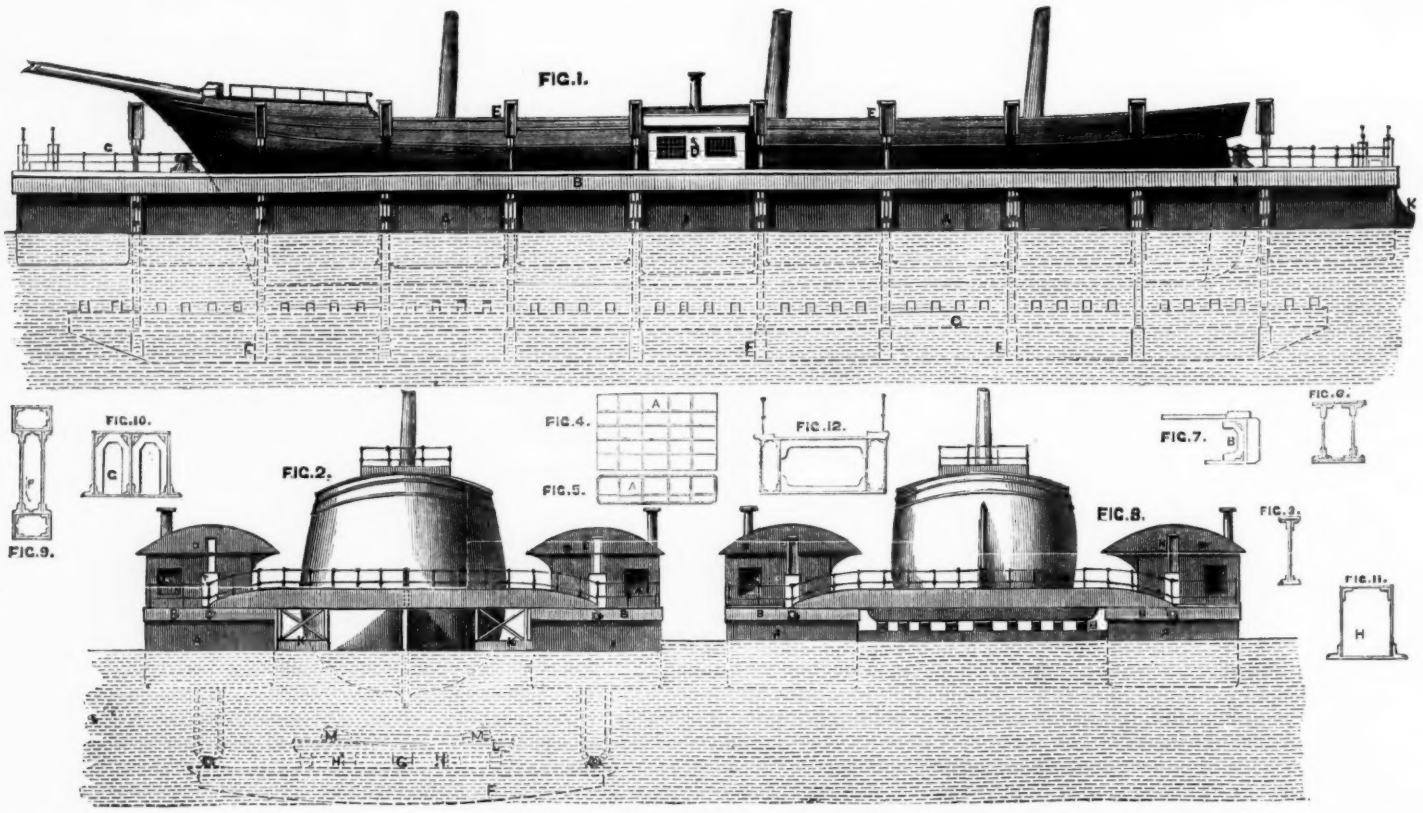


FIG. 1 represents a side elevation of a floating hydraulic lift graving dock, the invention of William H. Walker, of Liverpool, showing (in dotted lines) the transverse lifting stage lowered down for lifting out of the water, the vessel seen floated in between the double floating stage; Fig. 2 is an end elevation; and Fig. 3 is another, showing the lift stage elevated with a vessel resting upon it; Fig. 4 is a horizontal section of one of the pontoons A; Fig 5 is a vertical longitudinal section.

In this instance twenty-two pontoons are used, twenty of them 35ft. by 25ft. by 11ft. 3in. deep; and the other two 35ft. by 25ft. by 13ft. deep. The plating of the pontoons to be $\frac{3}{8}$in. thick; the landings to be overlapped, and the butts flush with the butt strips, $\frac{7}{16}$in. thick inside, the grain of the iron running at right angles to the line of butts. The rivets to be snap headed, and to be spaced six to the foot, and the but, strips and landings of the plates to be caulked thoroughly both inside and outside. The frames to be of angle iron, 3½in. by 2½in., by $\frac{3}{8}$in., spaced about 2ft. 9in. centre to centre, in sides and bottom and top. Two opposite bottom corners of the pontoon to be rounded to a radius of 1ft.; the other corners to be square, with 3in. by 3in. by $\frac{3}{8}$in. angle iron. Each pontoon to have 24 stanchions of 2½in. by 2½in. by $\frac{3}{8}$in. angle iron, to run from floor to deck, and eight cross stays of 2½in. by 2½in. by $\frac{3}{8}$in. angle iron, to be secured by knee plates to frames and sides of pontoon; and angle irons 3in. by 3in. by ½in. are used on top of pontoons to secure them in their places.

Fig. 6 is a vertical section of one of the centre girders on the top of pontoons, which are of the form shown, and being 3ft. in height and 2ft. 6in. broad, and extending the full length of the dock, and stiffened vertically by angle or T irons at intervals of 30in.

Fig. 7 is a section of one of the pontoon side girders B, and which extend the whole length of the dock, and are stiffened vertically, as centre girders, 3ft. in height by 18in. in width, with a rubber of rock elm 3ft. wide by 6in. thick all round.

Fig. 8 is a vertical section of the thwartship pontoon beams to connect the girders, and are 3ft. in height by 12in. wide, and are secured by angle irons 6in. by 6in. by $\frac{3}{8}$in. in the corners to the girders. In addition to these thwartship beams, angle irons 3½in. by 3in. by $\frac{3}{8}$in., to be spaced at regular intervals and secured for carrying the decks.

Fig. 9 is a centre vertical section of one of the girder beams F for carrying the ship, to be of the form shown in the elevation of the dock, or with the curvature equally divided between top and bottom. The length of the beams to be 86ft. between the supports, 2ft. broad, and 7ft. 6in. deep, made perfectly water-tight, and most carefully rivetted, so as to secure the full strength of the material, and they are fitted with manhole doors at each end, and with wrought iron hoops for attaching the chains. The girders are tied to each other at bottom by three sets of wrought iron tie-rods of 2in. diameter.

Fig. 10 shows a cross section of the keel girder G, which is a longitudinal centre girder fixed on the top of the thwartship girder beams F, and is 4ft. high by 4ft. wide at the top, and 5ft. wide at the bottom, with three vertical plates stiffened by angular or T irons at intervals of 30in. and made as shown, and extends the whole length of the dock, and has fixed to it 70 cast iron graving dock blocks, with taper wedges for shifting, and hard wood cappings.

Fig. 11 is a cross section of one of the four bilge keelsons H which extend the full length of the dock, two on each side of the keel girder fixed on the top of the girder beams; and on these bilge keelsons portable wrought iron inclined beams, to be placed at regular intervals to receive the bilge blocks; these bilge keelsons are about 4ft. high by 2ft. wide on the top and 3ft. wide at bottom plate.

The inclined beams are as shown, Figs. 2 and 3, numbering 10 on each side of the vessel. The bilge blocks are made to slide on the top of the inclined beams, and are fitted with tackles for drawing them in to support the bilges of the ship as soon as the keel takes on to the keel blocks. The lower part of the blocks are of cast iron, made with taper keys and wedges, so as to admit of their being driven in or out. The top of the blocks are capped with wood, as required, to suit the form of the ship.

Fig 12 is a cross section of the end bridges or binders I, which are constructed each with two girders 3ft. 6in. deep at centre, and 18in. broad, and to be formed of wrought iron, as seen in the figure, and are stiffened by vertical angle irons, every 30in., inside. The girders are 5ft. apart, secured to each other by short beams, and decked on the top with 2½in. yellow pine, covering boards of teak 3in. thick, with wrought iron stanchions and double rails; provision to be made for securing the bridges at each end, so as to keep the pontoons steady at the same distance from each other athwartships. The two bridge pontoons are 25ft. long by 10ft. wide, by 4ft. deep, formed of plates a ¼in. thick, and framed and stiffened with 3in. by 3in. by $\frac{5}{8}$in. angle iron, spaced about 2ft. centre to centre, and with stanchions, as required, from floor to deck. The bridge is raised from the top of the pontoons by wrought iron framework to a sufficient height to lift the bridge on to the top of the larger pontoons when the dock is at its light draught; each pontoon is fitted with a suitable brass sea cock to regulate their draught.

A, the pontoons upon which the apparatus float; B, the pontoon side girders; C, wrought iron stanchions and double rails running all round the outside of the pontoon decks. The deck planking is of yellow pine, 3in. thick by 5in. wide, laid, fitted, and caulked over the top of the pontoon girders the whole length of the dock, with teak covering boards 12in. by 4½in. all round. D, two engine houses of wood, one on each side of the dock to receive the engines, pumps, and boilers, with all necessary fittings; E, hydraulic presses, by which the thwartship girders on which the ship rests are to be raised or lowered; they are twenty in number, with double or single cylinders as may be preferred. Each press to have an area of the rams equal to 78½ square inches and an effective working stroke of 5ft., and constructed to sustain a proof strain of at least three tons to the square inch. The presses are fixed on strong bed plates on the top of the pontoon girders, and connected by strong wrought iron pitch chains to the end of the thwartship girder beams. F, the girder beams (shown in section at Fig. 9); G, the keel girders (seen in section at Fig. 10); H, the bilge keelson (seen in section at Fig. 11); I, end bridges (seen in cross section at Fig 12); K, pontoons, upon which the bridges can be floated; L, the inclined beams, upon which rest M, the bilge blocks, which are made to be drawn in or out from the keel to suit the form of the vessel, on the inclined thwartship beams, which are to be placed at proper distances on the top of the longitudinal box beams.

RAILWAY BILLS.

DURING the week the examining barristers of the Houses of Lords and Commons have announced that the following Railway Bills have complied with the standing orders:—London and South-Western—widening the existing line near the Vauxhall and Southampton stations; increasing the station accommodation at Nine Elms; and making a railway from Wareham to Knowle, and taking power to raise £500,000 and to borrow £166,600; also for making junction lines to connect the Andover and Redbridge Railway with the London and South-Western, and to lease the former and raise £60,000. South Yorkshire—to enable the company to construct new railways near Sheffield and Thorne, at a cost of £100,000. The other railway bills passed were to enable the Maryport and Carlisle Company to make branch railways to Bolton and Wigton, to enlarge their station there, and to raise £100,000; Radstock and Keynsham, to unite these places with the Great Western Railway, to make branches, and raise £160,000, further adjourned to the 27th inst.; Inverness and Aberdeen, and Inverness and Rosshire—amalgamation; Brean Down—for the construction of a railway, pier, and harbour at Brean Down, in the Bristol Channel, and to raise £100,000; North Devon—for the construction of a railway dock.

THE LONDON, BRIGHTON, AND SOUTH COAST BILL, to authorise them to make new lines in Surrey and Sussex, was opposed by the London, Chatham, and Dover, and on the memorials of numerous landowners. The standing orders were declared not to have been complied with, but the allegations were not material.

THE HOLBEACH NORTH JUNCTION BILL, for making a railway from the Norwich and Spalding Railway at Holbeach to the Great Northern Railway at Algarkirk, and to raise £80,000, was withdrawn.

METROPOLITAN AND THAMES VALLEY.—To make new railways through the valley of the Thames from the Great Western Railway to Richmond, Hampton, Shepperton, and Chertsey, at an estimated cost of £250,000. The junction with the Great Western would be near Southall, and run into the South-Western near Twickenham and Kingston-bridge.

SOUTH-EASTERN.—The widening of the North Kent line at certain points, and also two new lines, one from Deptford to Tunbridge, and another from Lewisham to Dartford, requiring a further capital of £1,200,000.

MANCHESTER, SHEFFIELD, AND LINCOLNSHIRE.—The bills of this company were for the construction of a Liverpool central station, together with a railway from Toxteth Park to Liverpool, at an estimate of £395,000, and a branch between Godley and Woodley, at £56,000. The other railway bills passed were those of the Barnsley Coal Railway for an extension to Wakefield and Barnsley, and to raise £160,000, and for an amalgamation of the North British, Edinburgh and Perth, and West of Fife.

In the case of the Oswestry, Ellesmere, and Whitchurch Railway, for deviation and alterations of levels; the Edinburgh, Dunfermline, and Perth, for improving the railway communication between Edinburgh and Perth, *viâ* the Firth of Forth, and to raise £385,000 for these purposes; and in the case of the Dublin and Meath, the standing orders were declared not complied with. The Bill of the Scottish Central Railway Company was withdrawn, and the further hearing of the Great Northern and Western of Ireland, the Ellesmere, Ruabon, and Shrewsbury; the Launceston and South Devon, the Moretonhampstead and South Devon, and the South Staffordshire and Central Wales (Dudley and Bridgenorth), was postponed.

THE GREAT INTERNATIONAL RAILWAY SUSPENSION BRIDGE OVER THE NIAGARA RIVER.—This magnificent work was erected for the purpose of connecting the New York Central and the Great Western of Canada Railways, and the cost was contributed by both companies in equal portions. It is by means of this bridge only that an unbroken journey can be made from New York, or Boston, to the western part of Canada, without changing carriages. The Niagara Railway Suspension-bridge was erected from the designs of Mr. John A. Roebling, at a cost of 400,000 dols. The first engine crossed over it on the 8th of March 1855. It carries a double line of rails on the upper part, and an ample roadway for carriages below. The plan adopted in the construction of this suspension-bridge differs materially from those usually built in England Instead of flat wrought iron plate-links, connected together by pins passing through their extremities, Mr. Roebling uses a simple wire-cable, or rather four wire cables, each 10in. in diameter, and composed of 3,640 separate wires, the whole of the cables being capable of bearing a weight of 12,000 tons; the actual load they carry never exceeds 1,000 tons. The wire ropes are securely anchored in the solid rock, 30ft. below the surface; they pass over the summits of four solid stone towers, 80ft. in height. Beside the wire cables there are 624 suspending-rods, whose ultimate strength is equal to 18,720 tons; these support the roadway at different parts, and are connected with the cables above. There are also sixty-four over-floor stays, whose ultimate strength is 1,920 tons, and fifty-six river-stays, whose ultimate strength is 1,680 tons; these latter stays extend from the bridge to the rocks on either side of the ravine. The total length of span between the towers is 800ft. and the "railway track," as it is always called in America, is 250ft. above the surface of the water in the river. The great object sought to be obtained in this remarkable bridge, after strength to carry its load, was rigidity; for in all suspension-bridges, as ordinarily constructed, the deflection and oscillation would be such as to entirely prevent their being used for the purposes of carrying railway traffic. The Niagara suspension railway bridge, although not perfectly rigid, is sufficiently so to allow of heavily laden trains passing over it at a maximum speed of five miles per hour; even then a very considerable deflection takes place, but not such as to in any way betray weakness; on the contrary, it is rather an indication of strength, as showing the correct action of all its parts, by which means a true bearing is obtained over every part of it. A wonderful amount of ingenuity and mechanical skill is displayed in the construction of the roadway, which forms a species of lattice or tubular girder, the railway track being on the top outside, and the carriage roadway on the bottom inside. The frequent admixture of wood and iron, and the numberless small bolts and screws passing through the former material, will require constant care and supervision to prevent decay occurring, and may probably cause the cost of maintenance of the bridge to be excessive. Portions are now being constantly renewed, and always with an increased strengthening of the parts. The bridge, however, taken as a whole, must be looked upon as a decided success, and a triumph of American engineering skill; while the advantages of a perfect communication between the United States and the most valuable portions of the British possessions in North America cannot be overrated. The general effect of the Niagara suspension bridge is that of extreme lightness and beauty; the situation in which it is placed is exceedingly fine, being in view of the Great Falls, while below it the Niagara River rushes through its confined channel, a foaming, noisy rapid 150ft. deep, almost as terrible in its roar and force as the mighty cataract itself. A bridge similar to the Niagara suspension bridge, and of even greater span, but only carrying an ordinary roadway, has been built over the river St. John, in the city of St. John, in New Brunswick. This bridge, some time after it was erected, gave way during a terrific gale of wind. The suspension cables remained sound and fully equal to their duty; but the roadway had been insecurely connected with the abutments, and it broke adrift at that point. The whole length of roadway oscillated many feet clear of the abutment altogether, yet only a portion of it gave way, the bridge proving itself in all other respects equal to withstanding strains that it never was expected to be subjected to.

TO CORRESPONDENTS.

*** *We must request those of our correspondents who desire to be referred to makers of machinery, apparatus, &c., to send their names and addresses, on which, after publishing their inquiries, we will forward any letters we may receive in answer. Such answers, published to catch the eye of an anonymous querist, are in most cases merely advertisements, which, we are sure our readers will agree with us, should be excluded as much as possible from this column.*

*** *We shall publish next week a double number, containing the Index to our Twelfth Volume, including a complete classified list of all the Patents published during the last six months. Price* 1s.; *Stamped,* 1s. 2d.

*** *In consequence of an unusual pressure upon our space we are compelled to ask the indulgence of our correspondents until next week.*

MEETINGS NEXT WEEK.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, January 28th, at 8 p.m. "On the Form and Materials for Iron-Plated Ships, and the Points requiring Attention in their Construction." By Mr. JOSEPH D. A. SAMUDA.

SOCIETY OF ARTS.—Wednesday, at 8 p.m., "On some Recently-Executed Deep Wells and Borings." By GEORGE R BURNELL, C.E., F.G.S., F.S.A.

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Letters relating to the advertisement and publishing department of this paper are to be addressed to the publisher, MR. BERNARD LUXTON; *all other letters and communications to be addressed to the Editor of* THE ENGINEER, 163, *Strand, London, W.C.*

THE ENGINEER.

FRIDAY, JANUARY 24, 1862.

CIVIL ENGINEERING AND THE PRESIDENT.

THE new President of the Institution of Civil Engineers grasps his profession with his understanding, and this in no contracted spirit. He recognises its nobility, scope, and universality — that it takes in all things tending to the advancement of humanity in the process of winning the world from the wilderness. With worthy manhood, he recognises brotherhood in this great work. He, a chief and leader, a general over the noble army of workers, does not believe that any one brain can serve at one time in every department of the work, but that many and divers hands and minds must be employed to ensure success, and that his own honour is increased by the skill and judgment wherewith he selects his officers, and they in turn fill up the rank and file, and that it is no honour to seek with disloyal cunning to appropriate to himself the works of others, like certain chiefs of whom we have had many samples. He knows that without earnest, thoughtful, and persevering students in mechanics and chemistry—practical workers out of the new and the unknown—progress would be at a standstill, and Englishmen would become as the Chinese—a stereotyped nation. Keeping, therefore, a strong hold on the actual, he would act as a brake upon the uncertain, and hold himself in readiness to take to the new, when ripe and proven. All this is clearly expressed in the opening paragraph:—

"It is important to notice at the outset that the wide range of subjects which the profession of a civil engineer embraces renders it imperative on every member of it to avail himself of all the help he can obtain. He requires the assistance of many departments of science and art, and must call into employment important branches of manufacture. He can perform no great work without the employment of a great variety of workmen, and it is on their strength and skill, as well as on their scientific direction, that the perfection of his work will depend. The personal experience of one individual cannot fit him for the exigencies of a profession which is ever extending its range of subjects, and is constantly dealing with new and complex phenomena; phenomena which are all the more difficult to deal with from the fact that they are generally surrounded by such variable circumstances as render them incapable of being submitted to precise measurement and calculation, or of being made amenable to the deductions of exact science. Consequently nothing is more certain than that he must avail himself of the experience of others as well as of his own, and that he will not unfrequently find the sum of the whole little enough to guide him. And let no inventive genius suppose that his own tendencies or capabilities relieve him from this necessity."

Civil engineering then requires a theoretic knowledge of most things falling into the category of the useful arts; not necessarily a specific knowledge of details, but a capacity for entering into them and judging of them when the occasions call for their application. The civil engineer is distinguished from the mere workman or mechanical engineer by this capacity. He can theorise as Mr. Watt did, and apply theories as Mr. Watt did, for without these two processes there can be no progress. The profession of the true civil engineer takes in architecture and buildings as well as land and water roads, and land and water stations. It takes in machines for making shoes, and machines for making stitches, as well as steam-engines. It takes in the small as well as the great; from the tiny machine driving an amateur lathe to the largest machine wheels on a land-way, up to the Great Eastern on a water-way, and to the yet more marvellous things to which the Great Eastern is but an ascending step.

There is much truth in the next paragraph:—

"There is, I believe, no such thing as discovery and invention in the sense which is sometimes attached to the words. Men do not suddenly discover new worlds, or invent new machines, or find new metals. Some indeed may be, and are, better fitted than others for such purposes, but the process of discovery is, and always has been, much the same. There is nothing really worth having that man has obtained that has not been the result of a combined and gradual process of investigation. A gifted individual comes across some lod footmark, stumbles on a chain of previous research and inquiry. He meets, for instance, with a machine, the result of much previous labour; he modifies it, pulls it to pieces, constructs, and reconstructs it, and by further trial and experiment he arrives at the long-sought-for result. While, however, it is necessary, if our progress is to be safe, that we should proceed with due caution, it is exhilarating to notice that, in the matters to which our profession relates, progress is more apparent than it is in most other pursuits."

But we must not lose sight of the fact that to obtain a fire we must first obtain a spark, as in the old time by the flint, and in the modern time by the chemical agent so well called a lucifer, *i.e.*, a light-bearer. There is a quality of the human mind called perception. How many thousands of persons had seen apples fall who, for lack of the perception of a Newton, failed to draw from them Newton's theories? To invent is to discover, (*i.e.*), uncover—find out; but how can any one find out without perceptive faculties? A man must be able to see, or to feel by the processes of touch, taste, smell, or hearing, or by mental acuteness, or he will hardly become conscious of anything around, or above, or beneath him. The simplest things are occult till the discoverer points them out by his perceptive faculties, and this faculty of perception is in no wise to be despised, even though the possessor's merit may stop short of utilising, for want of other mental qualities. Gifted individuals do not always "come across connected foot-marks." Much, no doubt, is realised by perceptive faculties dealing with analogies, but there is also the instinct which is a part of the original power given by the Creator to man, which is not based on "foot-marks." There must have been some one individual who first discovered the uses of electricity as well as Newton discovered gravitation. It is quite true that, in many cases, some men have improved machines much by persevering labour, and arrived at results; but there must have been some one to make the first machine. Highly as we value existing perfect manufactures wide-spread, still, the imperfection of a probable future which shall render valueless the existing, is, to the philosophical mind, a far more interesting problem, for it is the problem of progress in contrast to stagnation. Whatever one man has done numerous men may do; but what man has not done yet, and it is desirable to have done, is that which distinguishes Englishmen from Chinese. It has become the fashion to assume that origination is easy, and, therefore, to talk lightly of it; but the list of patentees, small and great, is less in amount than the list of poets and rhymers; and it is well known that, when the improvement in looms had made a dearth of yarns spun by hand, it took some forty-five years before a machine was designed to supply the want, and that, with all the magnificence of the reward before the eyes of inventors.

In the extensive reviews which the President has made it is remarkable how much turns upon practical mechanics. Almost everything of large account, whether ships or steam engines, or guns, or ports, or roads, is taken to be within the province of the civil engineer. The distinction between mechanical and civil disappears, and they merge one into the other. The shipbuilder's is no longer a profession apart; that also merges into civil engineering.

The President, speaking of steamships, says "that the rapidity with which iron fouls will, unless some remedy can be discovered, always be a source of trouble."

The remedy will some day be found, and prove very simple. Surely the originator of the remedy will deserve a large reward. Yet there are "footmarks" to be found.

The fouling of iron ships is principally by the adhesion of the shells of barnacles. When in full growth, each barnacle protrudes a hollow membrane an inch in diameter and 2ft. in length, full of salt water, and the retardation of a vessel may be easily imagined from this cause. On ordinary iron ships the barnacle shell adheres only by the edges, the fish inside coming in contact with the iron. But when the iron is painted over with any composition poisonous or distasteful to the fish he quietly floors over the interior of his shell, from the edges, with a plate of lime, thus forming a close box to exclude annoyance.

We agree with the President that the Warrior is a mistake in the attempt to combine iron and wood, and we are quite sure that the time will arrive when the process of rivetting will be dispensed with by the process of gas-welding, rendering the whole vessel one single shell, as far as the floating form goes. But we demur to the proposition that the armour to resist shot should be part and parcel of the vessel itself. The true plan is to apply the armour so that it can be renewed, when damaged, without pulling the ship to pieces. It is probable that 3-in. armour, solidly welded together, without joints, would be more effective than jointed scales of 4½in. It is in this question of gas welding that the solution of the difficulty is to be found, and to that the attention of the authorities should be turned. Till this be accomplished only improperly constructed, and far more costly vessels can be obtained. It is quite true that the question of speed is at present, so far as we know, a question of cost, and that we cannot dispense with sails till we are provided with fuel; but it does not follow that we have attained yet the most perfect nor even the cheapest fuel. Nothing can well be worse, more ineffective, or more cruel to the unfortunate stokers, whom we roast alive, than our present method of heating boilers, and the question is one of how to obtain better fuel. There is a better arrangement looming in the distance. From Canada we have accounts that earth oil is obtained as cheap as water, *i.e.*, at the cost of pumping from under ground—about 1d. per gallon. This would be as cheap as coal. In locomotive steamers and locomotives on land it is very desirable to be able to raise and lower the generation of steam at pleasure. The present process is by banking up the fires in water locomotives, and opening the fire-doors and letting cold air pass through tubes on land—a wasteful process in either case. Now earth oil is liquid gas, and would be the best possible steam generator. If it were carried in tanks on board, and made to supply a cistern above the furnace, so as to drop in more or less quantities on incandescent coke, which would serve as a wick, the whole difficulty would vanish, and the labour of the stokers and the wasting process would wholly disappear. In Rangoon we have this oil. In Trinidad we have a pitch lake, formed by the sun drying up the oil, which wells up from below, and there is little doubt that when experiments of boring through the pitch are made, that similar results will ensue. The oil is manufactured by nature from coals at great depths, distilled by the earth's heat, and then it finds its way by natural or artificial springs to the surface. This is a plan well worth trying in English coal pits of great depths. Apart from this, we are yet far from having developed all the resources of chemistry on the production of fuel. The quantities of coal are limited, but long before they are exhausted some original mind may discover how simply to treat the gases found in air and water, and develope fuel at pleasure, and then sails may be finally dispensed with. We do not believe that it is in the order of nature to make the existence and multiplication of man depend on finite quantities of fuel. Just as coal supplies the place of diminishing timber fuel, and as iron supplies the place of diminishing timber structures, so will something else supply the place of diminishing coal as the cellars of nature get emptied. It is probable that the oil, or, "fluid fuel," heating the locomotive as by a large lamp would be found very useful in the Metropolitan and other tunnel railways.

In treating of the question of speed on railways the President wisely remarks that it is a question of cost, and that greater speed will necessitate greater outlay on permanent way and rolling stock, *i.e.*, a larger weight of material. But this seems to assume that the present material is dealt with in the most perfect mechanical methods. We doubt this. Throughout nature one great element of motion is elastic resilience. Without elastic resilience motion is destructive. Speed travelling in vehicles was not obtained till after the invention of springs, and, if the art of making springs were lost, speed on highways would again disappear. Practically, on railways elastic resilience is ignored, save in carriages where influential passengers make an outery, and also to moderate longitudinal concussion. The locomotive, which, by its weight, is the great rail destroyer, is almost springless, as they who ride on it well know. It is in this direction, and in the process of converting the present sledge-like rollers into true wheels, that the prevention of destruction is to be found. When these questions shall cease to be ignored it will be found that greater speeds may be attained with a less amount of destruction, and with no increased cost in outlay. Increased speed no doubt demands more fuel in proportion, but, if waste of fuel be prevented, the cost need not be increased.

We cannot quite agree with the President in his views of the question of gunnery. The range of artillery has been doubled, it is true, but reducing the weight of the gun in proportion to that of the projectile is scarcely in accordance with the problem of obtaining the greatest amount of duty. It is the weight or inertia of the gun which provides the fulcrum from which to impel the projectile; and a light kicking gun is very wasteful in powder, as a sportman knows who has to receive the kick on his shoulder. The real gain in the modern guns is the prevention of windage, and the reduction of the resisting area of the shot, while increasing its weight by elongation. But this is accomplished by a loss of initial velocity, proven by the fact that the old smooth bore 68 lb. round shot is still the most formidable batterer of iron sides. The gain in range is by reduction of frontal area and prevention of windage. The loss is by the friction induced by the rifling process needed to prevent a badly formed shot from turning over in its flight. If the wrought-iron gun be stronger than the cast that is a clear gain, as the main question of gunnery is based on the greatest resisting power in the largest possible tube; *i.e.*, the largest and heaviest projectile from an unburstable gun. Till this knowledge—the limit of practicable artillery—be attained, it seems superfluous to calculate the power of defences, either on land or on water. It may be that a single gun of enormous weight and range, placed longitudinally in a comparatively small vessel, serving as it were for a stock to it, and of great speed, may throw such a shot as will smash in the side of the heaviest armoured ship capable of floating. It would be as the sword-fish and the whale—the smaller more formidable than the larger; and in such case the only mode of dealing with it would be by a great mass of absorbent material beneath the armour too thick to be pierced by the shot. But this would render great speed in a large ship almost impracticable. The remark of the President, that iron forms the best material for the construction of forts, is quite true, by reason of greater strength and diminished opening, but there is no reason why the opening should not be closed altogether by a ball and socket formed of the muzzle of the gun, which, being a breech loader, would keep the gunners absolutely intact from the entry of shot, the gun, at the same time, being capable of turning at great angles. We think that the proposition of Mr. Longridge, to make guns with wire binding, is one that should not be overlooked in working out the problem of the largest and strongest gun.

These large and heavy guns have reference only to naval and fortress warfare. But the problem for field artillery is not yet worked out; both shot and gun are very far from what they should be, to deal with masses of men on the battle field at long range. Shell is, after all, only a variation of the old "blunderbuss," and far from being an arm of precision, unless at point blank range.

We do not agree with the President in his estimate of the character of the late Lord Dundonald. He was not an engineer in the sense so clearly laid down by the President—"a great and philosophical mind, capable not only of discerning the dawning of a great truth and appreciating its magnitude, but also of patiently pursuing its evidences until the whole is made clear as noon day." The character of Lord Dundonald's mind was essentially perceptive, but with great lack of judgment. Lord Cochrane was essentially perceptive, and had much influence and considerable means, but we are not aware that he brought anything to bear. His portraits have a character of vagueness, and the prominence of the eyes is akin to that of many of the lower animals whose physical attributes require a prominent eye to take in a larger circle of the horizon, before and behind, to guard against or inflict surprise. The essential character of Lord Cochrane's mind was the power of escaping from difficulty, as shown in his sea experience and his escape from prison in the Fleet, and also in his power of planning surprises. He was as true a mariner as any of our Danish ancestry, whom he strongly resembled in character. His talents were not of the industrial order, but of the genus *rapax*. He was of the Drake and Prince Rupert class, and not of the Blake, or Newton, or Watt school.

His faculty lay in surprising—the class of surprises that tell by their newness. He was essentially a speculator, and his history, if ever written by an analytic mental philosopher, would be a curious one. He speculated in street lamps, but gas set them aside. He speculated in Trinidad pitch to line iron vessels and prevent rust. He persuaded the Admiralty or some other Government Board to give him *carte blanche* to try experiments on steam, but nothing came of any that we have heard of. What he did succeed in was as a sea leader—not an admiral but as a partisan—and he would have made as good a land leader; in short a Prince Rupert, had circumstances lain that way. How he circumvented Frenchmen and Spaniards on the narrow seas with innumerable devices, like those of roguish schoolboys, is well known. He used to carry quick-lime on board his ship to blow in the enemy's eyes when boarding to windward, and he had snuff in his pockets to throw in the officer's eyes when taken into custody in the House of Commons. He was born poor and needed money, and he took it whenever he could find it in the ships of England's enemies, and as Jack, too, also loves prize-money, he followed the leader who was most successful in obtaining it. He became popular with the sailors, and advocated their grievances with the Admiralty, whom he thereby displeased, and got a black mark set against his name—the source of all his subsequent troubles. A notion prevailed that he was a Radical politician, but it was not so. Admiralty persecution led him to associate with Radicals, but he was as veritable a Conservative feudal chieftain as ever lived. He could not brook an equal, though kind to those who served him faithfully and inquired not too curiously.

The President alludes to Lord Cochrane's patent for using compressed air to force out water from underground workings. The history of its origin he may not be aware of, and we now give it.

When all hope of employment by the British Government had ceased, and the tithe of a million earned in the French wars was all expended, Don Jose Alvarez, envoy from Chilé to England, ere Canning "called the New World into existence to redress the balance of the Old," treated with Lord Cochrane, and gave him a command as Vice-Admiral of Chilé to fight against Spaniards in the Pacific. It was a good speculation on both sides. He who had scared Spaniards in Europe, and gathered golden ounces in the Mediterranean, was the man of all others to do the same thing on the coasts of the Pacific. A vision of novelty instantly floated before his mind's eye. A steamship with no visible means of propulsion, with a smokeless fire and a picked crew, and long guns amidships, could, single-handed, sweep the whole commerce of Spain from Cape Horn to California, and with very few hands to divide the spoil. Ragnar Sodbrog and his Black Rover over again. So, having permission from the envoy to expend £80,000, moneys of Chilé, he foregathered with Alexander Galloway, then an engineer of Smithfield, and exulted in his new scheme. A vessel was built called the Rising Star, rigged polacca-fashion, and the paddle-wheels, instead of being placed outside the vessel, as was then done on the London Engineer built for the Dover and Calais traffic, were placed in two holes or boxes formed of iron one on each side of the keel, the paddle-blades being level with the bottom, and rising above the water level, which stood in the paddle-boxes at the same height as outside. There were no channels fore or aft from the boxes. Whether his lordship claimed this in a patent or not, we do not recollect, but we do recollect the trying of it, and the fact of the wheels filling the boxes full of water without moving the vessel. Great was the disappointment, but after a week's incubation his lordship came to Mr. Galloway, the contracting engineer, in a state of great jubilation, and in good northern Doric explained to him that he had now got over all difficulty by a new plan. It was neither more nor less than to press down the water level in the paddle-boxes by pumping in air. So Mr. Galloway made the alterations at "measure and value." The result of the second experiment was that the air and water churned admirably together, and produced great masses of froth, but did not move the vessel. Finally his lordship gave it up, and sailed in the Rose. The Rising Star was then arranged to project the blades of the paddles a little below the bottom, then they were taken up, and the holes boarded over to make a close bottom. And thus she sailed, and after putting into Ireland for repairs, arrived in Chilé, where his lordship made one fruitless trial of her, and then she was anchored in the Fisherman's Bay, and finally driven ashore in a northerly gale. After serving the Chilenos, and the Brazilians, and the Greeks, his lordship in his leisure time bethought him of the fact that the air pumped into the paddle-boxes did keep down the water when not in motion, and so he patented its application to waterworks.

In all this there was a perceptive faculty, but no judgment—none of that quality essential to the successful engineer. The only surprise was that the experiment should ever have been tried.

There was indeed another surprise. The Spaniards either did, or affected to, despise the admiral's daring. Notwithstanding, he blockaded the port of Callao, where, amidst a large fleet of merchantmen of all nations, lay the Esmeralda frigate, moored stem and stern, with a double crew on board, under the guns of a fortress numbering three hundred pieces. In the dead of night Cochrane's boats, one after the other, entered the harbour, and, unchallenged, penetrated to the frigate, where Cochrane was the first man to mount, and shot the sentinel in answer to his challenge, receiving a bayonet wound on his thigh, and dropping his pistol, one of a pair of duellers, which had formerly belonged to Lord Camelford. While sending his boarders to the tops to lower the sails, and others to let go the anchor cables, he found time and coolness to tell one of his followers to look after the pistol, for it was too valuable to lose. And the hatches were battened down, and the vessel was under weigh ere the guns of the fortress began to play, and, in the darkness, hit the British and American men-of-war, while the Esmeralda's crew, surrounded in the midst of the blockading squadron, had nothing to do but surrender. Verily this man was a soldier-sailor, brave, cool, and calculating, but not an engineer.

The President states that the consumption of coal in the best steam-engines has been reduced to 2½ lb. per horse-power per hour; but the mechanical result is only equivalent to one-fifth of its absolute value if wholly utilised.

This is a matter to work at, inasmuch as it would, when worked out, enable an ocean steamer to travel five times as far with the same quantity of fuel, or give an equivalent in increased speed.

We say thoroughly Amen! to the following paragraph:—

"In constructing railways, telegraphs, and steamboats, and their adjuncts docks and harbours, and moulding and fashioning the face of the material universe to the wants of man, in overcoming its barriers, overleaping its valleys, and spanning its seas, engineers annihilate both space and time, bring into juxtaposition nations and people, and accelerate, beyond all human expectation, personal communication, and that interchange of ideas which is all important to the advancement of civilisation and knowledge.

"Distance and separation have led, and will always lead, to misapprehension and prejudice, to ignorance and mistrust, to rebellion and war; and engineers may feel, when labouring on the great public works that facilitate the intercourse of nations, that they are not merely conquering physical difficulties, but that they are also aiding in a great moral and social work."

It will speak well for the body of engineers if they never have a president producing an inauguration paper of less wisdom and scope than has now been given us by Mr. Hawkshaw.

BRIDGE FOUNDATIONS.

Simple as are the principles upon which all subaqueous foundations are constructed, hardly any class of engineering works admits of less generalisation in their application. It may be easy enough to drive a few score of piles, or to shoot a few hundred cubic yards of concrete—it is not always difficult to put in a coffer dam, and the application of caissons, undersunk wells, pneumatic piers, &c., is well enough understood; but knowing how to execute such jobs and to carry out such works is a very different matter from a knowledge of the circumstances which rightly determine the choice of one kind of foundation instead of another. The greatest possible range of variability is found in the nature of river bottoms, and in the depth, currents, tides, floods, and scour of the streams themselves, as well as in the circumstances of navigation, wharfage, over-traffic, water power, &c., involved in different cases. A coffer dam, for example, may be successfully put in at almost any point in the Thames, but at Westminster bridge the lowness of the approaches and the importance of avoiding a steep inclination in the roadway required the adoption of a very moderate headway—a low headway required (unless a hideous level girder bridge had been adopted) a considerable number of arches of moderate span—and with six piers the obstruction which as many coffer dams would have caused to the navigation was out of the question, while the construction of one dam, and the completion of one pier, at a time, would have prolonged the work indefinitely. Thus there were grave difficulties in the way of the adoption of an excellent, though costly, mode of putting in the foundations, and thus, without the coffer dams, it was not an easy matter to carry down courses of heavy masonry into the London clay under the bed of the river.

The great diversity of circumstances under which bridge foundations are put in almost precludes any such thing as a general discussion upon them. The study of such foundations is not the less interesting, however, and no engineer can, we think, devote to it too much attention. With solid rock to work upon, the engineer can hardly fail to start his piers securely, and, among others, the abutments of the great arch of Grosvenor bridge, at Chester, furnish an example of masonry started on a bare surface of rock. In the Victoria bridge, at Montreal, the twenty-four piers were founded on rock, over which was an average of 8ft. of gravel and clay, which had to be worked through in coffer dams. The Chepstow bridge piers reach rock through mud 43ft. in depth below low-water, and the central pier of the Saltash bridge goes down through 70ft. of water and 20ft. of mud to solid rock below. In this case, coffer dams, as usually made, were out of the question, and our readers are already familiar with Mr. Brunel's vast iron cylinder, 100ft. high and 37ft. in diameter, within which, and under atmospheric pressure, the masonry of the principal pier was started on the deep bottom of the Tamar. At Hexham, Smeaton had gravel to work upon, and it worked out from beneath his piers, and his bridge fell into the river. This engineer never employed piles while he could possibly do without them. The bed of the Thames is gravel, too, nearly 10ft. thick, over the London clay under Westminster bridge. The Swiss engineer, Labeyle, started the piers of old Westminster bridge in caissons (a word which ought, by this time, to be rendered into English, caisson being the French for a box or coffer), and as he, too, would not use piles, the piers went down, and Mr. Page has been called in to remove the whole affair and make a new bridge altogether, more worthy of the site. Mylne, too, was sparing of piles at Blackfriars, and there, also Mr. Page is about to engage in a heavy work of untimely renewal.

The Thames bridges refuse to stand on anything but the clay, and—either by excavation or by piling—the load upon their piers must be carried down to this support, the footings being either of masonry or concrete. The most ingenious mode of reaching the hard bottom is probably that of Mr. Page, who drives a wall of iron piles, both columns and sheets, deep below the gravel (but stopped off 6ft. below low water to prevent being broken, as, in case of their projection above water, they assuredly would be by concussions from passing barges), and who drives closely-pitched elm piles into the enclosure thus formed, afterwards dredging out the silt and filling its place flush with the piles with concrete. All the piles reach well into the clay—a substance into which the late Mr. Rendel declared it to be impossible to force a *screw* pile more than 5ft., notwithstanding that iron screw piles are made to "bite" in clayey and coral rocks of considerable hardness, and to almost any depth. With the exception, however, of a timber outer casing, instead of one of iron, Mr. Page's mode of putting in piers had, after all, been extensively adopted on the Continent, the two great bridges of the Eastern Prussian Railway, over the Vistula and Nogat (the former having six lattice spans of 397ft. each), being thus founded, while, also, most of the bridges over the Seine, in Paris, have their piers carried up on bearing piles and concrete, the latter more generally, however, unprotected by timber casing. There are few foundations, however, of so elaborate a character as Mr. Page's, and no others, we apprehend, of such a compound construction, although, after all the evidence given before the Westminster bridge Committee, we will not say that this unusual variety of materials in a single foundation is improper. But we do not think that much is yet known of the real resistance of iron to the action of foul water. We have no evidence equal to Mr. Mallet's on this point, but we do not think that even his extensive experiments can be for a moment regarded as having settled the question considering, as we must, the variety in the quality of iron and in the waters to which it may be exposed. The late Mr. Stephenson had mentioned that in one of his own coal pits he had had occasion to renew cast-iron tubbing which, after 12 or 14 years only, had become quite soft. He had particularly tested the pit water, moreover, for sulphuric acid, but none was found. Mr. Fowler and others are of the opinion, however, that the stability of the piers of New Westminster bridge would not be affected by the decay of the iron sheeting, and that, therefore, although necessary at first, it would not require to be renewed.

Iron cylinder foundations are rapidly coming into favour wherever they can be introduced. Dr. Potts' plan, or, rather, as the late Mr. Cresy showed, the plan of M. Triger, a French engineer (for sinking piles by atmospheric pressure, the pile being partly exhausted) did not make much headway. It did not answer at Rochester, where hard stuff was met with in the bed of the Medway, and although it succeeded in putting in the foundations of the Great Northern Railway bridge over the Ouse, at Huntingdon, it failed in the case of the bridge on the same line over the Nene, at Peterborough, and in every other case where the bottom of the stream is else than soft homogeneous material, free from stones of any kind, the process in question necessarily fails. With Mr. Hughes' modification, that of charging the cylinders with compressed air, and thus converting them into diving bells, almost any kind of material in a river way may be successfully encountered. Wherever the cylinder, open at both ends, can be sunk, by scooping and weighting, until it reaches and closes upon an impervious stratum of clay, the foundations can be put in in the open air, and on the clay below the Thames and at Londonderry, Mr. Hawkshaw is getting in his foundations, in this way, with the best success. With the single exception of the difference in the material of the cylinders, this kind of foundation is much the same as the brick wells so much employed in India. The cylinders too, simply sunk, dredged out and filled with concrete, answer admirably in many situations. They were thus employed by the late Mr. Brunel, at Chepstow, by the late Mr. Stephenson, in the fathomless silt which forms the delta of the Nile, and in a great number of other cases, both in England and abroad. It would be hard to say what we should now do but for concrete, the most adaptable of all the materials now employed in a certain extensive and most important class of works. With concrete made with Portland cement, the French Government were enabled to get in the vast works at Cherbourg in far less time than it would have been possible to do with masonry for the same purpose. At Chassis, and especially at Toulon, concrete has been made to accomplish wonders, and the Paris builders actually make monolithic houses of it, with even the chimneys and mantles cast in whole.

A dozen years ago we had only the good old-fashioned pile, a huge spike or post, commonly of wood but sometimes of iron, wherewith to consolidate a soft or otherwise insecure river bottom. We had all kinds of contrivances in the way of engines to drive them, Nasmyth's steam pile-driver, in fact, among the number. And yet, in the case of New Westminster bridge, hand driving, or, rather, machines in which the ram is lifted by hand, are still preferred, the steam rams, it is said, greatly injuring the piles. Those who have seen the head of a heavy pile burst into flames under the tremendous battering of a Nasmyth steam pile-driver, as was the case at the works for the High Level bridge at Newcastle, will not wonder at a prejudice against such a mode. In Morrison's steam pile-driver, the ram is only lifted by the steam, although it can, nevertheless, be lifted 70 or 80 times a minute. For other than steam driving Sissons' endless chain, which picks up the ram the moment it has struck, appears to be the best of all.

Within the last dozen years, we have had the atmospheric pile, Mitchell's screw, and Mr. Brunlees' disc pile. Of the first we have already spoken, and the latter is now well known. With a 30in. disc at the bottom of a hollow iron pile, and with a 2in. water pipe projecting, through the pile, 2ft. below the bottom, Mr. Brunlees was enabled, by simply forcing water into the sand below, to sink the piles at the rate of 4in. a minute, and to considerable depths in the sand, the pile, when sunk in 20ft. of sand, afterwards supporting a load of 20 tons. This, too, was in a tideway, and it may be that by the same means lighthouse piers might readily be erected on the Goodwin Sands, off Deal, and which are 15ft. deep overlying blue clay. The High Level bridge at Newcastle is founded on a quicksand, from 30ft. to 40ft. deep, into which Mr. Stephenson drove piles 40ft. to 50ft. long, and cut off 10ft. below low water. These piles are enclosed in a coffer dam, which was left in as a part of the permanent work, but in a tideway, and with a great deal of scour, the foundations still require looking after, and stones and chalk have to be thrown in, from time to time, around the piers. In this case, we think, Mr. Brunlees' disc piles, had they been invented in season, would have been the very best for the purpose. But for the "unconscionable" royalty levied on the Mitchell pile, Mr. Brunlees might not have directed his wits to so simple an improvement. As it is, the Mitchell patent has not much longer to run, and its use will soon be open to everybody.

Before closing we may just notice certain modes which

have been adopted in putting in bridge foundations in America. Those for a railway bridge at Pittsburgh, U.S., were put in seven years ago, in the following manner. The Alleghany River at Pittsburgh, is about 1,200ft. wide, with a minimum depth of 12ft. at low water, rising to 42ft. in extreme floods, and to 30ft. in ordinary floods. The bottom is of coarse gravel with good-sized boulders interspersed among it, a bottom too porous to admit of the employment of coffer dams. The gravel was dredged to a level surface for the piers, and to 13ft. below low water. Over the surface so prepared were floated (or, rather, put together *in situ*) platforms or "cribs" of timber of a maximum thickness of 12ft., the timber being in 12 horizontal layers or courses of pine, each stick squared to 12in. The timber was laid close, or "solid," except where a few stones were let in to diminish the flotation of the work, so as to bring it nearly under water. Upon this bed of timber, and while yet rising above the water, the lower course of masonry was started, the weight of which sunk the timber upon its prepared bed and with its surface about a foot below low water. Thus immersed, the timber is imperishable, and the stone work was carried up without requiring any of the workmen to go into the water. Labelye's platform, under the piers of Westminster bridge, was 2ft. thick, but it is the gravel and not the timber that has given way and done the mischief, and if the dredged surfaces of the Alleghany river bridge hold up the 12ft. of timber, it may be considered as practically incompressible as well as imperishable. In putting in bridge foundations at one or two points on the Connecticut river, and for a railway bridge over the Schuylkill, within the city of Philadelphia, the following plan has been carried out. The soft bottom of the river has been driven with piles, averaging 2ft. 8in. apart, the tops of the piles being sawn off well below low water, and capped with a heavy timber grillage or grating. "Guide-piles," their heads projecting above high water, are then driven, these guide-piles being driven say 3ft. from each other, and in a hollow square, so as to form a sort of enclosure for the foundation piles. Before the guide-piles on one side of this enclosure have been driven, a solid timber platform, 4t. thick, and formed of four layers of 12-in. sticks, well pinned together, is floated in over the foundation piles. Alternate timbers in the bottom layer of this platform are left projecting outwards, so as to come in the intervals between the guide-piles, the remaining row of which, completing the hollow square enclosure, is driven after the timber platform is floated in. The guide-piles being capped at the top, stout iron bolts are so fitted as to suspend the floating platform from the cap timbers extending over the guide-piles. The masonry is then started on the platform, which is let down by means of the screw-bolts only as fast as is desired until it takes its final bearing upon the grillage covering the foundation piles. All the work is thus done at leisure out of water, and all the timber is finally left well below low water, where timber originally sound will remain, perhaps, for ever, if the *teredo* does not get hold of it. The guide-piles are afterwards drawn and carried away. The sawing off of the foundation piles is neatly done by a circular saw, working at a proper depth under water. The saw is fixed to a tall upright shaft, which revolves in readily-adjustable bearings in a floating scow; and although the scow rises and falls with the tide (only 6ft. in the Schuylkill below Fairmount dam, at Philadelphia), the position of the saw-shaft is adjusted with such accuracy, by means of instrumental observations taken from the shore, that the common level of a hundred pile-heads, thus sawn, is as true as it could be made by the best arrangement of machinery working out of water.

THE HARTLEY COLLIERY DISASTER.

We can add no word of description or explanation to the abundant details—already published through the daily press and now forming the subject of painful comment in all parts of the kingdom—of the most lamentable calamity whereby 215 men and boys have perished in the Hartley colliery. Like most collieries, the Hartley had but one shaft. On the morning of Thursday week, the engine beam, which overhangs the pit, broke short off at the main centre, and one-half of it, weighing upwards of 20 tons, fell down the pit, killing five men who were then coming up, carrying the bratticing with it, and forming, with the material accumulating in its progress, a deep and almost impenetrable mass far down the pit, but, unhappily, above the upper seams. It was not until late on Wednesday that the most strenuous and unceasing exertions resulted in so far effecting a passage as to permit of a few daring men going down to the upper seam, opening into the shaft. Then it was too late. What with foul air and starvation, not one man or boy had been left alive. In this simple statement is contained a world of agony.

We will not ask whether the men could have been reached sooner. It did appear to us that, to remove all apprehension as to the falling in of the sides of the shaft, old boilers, or boiler flues, or water pipes might have been coupled together and let down with supports across the pit's mouth, and within this shield the rescuing party could have worked without interruption. We have not seen it stated, either, that a borer could not have been got through the dense mass wedged in the shaft, so as to have let down, at least, bottles of wine, soup, and other refreshments, while the heaviest work of removal was in progress.

As for double shafts to every colliery, we can hardly expect them to become general. The great shaft at Dukinfield, 2,000 odd feet deep, cost £100,000, and although with two shafts neither would be made as large as is necessary with one, an extra opening would nevertheless cost heavily, and would hardly have any other advantage than that of affording means of escape in cases of emergency. The projection, however, of a cast iron beam, always liable to break, over the unprotected mouth of a pit, ought never to have been allowed. In other collieries similar accidents have led to the perilous (but, happily, not fatal) imprisonment of the men for 20 hours and even for 24 hours. A case has lately occurred which, although unattended with fatal consequences, or even personal inconvenience, affords significant evidence of the risks involved by cast iron engine beams. The Cunard steamship Scotia is now having her great side-lever engines put in at Glasgow. After keying on one of the levers it suddenly cracked short off at the main centre. On removing the ends, the fracture, we understand, showed apparently sound iron. The lever might have been keyed on too tightly, but all like parts of machinery are liable to the same contingency. Wrought iron side levers, we learn, are now being rolled at the Butterley Ironworks to replace those of cast iron already fitted in the Scotia, and this is the cause of the delay in sending that vessel to sea. In the case of the Hartley beam the iron was found to be deeply honeycombed. Had it, as Mr. Fairbairn remarked this week at the meeting of the Manchester Boiler Association, been forged in wrought iron, this most distressing calamity might never have happened.

The *Times*, in a feeling, and generally excellent article on the subject, is willing to admit that such accidents cannot be prevented. This view is so wholly and palpably wrong that we feel bound to protest strongly against it, and we shall be disappointed, indeed, if the Mining Act is not so far extended as almost effectually to prevent such accidents in future—accidents of which there is now constant danger in great numbers of coal pits in the kingdom.

STEAM ENGINE ARCHÆOLOGY.

The time will come, we think, when old steam engines, imperfect and uncouth though they be, will be regarded with a far greater amount of interest than at present, an interest akin to that which now so generally attaches to ancient buildings and other early works of construction and art. We may say at once, therefore, that it would afford us pleasure to receive and record brief notices of antiquated engines, the whole or portions of which are still in existence. There are many engineers who would be glad to go far out of their way to visit one of Newcomen's, or Smeaton's, or Watt's engines; and even the early locomotives, such as the Globe of Hackworth, the Rocket of Stephenson, the Liverpool of Mr. James Kennedy, or the Eclipse of Dr. Church, would, although none of them are forty years old, be looked upon with much antiquarian interest. Many of the old atmospheric steam engines are, we do not doubt, still in existence, and it may be that some of them are still working. It is not many years since nearly all the winding engines in Staffordshire were atmospheric engines, all having beams, their connecting rods, with their huge balance weights, being shaped more like fiddles than anything now made for the transmission of power. Near a place known as Park Bridge, which is in the neighbourhood of Ashton-under-Lyne, there is, we believe, a veritable ruin of a steam engine, the old walls of the engine-house having long since become overgrown with ivy. This Ancient Briton was once employed to pump a coal pit, but either the coal was finally worked out, or else gave in to water, when the wheezing old machine at last stopped. The owner of the property on which it stands will not allow it to be disturbed, but gives the iron-work a coat of gas-tar, now and then, and leaves it to itself as if it were a relic of feudal times. Old machinery is so readily convertible into merchantable castings or forgings, that we cannot look for any general imitation of the conservatism to which the existence of the ruin in question is due, but there are, we hope, cases here and there of a like regard for the efforts of the earlier engineers.

The atmospheric engine erected by Smeaton to pump water for the supply of the City of York was working only a few years ago. It stood close to where the girders of the Lendel Bridge lately fell over. The cylinder was cast, we believe, at Coalbrookdale, and bore the year of its construction, 1753, in large figures. It would be interesting to know what has become of this old engine. Another of Smeaton's engines, on the atmospheric plan, was working not long since at the Carron Ironworks, near Grangemouth, Scotland, where it was erected sometime, probably, between 1760 and 1770, a pig of iron in the gable of the casting house bearing the date of 1759. This engine was employed for a singular purpose; the machinery of the works was driven by a water wheel, but occasionally, in the summer, Carron Water run low, when the steam engine was started to pump up the discharge from the tail race to flow again over the wheel.

The old engine at Killingworth colliery, repaired by George Stephenson was working not long ago, and may be still in existence. Its cylinder was 6ft. or 7ft. in diameter, and at some time subsequent to its original construction it was "compounded" by applying two cylinders of about 20in. diameter, one on either side of the large cylinder, the three pistons being connected to the same cross-head, and having, therefore, the same stroke. This was also an atmospheric engine, the top of the cylinder being open and the piston being covered with water.

Messrs. Combe, Delafield, and Co., have at their brewery, in Castle-street, Long Acre, the second steam engine erected by James Watt, in London. It is still in good running order, and is worked occasionally whenever a newer and more powerful engine on the premises is being repaired. The old engine originally had a wooden beam and connecting rod, both of which have been changed for others of cast iron. The original sun and planet wheels of brass are still retained, the fly wheel making two revolutions for every double stroke of the piston. The cylinder is 24in. in diameter and the stroke 6ft. The steam pressure to which the engine is worked is 10 lb. per square inch.

We have understood that the first engine erected by Watt in London, at Whitbread's Brewery, is still in existence. The pair of fly-wheel pumping engines erected at the East London Waterworks at Old Ford, in or about 1807, are still in good working order. We do not doubt that a little inquiry and communication among engineers would disclose many an example of very old engines, some of them, perhaps, still at work, and as we have already said, we would be much pleased to hear from such of our readers as can supply authentic particulars of such engines.

It is our impression that Timothy Hackworth's locomotive—the Globe—turned out in 1829, and the first ever made with inside cylinders and a crank axle, has not passed entirely out of existence. A year afterwards Edward Bury, or, it may be more just to say, James Kennedy, built the Liverpool with a crank axle, inside cylinders and 6ft. driving wheels, and it was not until after the Liverpool had been run for some time on the Liverpool and Manchester line that George Stephenson delivered his first inside cylinder engine. Whether either of these engines has been preserved from the scrap heap we do not know, but the Rocket, built in 1829, and which was the nineteenth locomotive made by George Stephenson, besides being the second made by him for the Liverpool and Manchester Railway, is still treasured up at the Forth Street Works at Newcastle. We had a description not long since, from an American paper, of an old engine built by Stephenson for the Camden and Amboy Railroad, in the United States, and it appeared that, although one of the first run in the States, it was still in a good state of preservation. The first locomotives ever run in the States were built at Stourbridge in 1828, and had the old single-flue boiler of the period. As they were not found to answer their intended purpose, we doubt if any respect was paid them, and probably nothing is now left of them. A correspondent was good enough, not long since, to give us the present whereabouts of Dr. Church's tank locomotive, the Eclipse, made in or about 1835.

Unlike many of the works of mediæval and ancient times, the primitive steam-engines were not at all excellent in their way. No practical profit could now be derived from studying them, whereas something might be made by consigning them to the cupola and the forge. There will, we nevertheless hope, be found some lovers of the old and curious who will make it their business to preserve the few examples still extant of the steam engineering of a former century, for, in respect of this measure of time, historical truth does not allow us to speak in the plural.

TESTING SUBMARINE TELEGRAPH CABLES.

Nearly nine years ago, Mr. Reid, the well-known telegraph engineer, foreseeing the difficulties to be encountered in making and working submarine cables, patented an apparatus for testing their soundness, or, at least, impermeability to water. Whatever may be the material of the insulating covering, it is found almost impossible to perfectly exclude air from it in the course of its preparation or application. The wire, as is generally known, is encased in three concentric coatings or tubes of gutta-percha, applied successively with the intention that any flaw in the first shall be covered by the second coating, its own flaws being, in like manner, sealed by the external layer of percha. Unless the material of all the coatings was very porous, it would be a rare chance, one might suppose, that three faults, one in each of the coatings, should coincide, or, at least, fall so nearly together as to communicate with each other through a thin seam of air enclosed between the coatings. Yet such defects are of very frequent occurrence, and, unless detected before the submersion of the cable, irremediable. If they cannot be altogether prevented in the first instance, it is important that they be discovered and remedied as soon as may be after the gutta-percha is on, at any rate, before the application of the protecting covering of wire, tarred yarn, &c. Mr. Reid provided, therefore, in his specification of April 27th, 1853, for enclosing gutta-percha covered wire in a close vessel, from which all the air could be exhausted, and into which water could afterwards be forced to a pressure corresponding to any depth of sea in which the cable was intended to be laid. Under the searching ordeal of this process, very minute, and, possibly, the minutest openings in the insulating core are penetrated by the water, and, as one end of the coated wire may be carried through a stuffing box in the insulating tank, and thence to one of the poles of a battery, while another wire passes from the body of the tank to a galvanometer in circuit with the other pole of the battery, the least contact of water with the wire undergoing the test would complete a "short circuit," which would cause a greater or less deflection of the needle of the galvanometer. The two ends of the wire being tested, that which is not taken to the battery is, of course, sealed up. Whether or no this mode of testing the impermeability of the gutta-percha covering is complete, it is certain that it discloses defects which escape any other test that can be made before the cable is laid at its intended depth in the sea. Cables which, coiled in a tank and under a few inches, or even a few feet of water, might show perfect insulation, would often be found to be altogether unfit for use by being first placed under the exhausting action of the air-pump, and afterwards under a hydrostatic pressure of one, two, or, perhaps, five tons per square inch. While the Atlantic cable was lying at Birkenhead, Mr. Reid detected eight coils which, subjected to his test, were so defective that, once laid in the cable, no messages could have been sent through. Had the whole length of the Atlantic cable been tested under exhaustion and subsequent hydrostatic pressure, it might have been so far perfected as to be good for many years of uninterrupted service. The original Rangoon and Singapore, now the Malta and Alexandria, cable was thus tested, and so was the French Government cable from Toulon, *viâ* Corsica to Algiers. With such disastrous experience as the history of submarine telegraphy presents we cannot doubt that, in the case of any future enterprise, the test by exhaustion and pressure will be rigorously applied, and it may be found that the mysterious causes of previous failures will thus become apparent, and that, once detected, they admit of prompt and simple remedy.

It is not so long since it was conclusively ascertained that the conductivity of a telegraph wire was not diminished on being subjected to pressure. Some insulating materials, too, are found to be improved by pressure. This is the case with any insulator which is naturally porous, india-rubber being the least improved by pressure. With good insulation, Mr. Latimer Clark has made experiments on copper wires under a pressure of 3 tons per square inch, equal to about 2½ miles in depth of sea, and he found that, in a length of one-eighth of a mile of wire no difference whatever in conductivity could be detected, whether the pressure was on or off, not even when the pressure was very suddenly applied and removed. Lest there might be some doubt of the sensitiveness of the instruments with which the tests were made, Mr. Clark experimented with 220 yards of wire in the open air, and 220 yards and

3 in. of the same wire under pressure, when the slight increase of length in the latter was found to give a perceptible increase of resistance. Even a difference of 2in. produced a visible deviation on the galvanometer. Mr. Clark observes that "In an Atlantic cable, 3,000 miles in "length, the alteration of conductivity due to the super-"incumbent pressure (of 2,550 fathoms of water) would "therefore not be equal to that produced by an addition of "1 mile to its length."

We ought not to neglect to notice the ingenious construction of Mr. Reid's testing tanks, or cylinders, three of which have been made, and erected in the premises, in the Wharf-road, City-road, originally fitted up for the Government experiments on submarine cables. The first was made about two years ago. It was intended to bear a pressure of only 600 lb. per square inch, at which pressure it was employed to test the Rangoon (now the Malta and Alexandria) cable. It is an upright cylinder, 37½in. in diameter inside, and 8ft. or 9ft. high, made of 1¼in. Lowmoor iron, double rivetted, through butt plates, in an unusually strong manner. A removable cover is applied, both at the top and bottom, and confined with 35 large bolts. The second cylinder, 39in. in internal diameter, and intended for a pressure of 1,000 lb. per square inch, is made much like the first. The caps or covers are solid forgings of great weight and strength, and are held on by 39 bolts, 2¼in. in diameter. The fixed flange around the cylinder has long radial slots formed to take the bolts, and in the cap the openings for the bolts are cut through to the edge, the cap being thus made to resemble a spur wheel with 39 massive teeth. Thus, instead of taking the time to remove 39 nuts, these require only to be loosened when the bolts may be at once drawn laterally away from the cap. The latter is put on with an india-rubber joint.

The last testing tank made, and which has been in use for about a year, is, however, the most remarkable. It is made to bear a pressure of 10,000 lb. per square inch, to which it has often been tested. It is 24in. in internal diameter, the body or chase of the cylinder is made of cast iron, 2¼in. thick, over which are shrunk concentric rings of wrought iron, as in a Blakely gun, and whereby the whole thickness is increased to 10in. The cap is a solid casting about 17in. thick, and entering the bore of the cylinder for 6in. It and the bottom cover, which is of the same construction, are held together by 16 bolts, 4½in. in diameter, and having plain round heads at both ends without nuts, these bolts are withdrawn laterally from the flanges, as in the testing cylinder already described. The cap is not, therefore, screwed down to a bearing, but is tightened by a cup-leather ring inside, which receives the pressure of the water. The cap is removed and replaced by means of a crane. A drum of gutta percha covered wire, five miles in length, is placed within the tank, one end being electrically sealed and the other led out through a gun metal stuffing box to one pole of the battery. The cap being replaced, the air pumps are set to work, and a vacuum of 27in. or 28in. soon obtained. A sluice cock is then opened in a pipe leading from a water cistern to the testing cylinder, when the latter quickly fills with water. The force pumps are then set to work and the pressure raised to the required point. The whole process, as applied to five miles of wire, occupies but a few minutes, and, if the galvanometer discloses a fault, this can be soon tested for and discovered, when, if it be slight, the percha can be "tooled up" and, if considerable, cut out altogether.

PRESERVATION OF TIMBER.

In The Engineer of the 10th inst., page 37, we gave an abstract of the specification of Mr. J. Cullen, now of the North London Railway, Bow, for preserving wood and iron, more especially in India. Mr. Cullen was for some time employed, under Government, in the erection of barracks and other works in Scinde and the Punjaub, and met with the common experience in respect of the ravages of the white ants in wood, and the corrosion of iron work in the nitrous soil of the country, a soil which is often so highly charged with saltpetre as to scintillate when powdered and thrown upon the flame of a candle in a dark room. As an expedient for the protection of the materials under his care, he hit upon a mixture of coal tar, quick lime, and powdered charcoal, in the proportion of two measures (by bulk) of the tar, to one measure of the lime and one of charcoal. Lime, Mr. Cullen found, was freely dissolved in coal tar, with which it forms a cement which takes readily to wood, brick, iron, or other building materials however wet, and which sets with nearly the cohesion of mortar or hydraulic lime. With the addition of the charcoal, mixed in an exceedingly fine state, it was found that the white ants, which attack and destroy creosoted wood, were effectually excluded, carbon, it appears, being especially poisonous to them. Under the orders of Captain Hutchinson, Captain Black, Executive Engineer of the Lahore division, buried six pieces of deodar, or Himalaya pine, in a place particularly infested with white ants, three of the pieces being protected by Mr. Cullen's preparation, and the three others being left in their natural state. At the end of five months, the blocks were dug up, when those which had been coated were found to be as sound as when put down, while those which had been left unprotected were found riddled with the perforations of the ants. The experiment would have been more nearly complete had blocks of ordinary creosoted pine and blocks also of sálwood been placed with the others, but, as compared with unprotected pine, the evidence actually obtained was conclusive as to the protection afforded by the compound coating.

In the case of iron, creosote is believed to be a complete protection in ordinary soils, but, in the presence of saltpetre, as in the soil of the North West Provinces of India, creosote is said to be of no use whatever. Captain Black experimented, therefore, with six pieces of thin iron, three being coated with Mr. Cullen's preparation, while the others were left as they were cut from the original plate. The experiment was but for five months, a period of course altogether too short to test the endurance of the preservative compound, but it afforded the negative evidence that the iron was completely protected for that time at least, whereas the pieces put down in their ordinary state were found to have been much rusted. The importance of preserving the iron-work of the Indian railway bridges is too great to be dwelt upon, but whether the preparation in question suffices or not for that purpose, its virtue as a defence against white ants appears to have been established.

Some of the Indian railway companies are, we are glad to know, already experimenting with Mr. Cullen's mixture, and if, as we may fairly expect, it will be found to render them independent of iron sleepers, to which the Madras and some other companies have been already compelled to resort, the importance of the discovery will be very great. At the same time its value in the general application of timber to works of construction in India will be almost incalculable.

ARTIFICIAL PLUMBAGO.

For some time past Dr. Crace Calvert, F.R.S., has been engaged in experimenting upon the composition of a carboniferous substance existing in grey cast iron, or, to use a more popular definition, in producing plumbago from cast iron. The effect of his experiments has been to arrive at results which throw much light upon the chemical composition of the substance, proving it to be composed of iron, carbon, nitrogen, and silicium. The substance occupies exactly the same volume as the cast iron from which it is obtained, and is sufficiently soft to be easily penetrated by a blade. The mode of experimenting pursued by Dr. Calvert consisted in placing cubes one centimetre in dimension, of Staffordshire cold-blast cast iron in corked bottles, with eighty times their volume of weak solutions (each one alkalimeter), of the following acids:—Sulphuric, nitric, hydrochloric, acetic, oxalic, tartaric, and gallic. Besides these phosphoric, carbonic, oleic acids, tannin, and acid peat water were also used. After three months of contact he found that, although the external appearance of the cubes was not changed in any of the vessels, still those in contact with the weak sulphuric, hydrochloric, and acetic acid solutions, especially the latter, had become so soft externally that the blade could penetrate three or four millimetres into the cubes. He, therefore, removed the solutions from the vessels, and replaced them by an equal bulk of each weak acid solution, and continued to do so every month for two years, at the end of which time the cubes in contact with the acetic acid ceased to yield iron to the acid, although they were still of the original size; they had, therefore, become transformed into the carbonaceous substance, or artificial plumbago. The action of the weak acetic acid solution Dr. Calvert found to be complete, that of the hydrochloric and sulphuric solutions nearly so, and that of the nitric much less complete, whilst the other solutions either showed no similar action, or a very slight one.

The action of acetic acid on grey cast iron is most interesting; for instead of ceasing when saturated with oxide of iron, as is the case with other acids, its action is continuous, if the precaution be taken to close the mouth of the vessel with an ordinary cork. Thus he has had cubes of cast iron in contact with the same quantity of acetic acid for two years, and the chemical action still existed when the bottles were examined. This action of acetic acid appears, therefore, to be analogous to that which it has on lead. To examine the chemical composition of the cubes transformed by the action of acetic acid they were reduced to a fine powder in an agate mortar, and well washed with boiled water slightly acidulated with acetic acid. The powder was then dried at 115 deg. centigrade in a dry atmosphere of carbonic acid or hydrogen, according to the nature of the body to be determined in the mass. The cubes of grey cast iron, which originally weighed 15·324 grammes, weighed after the two years' treatment only 3·489 grammes, and their specific gravity was reduced from 7·858 to 2·751. From the figures, obtained upon careful analysis, it appears that the largest part of the nitrogen originally existing in the cast iron remains in the graphitoid substance, and only a small portion is transformed into ammonia. He has ascertained by direct experiments that it is silicium and not silica that enters into the composition of the carbonaceous mass. Like silicium, the quantity of carbon found in the carbonaceous compound does not represent the whole of the carbon pre-existing in the cast iron, as carburetted hydrogens are given off during the slow action of the acetic acid in the iron. Dr. Calvert has found the carbonaceous compound (even after the acetic acid has ceased to act upon it) contains 79·960 per cent. of metallic iron—not oxide of iron. Though, in the present state of his researches, Dr. Calvert considers it would be premature to attempt to assign any definite composition to this substance, we may state that our inference is that it is a compound of sesquiferride of carbon with a nitride of silicium, and the following table given by him substantiates this view:—

	Composition of the original views.	Composition of the carbonaceous substance.
Iron	95·413	79·960
Carbon	2·900	11·020
Nitrogen	0·790	2·590
Silicium	0·478	6·070
Phosphorus	0·12	0·059
Sulphur	0·179	0·096
Lost	0·108=100·000	0·205=100·000

As Dr. Calvert's discovery has been referred to in a manner which would induce the opinion that his researches are nothing more than a repetition of those described in a paper "On Black Lead from Cast Iron," of Dr. J. Macculloch, communicated to the "Edinburgh Philosophical Journal" in 1822, we may take this opportunity of stating that the experiments of the two chemists were not similar, and that the results obtained are directly opposed to each other: Macculloch maintained that plumbago is a distinct metal, and that blacklead is its oxide, whilst Calvert proves that plumbago (or rather that which Macculloch calls plumbago) is a compound of iron; being, in fact, a compound of about 91 per cent. of a subcarbide of iron, with about 8½ per cent. of a nitride of silicium, and traces of phosphorus and sulphur. Macculloch added little to that which was previously generally known on the subject; but Calvert has carried out his researches with such care and minuteness that we trust ere long to be enabled to give a final reliable opinion upon the subject. In the paper referred to Dr. Macculloch describes certain experiments which he had made in consequence of his attention having been drawn to specimens of iron that had lain for years at the bottom of the sea, or had been subject to constant soakage in the porter-backs used at breweries. He notices the fact that certain iron guns, fished up in 1740 off Tobermory, from one of the sunken vessels of the Spanish Armada, had become so soft that they could be easily scraped, and that wherever scraped the surface of the metal grew too hot to be touched with the hand. A similar phenomenon was observed in some of the iron fittings that had been long exposed to the weak acid present in porter; the metal, moreover, had all the appearance of plumbago, and was not reduced in bulk. The doctor tested his conclusions by experiments in the laboratory, and found that he could produce plumbago and black-lead at pleasure, without any diminution in bulk of the pieces of iron experimented on; and that the converted metal always became hot if scraped, while any moisture remained, as had been remarked of the long-submerged cannon. In describing his experiments on the soaking of pieces of iron he mentions that, to procure the black lead in perfection, the acid should be very weak, and the operation is then necessarily tedious. Acetous acid appears to be the best, and it is by this that it is produced in porter-backs, in the waste-pipes of breweries, and in calico-printing houses, where sour paste is used. If the experiment be perfect the black-lead becomes hot on exposure to air, smoking while there is any moisture to be evaporated, particularly when the surfaces are scraped off in succession, so as to give access to the air. Macculloch would thus appear to have proceeded little further than the point at which Calvert commences, for, if we assume the contrary to be the case, we could only come to the conclusion that, to express the opinion, as the result of his researches, that the carbonaceous substance found in cast iron was a distinct metal, Macculloch must have been a very clumsy manipulator, and a chemist upon whom no reliance could be placed.—*Mining Journal.*

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

2473. William Malam, Skinner-street, London, "Improvements in apparatus for the manufacture of gas."—*Petition recorded 3rd October*, 1861.

2873. William Leopard, Hurstpierpoint, Sussex, "Improvements in railway brake apparatus."—*Petition recorded 14th November*, 1861.

2986. Hermann Brambach, Lungengasse, Cologne, Germany, "A new mode of manufacturing gas for illuminating purposes."—*Petition recorded 27th November*, 1861.

3016. Richard Cook and George Holme Spencer, Hathersage, Derbyshire, "Improvements in the manufacture of umbrellas and parasols."—*Petition recorded 29th November*, 1861.

3019. John Cooper, St. Margaret's Ironworks, Ipswich, Suffolk, and Charles Garrood, Penge, Surrey, "Improvements in cultivators, horse hoes, and horse-rakes."—*Petition recorded 30th November*, 1861.

3055. Michael Henry, Fleet-street, London, "Improvements in printing and ornamenting textile fabrics, paper hangings, and other materials, and in surfaces and apparatus for such purposes."—A communication from Alexandre Adrien Desperdaux, Boulevart St. Martin, Paris.—*Petition recorded 5th December*, 1861.

3096. Thomas Higgins, Bow, Middlesex, "Improved machinery for filling dipping clamps with tapers, match-stems, and splints."—*Petition recorded 10th December*, 1861.

3103. William Clark, Chancery-lane, London, "Improvements in stoppering bottles and other vessels."—A communication from Mr. Victor Hippolyte Solon, Boulevart St. Martin, Paris.—*Petition recorded 11th December*, 1861.

3144. Ferdinand Kohn, Southampton-terrace, Waterloo Bridge, London, "An improved mode of copying writings, drawings, prints, and similar objects."—*Petition recorded 14th December*, 1861.

3152. George Prince Vallas, Kentish-town-road, Camden-town, London, "Improvements upon or additions to certain description of portable baths, with the object of rendering them available for use as trunks or boxes."—*Petition recorded 16th December*, 1861.

3160. John William Chalfont, Denmark-grove, Islington, and David Keys, Craven-street, Strand, London, "Improvements in the method of, and apparatus for, winding up fusee watches and pocket chronometers, and setting the hands without key."—*Petition recorded 17th December*, 1861.

3184. Joseph Henry George Wells, Sandhurst-villas, Binfied-road, Stockwell, Surrey, "Improvements in the method of, and apparatus for, pumping elastic fluids."—*Petition recorded 19th December*, 1861.

3188. John Smith jun., and John Birch, Coven, Staffordshire, "Improvements in threshing machines and in mills for grinding, and in apparatus for raising or moving grain in granaries and other places."

3202. George Tomlinson Bousfield, Loughborough Park, Brixton, Surrey, "Improvements in machinery for attaching the soles of boots and shoes to the upper leathers."—A communication from Simon Smith Bucklin, Brooklyn, Massachusetts, U.S.—*Petition recorded 20th December*, 1861.

3206. William Bennetts, Tuckingmill, Camborne, Cornwall, "Improvements in the mechanism required for and in the manufacture and composition of gunpowder."

3208. William Mattieu Williams, Handsworth, Staffordshire, "An improvement or improvements in treating coal and other bituminous minerals and peat, in order to obtain solid and liquid hydro-carbons therefrom, and in apparatus to be used for that purpose."—*Petitions recorded 21st December*, 1861.

3222. Thomas Edward Vickers, Sheffield, Yorkshire, "Improvements in the wheels of railway engines and carriages, and in the machinery or apparatus to be used in making the same."—*Petition recorded 24th December*, 1861.

3236. Henry Dawes, Sale-green, Sale Moor, near Manchester, "Improvements in the method of treating steel for the manufacture of crinoline." *Petition recorded 26th December*, 1861.

3243. Thomas William Atlee, Birmingham, "Certain improvements in cocks or taps for drawing off fluids."

3246. Richard Archibald Brooman, Fleet-street, London, "Improvements in steam generators, and in fire-bars employed therein."—A communication from Alexandre Friedmann and Emile D'Erlanger, Paris.—*Petitions recorded 27th December*, 1861.

3259. Arthur Warner, Threadneedle-street, London, "Improvements in the manufacture of cases or receptacles for oil fuses and other articles used in the military and naval services."—*Petition recorded 28th December*, 1861.

3260. William Tongue, Chryssell-road, Brixton, Surrey, "Improvements in the manufacture of certain descriptions of woven looped and bobbinet fabrics by the application of certain fibrous materials thereto."

3262. William Tongue, Chryssell-road, Brixton, Surrey, "Improvements in the manufacture of umbrellas and parasols."

3265. Thomas Pickford, Fenchurch-street, London, "Improvements in the manufacture of manure."

3268. John Haslam, Preston, Lancashire, "Improved apparatus for winding, holding, and letting go cords, bands, or chains, particularly applicable to window-blinds."

3270. William Edward Newton, Chancery-lane, London, "Improved apparatus for obtaining motive power from explosive compounds."—A communication from Eugene Barsanti and Felix Matteucci, Florence, Italy.—*Petitions recorded 31st December*, 1861.

1. John Martin Rowan, Glasgow, Lanarkshire, N.B., "Improvements in the manufacture of railway wheels, and in apparatus to be used therein."

2. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in hose pipe joints or couplings."—A communication from Thomas Braisted, New York, U.S.

5. John Walker, City-road, London, "Improvements in the construction of forts and fortifications which are applicable to floating batteries."

6. Thomas Charles Clarke, Liverpool, "Improvements in the construction of apparatus for heating and circulating water and other liquids."

7. John Bradbury, Pendleton, near Manchester, "Improvements in self-acting mules."

9. Richard Archibald Brooman, Fleet-street, London, "Improvements in supporting and propelling vessels."—A communication from Auguste Salzmann, Paris.

10. William Bush, Tower-hill, London, "Improvements in omnibuses and other carriages."

13. William Barker Patrick, Highgate, Middlesex, "Improvements in the manufacture of sugar, and in the apparatus employed therein."

14. Edmund Francis Davis, Tavistock-house, Tavistock-square, London, "Improvements in gas-burners."

16. William Edward Newton, Chancery-lane, London, "Improvements in coffee-pots and boilers for culinary purposes, part of which improvements are also applicable for generating steam."—A communication from Edward Fielding Woodward, Brooklyn, King's county, New York, U.S.—*Petitions recorded 1st January*, 1862.

18. William Edward Gedge, Wellington-street, Strand, London, "Improved apparatus for roasting coffee."—A communication from Jean Louis Rivret-Justin, Passage des Petites Ecuries, Paris.

21. Matthew Cartwright, Carlisle, Cumberland, "Improvements in the manufacture of models and of 'plates' or 'pieces' for artificial teeth."

23. Hermann Eschwege, Mincing-lane, London, "Improvements in treating wood and other vegetable spirit."—*Petitions recorded 2nd January*, 1862.

24. Edward Nugent, Brooklyn, King's county, New York, U.S., "Improvements in fire-arms."

26. François Sebastien Belloche and Herman Bollack, Rue St. Martin Paris, "An improved parasol."—*Petitions recorded 3rd January*, 1862.

29. James Whitton Arundel, Gresham-house, Old Broad-street, London, "An improved method and improved apparatus for removing impurities from coal, parts of which invention are applicable for the separation and cleansing of ore and other minerals."—A communication from Mr. Martin Neuerburg, Kalk, Rhenish Prussia.

31. Christopher Cross, Stratford, near Manchester, and Edward Padmore, Manchester, "Improvements in the manufacture of piled fabrics, and in machinery or apparatus employed therein."

33. George Leyburn, Tividale, and David Beckley, Brockmoor, Staffordshire, "An improvement or improvements in brakes for retarding and stopping carriages on railways."

37. Arthur Warner, Threadneedle-street, London, "Improvements in preparing materials for and in purifying coal gas."—*Petitions recorded 4th January*, 1862.

40. George Betjemann, George William Betjemann, and John Betjemann, Pentonville, London, "Improvements in dressing-cases, applicable to other cases and boxes."

41. Patrick Benignus O'Neill, Hart-street, Bloomsbury, London, "Improvements in screw-wrenches or spanners."

45. Frederick Brown, Luton, Bedfordshire, "Improvements in kitchen ranges and cooking apparatus."—*Petitions recorded 6th January*, 1862.

45. James Higgins and Thomas Schofield Whitworth, Salford, Lancashire, "Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous materials."

48. Arthur Wallis and Charles Haslam, Fashingstoke, Southampton, "Improvements in rotary screens."—*Petitions recorded 7th January*, 1862.

49. David Beale, Cobden-street, St. Leonard's-road, Bromley, Middlesex, "An improved method of fastening iron plates to ships' sides."

51. Anthony Heath, Union-square, Islington, London, "Improvements in the construction of inkstands."

53. Charles Pilkington and Thomas Pilkington, Sheffield, Yorkshire, "Improvements in skates."

55. John Stenhouse, Upper Brunswick-terrace, Barnsbury-road, London,

"Improvements in rendering certain substances less pervious to air and liquids."

57. WILLIAM BRADSHAW, jun., Coventry, Warwickshire, "Improvements in watches."—*Petitions recorded 8th January*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

124. WILLIAM CRAFT, Cambridge-road, Hammersmith, THOMAS WILSON, Bradmore-house, Chiswick, Middlesex.—Dated 14th January, 1859.
129. WILLIAM HENRY EDWARD MCKNIGHT, Lydiard-house, near Swindon, Wiltshire.—Dated 15th January, 1859.
130. POLYNICE AUGUSTE VIETTE, Faubourgh de Schaerbeck, near Brussels. —Dated 15th January, 1859.
133. WILLIAM BETTS, Wharf-road, City-road, London.—Dated 15th January, 1859.
227. JOHN WHITE, Finchley, Middlesex.—Dated 25th January, 1859.
139. PIERRE AMABLE DE SAINT SIMON SICARD, Paris.—Dated 17th January, 1859.
147. WILLIAM NEWMAN, Aston, near Birmingham.—Dated 18th January, 1859.
190. CHARLES O'HARA, Upper Seymour-street, Hyde Park, London.—Dated 21st January, 1859.
224. RUDOLPH BODMER, Thavies-inn, Holborn, London.—Dated 25th January, 1859.
137. JAMES MONTGOMERY, New York, U.S.—Dated 17th January, 1859.
143. ROGER GEORGE SALTER, Alphington, Devonshire.—Dated 17th January, 1859.
155. RICHARD BRADLEY and WILLIAM CRAVEN, Westgate-common Foundry, Wakefield, Yorkshire.—Dated 18th January, 1859.
156. WILLIAM TROTTER, South Acomb, Northumberland.—Dated 18th January, 1859.
163. JAMES WHITEHEAD, Halifax, Yorkshire.—Dated 19th January, 1859.
166. WILLIAM POUPARD, Blackfriars-road, Surrey.—Dated 19th January, 1859.
160. PEHR AMEJORN SPARRE, Chancery-lane, London.—Dated 19th January, 1859.
170. JAMES CROFT REID and WILLIAM MILNER, Liverpool.—Dated 20th January, 1859.

Patents on which the Stamp Duty of £100 has been paid.

106. GEORGE RILEY, Portland-place North, Clapham-road, Surrey.—Dated 15th January, 1855.
231. HENRY DAVIS POCHIN, Salford, Lancashire.—Dated 30th January, 1855.
129. CONSTANT JOUFFROY DUMERY, Essex-street, Strand, London.—Dated 18th January, 1855.

Notices to Proceed.

2257. JAMES SMITH, Saddler's-place, London-wall, "Improvements in sewing machines."—*Petition recorded 10th September*, 1861.
2269. WILLIAM WILLIAMS CLAY, Nottingham, "Improvements in knitting machinery."—*Petition recorded 12th September*, 1861.
2272. WILLIAM DAVIS, Snow-hill, Birmingham, "An improved apparatus for the prevention of accidents to vehicles drawn by affrighted horses."
2273. WILLIAM FARLAR, Turnham-green, Middlesex, "Improvements in sash fastenings, which improvements are also applicable to other purposes."
2276. ROBERT SMITH, Weymouth-cottage, Hornsey, BENJAMIN BROOKS, Albert-terrace, York-road, King's-cross, London, and JAMES SMITH, Oak-villas, Wood-green, Tottenham, Middlesex, "Improvements in the construction of roof and other lights."
2279. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in machines for weighing and measuring corn and other grain."—A communication from Joseph Alexandre Auguste Catenot, Lyons, France.
2282. CHARLES SUTTON, Salford, Lancashire, "An improved method of and apparatus for indicating the position of sunken ships or other vessels."
2283. HENRY DIXON, Pendleton, Lancashire, and JOHN ROBINSON RENNER, Liverpool, "Improvements in the mode of and apparatus for carbonising sawdust and other vegetable substances."—*Petitions recorded 13th September*, 1861.
2288. RICHARD WALLER, Baker-street, Portman-square, London, "Improvements in machinery and apparatus for manufacturing and refining cane juice and other saccharine substances."
2289. WILLIAM WHEATSTONE, Conduit-street, St. George's, Hanover-square, London, "Improvements in concertinas and other musical instruments, the tones of which are produced from the vibration of springs."
2292. FREDERIC BARNETT, St. Mary-axe, London, "Improved automatic electric signals to prevent collisions on railroads and railways."—*Petitions recorded 14th September*, 1861.
2300. SAMUEL HORSLEY and EDWARD HOBSON JONES, Liverpool, "Improvements in apparatus for cleaning and polishing boots, shoes, and other coverings for the feet, partly applicable for cleaning plate and other articles of domestic use."
2302. WILLIAM EDWARD GEDGE, Wellington-street, Strand, London, "Improved apparatus for drying grain."—A communication from Casimir Druart, Passage des Petites Ecuries, Paris.
2304. THOMAS MERITON, Second Bernard Strasse, St. Pauli, Hamburg, "Improvements in steering apparatus."
2313. WESTON TUXFORD, Boston, Lincolnshire, "Improvements in threshing machines, and in raising and stacking straw and other agricultural produce."—*Petitions recorded 16th September*, 1861.
2316. FREDERIC BARNETT, St. Mary-axe, London, "An improvement in the light given by street and other lamps, by means of reflectors in white earthenware, china, and all enamel materials, in conjunction with an improved chimney to draw up the exhalations and smoke of all lighting materials."
2319. GEORGE DAVIES, Serle-street, Lincoln's-inn, London, "Improvements in machinery or apparatus for the manufacture of horse-shoe and other nails."—A communication from Charles Alexander Louvrier, Paris.
2320. JOSEPH STATHAM, Salford, and WILLIAM STATHAM, Openshaw, Lancashire, "Certain improvements in machinery or apparatus for mowing and reaping."
2321. JOSEPH LEE and BENJAMIN DUTTON TAPLIN, Patent Crank Works, Lincoln, "Improvements in traction engines."—*Petitions recorded 17th September*, 1861.
2324. GEORGE WHITE, Pancras-lane, London, "Improvements in apparatus for filtering or purifying water or other liquids."—A communication from Mr. Jean Antoine Victor Burg, Paris.
2327. HENRY WICKENS, Tokenhouse-yard Bank, London, "Improvements in reaping and mowing machines."—A communication from Nicholas Coones, London, Middlesex, Canada.
2328. EDWARD PARTINGTON, Heap Bridge, Lancashire, "Certain improvements in machinery or apparatus employed in the manufacture of paper." *Petitions recorded 18th September*, 1861.
2334. JAMES CLOUGH, Bolton-le-Moors, Lancashire, "Certain improvements in machinery for preparing cotton and other fibrous substances."
2345. SAMUEL HAWKSWORTH, Doncaster, Yorkshire, "Improvements in the manufacture of floorcloth and in ornamenting other surfaces."—*Petitions recorded 19th September*, 1861.
2351. JOHN OLIVER, Colchester, WILLIAM SINNOCK, Sylvan-cottage, Woodford, Essex, JOHN GRANTHAM, Nicholas-lane, and MONTAGUE RICHARD LEVERSON, St. Helen's-place, London, "Improvements in the mode of obtaining certain chemical substances, and in the treatment of vegetable fibre, and in obtaining manurial and other products therefrom."—*Petition recorded 20th September*, 1861.
2376. JAMES FRICE, Dundalk, Ireland, "Improvements in the permanent way of railways."
2377. JOSEPH JACOB, Golden-square, London, "Improvements in the mode of, and apparatus for, obtaining and treating hydrogen gas, and the application thereof to various purposes, parts of which improvements are applicable to the manufacture of iron and steel."—A communication from Carl Preisenhammer and Carl Weniger, Zöptau, Austria.—*Petitions recorded 23rd September*, 1861.
2381. GEORGE JOSEPH GLADSTONE, Blackwall, London, "Improvements in apparatus fos disengaging boats."—*Petition recorded 24th September*, 1861.
2289. JOSEPH MUSGRAVE, Globe Ironworks, Bolton-le-Moors, Lancashire, "Certain improvements in the application of steam power."—*Petition recorded 25th September*. 1861.
2412. WILLIAM CLARK, Chancery-lane, London, "Improvements in the manufacture of peat."—A communication from Auguste Marcellin Manrique Comte de Lara et du Ren, Boulevart St. Martin, Paris."—*Petition recorded 26th September*, 1861.
2422. JOHN ADAMS KNIGHT, Symond's-inn, Chancery-lane, London, "Improvements in steam pumping engines." — A communication from Wellington Lee, East 19th-street, New York, U.S.—*Petition recorded 27th September*, 1861.
2470. THOMAS EVANS, Westmoreland-street, Westminster, Middlesex, "Improvements in the manufacture of boots, shoes, and other coverings for the feet, and in the machinery, apparatus, and means connected with such manufacture."—*Petition recorded 3rd October*, 1861.
2475. PETER KNOWLES, Bolton-le-Moors, Lancashire, "Improvements in machinery for opening and cleaning cotton and other fibrous materials." —*Petition recorded 4th October*, 1861.
2567. CHARLES DENTON AEEL, Southampton-buildings, Chancery-lane, London, "Improvements in apparatus for the simultaneous manufacture of white lead and vinegar."—A communication from Robert Rowland, New York, U.S.—*Petition recorded 18th October*, 1861.
2628. FERRAR FENTON, Fishguard, Pembrokeshire, "Improvements in obtaining and treating fibrous substances."—*Petition recorded 21st October*, 1861.
2648. HENRY KEACH, Ledford terrace, Aridover-road, Holloway, London, "An improvement in the manufacture of cigars."—*Petition recorded 23rd October*, 1861.
2683. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improved apparatus for ascertaining the presence and degree or cessation of vitality in the human body and in animals of the higher class, applicable to the semeiosis of health, disease, and death."—A communication from Léon Victor Collongues, Grande Rue, Passy-les-Paris, France.—*Petition recorded 26th October*, 1861.
2802. THOMAS CHURCHMAN DARBY, Little Waltham, Essex, "Improvements in the construction of horse-hoes."
2833. BENJAMIN DOBSON and JAMES CLOUGH, Bolton-le-Moors, Lancashire, "Certain improvements in machinery for combing, preparing, and spinning cotton and other fibrous substances."—*Petitions recorded 8th November*, 1861.
2970. WILLIAM SELLERS, Keighley, Yorkshire, "Improvements in means or apparatus for sewing."—*Petition recorded 26th November*, 1861.
2990. WILLIAM CLARK, Chancery-lane, London, "Improvements in the clasps or fastenings of purses, bags, portfolios, tobacco-pouches, and other like articles."—A communication from Mrs. Joseph Schoen Feld, Boulevart St. Martin, Paris.—*Petition recorded 27th November*, 1861.
3067. THOMAS LAWES, City-road, London, "Improvements in the manufacture of quilts and coveriets."—*Petition recorded 7th December*, 1861.
3122. RICHARD ASHWORTH, GEORGE SHEPHERD, JOHN CORMACK, and JOHN DEARDEN, Stacksteads, Lancashire, "Improvements in looms for weaving."
3130. THOMAS WALKER, Birmingham, "Improvements in means or apparatus for indicating the speed of vessels, and for taking soundings."—*Petitions recorded 13th December*, 1861.
3160. WILLIAM CHALFONT, Denmark-grove, Islington, and DAVID KEYS, Craven-street, Strand, London, "Improvements in the method of, and apparatus for, winding up fusee watches and pocket chronometers, and setting the hands without key."—*Petition recorded 17th December*, 1861.
3208. WILLIAM MATTIEU WILLIAMS, Handsworth, Staffordshire, "An improvement or improvements in treating coal and other bituminous minerals and peat, in order to obtain solid and liquid hydrocarbons therefrom, and in apparatus to be used for that purpose."
3249. WILLIAM LOADER ALLCHIN and WILLIAM ALLCHIN, Globe Works, Northampton, "Improvements in apparatus applicable to the superheating of steam."—*Petitions recorded 21st December*, 1861.
3252. JOHN PETER DORMAY, JAMES SHIRLEY AIKENHEAD, and THOMAS JOHNSON, Wandsworth, Surrey, "Improvements in the construction of boats for sailing or rowing."
3256. GEORGE HENRY BURKECK, Southampton-buildings, Chancery-lane, London, "Improvements in apparatus for raising or forcing water or other fluids."—A communication from Mr. Edward Bruce Boughton Barker, H.B.M.'s Consul at Samsoun and Sinope, Black Sea.—*Petitions recorded 30th December*, 1861.
3260. WILLIAM TONGUE, Chryssell-road, Brixton, Surrey, "Improvements in the manufacture of certain descriptions of woven looped and bobbinet fabrics by the application of certain fibrous materials thereto."
3262. WILLIAM TONGUE, Chryssell-road, Brixton, Surrey, "Improvements in the manufacture of umbrellas and parasols."—*Petitions recorded 31st December*, 1861.
1. JOHN MARTIN ROWAN, Glasgow, Lanarkshire, N.B., "Improvements in the manufacture of railway wheels, and in apparatus to be used therein." —*Petition recorded 1st January*, 1862.

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 18th January, 1862.

20, 3d. ; 1416, 3d. ; 1417, 3d. ; 1418, 9d. ; 1419, 3d. ; 1420, 11d. ; 1421, 7d. ; 1422, 3d. ; 1423, 10d. ; 1424, 3d. ; 1425, 3d. ; 1426, 9d. ; 1427, 5d. ; 1428, 3d. ; 1429, 3d. ; 1430, 1s. 1d. ; 1431, 1s. 1d. ; 1432, 6d. ; 1433, 7d. ; 1434, 9d. ; 1435, 3d. ; 1436, 3d. ; 1437, 6d. ; 1438, 7d. ; 1439, 1s. 7d ; 1440, 3d. ; 1441, 9d. ; 1442, 10d. ; 1443, 3d. ; 1444, 3d. ; 1445, 1s. 4d. ; 1446, 3d. ; 1447, 10d. ; 1448. 3d. ; 1449, 3d. ; 1450, 1s. 4d. ; 1451, 3d. ; 1452, 3d. ; 1453, 10d. ; 1454, 7d. ; 1455, 6d. ; 1456, 3d. ; 1457, 6d. ; 1458, 1s. 3d. ; 1459, 3d. ; 1460, 3d. ; 1461, 10d. ; 1462, 3d. ; 1463, 7d. ; 1464, 5d. ; 1465, 5d. ; 1466, 3d. ; 1466, 3d.

***** Specifications will be forwarded by Mr. Bennett Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.**

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

(Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.)

1641. D. F. GRIMALDI, *Teramo, Italy*, "*Rotatory steam boilers.*"—*Dated 27th June*, 1861.

These improvements relate to an invention for "improvements in the instantaneous generation of steam," for which a patent was granted to the present inventor on the 9th August, 1860 (No. 1,927), and these improvements consists, First, of tubes to be added to the rotatory boiler, described in the above-mentioned patent, so as to greatly extend its heating surface; then the boiler is not entirely enclosed in the furnace, but one of its ends is there, and the other in the smoke chamber, the products of combustion passing from the former to the latter through the tubes of the boiler. This can be made of only one cylinder fitted with the above said tubes, or of two cylinders, the one provided with tubes and the other without, and connected together by a central neck and several tubes at their circumference, so that water and steam can pass freely from one cylinder to the other; in this case the steam pipe and the two pipes of the water gauge communicate with the last cylinder. Secondly, of making hollow both the trunnions by which the boiler is supported on the bearings, so that the feeding pipe finds its way into the boiler through one of the trunnions, and the steam pipe and the two pipes of the said water gauge through the other. Thirdly, of bending up the steam pipe within the boiler, so as to take the steam near the top of the same. Fourthly, of substituting, partially or totally, a double-casing to the brickwork, or enclosing one or more rotatory steam boilers within an ordinary boiler. Fifthly, of fitting the safety valves and steam gauge directly on the steam pipe near the boiler when a steam-chest is not made use of. Sixthly, of making the trunnions revolving, not directly through the bearings, but revolving on pinions fitting in the inner surface of the bearings in the case, the trunnions being of a large diameter; in this way the friction is greatly diminished.—*Not proceeded with.*

1643. W. MCNAUGHT, *Manchester*, "*Supporting diagonal, condensing, and other steam engines.*"—*Dated 27th June*, 1861.

This invention relates, particularly, to a certain description of direct self-acting steam engines, being principally applicable to diagonal condensing engines, with either one, two, or more cylinders, and consists in such an arrangement of framing that the patentee is enabled to dispense with all the usual stone foundations, the stability of the engines depending upon the "side walls" of the engine house. He attaches, by bolts or other convenient means, the framing of the engine to the side walls, and also provides transverse beams extending from each side wall to assist in supporting or carrying the engines; such beams may be of iron, or other material, as desired, as long as the principle of the invention be maintained, and that the firmness of the engines depend chiefly upon the side walls of the engine house, instead of the ordinary expensive and inconvenient stone foundation. The air-pump and also the condenser may be supported or suspended from the said cross beams.

1647. J. DOUGHTY, *Craven-buildings, Drury-lane, London*, "*Apparatus for obtaining and applying motive power.*"—*Dated 27th June*, 1861.

In carrying out this invention the inventor proposes employing a bed-plate, having standards erected thereon, to carry a driving shaft, upon which shaft is secured the motive-power wheel. This wheel is divided into sections by channels or grooves, in which are metal slides actuated by toothed wheels and screws. And it is provided with two semicircles near its centre, one having teeth around its periphery, the other having teeth within, so that, when each slide leaves its vertical position, it commences to project from the edge of the wheel, when, by its own weight, it falls into a horizontal position, and, the weight of the next slide carrying it past, it then commences to return, by the means before stated, until it again takes a vertical position, by which time it is quite returned to its place within the periphery of the wheel, neither end projecting, and so on with each succeeding slide, thus imparting a continuous motion to the shaft.—*Not proceeded with.*

1673. J. SHEPHERD *and* W. GODFELLOW, *Manchester*, "*Apparatus for carrying off the scum in the water in steam boilers.*"—*Dated 1st July*, 1861.

In order to collect and carry off the scum that is constantly forming on the surface of the water in steam boilers the inventors employ one or more floating receivers, rendered buoyant by air-tight chambers, or other means, the said floating receivers being connected to the waste pipe by tubes within each other, similar to a telescope, or by jointing one tube so that it can vibrate upon another tube, in order that the receivers can rise or fall with the surface of the water as it varies in height or depth, and thereby carry off the scum to the waste pipe, which is opened as required.—*Not proceeded with.*

1679. J. G. WILSON, *Rastrick, near Halifax*, "*Feeding steam boilers with hot water.*"—*Dated 2nd July*, 1861.

This invention consists in the application of a valve to the said tubes or feeding apparatus, so arranged and connected with the boiler that, when the pump ceases to force the water through the tubes, the valve will open to the water in the boiler, and allow it to circulate in the tubes, and thus prevent explosion or damage to the said tubes.

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

1614. R. MOORE, *Cannon-street West, London*, "*Constructing, steering, and propelling of ships.*"—*Dated 24th June*, 1861.

The First part of this invention is for constructing ships and other vessels, for which, wholly or in part, the inventor employs voluted plates, sheets, or strips of iron, and other suitable metal, or admixture of metal with other material of a plain or uniform surface, attached, alone, or in combination with other voluted or flatted sheets or strips, or with bar or angle iron, with or without filling or lining pieces, or in combination with cast iron or with timber, and also with or without other material, simple or compound, to maintain or increase the cohesion, compactness, or solidity of the metallic substances, or of all the component parts. The Second part of the invention relates to the means of steering—applied either as auxiliary to, or in substitution and independent of, a rudder, and consists in the employment of two or more helical vanes placed in the forward or after cant body of the ship or other vessel, or in both. The plane of rotation of such vanes should be parallel or oblique to or upon the line of midship section of the vessel, and entirely independent of the action of the propeller, so far as propulsion is concerned. These vanes act laterally or sideways on the water at both sides of the ship, in a frame or transverse passage or opening (made watertight when necessary to prevent leakage in the ship), and are driven by any mechanical contrivance or motive power available for such purpose. The Third part of the invention consists in the adaptation of one or more adjusting frames movable in a vertical direction at the stern of ships propelled by helical paddles or screws of any kind whatever, for the purpose of permitting the propeller to be driven by direct shafting or by gearing, with variable immersion, irrespective of the ship's load line. The Fourth part of the invention consists of an improvement in pumps, applicable to other purposes. In a cylindrical chamber, with lateral openings communicating with a shaft, tube, or conduit, and rotating horizontally, a central cone acts on the water admitted, and transmits it to any level, or in any direction, operating either as a lift or force pump for any purpose for which it may be required.—*Not proceeded with.*

1621. W. CLARK, *Chancery-lane, London*, "*Propelling vessels.*"—*A communication.—Dated 25th June*, 1861.

This invention consists of a wheel with floats or pallets mounted at each side of a vessel; these wheels are submerged and placed horizontally in cavities made in the side of the vessel, in such way that a third or fourth part only of their diameter projects and is uncovered. The cases containing the paddle-wheels are placed within the planking of the ship, which should be well caulked or constructed so as to prevent all ingress of water to the ship, and, at same time, to receive the axes of the above mentioned wheels. The axes are, of course, necessary for the working of the propellers, which should be disposed at the greatest breadth of the vessel immersed, and placed below the surface of the water under the conditions mentioned. The propellers should be disposed somewhat nearer the bow than the stern, and though placed lower or higher in the sides of the ship, they should always be disposed as experience may suggest, and as best calculated for their action. When the wheels are at rest the water will completely occupy and envelope the isolated cases and the wheels, but, when put in motion, the floats or boards of these wheels, bearing on the columns of water which surround them, will form turbines, the one half or more of which will be neutralised by the sides of the vessel, and the water contained in the cases will be compelled by their movement to leave, without being able to again enter until the wheels stand again still. To render the action more certain the case receiving the wheel is itself incased in a second casing, forming a double envelope with the first, which permits of its being repaired and changed at will.

1624. C. STEVENS, *Charing-cross, London*, "*Nose-band for stopping runaway horses.*"—*A communication.—Dated 25th June*, 1861.

The noseband or musrol consists of an open steel spring covered with leather, and furnished with an oval-shaped piece at each end, and is fitted just over the commencement of the nostrils of the horse; a strap is attached to the back of the musrol, the other end of which is secured to the pummel of the saddle, and, on pulling this strap, the spring opens, and the oval pieces press and seize the nostrils, and so prevent breathing.

1635. H. A. FLETCHER, *Whitehaven, Cumberland*, "*Railway wheels and tyres.*" —*Dated 26th June*, 1861.

Under one modification of this invention the tyre of the wheels is rolled or made with a feather or central projecting rib formed on the back or inner surface of the tyre. The sides of this feather are turned or otherwise shaped to form a dovetail or wedge-shaped rib, the narrower portion of the rib being next the inner face of the tyre. The wheel is formed in two halves, which meet together at the central part, forming the boss of the wheel; the spokes are duplex, and extend outwards a little from the boss in a diverging or angular direction. Each of these duplex or double series of spokes is connected at the outer extremities by a rim; there are thus two rims arranged parallel, and with their inner faces converging towards the peripheries. The dovetail feather of the tyre is inserted between the converging faces of the rims, so that, when shrunk on, the tyre is tightly wedged between the rims. The tyre is further secured by a bolt passed through the head of each spoke, and secured on the other side by a nut.—*Not proceeded with.*

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

1684. H. B. BARLOW, *Manchester*, "*Machinery for spinning.*"—*A communication.—Dated 3rd July*, 1861.

This invention consists, First, in certain improved combinations of machinery for imparting a variable speed to the carriage of the spinning machine, which speed can be modified according to the nature and quality of the fibres to be spun. Secondly, in performing the operations of roving, or coarse spinning and fine spinning, in the same machine, thereby economising time, and obtaining the same result as has heretofore been produced by two separate operations. Thirdly, in the application of self-acting mechanism to machinery for spinning carded wool, or other animal fibres, by which the running in of the carriage, the backing off the winding on, and the other motions required to render the machine self-acting are effected. Fourthly, the application of differential motion to the spindles while the twist is being given to the yarn.

1687. J. WOOLLATT, *Preston*, "*Looms.*"—*Dated 3rd July*, 1861.

This invention relates to improved modes of working several shuttles. Instead of the shuttles being placed in a drop box, as at present adopted, the inventor places them in a box at each end of the loom, apart from the slay or lathe, which boxes work in guides attached to the framework, and are moved as required by racks and pinions, the said pinions being turned as required, according to the pattern, by a jacquard motion.—*Not proceeded with.*

1694. J. PETRIE, *jun., Rochdale*, "*Apparatus for washing and drying wool, cotton, &c.*"—*Dated 3rd July*, 1861.

This invention refers, First, to a method of driving such feed aprons of machines for washing wool and other fibrous materials as are caused to travel by means of rollers which act independently of those over which the apron passes, and consists in causing the said rollers to bite upon strips of leather, india-rubber, or other flexible material, so as to prevent them from acting upon the said aprons direct. Another part of the invention consists in drying cotton by causing a current of air, heated, or at the ordinary temperature, to be drawn or driven through the material by the exhausting or blowing action of a fan or fans.

1720. H. SCHUTT, *Bradford, Yorkshire*, "*Spinning frames.*"—*A communication.—Dated 6th July*, 1861.

This invention consists of a contrivance to cause the thread of yarn which is being spun, when it chances to run into curls and entangled hard spun lumps, to cease spinning, and to cause the prepared material which was being spun to wind round the rollers in the shape of what is termed soft-waste, suitable to be again prepared for spinning, instead of hard-waste yarn of little value.

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

1688. J. SIMONTON, *Belfast*, "*Traction engine and apparatus applicable to the cultivation of land.*"—*Dated 3rd July*, 1861.

The patentee claims, First, an endless railway or platform, placed below the frame of the engine, which will support the weight of the engine, and, at the same time, in a peculiar way take hold of or grasp the surface of the soil firmly and tenaciously, so that the power of the engine may be

applied to the traction of cultivating implements. Secondly, a mode of preventing priming in the boiler of such portable engine by suspending the boiler from an oscillating centre above it, so that it shall, by its own weight, always hang horizontally, even when the engine is ascending or descending inclines.—*Not proceeded with.*

1630. G. DAVIES, *Serle-street, Lincoln's-inn, London,* "*Apparatus for grinding corn, &c.*"—*A communication.—Dated 3rd July,* 1861.

This invention consists, partly in employing a nether stone or bed, embracing only a fourth part of the circumference of the moving stone, one of the extremities being about opposite to the horizontal radius of the circular stone, and the other extremity being about opposite to the lower vertical radius of the same. Secondly, in so mounting the bed stone that it can be rocked or oscillated on its points of support in order to facilitate the dressing or setting of the same, and in forming any number of inclined transverse grooves therein (three being preferred). Thirdly, in the use of pedestals (for carrying the circular or revolving stone) capable of moving on slides fixed at an angle of about 45 deg., so that, as the circular stone is slides fixed at an angle of about 45 deg., so that, as the circular stone is set to or from the bed, it moves on a line passing through the centre of the curve of the latter. Fourthly, in the employment of a small trough or spout to feed the grain to the mill, to which an alternate circular or rectilinear motion is given, in order to distribute the grain more evenly between the surfaces of the stones.

1697. J. PATTERSON, *Beverley,* "*Machinery for applying the power of horses or other animals to drive mills, &c.*"—*Dated 4th July,* 1861.

This invention is carried into effect by mounting a mill or other machine upon a carriage with travelling wheels, so as to be portable, and so that, when the carriage is connected to a fixed centre attached to the ground or floor on the place where the machinery is used, and is moved round such fixed centre in a circle by any animal or animals yoked to the carriage, the mill or other machine is driven by the action of the travelling wheels.—*Not proceeded with.*

CLASS 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

1686. J. TERRY, *Birmingham,* "*Window-sash pulleys, side pulleys, screw pulleys, and upright pulleys.*"—*Dated 3rd July,* 1861.

This invention consists in manufacturing the pulleys or rollers of window-sash pulleys, screw pulleys, and upright pulleys, of glass china, earthenware, or other vitreous or semi-vitreous material, instead of making them of metal, as ordinarily practised.

1713. W. ENGLAND, *Wollaston Works, near Stourbridge,* "*Manufacture of bricks.*"—*Dated 5th July,* 1861.

This invention consists in moulding bricks in such form that no mortar-bed or joint is perceptible upon the face of the work, a rebate or flange upon the edges of each brick concealing the joint.—*Not proceeded with.*

1719. J. E. REID, *Fleming-road, Newington,* "*A safety window-sash fastener and draught excluder.*"—*Dated 6th July,* 1861.

This invention consists of a hollow bar of brass or other metal fixed horizontally on (and the entire width of) the upper side of the meeting rails of sashes to ordinary windows, immediately over the cavity formed by the junction of the inner and outer sash. It is fixed by means of a continuous hinge partly let into the wood of the inner sash rail, and being in shape half round, or semicircular in section, it forms, when closed, a bridge over the before-mentioned cavity, its opposite edge falling into a small groove cut in the outer sash, thereby effectually excluding all draught. The ordinary catch of the present sash-fastener is not required, in lieu of which the hollow bar is made solid in the centre or point opposite the bolt, and a quadrant-shaped slot is cut in a transverse, and also in a horizontal direction, to allow of the free traverse of the spindle of the bolt.—*Not proceeded with.*

CLASS 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defences, Gun Carriages, &c.

1627. J. BROWN, *Norwich,* "*Window frames and blinds.*"—*Dated 25th June,* 1861.

For the purposes of this invention, in order more advantageously to employ wire gauze or perforated blinds for the purpose of ventilation, the upper part or arch of the opening for a window frame is cut away, if already built, in order to receive an air or perforated block in the form of a key stone, but in new buildings such arch head is to have a perforated block in stone, brick, or iron, with curves at the back of the same introduced in the arch when constructing it. The upper part of the window frame is enclosed above the top of the upper sash, so that there is a hollow chamber at the upper part of the window frame into which air can readily enter from the external air through the perforated block in the arch. In the interior of the room there are one or more openings or air passages into this hollow chamber, which are covered with wire gauze, or perforated metal, by which air may pass from the chamber above the sashes to the room, or from the room to the outer atmosphere.—*Not proceeded with.*

1629. S. WENTON, *Clerkenwell, London,* "*Ventilating apparatus.*"—*Dated 29th June,* 1861.

This invention relates, particularly, to the mode of arranging and giving motion to a series of what are technically termed louvre or buffer-boards, or flat strips or pieces of wood, metal, glass, or other suitable material, enclosed in a frame, and capable of being placed at any angle, so as to be capable of opening or closing the apertures in which they are placed to any extent desired.

1631. J. REDFERN, *Hanley, Staffordshire,* "*Raising the temperature of air in order to warm churches, conservatories, houses, &c.*"—*Dated 30th June,* 1861.

The inventor proposes fixing a fire grate in the centre of a circular plate. This circular plate will have attached to it an ash-box with register door, and a cylinder with fire-door will be placed upon it, such cylinder having an open top, on which he proposes fitting a syphon tube connecting this first mentioned cylinder with a second cylinder placed on a second circular plate, to which plate will be attached a flue to carry off the gases from the fire to the chimney. The above mentioned parts of apparatus may be made of iron or any suitable material.—*Not proceeded with.*

1645. H. HAMER, *Horsforth, near Leeds,* "*Chimney tops and ventilators.*"—*Dated 27th June,* 1861.

This invention consists in arranging and constructing apparatus with flanges and openings or apertures, in such manner that downward currents of wind will be reversed or diverted when coming in contact therewith, and caused to ascend, instead of descending, the chimney or ventilating shaft, thus tending to increase the draught.

CLASS 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

1606. J. CHURCH, *Upper Kennington-lane, Vauxhall,* "*Stand or rest for pianofortes, &c.*"—*Dated 22nd June,* 1861.

This improvement has for its object to increase the sounds of pianofortes and other musical instruments, such as harps, double bass, and others requiring to rest on the floor or other stand, and consists in a stand made of wood or any other suitable material, into which stand is placed a spiral or any other form of spring made of steel suitably tempered, or any other convenient metal, and upon this spring is placed a cover made of brass, or any other suitable metal or material, suitably formed for the castor or leg of the piano or other instrument to rest on, and which, for convenience, is fixed firmly by means of a screw and nut, or any other convenient means. These rests can then be placed one under each leg or castor of the piano or other musical instrument, as above mentioned.

1636. H. COULTER, *Philadelphia, U.S.,* "*Lamps specially intended to burn oils, and other inflammable fluids rich in carbon.*"—*Dated 26th June,* 1861.

This invention consists in directing to the upper part of the flame a large supply of oxygen of the air, which the inventor proposes to effect by enclosing the wick and lower part of the flame in a cap, the sides whereof are pierced with small holes for the passage of atmospheric air. One side of the aforesaid cap impinges against the flame, and at the opposite side space is left between the wick holder or tube and the cap for the purpose of creating a draught. The wick holder consists of a sliding tube connected to the top of the cap, and fitted with a spring for raising and lowering the same. The above mentioned cap may be formed with one or more slits, and instead of being entirely open at top may be partially closed.—*Not proceeded with.*

1658. G. GLASSBROW, *Rhadal terrace, Islington,* "*Pianofortes.*"—*Dated 8th June,* 1861.

This invention relates to various improvements upon the action of pianofortes, and applies more particularly to upright pianofortes. Among the most important features of the invention are the following:—The instrument is constructed with a double sounding board, or rather two sounding boards, placed back to back, and glued, or otherwise secured, to the strong timber framing on all sides except the top side, which is left open so that the sound may escape from the interior. By thus boxing in the framing, and forming a kind of sound or wind chest, great sonorousness is produced. A double set of strings are employed; one set is placed in front, as usual, and these are the strings which are struck by the hammers. The other set of strings is placed on the reverse side of the sound chest, that is, on the other sounding board, and, when both these sets of strings are drawn up in tune, the tension of one set will be found to counteract the tension of the other, and, therefore, the instrument will not be liable to get out of tune by any undue strain upon its parts, as is the case in pianofortes of the ordinary construction. The back and front pin-plates in instruments of the ordinary construction are made in separate and distinct pieces, and are screwed into the back and front of the wooden framing. Instead of forming the back and front plates of separate pieces, as heretofore, the inventor proposes to unite the two plates, and make them in the form of a trough or shoe that shall embrace and fit the under side of the framing, so that, when the strings are drawn up tightly on the pins, they will draw up the trough or shoe-plate, and hold the parts firmly together. This trough or shoe may, for convenience, be divided into two, three, or more sections, as may be desired. As there are two sets of strings, one at the front and the other at the back of the instrument, there must, of course, be two sets of dampers, one to act on each set of strings, and either one of the back strings will be set in vibration by striking the corresponding string of the front set. The corresponding dampers of both sets are made to act simultaneously, as they are actuated by the same mechanism which is set in motion by the keys which actuate the hammers. The motion from the mechanism in front is transferred to the back dampers by rods which pass transversely through the instrument. The whole of both sets of dampers may be operated simultaneously by means of a pedal lever, which, by means of suitable rods, transfers the motion from both sets. In order to prevent the hammers from returning and striking the strings a second time after the desired blow has been given the inventor employs a check action, which is made to bring a stop up against either the head or the butt of the hammer.—*Not proceeded with.*

CLASS 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

1611. J. S. MCARLE, *Galway,* "*Treatment of sea-weeds.*"—*Dated 22nd June,* 1861.

The sea-weed being freshly gathered on the coast, the first of the preliminary processes consists in washing it with water treated by steam for the purpose of removing all saline matter, which, to some extent, retards the decomposition which takes place in the next stage of operations, which consists in piling the mass of washed sea-weed up into a heap, when, by means of the usual effects of heating, fermental decomposition takes place, and the bulk of the materials becomes reduced; during the heating process the mass of weed operated upon must be kept dry. At this stage of the operation the patentee now reduces the mass down, and obtains the salts therefrom, leaving the alkaline and saline matter unaffected, the organic matters which are generally attached to the crystals being removed by a slight charring. The water which is employed for washing, after repeated use, gets saturated, and he then evaporates it, and obtains the crystals held in suspension. In order to obtain the ammonia, which exists to the extent of about 1½ per cent. in sea-weed, he mixes the weed with a caustic alkali, preferably potash, or with an alkaline earth, lime, and subjects the mass to distillation. The alkali here covers again in combination with the residual salts, which are unaffected by the process, and the hydrogen of a portion of the water, uniting with the azote or nitrogen of the sea-weed, passes off as ammonia, which is condensed by means of sulphuric or hydrochloric acid, forming sulphates or muriates of ammonia.

1650. T. SWINTERTON, *Dudley, Port Tipton, Staffordshire,* "*Manufacture of coal gas by the surplus or waste heat of the blast ovens and puddling furnaces used in the manufacture of iron.*"—*Dated 28th June,* 1861.

The patentee claims disposing or arranging (essentially in the manner described and illustrated) gas retorts in the said blast ovens and puddling furnaces, so that the surplus or waste heat of the said ovens and furnaces may heat the said retorts, and generate gas from the coal charged into the said retorts.

1656. W. CLARK, *Chancery-lane, London,* "*Distillation of solid and liquid combustible matters.*"—*A communication.—Dated 29th June,* 1861.

This invention consists in injecting in the middle of the combustible materials hot incombustible gases, so that the heating and destructive distillation may be, so to speak, interior and molecular, and have an active effect on the gaseous or liquid products which are evolved. The patentee employs this method of distillation for all combustible materials, either solid or liquid, or a mixture of the two under the name of incombustible gas is implied azote, carbonic acid, hydrogen, and other gases employed either separately or together, and previously heated. He can employ especially the fumes resulting from complete carbonisation. He applies, for example, this new method of distillation to peat placed in furnaces similar to those used in the manufacture of gas. In order to obtain greater results and more perfect distillation he reheats the volatile products generated in a new and special retort, in which all the carbonate of hydrogen liquids or tars are converted into gas.

1695. P. SPENCE, *Norton Heath, near Manchester,* "*Improvements in economising the manufacture of sulphuric acid, and in obtaining copper from ores used in such manufacture.*"—*Dated 3rd July,* 1861.

This invention relates to a peculiar method of roasting or calcining ores of copper containing sulphur, for the purpose of obtaining sulphuric acid, and the said method is also applicable to the treatment of ores in their native or other condition, for the purpose of calcining them, in order that copper may be obtained therefrom, according to the process for which letters patent were granted to the present patentee, bearing date the 3rd day of November, 1860 (No. 2,703). The essential feature of this invention consists in subjecting such ores to the action of a roasting heat as they are passed from one end of a furnace to the other, during which transference a current of air is caused to travel over them in an opposite direction. To accomplish this the patentee uses a furnace of considerable length, having several doors, for the purpose of introducing apparatus by which the transference may be effected.

CLASS 9.—ELECTRICITY.—NONE.

CLASS 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

1584. J. FLETCHER *and* J. W. FULLER, *Salford,* "*Machines for planing, boring, and turning.*"—*Dated 26th June,* 1861.

This invention consists in rendering such machines available for being used to plane two or more articles of different dimensions and shapes at the same time. In order to accomplish this the patentees make the bed with the required number of guides or grooves for two or more tables, each of which is furnished with a tool holder, and an independent starting, driving, and stopping apparatus. The improvements in machines for boring and turning are applicable to such machines as are capable of operating upon several articles at the same time, and they consist in certain improved combinations and arrangements of parts for boring and turning several articles simultaneously, and for starting and stopping them independently of each other.

1585. C. STEVENS, *Charing-cross, London,* "*Spiral springs.*"—*A communication.—Dated 26th June,* 1861.

This spring, which is of tempered steel or other metal, is furnished with two sockets of different diameters, the smaller being able to pass in the spring, and serve as a guide; the other forms a shoulder, and serves as a prop to the spring. These sockets have a groove crossing them in which the ends of two iron wire rods bent at their extremities rest. The springs thus arranged are placed where required, and instead of drawing on the two ends of the spring, so as to stretch it, the two ends of the spring are drawn on, but so as to compress it.—*Not proceeded with.*

1588. C. STEVENS, *Charing-cross, London,* "*Smoke consuming furnaces*"—*A communication.—Dated 26th June,* 1861.

These improved furnaces are constructed with two grates placed opposite and beneath the boilers and rectangular openings, 12in. long by 4½in. high, are made in the horizontal plan of the grates, allowing the divisions of the two fire boxes to communicate with a third compartment, which is situated between them, and in which the smoke is consumed. The third compartment or smoke consumer is divided into other compartments, corresponding with the openings made in the grates, as above mentioned, the number of which must depend on the length of the grate. The small divisions perpendicular to the longitudinal axis of the furnace, and serving to separate the smoke consumer into compartments, are only about half the height of the space which separates the grate from the boilers, thus allowing a free access above, by which the products of the combustion are conducted into the flue placed at the upper part of the fire bridge of the furnace. The course taken by the flames is as follows:—The air passes through the grate, is partly burnt, and then ascends and heats the boilers, and, finding no escape, descends and escapes by the openings above mentioned, which, being opposite each other, the flames on both sides become united in the smoke consumer. It is by thus uniting that the volatile products are consumed, and to effect this it is necessary that the grates be fed alternately, so that only one of the fire bars contains fresh coal at a time, the coal being in the other almost or entirely converted into smoke.

1590. A. N. LESUEUR, *Paris,* "*Manufacture of panels of ceramic or pottery ware.*"—*Dated 26th June,* 1861.

In carrying out this invention the patentee forms the panels with two grooves or mortices cut in dovetail in the back of the panel. These grooves may be made transversely, vertically, or otherwise, according to requirement. These grooves taken out of the thickness of the panel, and cut in dovetail mortices, constitute the principal part of the invention.

1596. G. TURNER, *Rose-terrace, Brompton,* "*Apparatus for beating eggs, &c.*"—*Dated 27st June,* 1861.

In carrying out these improvements the inventor employs, by preference, a rectangular frame, which is caused to rotate within a suitable vessel or chamber containing the eggs, batter, milk, or other fluids or materials to be beaten, agitated, or mixed. The rectangular frame is connected to a pin or axis which turns in a suitable frame or support, and rotary motion is communicated to the pin or axis by toothed wheels, or by other convenient mechanical means. The flat surfaces of the vertical bars of the rectangular rotating frame are placed at an angle to the outer circumference or sides of the vessel, so that, in their rotation, the fluids or contents of the vessel are forced towards the centre thereof; and the inventor prefers to form or intersect the rectangular frame with one or several diagonal, horizontal, or angular bars, to force or direct the fluids or materials in different directions. The vessel may be formed with, or surrounded by a chamber to receive steam, hot water, ice, freezing mixtures, or other materials as may be required. If desired, two or more rectangular frames, as above described, may be arranged to work together in the same vessel.—*Not proceeded with.*

1600. W. F. HENSON, *New Cavendish-street, London,* "*Floor-cloth.*"—*Dated 21st June,* 1861.

This invention consists in manufacturing floor-cloth, and other such like articles, by the admixture of flock with the material known as "kamptulicon," so as to produce a flock surface of the desired colour, and when required to be ornamented with any particular design, pattern, or device.

1601. W. HOBSON, *Sheffield, Yorkshire,* "*Steam hammers.*"—*Dated 21st June,* 1861.

This invention contemplates the substitution of a simple self-acting motion, and peculiar cylindrical valve, for the complicated gearing generally in use. To the guide handle is attached a slotted or mortised tabbett, which moves upon an elbow tabbett connected with the rod which actuates the steam valve; the trip or hammer in moving strikes against the elbow tappet, and, therefore, influences the sliding tabbett, rendering the combination self-acting. The valve is cylindrical, and acts vertically; it is formed with flanges, so as to admit of a concentric space for steam. When the valve is raised, so that the top flange passes over the steam port or orifice in the top of the cylinder, this port becomes the inlet, and depresses the piston and hammer. The length of the valve is so regulated that the lower steam port is then below the lower flange, and becomes an exhaust port, the steam passing off through the centre of the valve to the exhaust pipe at the top. When, on the contrary, the valve is depressed, the lower flange passes below the port in the bottom of the cylinder, which then becomes the inlet, the exhaust steam passing off by the top port to the outlet.

1603. J. H. JOHNSON, *Lincoln's-inn-fields, London,* "*Reproduction of forms of objects applicable to the production of printing surfaces.*"—*A communication.—Dated 2 st June,* 1861.

The essential feature of the new processes which constitute this invention is the employment of expansible and contractible plastic substances, such, for example, as gelatine, gluten, coagulated albumen, caoutchouc, and plastic substances used in the ceramic art, fibrine, and other substances of an analogous nature.

1608. J. COMRIE, *Stirling,* "*Churns.*"—*Dated 22nd June,* 1861.

Under one modification of this invention the arrangement of the churn consists of two cast iron end standards, connected in the usual way by means of tie bars. The upper ends of these standards form the bearings for the axle of the churn or milk holder. The churn is made of wood, and is formed of an elliptical figure, which is arranged with its longer axis in the horizontal plane. This oval box is supported in the end standards by means of T-shaped iron straps, which are screwed to the sides of the churn, and have laterally projecting studs which are supported in the forked ends of the standards. An opening is formed at the upper part of the churn to admit of access to its interior, and this aperture is fitted with a lid in the usual way. Parallel with the opening are fitted two handles, by means of which the churn is put in motion. Inside the churn are fitted three vertical partitions; these are perforated, and the central portion of each is made to slide up and down in grooves which are formed in the fixed side pieces. When the churn is put in motion the operator causes it to rock to and fro by means of the handles; with this oscillatory movement the milk falls to the lower part of the churn, and in its descent it passes through the perforations in the partitions, and is thereby very effectively churned. The manner in which the churn is suspended renders the labour of churning very light, and from the peculiar arrangement of the parts the time usually required is reduced.

1610. R. RUSSELL, *Sheffield,* "*An improved valve.*"—*Dated 22nd June,* 1861.

This invention embraces a valvular arrangement suitable for various purposes, whereby the flow of water is so directed that the pressure from the inlet is made available for shutting off the supply. A valve seat is formed above the outlet in the valve-box or cylinder, and above the valve seat in connection with the inlet, an orifice, the water-way of which is regulated by a wedge and screw; this orifice communicates with a water port or channel which leads to a converge receptacle; beneath the outlet from the bottom of this receptacle there is a small water passage, which may be closed or opened at pleasure. To the spindle or valve rod two valves are attached, one with the face towards the valve seat above the outlet, and the other with the face towards the dished receptacle below the outlet. When the small water passage from the receptacle for the accumulation of water below the main outlet is open the water passes away, and relieves the face of the lower valve from pressure; the water then acts with full force on the face of the top valve, and depresses it below the main outlet, through which it flows uninterruptedly until the water passage communicating with the dish or receptacle is again closed. The valves actuated by a ball and lever attached to the spindle or valve rod are then raised, the water flows from the inlet through the port into the receptacle below the main outlet, and, acting on the face of the lower valve, presses the top valve firmly on its seat, and thus effectually precludes the further flow of water.—*Not proceeded with.*

1616. E. DANCE, *Bolton,* "*Crinoline fastener.*"—*Dated 24th June,* 1861.

This invention consists, essentially, of a flat metallic tube, in the interior of which the ends of the crinoline hoop are held by means of teeth or serrations situated within the said tube.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

CONTINUED DULNESS OF THE IRON TRADE: *How the Breaking of the Blockade would be Received*—THE QUALITY OF THE IRON NOW BEING MADE IN SOUTH STAFFORDSHIRE—CHANGE IN THE PROPRIETARY OF THE CORBYN'S HALL WORKS—FORGE AND MILL FURNACES IN SOUTH STAFFORDSHIRE IRONMASTERS TO "MOVE ON" IN WOLVERHAMPTON—DEATH OF MR. JOSEPH HALL—COAL TRADE—GENERAL MANUFACTURING TRADES—THE ACT RELATING TO MARINE STORE DEALERS: *Salutary Influence on Dealers in Old Metals*—THE ZOLLVEREIN TARIFFS AND THE MANUFACTURERS OF THIS DISTRICT—THE TRADERS AND THE RAILWAY CARRIERS—STATE OF TRADE IN AMERICA—FEARFUL COLLIERY ACCIDENT NEAR DUDLEY—OPENING OF A BRANCH OF POTTERIES STREET RAILWAY—COMMENCEMENT OF A LOCAL RAILWAY.

WE are unable to report anything satisfactory of the trade in Birmingham and South Staffordshire this week. Some ironmasters report a slight accession of orders, but they are not easily to be traced. Others, however—and by far the larger number—say that business is really no better now than it was during the time that it was feared there might be war with America. The expectation of a thorough revival in trade seems to be given up until the strife between the Northern and Southern States of America shall have ceased. The breaking of the blockade would be heartily welcomed, for, although ironmasters would desire that the Americans should themselves fight it out, yet the end seems to be so far off that the consequences, to nearly every branch of trade in most of the European countries, and in England and France in particular, are now so serious, and will become increasingly so as the conflict lasts, that such an intervention as is now so broadly hinted at is regarded as likely to prove scarcely other than a necessity. The suspension of Messrs. J. and G. Calvert and Co., of the Railway Foundry, York, was talked of in Birmingham and Wolverhampton very widely, but there is no reason to conclude that this district will be affected. The Canadian orders for thin sheets, and the like, are not yet in hand to any great extent. Much of the best iron now being sent away is going, in great part, to London to be sent out as back cargoes.

Iron is being made in South Staffordshire at this date that will reflect every credit upon the district. We have more than once adverted to the case with which the Government tests are being met by firms whose names are well known wherever iron is used, and to the folly of any house that may have recently entered the finished iron trade, supposing that they have acquired the Yankee gift of "licking" all who have gone before them. An instance has come under our observation in the past week, in which a maker, who is so far from being able to class himself with the "great firms," that he has a capacity for turning out not more than one hundred tons a week, yet he is making boiler plates in the ordinary course of business that bear a strain of 27 tons; and he, too, has just sent to

Woolwich a piece of iron "to be tested by the Government authorities," that he warrants will bear a strain of 36 tons to the inch. Referring to a recent notable example of the parading of the iron of a certain distinguished maker, this man expressed himself in a style which indicated in an unmistakeable manner that in even his opinion the professional character of the trade had been little less than traduced by such tests being boasted of as exceptions.

The Corbyn's Hall Malleable Ironworks have been taken by Mr. Henry Sparrow, to whom a lease has been granted, and the stock, &c., sold. The firm was "The Corbyn's Hall Malleable Iron Company" up to the 9th instant, on which day the purchase by Mr. Sparrow was made. The works will be carried on by Mr. H. Sparrow in his own name.

A statement just compiled and published by Mr. Samuel Griffiths shows that there are in the South Staffordshire district 1,982 puddling furnaces in, belonging to seventy-eight different firms, and 100 distinct works.

A police notice was posted in Wolverhampton yesterday warning the ironmasters from meeting in the open street after the 5th of next month on pain of being summoned. They have been accustomed to assemble weekly in front of the hotel of that town.

The founder of the eminent firm of Barrows and Hall, of Bloomfield (Mr. Joseph Hall), has died since our last. His demise occasions universal regret throughout the trade.

The coal trade is brisk in household samples.

The general manufacturing trades of Birmingham and Wolverhampton remain very dull; and they present no features calling for mention. Mr. John Rubury, an umbrella manufacturer, whose liabilities are estimated at £30,000, suspended on Monday. He has had heavy losses in the American trade.

A large amount of satisfaction is being expressed by the manufacturers of Birmingham and Wolverhampton at the existence of the new law relative to dealers in old metals. For many years past employers have been seriously plundered by their workpeople, in consequence of the facilities which the marine store dealer enjoyed, of purchasing the proceeds of such plunder, and on account of the many difficulties which were in the way of successfully punishing either the thief or the receiver. By the new law, however, which has just recently come into operation, many of these difficulties are overcome. Steps to improve upon the existing law were first taken by the Birmingham Chamber of Commerce, efficiently aided by Mr. Kynnersley, the stipendiary magistrate of that town. By these it was felt that what was wanted was a provision which, in the case of goods reasonably supposed to be stolen, would cast upon the person in whose possession they were found the onus of proving that he had acted honestly and with due caution in purchasing them. Although this was no new principle in law, yet the Legislature, who had recognised it in the Metropolitan Police Act, in the Improvement Acts of Liverpool and other boroughs, declined to extend to manufacturers in metal the protection which was conferred upon many other classes of traders. When it was proposed to place marine store dealers under police control there was an instant outcry about the liberty of the subject, although it was conclusively shown that no fears on this head need be entertained, since no dealer would be subjected to police surveillance until he had been actually convicted of receiving stolen goods. It was not until last session that any measure at all could be obtained, and even then the bill sent up from Birmingham was submitted to a process of clumsy tinkering which deprived it of half its value. As the bill originally stood it would have given the police authority to seize promptly upon metal goods suspected to have been stolen, and the possessor would have been compelled to give a full account of how he became possessed of the property, a hold being constantly kept upon him by compelling him to register himself at the police-office as a dealer in old metals, and to keep a detailed account of the persons with whom he dealt, the goods he bought, and the mode in which he disposed of them. The bill would also have provided a very simple and expeditious form of procedure, and have contained an ample definition of the words "marine store dealers," from which the acutest member of the class would have found it impossible to claim exemption. Although the existing bill was greatly mutilated and defaced in going through Parliament, it will still be found a vast improvement upon the previously existing laws. It may be convenient to indicate briefly the leading provisions of the measure. A "dealer in old metal" is defined to mean any person dealing in, buying, or selling old metal, scrap metal, or partly manufactured goods, whether he deals in such articles only, or together with second-hand goods or marine store. A complaint being made to a justice that the complainant believes old metal to be kept or secreted in the shop or house of a dealer in old metals, the justice may empower a constable by special warrant to search for and seize all such metals; a summons is to be then issued to the metal-dealer, and, if he cannot satisfactorily account to the justices for his possession of the articles in question, he may be fined £5 for the first offence and £20, or three months' imprisonment, for the second offence, or as at present he might be proceeded against by indictment at Quarter Sessions. When a dealer in old metals has been convicted under the section just mentioned the justices may order him to be registered for three years in the police books, and on every subsequent conviction the period of registration may be extended for three additional years. When any such registered dealer removes to any other town he must give notice to the police of the town to which he has removed, in order that the unexpired period of registration may be completed, notwithstanding the removal. A metal dealer, who has subjected himself to registration, is placed under the direct supervision of the police, who may search his premises at any time without special warrant. The dealer must keep a book in which he must enter an account of all old metals in his possession, specifying the names, addresses, and occupation of the purchaser, the vendor, and the persons to whom the goods may have been afterwards disposed of. He must not purchase old metal before nine in the morning or after six in the evening, or from any person under sixteen years of age, nor shall any person under that age be employed upon his premises. He must keep every article purchased by him without changing the form in which it was when purchased, or disposing of the same in any way, for a period of forty-eight hours after such article has been purchased or received. He must give immediate notice to the police of the receipt or possession of any stolen property of which a description may have been left with him. Finally, at any time when he may be required, he must produce to the police the book containing entries of all his transactions. In certain cases an appeal is allowed to the Quarter Sessions, and it is provided that the act shall extend to England only. The measure would, undoubtedly, have been more effectual had it provided for the preliminary registration of all old metal dealers, and had it authorised the police to make searches without special warrant; but the latter difficulty will, no doubt, be got rid of by the police assuming the responsibility of taking action in cases of strong suspicion. With all its defects the act will do a great deal towards preventing the enormous frauds hitherto carried on by the assistance of marine store dealers, and the warmest thanks of every mercantile community, and we would add, of those three especially which are the seats of the hardware trades in this country, are due to the Birmingham Chamber, and to Mr. Kynnersley, who has further increased the previous obligation by publishing a little book entitled "The law relating to dealers in old metals."

On the 12th ult. a letter was addressed to the Wolverhampton Chamber of Commerce, from the Board of Trade, inquiring the effect of the existing Zollverein duties upon the branches of trade in this district, and the nature of the alterations required to place them upon a satisfactory footing. In answer to this communication the secretary, on the 17th instant, was directed to reply that the products of the Wolverhampton district were divisible into two classes—first, iron and steel in various stages of manufacture, as pigs, bars, and boiler plates; and, second, finished goods coming under the general denomination of ironmongery and hardware. With regard to the former, as the Board of Trade have lately been in communication with the London Committee of the Iron Trade, it was thought unnecessary to add anything to the representations that had been made. With respect to ironmongery and hardware the letter of the chamber states that scarcely any trade in these goods is carried on between Wolverhampton and the Zollverein states, by reason of the heavy duties imposed. Thus on nails, flat irons, and chains, the price of which varies from £7 per ton upwards, a uniform duty of £18 per ton is levied, being, in many cases, more than £200 per cent. In order to promote any trade at all with the countries included in the Zollverein, it is first necessary that all the duties on iron and steel should be very largely reduced. The next point to be considered is the way in which such duties are to be levied, and the chamber are of opinion that the only fair and just way is by an *ad valorem* rate. It is impossible they say to classify heavy goods in such a way that specific duty can be even roughly approached. Besides, *ad valorem* duty is so simple as to facilitate the operations of business, and render easier any alteration or reduction of the tariff. If the Zollverein authorities should insist on specific duties the arrangement already adopted under that tariff appears to the Wolverhampton chamber preferable to that adopted as the French tariff, with some few exceptions, which are afterwards pointed out. The letter concludes by offering whatever assistance can be given by the chamber.

The railway carriers have recently resolved upon an alteration in their rates, which will seriously affect the interests of a large number of our readers. The authorities of the Railway Clearing House have resolved not to allow special rates for any quantity of goods less than two tons, instead of one ton, as before. The matter has been taken up by the Wolverhampton Chamber of Commerce, and it was discussed at the last meeting of the council of that body, held on the 17th inst. Members expressed their views upon the subject somewhat strongly, and pointed out the extremely injurious effect that such a regulation would have upon the trade in iron and hardwares. A sub-committee has been appointed to communicate with the Chamber of Commerce of Birmingham, and with the Ironmasters' Association on the subject, and the secretary of the chamber has forwarded to the clearing house the following document:—"I am directed by the council of this chamber to call your attention to the new rule established by the Railway Clearing House, which provides that, from the first of February next, no goods shall be carried at special rates, except in lots of not less than two tons. The consequence of that rule will be very serious and prejudicial to the trade of this district, and indirectly, as we cannot but believe, to the railway companies themselves. It will, in the first place, almost prohibit the sending of sample orders in many classes of goods in which samples of more than one ton are very rare. In the next place, it constantly happens that, although a contract may be made for twenty or thirty tons, yet the deliveries on such a contract are made as required by the customer. In another case, the greater part of an order may be completed, while arrears remain which could easily be made up to one ton, but not so easily to two tons. One firm in this town, paying to carriers £400 per month on an average, complains that the new rule will raise the rates on fully one-half of its deliveries to such a point that it will not pay to deliver. Another firm writes:—'We forwarded, during last year, 2,763 orders in quantities of under two tons. It will, if this arrangement is enforced, render it necessary, on our part, to decline the majority of such orders, and so cripple our future trade.' These are two cases out of many. It appears to the council of this chamber that, when these facts are placed fairly before the authorities of the railway companies, they cannot fail to see the injury that will be done both to trade and to traffic, and the necessity of abolishing a rule so injurious." This is a course of action on the part of the Wolverhampton chamber which reflects considerable credit upon them, and if the matter is as vigorously taken up by the Birmingham, Sheffield, and other chambers, we have no doubt but that the railway companies may be induced to reconsider the determination to which they have come. The case is very fairly stated in the letter given, and it is clearly indicative of the fact that there is reason to conclude that such a rule may work injuriously to the interests of the carriers themselves.

Some of our readers will be not a little surprised at the state of trade in America in certain branches, as described in the following letter, dated Boston, Dec. 31, and which has been received in Wolverhampton:—"One thing astonishes me here. All of us have many friends who have gone to the war—indeed, the list would be almost endless if we were to try to name them all, and we know that an army of more than half a million volunteers has been raised in an incredibly short time—yet we do not miss the men. The streets seem to be as full as ever of strong able-bodied young men. Business also has revived, and appears to go on as briskly as ever, though more of the articles bought and sold are of our own manufacture, the importations having been very small; and they tell me, at the jewellers and fancy goods dealers, that no holiday season for years has brought them more customers. No one can be more surprised than ourselves how we bear so great a strain. There is as much courage for the good cause now as at first." Another letter received in the same town, and dated New York, Dec. 28, says—"We are getting immense quantities of arms from Germany. My son is now unloading a ship for the Government that has brought 2,100 cases of rifles."

A terrible accident has happened at the pit of Mr. W. H. Dawes, at Blackheath, near Dudley:—"On Saturday morning Mr. Llewellyn, the chartermaster, heard a noise, as if an explosion had occurred down the pit, and immediately there arose from the upcast shaft an immense volume of smoke and rubbish. An engine of about 14-horse power has been used down the pit for drawing the loaded skips out of the deep workings, and also for the purpose of pumping water out of the deep into the 'sump.' What occasioned the noise that Mr. Llewellyn heard is not at present known; but it is conjectured that the boiler burst, and scattered the burning fuel in the furnace about in every direction, setting fire to the adjacent supporting timbers, and that thus the conflagration extended upwards out of the stone pits into the coal workings. The flames extended up one of the shafts, and almost set on fire the pit frame above, while the cold air rushed down the other shaft to feed the flames. It was attempted to smother the flames by throwing large quantities of water down the up-cast shaft, but it was altogether ineffectual. The up-cast shaft was then scaffolded over and covered with rubbish to prevent the air getting down the pit, but it was of very little use, the flames continued to make way, and the 'guides' and other appliances inside the shaft were entirely destroyed. The other shaft was then scaffolded over and thickly covered with rubbish and sand; but still the smoke came through the mass of covering above, and was plainly visible during the whole of Sunday. There were three men in the pit at the time the accident occurred, and also seventeen horses. During Saturday several attempts were made to descend one of the shafts, but it was perfectly impossible to do so for some time, the steam and smoke which arose being very dense and suffocating. At last the engineer on the 'bank,' with two colliers, managed to get to the bottom of the down-cast shaft, and they immediately went to look for the men; but it was impossible to get anywhere near them, as all the passages were on fire. Four horses were seen dead in one of the stables, but the others could not be reached. The horses are computed to be worth at least about £350 or £400. There is not the remotest chance of ever recovering either men or horses, as the mine will very likely continue to burn for weeks, and all in it will be reduced to ashes. During Sunday the workmen were busily engaged in heaping up sand on the top of the shaft mouths, and the result of their labour has been that no smoke is now seen to arise, so that it may be fairly assumed the fire is gradually smouldering away. More than a week must, however, elapse before even the downcast shaft can be opened, or any correct idea of the devastation be formed."

The Hanley and Burslem branch of the Potteries Street Railway has been opened, and it is about two miles in length. The line is part of a projected line to connect together all the Pottery towns. The inauguration was celebrated in both Hanley and Burslem with spirit.

The first sod of the Nantwich and Market Drayton Railway has been turned. The company which is constructing the line was formed about eighteen months ago, and the act was obtained last session. The line was laid out by Mr. John Gardner, engineer, of 18, Adam-street, Adelphi, London. It will be probably the cheapest ever constructed, the cost being only £5,000 per mile. The country through which it passes is extremely level. Not only is there no tunnel, but there is no heavy cutting or embankment, and the direction is nearly straight, the sharpest curve being of 40 chains radius, and the steepest gradient 1 in 150. The land has been acquired on very favourable terms compared with what has often been, the case as the landowners have all been desirous of securing the line, and about half of them hold shares. The capital of the company is £60,000, in 3,000 shares of £20 each, and the borrowing powers extend to one-third that amount, making the total available capital £80,000. The local gentry, &c., have taken shares to the amount of about £40,000. The act was unopposed, and it cost only £2,000. The line is at present to be single, but sufficient land has been secured to enable another line of rails to be laid down when circumstances shall justify that course. The engineer's estimate for the construction was £45,000, and the actual contract has been taken by the eminent contractors, Messrs. Brassey and Field, for £44,750, and it is understood that the contractors, as is now usually the case, take a portion of the payment in shares. The line is to be completed in eighteen months from its commencement. Four projects are in Parliament which would afford an extension of the line in that direction. One is the Wellington and Potteries line, another the Wellington and Cheshire Junction, and a third the Drayton and Norton Bridge, a fourth the Drayton and Newport, with an intention to extend from Newport to Wolverhampton, and this project is favoured by the Nantwich and Drayton Company.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(*From our own Correspondent.*)

THE IRON TRADES OF SCOTLAND AND THE NORTH-EASTERN COUNTIES—NORTHERN MATTERS: *Wansbeck Valley Railway: Large Ropes for Inclined Railway Planes: Progress of Sunderland Dock: Newcastle Town Council: The Lendal Bridge at York*—THE BOILER EXPLOSION AT BYER MOOR COLLIERY: *Letters from Mr. Matthias Dunn, Government Inspector of Mines*—THE STOCK OF COTTON: *Increasing Gravity of the Question*—GRAND TRUNK RAILWAY OF CANADA: *Mr. Watkin going out again: Manchester and Improved Railway Communication in British America* — INFORMATIONS UNDER THE MINES REGULATION AND INSPECTION ACT — MERSEY DOCK BOARD—STATE OF TRADE AT SHEFFIELD—GLASGOW: *Parkhead Forge Works: Railway Contracts: The Cunard Line of Steamers.*

We find the following observations in a trade circular in regard to the north eastern and Scottish iron trade:—"The year 1861 opened with an uneasy feeling, arising out of the unsettled state of affairs in the republic of North America. Taking a general review of the pig iron trade of Scotland of last year, it exhibits, upon the whole, a somewhat improved aspect. It is true the greatly enlarged shipments that characterised the first six months were not sustained, the total deliveries, throughout the year, showing an increase not exceeding 20,000 tons. This result, however, although short of what at one period was expected, must, considering the interruption to our transactions with America, be regarded as not unsatisfactory, as it affords an indication that at least the trade has taken a turn for the better. Prices, during the year, have ranged between 47s. and 51s. 9d. for mixed number warrants, the quotation at the close being 48s. 6d. The most disheartening circumstances connected with the Scotch trade is the large addition that has been made to the already heavy stocks, and with such accumulation, so long as the demand continues limited, effectually represses every effort towards improvement. Referring to that now great rival district on the north eastern coast of England, and in the proceedings of which much interest is now felt by the trade, what are the results that may be reported from the operations of last year? The number of furnaces that have been in work, for longer or shorter periods throughout the year, is 66. The aggregate produce of pig iron from these furnaces may be estimated at 607,000 tons. The present number in operation is 60, and there are now 40 furnaces out of blast. The statistics compared with those of the previous year, show that sixty-six furnaces in all have been employed in place of sixty-eight, and that the make has been curtailed by about 26,000 tons. That sixty furnaces are now in blast, instead of sixty-five at the close of 1860. The foreign exports show an increase of 38,300 tons compared with the shipments of 1860, and the home consumption a diminution of something like 74,300 tons. The stocks are 2,000 tons less than they were twelve months ago, and, from their insignificance, contrast strikingly with the enormous stocks on hand in Scotland. It may be asked, "Why this amazing discrepancy?" The answer is simply this—that in the North of England there exists no class of buyers, as is the case in Scotland, intermediate between the producer and consumer. The consequence is, that, beyond the ability or inclination of the maker to hold, the manufactured article passes directly from the furnaces into consumption. Throughout the year the quotations, issued from an official source, have ranged from 50s. to 47s. 6d. for No. 1, and from 45s. to 44s. for No. 3, shipped free on board. The present quotations are 50s. No. 1 and 44s. No. 3."

As regards northern items it may be added that the directors of the Wansbeck Valley Railway have made a satisfactory trial-trip over the line, which will be opened for traffic between Morpeth and Maldon in a few weeks. Some of the largest wire-ropes ever used on inclined planes have been made for the Mahanoy Mountain Railway by Messrs. R. S. Newall and Co., of Gateshead. One of these ropes measures 8in. in circumference, and is 471 fathoms long, weighing nearly 12 tons. The affairs of the River Wear Commission seemed in a flourishing state, the tonnage using the dock having increased last year to the extent of 36,327 tons, while the gross revenue of the dock advanced from £45,874, in 1860, to £50,961 in 1861. The Executive Committee of the commission reported at the last meeting of that body:—"We have ordered the erection of two new breakwaters in the Southern Outlet, which will have the effect of materially stilling the waves and checking the force of the sea, and we have also ordered a number of loose timber booms to be prepared ready to let into grooves immediately in front of the gates, which we think will afford them a great protection. We have ordered the necessary repairs to be made at the southern gates, and also to restore the woodwork that was destroyed on the north pier of the outlet. The subject of the dock gates, and more particularly the removal of No. 1 45-feet gate at the northern entrance, has attracted much of our attention, and, looking at the importance of this subject, we have deemed it prudent to request our engineer to confer with Mr. Harrison, C.E., on these matters, and we hope, at no distant period, to be able to lay before the board the result of their united judgment. We contracted with Messrs. R. Thompson and Co. for two new hopper vessels, which are now completed and ready for use. We have given directions for the erection of a new ballast crane at the south end of the docks, and for a new ballast tip at the South Outlet. We also have to state that we have been obliged to order a new engine for the use of the works at the cofferdam in the Northern Half-tide Basin, and have agreed with Messrs. Nicholson and Co., of Newcastle, for the same." The engineer (Mr. Meik) reported that the quantity of material raised by dredging during the season had been 490,826 tons. At a meeting of the Newcastle Town Council last week a tender from the Derwent Iron Company for the supply of rails and other materials in connection with operations on the quay was accepted. The re-construction of the hitherto Lendal bridge, at York, has been entrusted, we understand, to Messrs. Hawks, Crawshay, and Sons.

A fatal boiler explosion at Byer Moor Colliery was noticed in a paragraph in last week's ENGINEER, and the result of

the official inquiry was also announced. Mr. Matthias Dunn, Government Inspector of Mines, writes on the subject:—"The principal features of the case were as follow:—Two boilers, each 40 feet in length and 5ft. 3in. in diameter, were applied to work the colliery engine. The plates were ⅜in. in thickness and 7ft. in length, and were purchased from three different manufacturers, chiefly in Yorkshire. Each boiler was properly fitted up with double safety valves, one 4in. and the other 5½in. diameter; as also a steam gauge, duplicate feed apparatus, one common and another with Turnbull's whistle attached; also a sludge-pipe, which was opened to let off a few inches of water several times a day. The fire was at one end, and was connected with a wheel flue which passed the flame underneath, and afterwards around the boiler. At the time of the accident the consort boiler was off, and although the steam was required to be up to 30 lb. per inch, yet very little work was doing. The boiler was rent into four pieces, some of which were thrown to a considerable distance, and the portions over the fire showed indubitable proofs of having been overheated. It came out in evidence that both boilers, although so little worn, had been under repair; and that the fatal boiler, having been seen to leak and to bulge out, had the plate over the fire, 7ft. in length, taken out and replaced by one of the Farnley plates, which plate, in turn, had suffered extreme heat. A most important part of the evidence was the statement that this boiler had been thoroughly cleaned only four days previously, and that very little sediment had been discovered in it. Mr. Thompson, the colliery engineer, admitted 'that the boiler had given way immediately over the fire.' A very small 'furring,'—$\frac{1}{16}$in. thick—was produced as having been taken out of the boiler at the last cleaning, which he alleged to be quite different from ordinary 'furring,' as it had been produced in four days. This deposit, witness considered, would keep the water off the plate until it got hot, when the pressure of the steam and water in the boiler would bulge the boiler and break the deposit, and then the water would come in contact with the hot plates over the flue and would cause the explosion. The water was drawn from the Busty Bank seam of the pit at nights and put into a pond till used. The workmanship and fittings of the boilers were unexceptionable. Sunderland, the enginewright, was at the cleaning four days before, and 'saw nothing peculiar; there was no deposit similar to this specimen produced. The boilers were cleaned once a week. He was on the boiler twenty minutes before the explosion, and reported the valves, &c., as being all right. Had never seen a deposit like this before. There would be 3ft. 4in. of water over the fire when the boiler was in working order.' Mr. Berkley, the colliery viewer, explained that these boilers had only been at work two months, and that nothing had been done in the pit to occasion any material change as regarded the water used in the boilers. The conclusion come to by Mr. Thompson was concurred in by several engineers and boiler-builders, who all agreed in their approbation of the workmanship and the efficiency of the boilers, at the same time admitting that they had never experienced so rapid a formation of incrustation as was here reported. I think it my duty, therefore, to review the circumstances under which the explosion took place, and to endeavour to discover whether some other principle than that dealt with may not be assigned as having been concerned in causing the explosion; and on discussing the subject it is not a little remarkable that these boilers, under a pressure of only 30 lb. per inch, should each of them show signs of decay within two months of their being in operation; whilst the state of the water was admitted to have been, until very recently, satisfactory. One of the most striking facts in connection with this explosion is, that the boilers have, in three several instances, yielded to the influence of the firing, although the fire was about 3ft. distant from the bottom of the boiler. This fire had first to pass completely underneath the length of the boiler, then to turn into one of the flues, along which it passed to the fore end, and down the other side of the boiler, and finally out to the chimney, the length of which course could not be less than say, 140ft. or 150ft.; and taking the contents of the boiler, half full, at nearly 3,000 gallons, it necessarily demanded a succession of intense firing, the result of which may have produced effects not prominently brought to view. It was, therefore, this impression which induced me to put the question, 'Whether two fires instead of one might not be advisable?' in such a case as this, by distributing the heat more equally around the boiler. In conclusion I may state that I should feel much satisfaction if the above remarks should be the means of inducing any one amongst those who are scientifically and practically engaged in mechanical pursuits to turn their attention to this subject, in the hope that they might find a satisfactory solution of the cause of accidents of this description, which hitherto have so frequently baffled investigation. It may be well to bear in mind that this boiler was constructed of iron from three different manufacturers, and that it is probable such varieties of iron may possess different degrees of expansion and contraction, and therefore might affect the question at issue."

The deficiency in the receipts of cotton is now painfully visible in a statistical point of view, and will become more and more apparent week by week. Thus, the imports to the 18th inst. were as follow as compared with the corresponding period of 1861:—

		1862.		1861.
American	bags	109	..	117,667
South American		10,594	..	1,814
W. Indies, Demerara, &c.		—	..	112
East Indies		27,734	..	7,728
Egypt, &c.		7,876	..	10,091
		46,313		137,412

While the imports this year have thus declined to the extent of 90,099 bales, as compared with 1861, the exports in the same periods increased from 4,011 bales last year to 18,553 bales this year, 13,443 bales of American and 5,110 bales of Indian having been re-shipped. Yet stocks at Liverpool are still well maintained in consequence of the increasing curtailment of business by spinners. Thus the latest figures exhibit the following results:—

	Jan. 17, 1862.	Jan. 17, 1861.
American	235,520	364,570
Pernambuco	11,030	2,470
Bahia	16,040	310
Maranham	3,560	6,920
Egyptian	14,180	25,260
Common West India	700	2,530
Surat, &c.	285,740	117,810
Total	566,790	519,870

An increase of stock is here apparent as compared with last year to a no less extent than 46,920 bales. The quantity taken by the trade on speculation and for export to the 17th inst. was as follows as compared with the corresponding period of 1861:—

	Trade.	Speculation.	Export.
1862	74,830	107,660	21,128
1861	145,190	46,770	7,032

The receipts, it is to be feared, from sources other than American, will be for some time on a restricted scale, as less than 100,000 bales are now estimated to be at sea *en route* for Liverpool, as compared with 335,000 bales at this time last year. All these figures, it must be admitted, are of a gloomy cast, and justify, we fear, the following observations from the *Manchester Guardian*:—"The spinners of a large proportion of the yarns produced in this district would willingly exchange the finished article for the raw cotton, weight for weight; and the makers of the bulk of the cloth produced in this district would willingly barter that cloth, weight for weight, against yarns wherewith to weave more such cloth; but neither holders of cotton nor holders of yarn will venture upon such transactions. We are assured by not a few millowners that, taking the present price of 'middling' or 'middling fair' American cotton, and the present price of printing cloths, shirtings, &c., the loss is not less than fourpence per pound. He who turns off weekly 10,000 pieces, weighing each 8¼ lb., will therefore incur upon them a loss of £1,333. Let that go on for a year and the sacrifice would be £69,316. A great many are not quite in this predicament. The trade may hold (though many say not) an average of a month's supply of cotton, laid in at different steps under this day's prices; but every week will subject more and more to the destructive action of this terrible screw. In the coarser goods the loss is not so great, but it is most serious. Those who buy yarns and weave it into cloth are not suffering nearly so much as those who spin as well as weave: the latter lose by both processes. According to the lowest calculation the productions of yarns and cloths is reduced 50 per cent.; more generally it is considered to be 60 per cent. Selling commission agents are the best judges in the case, and our inquiries are made from them as well as from great numbers of producers. There is no choice. Every day and every week will rapidly carry further the curtailment of spinning and weaving. Many are preparing to close their works (as others have been doing) when their stock of material is used up. Others are going from four to three, or from three to two days a week. Already the hands entirely unemployed are numbered by thousands in single localities. Looking at this and at the coming increase, the question is anxiously put on every hand—how are these people to be kept? And the question will press more and more from this time. To avoid, as long as possible, a total stoppage, some employers will at once go from four days a week to two (even a single day is spoken of), until the cotton or yarn in hand shall be used up." Mr. E. W. Watkin, the late general manager of the Manchester, Sheffield, and Lincolnshire Railway, is about to proceed again to Canada to make a further inspection of the Grand Trunk Railway of that great colony. Mr. Watkin will also endeavour to make improved arrangements as to the management of what has hitherto proved a most unfortunate and disastrous concern. Mr. Watkin is a gentleman of undoubted ability and perseverance; Messrs. Baring have, we think, rendered a great service to the undertaking in associating him with it; and if Mr. Watkin does as much for the Grand Trunk as he has effected for the Manchester, Sheffield, and Lincolnshire, he will deserve the lasting gratitude of the bondholders and shareholders. Mr. Watkin has been the means of inducing the General Purposes Committee of the Manchester City Council to adopt a memorial to Lord Palmerston, in which the following important observations occur:—"That independent access to the immense territory on the North American continent belonging to the British Crown, and to 3,000,000 of British subjects, is, from the want of internal communication, virtually closed for nearly five months of the year, during which period it is, in case of need, matter of extreme difficulty, cost, and danger, to send military succour to the provinces; whilst, under the circumstances, and at all times, British goods for Canada and the territories beyond, and all food or other produce therefrom destined for Great Britain, have to pass through the territory of the United States. That, in the opinion of your memorialists, it is essential to the safety not less than to the secure possession of the British North American provinces that they should possess within themselves an internal communication (which shall be at all times open, and secure from stoppage in winter) with Halifax, the best open harbour on the Atlantic. That the outlet to the Atlantic for the vast British possessions in North America, formerly possessed, was given up by the cessions of territory under treaties of doubtful wisdom; whilst, as your memorialists believe, the construction of a railway of 350 miles, which would complete the chain of railway communication, about 1,400 miles in length, from the Atlantic at Halifax to the extreme western boundary of Canada, would go far to restore the position sacrificed. That in case this important route be ever completed the British people might reasonably anticipate that considerable reduction in the military expenses now incurred for the defence and preservation of the British North American provinces would result; that subsidies to postal steamers to the ports of the United States, as no longer either necessary or defensible, would cease; whilst the manufacturers of this country would pass all the year round, without impediment or danger, through British territory into our North American possessions. That with such a complete and unbroken railway communication it would be in the power of the British Government, by arrangement for low tariffs with the provincial governments of North America, effectively to discourage any attempt on the part of the Government of the United States, by high protection tariffs, to exclude or limit the importation of British manufactures into their country, inasmuch as such high duties would become comparatively inoperative in the face of low duties extending in and over a country possessing a frontier of 1,400 miles alongside the territory of the United States. Your memorialists, therefore, respectfully pray her Majesty's Government to co-operate with the Governments of Canada, New Brunswick, and Nova Scotia, in affording such aid and encouragement as may be necessary to secure the formation, as early as may be practicable, of a railway communication between Quebec and Halifax, which upon general grounds, and for the reasons, amongst many others, now respectfully submitted, is, in the opinion of your memorialists, a work of great national value and importance."

On Monday, at the Royton Petty Sessions, Messrs. Marslands, Bailey, and Booth, proprietors of the Bower Colliery, Hollinwood, appeared to answer four complaints preferred by Mr. Dickenson, Inspector of Coal Mines, under the first and third general rules of the Mines Regulation and Inspection Act, 23 and 24 Vic., c. 151. The complaints were that the defendants had not provided sufficient ventilation; that the safety lamps were not locked; that there had been neglect to send notice of an explosion, which caused the death of a collier; and that the defendants had employed in the pit a boy under twelve years of age, contrary to the statute. The magistrate, after hearing evidence, inflicted a penalty of £5 in respect of the insufficient ventilation, and fines of 40s. each in respect of the other allegations, besides allowing costs.

In connection with Liverpool doings and Liverpool enterprise the Mersey Docks and Harbour Board generally affords a reliable *pièce de résistance*. At the last meeting of the board it was agreed, on the recommendation of the Works Committee, to appoint Mr. Hartley, who recently retired from the office of chief engineer, consulting engineer to the board, and to pay him £500 annually as a retaining fee, Mr. Hartley to be remunerated for any services he may render in his new character according to the usual fees and charges of civil engineers. The chairman said it might, perhaps, be gratifying to hear that Mr. Hartley wrote, in reference to the resolution—"I beg to tender to you and to the board my grateful thanks for the very kind manner in which the proposal has been made to me, and I value it more especially as an evidence of their confidence and appreciation of my past services. It will be a source of the greatest gratification to me to continue to be identified with the important works of this great port, in the construction of which my professional life has been spent; and I trust that sufficient health may yet be restored to me to enable me to be of some further service to the estate." The engineer was directed to proceed with the erection of the shed at the south end of the Sandon Dock; to reconsider the plans for a shed at the Canada Dock, with a view to covering in all the land up to the west wall; to consult with the Marine Surveyor as to laying down extra moorings for the Woodside Landing-stage; and, at his own request, to report upon the state of the works on the dock estate at the time of Mr. Hartley vacating his office as engineer of the board. Referring to the dock traffic Mr. Boult observed that the system would not be complete until the board had the roads and approaches to the docks widened and made passable for traction engines. The old system of carting in an immense town like Liverpool was effete; it belonged to a bygone age, and a better place ought to be introduced. The special committee on dock improvements having considered the plans for laying out the land at the north end, the engineer was directed to make a fresh plan showing certain alterations which were suggested. It was also resolved that the engineer should report on the probable cost of converting Toxteth Dock into a graving dock for temporary use, with reverse gates, so that it might be used as a floating dock if required. He was instructed, in addition, to report on the practicability of making graving docks on the Herculaneum Estate, and on the appropriation of the excavations for building purposes at Birkenhead. [We have since learnt that the engineer has delivered a very favourable report on the subject.] A letter was read from T. F. Clint to the effect that in October last he made a claim for £204 8s. 5d. for damage done to a ship and boiler, while loading the latter by one of the board's cranes at the Prince's Dock, the crane having broken under a considerably less weight than it was certified as being able to lift. He had had two eminent engineers to examine the crane, and they declared it had been fractured for some time prior to lifting the boiler, and, although notice of the intended examination had been given to the board, none of its servants attended. Mr. Clint stated that he just received a letter from the solicitors to the board, stating that the board were not liable, and he therefore asked that the case might be again reconsidered. The chairman said the letter would receive the best consideration of the Works Committee.

The orders received on home account at Sheffield are still on a very restricted scale, and in the present state of north of England enterprise it is to be feared that but little improvement can be anticipated for some time. As regards the Continental trade, some firms have fair average orders on hand from France for steel and files and other heavy goods.

We learn from Glasgow that Messrs. Rigby and Beardmore, of the Parkhead Forge Works, have just added to their establishment a steam rolling mill for the manufacture of armour plates to protect men of war from the effects of shot. The works cover an area of six acres, and have fourteen steam hammers of the heaviest and most improved construction. Among these are Nasmyth's, Condie's, and Rigby's patents.—The Blair and Pitlochrie contracts on the Inverness and Perth Railway have been let respectively to Mr. Wilson, contractor, Granton, and Mr. Granger, contractor, Perth; and the sums are stated to be about £60,000 and £40,000.—The Scotia, a new paddle steamer, larger than the Persia, and over 3,000 tons, built by Messrs. Napier, of Glasgow, for the Cunard Company, will start on her first Atlantic voyage next month.—The new steamer China will arrive at Liverpool in a few days from the Clyde, and will commence her first voyage across the Atlantic on the 15th of next month. The China will be the first screw steamer employed regularly by the Cunard Company in their passenger business.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£	s.	d.	Dis. p. ct.
IRON, English Bar and Bolt:—					
in London	pr tn	5	15	0	2
in Wales	,,	5	0	0	,,
in Liverpool	,,	5	10	0	,,
Deliv. into boats at wks: Staffordshire Bars (Nom. rates last qr. day for favourite brands)	,,	7	0	0	1½
Sheet, Sngl.	,,	8	10	0	,,
Dbl.	,,	10	0	0	,,
Hoop	,,	8	0	0	,,
Rod, round	,,	7	0	0	,,
Nail Rod, sq.	,,	7	5	0	,,
SHIPPING IRON, Staffordsh. Bars (Delivered in Liverpool 10s. per ton less)	,,	7	0	0	2
Sheet, Single	,,	8	15	0	,,
Double	,,	10	5	0	,,
Hoop	,,	8	5	0	,,
Rod, Round	,,	7	0	0	,,
Nail Rod, Square	,,	7	5	0	,,
IRON, Rails, in Wales, cash	,,	5	7	6	nett
,, ,, 6 months	,,	5	10	0	,,
Old, to cut up	,,	0	0	0	,,
Railway Chairs, in Wales	,,	4	0	0	,,
,, in Clyde	,,	3	15	0	,,
Pig No. 1, in Clyde	,,	2	8	0	,,
3-5ths No. 1 & 2-5ths No. 3		2	8	3	,,
No. 1, in Wales	,,	3	5	0	,,
No. 1, in Tyne and Tees	,,	2	12	0	,,
Ditto, Forge	,,		9	0	,,
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	,,	3	10	0	,,
Welsh Forge Pig (all Mine), at the Port	,,	3	5	0	,,
Acadian Pig, Charcoal	,,	7	10	0	,,
Scotch Pig, No. 1, in London	,,	3	0	0	,,

		£	s.	d.	Dis. p. ct.
IRON, Swedish, Indian assortments	pr tn	11	15	0	2
Russian CCND to arrive	,,	16	0	0	,,
STEEL, Swedish Keg, ham.	,,	16	0	0	2½
Ditto, rolled	,,	15	0	0	,,
Fagot		17	0	0	,,
SPELTER, on the spot	,,	18	10	0	net
To arrive	,,	18	15	0	,,
Hard, remelted	,,	17	0	0	,,
ZINC, in sheets	,,	24	0	0	,,
COPPER, Tile, 14 to 28 lb.	,,	107	10	0	2
Tough Cake	,,	107	10	0	2
Sheathing and Bolts	pr lb.	0	1	0	,,
Sheet	,,	0	1	0	,,
Bottoms	,,	0	1	0½	,,
Old	,,	0	0	10	,,
Yellow Metal	,,	0	0	10	,,
Burra	,,	103	0	0	,,
Russian do.	,,	105	0	0	,,
LEAD, British Pig	,,	20	10	0	,,
Spanish	,,	19	10	0	,,
W. B.	,,	21	0	0	,,
Sheet	,,	21	10	0	,,
TIN, English Block, nom.	,,	120	0	0	,,
Bar ,,	,,	121	0	0	,,
Refined ,,	,,	122	0	0	,,
Foreign Banca	,,	124	0	0	,,
Straits	,,	119	0	0	,,
TIN PLATES, Charcoal, IC	pr bx	1	8	0	,,
Ditto IX	,,	1	14	0	,,
Coke, IC	,,	1	2	0	,,
Ditto IX	,,	1	8	0	,,
Do. at Newport, 1s. pr bx less			—		,,
Do. at L'pool, 6d. ,,			—		
CANADA, Plates	pr tn	12	0	0	2
QUICKSILVER	pr bt	7	0	0	3

Rails are without change in price. There has been a good inquiry this week, and the market remains firm at our quotations.

Scotch Pig Iron.—During the past week the market has shown but little animation, and now closes in Glasgow somewhat easier, the quotations being 48s. buyers, 48s. 3d. sellers, cash, Mixed Nos. and three months open, 49s.

Spelter has been dull at £18 10s. on the spot, at which there are few buyers.

Copper not quite so good in demand.

Lead firmer, and a moderate amount of business doing.

Tin.—English unaltered. Foreign rather quiet. Banca still quoted £124, but Straits has been done at £119, which is £1 lower than last week.

Jan. 23rd, 1862. Moate and Co., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £	s.	£	s.	1862. £	s.	£	s.
Teak	15	10	17	0	15	0	16	0
Quebec, red pine	3	10	4	10	3	5	4	0
yellow pine	3	0	4	0	3	0	3	15
St. John, N.B., yel.	5	0	5	10	5	0	5	10
Quebec, oak, white	5	0	5	10	5	0	5	10
birch	3	10	4	0	4	0	0	0
Memel	0	0	0	0	0	0	0	0
elm	3	10	4	15	3	10	4	15
Dantsic, oak	3	10	6	0	3	10	6	0
fir	2	15	3	10	3	0	4	0
Memel, fir	3	10	4	0	3	10	4	0
Riga	3	5	3	10	3	10	3	15
Swedish	2	10	2	15	2	15	3	0
Masts, Queb. rd pine	5	0	6	0	5	0	6	0
yl. pine	5	0	6	0	5	0	6	0
rd pine	0	0	0	0	0	0	0	0
Lathwood, Dants, fm	6	0	6	10	6	0	7	0
St. Peters.	8	0	8	10	9	0	9	10
Deals, per C., 12 ft. by 3 by 9 in.								
Quebec, wht. spruce	13	0	18	0	15	0	19	0
St. John, wht. spruce	13	0	16	0	15	0	17	10

Per load—	1861. £	s.	£	s.	1862. £	s.	£	s.
Yel. pine, per reduced C.								
Canada, 1st quality	17	0	18	10	17	10	19	0
2nd do	12	0	12	10	12	0	13	0
Archangel, yellow	13	0	14	0	14	0	15	0
St. Petersbg. yel.	12	0	12	10	12	10	13	10
Finland	9	0	10	0	9	10	10	10
Memel	10	0	15	0	10	0	15	0
Gothenburg, yel.	10	0	11	10	10	0	12	10
white	9	10	10	0	9	10	11	0
Gefle, yellow	10	0	11	0	11	0	12	10
Soderhamn	10	0	10	10	11	0	12	10
Christiania, per C 12 ft by 3 by 9 in. yellow	22	0	25	0	22	0	24	0
Deck plank, Dnts per 40 ft. 3 in.		14	1	4	0	14	1	4
Staves, per standard M								
Quebec, pipe	60	0	70	0	50	0	55	0
puncheon	16	0	18	0	16	0	15	0
Baltic, crown pipe	160	0	170	0	170	0	180	0

SCOTCH PIG IRON REPORT.

			s.	d.		
No. 1	Gartsherrie	.. ..	55	0	f.o.b	Glasgow.
,, 1	G.M.B.	.. ..	48	0	,,	do.
,, 3	Do.	.. ..	47	0	,,	do.
M. Nos.	Do.	.. ..	47	6	,,	do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths ,, 3 .. G.M.B.	Cash prompt	48	3	per ton.
	1 mo. open	48	6	do.
	2 mos. ,, ...	48	9	do.
	3 ,, ,, ...	49	0	do.

MANUFACTURED IRON.

	£	s.	d.	
Bars, Govan	7	0	0	
,, Common	6	17	6	
Drumpellar, Common	6	17	6	
Do. Best	7	17	6	
Plates and Sheets	9	0	0	to £10.
Rails	7	5	0	
Pipes	5	0	0	
Chairs	4	0	0	

Glasgow, 22nd January, 1862.

The market has been usually inanimate during the past week, and quotations have scarcely varied 3d. per ton.

The demand for speculation is not so active as it was a fortnight ago, but the shipping demand keeps moderate.

Exports last week were 9,308 tons against 9,266 tons in the corresponding week of last year.

Shaw, Thomson, and Moore, Metal Brokers.

Benson's Watches and Clocks.—"Perfection of mechanism."—*Morning Post.* Gold watches 5 to 100 guineas; silver watches, 2 to 50 guineas. Benson's new Illustrated pamphlet, free for two stamps, descriptive of every construction of watch, enables persons in any part of the world to select, with the greatest certainty, the watch best adapted to their use. Watches sent free by post on the receipt of a remittance. J. W. Benson, 33 and 34, Ludgate-hill, and 46 and 47, Cornhill, London, E.C. Established 1749.—Adv.

INSTITUTION OF CIVIL ENGINEERS.

January 28th, 1862.

JOHN HAWKSHAW, Esq., President, in the Chair.

THE paper read was "On the Form and Materials for Iron-plated Ships, and the Points Requiring Attention in their Construction," by Mr. Joseph D'A. Samuda.

The author stated that, iron-plated ships having now become a necessity, it was important to ascertain, first, the best description of construction of ship and armour, and, secondly, the best form and dimensions of vessel.

To effect these objects there were four indispensable conditions: first, these vessels must be of such dimensions and power, and be built on such lines, that they should always command a superiority in speed over the best timber-built frigates afloat; secondly, they must be protected with armour over their entire length; thirdly, the armour must be so applied as to be capable of rapid replacement or repair; and, fourthly, the armour should enter into the construction of the ship, and thus give strength to the whole fabric, as well as protect it from an enemy's fire.

These conditions had only been partially attained in the vessels already constructed, or proposed to be constructed; for the Warrior class obtained speed alone, the Defence class failed in all, the Valiant class only approached the second condition, and the three new ships of 6,700 tons burthen, recently contracted for, at a cost with their engines of £400,000 each, would probably possess the first and second, but not the third and fourth conditions.

Although the Warrior was highly creditable as a first effort, and was not defective in strength, yet it was a complicated and costly construction, and its character should not, therefore, become stereotyped, as incapable of further improvement, or as if it were not desirable to seek for it.

The author proposed that the framework of the hull should be built as in an ordinary first-class steamer of the same size: and that outside the frame-work, and rivetted to it, there should be five longitudinal ribs, at intervals of 5 ft., reaching 20 ft. below the gunwale. These longitudinal ribs should be of bars of rolled iron, 2½in. in thickness and 16in. wide, the outer 4in. on each side being recessed 1in. The ordinary skin plates, 1in. thick, were then to be rivetted in these recesses, so as to form a flat surface for the reception of the armour, each strake of which was to be made to correspond with the distance, from centre to centre, of the longitudinal ribs. The edges of the armour plates, 5 in. in thickness, were then to be bolted or rivetted through the ribs longitudinally, the vertical butt joints of each plate made to break joint with the skin plates, being rivetted to corresponding ribs 2½in. in thickness, placed between the longitudinal ribs, and attached to them with fish plates. It had been determined, by experiment, that this thickness of rib would be sufficient to render the edges of the armour plates, when weakened by the rivet holes, equal in strength to the central body of the plates. By this arrangement a perfect ship, without armour, was first made; then a complete armour case was attached through the longitudinal ribs, without interfering with the joints or fastenings of the ordinary skin of the vessel. Indeed the skin would be so distinct from the armour that, in time of peace, the armour could be removed, and the vessel be used as a transport, if desired. By these means the armour could be rapidly repaired at any point, and there would be no necessity for tongueing and grooving the plates, adopted as an expedient by the Admiralty, to remedy the bending up at the edges, which the present imperfect mode of fastening rendered them liable to.

Thus protection would be obtained over the entire length of the vessel, by the armour admitting of rapid replacement, and entering into the construction of the ship. It remained only to show what dimensions and power were necessary to secure speed. For a 32-gun frigate constructed as described the best dimensions would be 382ft. long, 55ft. beam, and 31½ deep to the main deck; 5,600 tons burthen, and fitted with engines of 1,200-horse power, by which a speed of 15 knots an hour could be obtained, with the armament, ammunition, and coal on board, and with the port sills 9ft. above the water line. Such a vessel would have even greater speed than the Warrior, and be wholly protected over the entire length of the sides.

As the importance of complete protection had now been recognised by the Admiralty, it was desirable to compare this armour-skin vessel, of 5,600 tons burthen, with those now building. The Admiralty vessels were to be 6,700 tons burthen and 1,250-horse power, but they would not be able to carry a heavier armament, or possess a higher speed than the proposed vessel. They would be less manageable, form larger objects to fire at, and cost £400,000 each instead of £340,000, or, in a fleet of twenty-four such frigates, one million and a half pounds sterling more.

For coast defences vessels might be built, protected from stem to stern, having a length of 200ft., beam of 48½ft., depth of 25ft., burthen of 2,200 tons, and engines of 350-horse power, pierced for thirty-two 68-pounder guns but carrying only sixteen, with a draft of water of 16ft., when the guns, ammunition, and coal were on board, and capable of attaining a speed of eleven knots an hour.

In conclusion the author thought that the time had arrived when the Admiralty should see the propriety, and the advantage to the public service, of abandoning the monopoly of restricting all advance in the construction of mail-clad vessels to plans and systems emanating from themselves; and that it would be far better to trust to the engineering skill of this country, leaving it free to take the initiative in improving this branch of national defence, and the Admiralty only exercising a veto within such limits as experience fitted them to form a judgment upon.

THE ALGERIAN RAILWAY COMPANY.—The annual general meeting of this company was held recently in Paris. The report of the directors stated that the Minister of Algeria was authorised to pay, in the name of the State, a subvention of 6,000,000f. (£240,000) for the construction of the following railways, viz. :—1, from the Mediterranean to Constantine; 2, from Algiers to Blidah; 3, from St. Denis-du-Sig to Oran, with an extension to the port. The minister was authorised to guarantee in the name of the State, for a period of 75 years, an interest of 5 per cent., including sinking fund, upon the capital required for the construction of the above railways; but this capital was not to exceed 55,000,000f. (£2,200,000), and the guarantee interest was not to be more than £2,750,000f. (£110,000) per annum. These conditions not being considered by capitalists as sufficiently attractive, negotiations were entered into between the Imperial Government and the company, and they had resulted in the former consenting to modifications in the character of the works, which would reduce the total cost of the Algerian railways by the sum of 12,500,000f. (£500,000), while the guarantee of the Government remained undiminished. The company was, therefore, now in the condition to actively resume the works. A commissary of the Government announced to the meeting in the name of the Imperial Government that the company might reckon upon the support of the Ministry in carrying out the modifications referred to in the report, and that still further concessions and modifications to improve the position of the company would be granted before the next call on the shares. From the accounts submitted to the meeting it appeared that, of the first call of 125f. (£5) a share—the total amount of which was 13,750,000f. (£550,000)—the company had already received 13,736,500f. (£549,460), leaving only a balance of £540 to be received, and that with those means at the disposal of the company sufficient funds were in hand for the year 1862, during which the completion of the line from Algiers to Blidah would be accomplished, and the works on the two other lines would be commenced. Thus there would be no need for a fresh call to be made for many months to come, and not even then if the directors gave to such shareholders as desired to pay their instalments in advance authority to do so. Resolutions were passed unanimously approving the report and statement of accounts, and fixing the remuneration of the directors at 50,000f. (£2,000) per annum.

ON THE RESISTANCE TO TRACTION UPON RAILWAYS FROM FRICTION AND GRAVITATION.

By Mr. JOHN DIXON, C.E., Chief Engineer of the Stockton and Darlington Railway.

THE approaching completion of the South Durham and Lancashire Union and Eden Valley Railways having drawn my attention to rolling stock required for these lines, the gradients being unusually steep, I have had a series of experiments made with two kinds of wagons for the purpose of ascertaining the amount of friction.

The new wagons, for the sake of distinction, have been called trucks, and the old ones chaldron wagons—the former carrying about eight, and the latter about three tons of coals. The trucks have wrought-iron wheels, improved bearing brasses, buffer and draw springs, and the workmanship of superior character and accuracy.

In making experiments we scarcely find two carriages to run *exactly* alike. This arises from the imperfection of wheels, axles, bearings, &c. But as all our experiments were made with wagons taken promiscuously from the ordinary traffic trains, without any selection, the results will be more practically valuable. On the whole they may be considered rather favourable to the trucks, as they were all nearly new; whereas the chaldron wagons were of all ages, from fifteen years old downwards. In order to ensure accuracy, as far as possible, I obtained the co-operation of William Cudworth in all the experiments.

The method I adopted is recognised by Wood and Pambour in their celebrated treatises on railways (the correctness of which is, I believe, undisputed)—namely, that if we find a certain length of railway with such a gradient that the wagons will just about run of themselves without the application of any motive power whatever, the atmosphere at the time being perfectly calm, and then ascertain by accurate levelling the gradient or rate of inclination. Suppose for example we find it to have a fall of one foot in 224ft., the friction of the wagons will be $\frac{1}{224}$ of the gross weight of the load; now the $\frac{1}{224}$ of a ton being 10 lb, we therefore call this the friction per ton.

But inasmuch as it is not always practicable to find a gradient exactly suitable, we are justified by the authorities quoted above (and which I cordially indorse) in believing that it amounts to the same thing to let the wagons run freely down a steeper incline, having at the foot of it a portion of level or much flatter incline, and letting the wagons continue to run along this level or flatter part until they stop of their own accord. Then ascertain the total distance run, also the difference in level between the starting and stopping places, and divide the total length in feet by the total descent in feet. This will give the average gradient, which will be a measure or representation of the friction. Thus a train of laden trucks run down an incline of varying inclination for the distance of 121 chains or 7,986ft., and then stopped. The total descent found by accurate levelling between the said starting and stopping points was 30ft. Therefore 7,986ft. divided by 30ft. gives 266 as the average gradient, and $\frac{1}{266}$ part of a ton is 8·4lb., representing the friction per ton of the trucks by this experiment.

Other methods may be adopted, either by using a spring weigh machine, called a dynamometer, or calculations may be made by taking the time required for a wagon to run down a certain incline as compared with a weight falling perpendicularly from the same altitude as the height of the incline plane thus run over. But as this method involves the necessity of using mathematical formulæ, I consider it unsuitable for the present paper, my aim being to explain the subject in as simple a manner as possible.

The term friction is often erroneously used to represent the entire resistance of the train.

On dead level the friction of the wagons constitutes the only resistance to be overcome in order to move them, in which case could we contrive carriages so as to run without friction, there would be no limit, theoretically, to the load that a horse or locomotive engine could haul upon a perfectly level railway.

But, inasmuch as perfectly level railways do not practically exist, and all inclinations tend to lessen the resistance when the load descends, and to increase the strain upon the traces in ascending, and as all the railways have these deviations from a level, more or less, the resistance to be overcome by the motive power consists of the effect of raising the load up the hill against what is technically called the gravitating force, or more generally gravity.

This resistance is in the proportion ot the length of the incline to its height. Therefore a rise of 23½ft. per mile, or 1 in 187, adds to the resistance $\frac{1}{187}$ of the load; and $\frac{1}{187}$ part of a ton is about 12 lb. for every ton of load, and so in proportion for other acclivities or ascending gradients as they are called. A rise of 50ft. per mile, or 1 in 106, gives a resistance from this cause, namely, gravitation, of about 21 lb. per ton.

The real friction, as distinguished from gravitation, varies with the degree of accuracy with which the wheels, axles, &c., have been fitted up. The friction of common chaldron wagons has been usually called $\frac{1}{224}$ part of the load, or 10 lb. per ton; but, from experiments made on wagons taken at random from the trains, the result was 12 lb. per ton, whilst that of the trucks was found to be from 7 to 9 lb. per ton.

Hence we see that, if on a level railway the friction be taken at 12 lb. per ton, then up a gradient of 23½ft. per mile, or 1 in 187, there is to be added the resistance from gravitation, of 12 lb. per ton, making together 24 lb. the total resistance; being exactly double of what it is upon a level. Up an incline of 50ft. per mile, or 1 in 106, the resistance will be, from friction 12 lb. per ton, to which add resistance from gravitation, namely 21 lb. per ton, making the total resistance to be overcome 33 lb. per ton, which is nearly three times that upon a level.

This shows that up 1 in 106, the resistance from gravitation is nearly twice as much as that arising from friction; and all improvements in order to reduce this friction can only take effect upon the 9 or 12 lb. per ton; the gravitation, being an immutable law of nature, cannot be evaded or reduced. Upon still steeper inclines the resistance to be overcome by the motive power of gravitation alone becomes the principal resistance, out of which no saving can be made. Thus, for example, up an inclination of 120ft. per mile, or 1 in 44, the resistance from gravitation is ($\frac{2240}{44}$) 50 lb. per ton, and the friction, say 12 lb. making together 62 lb. per ton; and all our savings by improved carriages can only operate upon the 12 lb. out of 62 lb. Suppose, by way of illustration, that one half of the friction could be saved, thereby reducing it from 12 lb. to 6 lb. per ton, the resistance from gravitation and friction together would be 56 lb. instead of 62 lb., being a reduction only one $\frac{1}{10}$ of the whole resistance, in consequence of reducing the friction one half! I have worked out the practical results, and append the same in a tabular form for various gradients, and with wagons having different degrees of friction.

It must not be overlooked that, whilst greater force is required to drag the load up steep gradients, the effect of gravitation is to reduce the efficiency of the engine; so that upon a gradient rising 1 in 12·14, the whole power of the engine is absorbed in moving itself and tender.

The same power or expenditure of force is required to drag a load up an incline as though it had to be hoisted or lifted up a shaft perpendicularly, or the same depth as the rise of the inclined plane; for although spread over ever such a length, the weight of the load has in reality to be raised or lifted through whatever may be the rise of the plane. Thus up a rise of 22ft. per mile, or 1 in 240, one ton, or 2,240 lb. raised 22ft. = 2,240 × 22 = 49,280 lb. raised one foot.

And the gravitation up 1 in 240 is 9⅓ lb., therefore 9⅓ lb. × 5,280ft. or one mile = 49,280 lb. raised one foot, showing an equal expenditure of power.

Or, if the gradient was reduced by lengthening the plane to two miles, instead of one mile, the perpendicular height remaining the same, namely 22ft., the gradient being 1 in 480, one ton, or 2,240 lb. × 22, as before, = 49,280 lb. raised one foot. The gravitation up 1 in 480 = 4⅔ lb.: therefore, 4⅔lb. × 10,560 ft., or two miles, = 49,280 lb. raised one foot, showing that the absolute lift up a *given height* requires exactly the same expenditure of force, whether by a steep or an easy incline.

It may scarcely seem necessary to explain that these figures, namely 49,280 lb. represent the resistance of the load from gravitation *alone*. In all cases there is the friction to be added; that is, the load is both lifted, as in the above example, 22ft. perpendicularly, and also hauled over the space of a mile: therefore it is a simpler and more commonly adopted arithmetical operation to add the gravitating force per ton, to the friction per ton, and then multiply by the space travelled:—

Thus, say—Friction . . . = to 12 lb. per ton,
Gravitation $\frac{2240}{240}$ = to 9⅓ lb. do.
21⅓ lb. resistance up 1 in 240.

And 21⅓ × 5,280ft. = 112,640 lb. raised one foot, and at the same time hauled along a mile of railway.

Or, as shown in Fig. 1,

One ton, or 2,240 lb., lifted 22ft. = 49,280 lb. raised one foot.
And 5,280ft. × by 12 lb. (or 12 lb. moved 5,280ft.) ... = 63,360 lb. raised do.

112,640 lb. as above,

being the tractive force to be exerted by the engine in moving one ton a mile forward, and raising it 22ft., showing that whether the load is brought to the bottom of a shaft, as a coal pit, and then raised perpendicularly, or raised by an inclined plane, having the same altitude, the same work must be performed by the steam power. There would be no mechanical saving if coals were raised out of the pit by inclined planes instead of shafts; but the convenience of inclined planes, as compared with perpendicular hoists on railways, must be too manifest to require any explanation.

The total rise from Redcar to the summit on Stainmoor, bein 1,378ft., will require as much steam power to raise the load that height as would draw it out of a perpendicular shaft, or mine, of the depth of 222½ fathoms, in addition to the power required to drag the load on a level railway from Redcar to the said summit. And Sunnyside inclined plane, the rise of which is 432ft., is equal to a 72 fathom shaft.

In the following examples, worked out at length to avoid troublesome calculations, embracing small fractional parts, I have considered it sufficient for my purpose to call the friction of the common chaldron wagons 12 lb. per ton, and that of the new trucks 9 lb. per ton

It has been expected, by those who have not gone into the details, that the saving in haulage would be in the same proportion; that is, that an engine would be able to take a load of 120 tons in trucks, with the same ease as it would 90 tons in the common chaldron wagons. An inspection of the table at page 18, will show that such would be the case on a level railway, but not so upon ascending inclined planes.

In the following calculations the tractive force of the engine is taken at 8,000 lb.; weight of the engine, 28 tons; tender, 12 tons; friction of the engine, 18 lb. per ton, and friction of the tender, 12 lb. per ton. Tare one-third the gross load.

EXAMPLE I.

On a level.—Gravitation 0.
Friction of load 12 lb. per ton.

Tons.		lb.		lb.	
Then 28	×	18	=	504	friction of engine.
And 12	×	10	=	120	,, tender.
				624	resistance of engine and tender.

	lb.	
Then	8,000	tractive force of engine,
Less	624	resistance of engine and tender.
Difference	7,376	tractive force remaining for hauling the load.

Tons.
And $\frac{7,376}{12}$ = 614·6 gross load, exclusive of engine and tender.

Tons.		lb.		lb.	
Load, 614·6	×	12	... ...	= 7,376	friction of load.
Add resistance of engine and tender			=	624	
				8,000	resistance of train.

If the friction of the load is only 9 lb. per ton:

The tractive force for hauling the load being the same as above,

lb. Tons.
namely 7376; we have $\frac{7,376}{9}$ = 819·5 gross load, exclusive of engine and tender.

Tons.		lb.		lb.	
Load 819·5	×	9	... ...	= 7,376	friction of load.
Add resistance of engine and tender			=	624	
				8,000	resistance of train.

Again, suppose friction of load 6 lb. per ton:

The tractive force for hauling the load, namely, 7,376 lb., would still be the same as above.

Then $\frac{7,376}{6}$ = 1229·3 tons, gross load, exclusive of engine and tender.

Tons.		lb.		lb.	
Load 1,229·3	×	6	... ...	= 7,376	friction of load.
Add resistance of engine and tender			=	624	
				8,000	resistance of train.

Tons. Tons.
As 614·6 : 819·5 : : 100 : 133·3; and 133·3 — 100 = 33·3 per cent. increase of load, by reducing the friction from 12 lb. to 9 lb. per ton.

Tons. Tons.
And 614·6 : 1229·3 : : 100 : 200; and 200 — 100 = 100 per cent increase of load by reducing the friction one-half, or from 12 lb. to 6 lb. per ton.

EXAMPLE II.

On a gradient of 1 in 330.

Gravitation $\frac{2.240}{330}$ = 6·79 lb. per ton.

Friction of load, 12 lb. per ton.

	Tons.		lb.		lb.	
Then	28	×	6·79	=	190·12	gravitation of engine.
	28	×	18	=	504	friction of do.
	12	×	6·79	=	81·48	gravitation of tender.
And	12	×	10	=	120	friction of do.
					895·6	resistance of engine and tender.

	lb.	
	8,000	tractive force of engine.
Less	895·6	resistance of engine and tender.
Difference	7,104·4	tractive force remaining for hauling the load.

	lb.
Gravitation per ton ...	= 6·79
Friction of load per ton	= 12
Resistance per ton ...	= 18·79

Then $\frac{7,104·4}{18·79}$ = 378·09 tons, gross load, exclusive of engine and tender.

And $\frac{378{\cdot}09}{3}$ = 126·03 tons tare.

Hence 378·09 — 126·03 = 252·06 tons, net paying load.

	Tons.		lb.		lb.	
Gross load	378·09	×	6·79	=	2,567·3	gravitation of load.
	378·09	×	12	=	4,537·1	friction of do.
					7,104·4	resistance of do.
Add resistance of engine and tender, as above.				=	895·6	
					8,000·0	resistance of train.

Friction of load 9 lb. per ton

Gravitation per ton	...	= 6·79
Friction of load per ton		= 9
Resistance per ton	...	= 15·79

Then $\frac{7,104{\cdot}4}{15{\cdot}79}$ = 449·93 tons, gross load, exclusive of engine and tender.

And $\frac{449{\cdot}93}{3}$ = 149·97 tons tare.

Hence 449·93 — 149·97 = 299·96 tons, net paying load.

	Tons.		lb.		lb.	
Gross load	449·93	×	6·79	=	3,055	gravitation of load.
	449·93	×	9	=	4,049·4	friction of do.
					7,104·4	resistance do.
Add resistance of engine and tender =					895·6	
					8,000·0	resistance of train.

Again, suppose friction of load 6 lb.

Gravitation per ton	...	= 6·79
Friction of load do.	...	= 6
Resistance per ton	... ...	= 12·79

Then $\frac{7,104{\cdot}4}{12{\cdot}79}$ = 555·46 tons, gross load, exclusive of engine and tender.

And $\frac{555{\cdot}46}{3}$ = 185·15 tons tare.

Hence 555·46 — 185·15 = 370·31 tons, net paying load.

	Tons		lb.		lb.	
Gross load	555·46	×	6·79	=	3,771·6	gravitation of load.
	555·46	×	6	=	3,332·8	friction of do.
					7,104·4	resistance do.
Add resistance of engine and tender =					895·6	
					8,000·0	resistance of train.

Tons. Tons.
Then 378·09 : 449·93 : : 100 : 119, and 119 — 100 = 19 per cent. increase of load by reduction of friction from 12 lb. to 9 lb. per ton.

Tons. Tons.
And 378·09 : 555·46 : : 100 : 146·8, and 146·8 — 100 = 46·8 per cent. increase of load by reduction of friction from 12 lb. to 6 lb. per ton.

Example III.

On a gradient of 1 in 125.

Gravitation $\frac{2,240}{125}$ = 17·92lb. per ton.

Friction of load 12lb. per ton.

	Tons.		lb.		lb.	
Then,	28	×	17·92	=	501·76	gravitation of engine.
	28	×	18	=	504	friction do.
	12	×	17·92	=	215·04	gravitation of tender.
And	12	×	10	=	120	friction do.
					1,340·8	resistance of engine and tender.

	lb.	
	8,000	tractive force of engine,
Less	1,340·8	resistance of engine and tender.
Difference	6,659·2	tractive force remaining for hauling the load.

	lb.	
Gravitation per ton	=	17·92
Friction of load per ton	=	12
Resistance per ton	... =	29·92

Then $\frac{6,659{\cdot}2}{29{\cdot}92}$ = 222·5,668 tons, gross load, exclusive of engine and tender.

And $\frac{222{\cdot}5,668}{3}$ = 74·1,889 tons tare.

Hence 222·5,668 — 74·1,889 = 148·3,779 tons, net paying load.

	Tons.		lb.		lb.	
Gross load	222·5,668	×	17·92	=	3,988·4	gravitation of load.
	222·5,668	×	12	=	2,670·8	friction do.
					6,659·2	resistance do.
Add resistance of engine and tender =					1,340·8	
					8,000·0	resista ice of train.

Friction of load 9lb. per ton.

	lb.	
Gravitation per ton	=	17·92
Friction or load per ton	=	9·
Resistance per ton	=	26·92

Then, $\frac{6,659{\cdot}2}{26{\cdot}92}$ = 247·37 tons, gross load, exclusive of engine and tender.

And $\frac{247{\cdot}37}{3}$ = 82·46 tons tare,

Hence 247·37 — 82·46 = 164·91 tons, net paying load.

	Tons.		lb.		lb.	
Gross load	247·37	×	17·92	=	4,432·9	gravitation of load.
	247·37	×	9	=	2.226·3	friction of do.
					6.659·2	resistance of do.
Add resistance of engine and tender				=	1,340·8	
					8,000·0	resistance of train.

Again, suppose friction of load 6 lb. per ton:

	lb	
Gravitation per ton	=	17·92
Friction of load per ton =		6
Resistance per ton =		23·92

Then $\frac{6,659{\cdot}2}{23{\cdot}92}$ = 278·394 tons gross load, exclusive of engine and tender.

And $\frac{278{\cdot}394}{3}$ = 92,798 tons, tare.

Hence 278·394 — 92·798 =185·596 tons, net paying load.

	Tons.		lb.		lb.	
Gross load	278·394	×	17·92	=	4,988·8	gravitation of load.
	278·394	×	6	=	1,670·4	friction of do.
					6,659·2	resistance of do.
Add resistance of engine and tender =					1,340·8	
					8,000·0	resistance of train.

Tons. Tons.
Then 222·566 : 247·37 : : 100 : 111·1, and 111·1 — 100 = 11·1 per cent. increase of load by reduction of friction from 12 lb. to 9 lb. per ton.

Tons. Tons.
And 222·566 : 278·394 : : 100 : 125, and 125 — 100 = 25 per cent. increase of load by reduction of friction from 12 lb. to 6 lb. per ton.

Example IV.

On a gradient of 1 in 60.

Gravitation $\frac{2,240}{60}$ = 37·3 lb. per ton.

Friction of load 12 lb. per ton.

	Tons.		lb.		lb.	
Then,	28	×	37·3	=	1,045·3	gravitation of engine.
	28	×	18	=	504	friction do.
	12	×	37·3	=	448	gravitation of tender.
	12	×	10	=	120	friction do.
					2,117·3	resistance of engine and tender.

	lb.	
	8,000	tractive force of engine.
Less	2,117·3	resistance of engine and tender.
Difference	5,882·6	tractive force remaining for hauling the load.

	lb.	
Gravitation per ton ...	=	37·3
Friction of load per ton	=	12
Resistance per ton ...	=	49·3

Then, $\frac{5.882{\cdot}6}{49{\cdot}3}$ = 119·243 tons, gross load, exclusive of engine and tender.

And $\frac{119{\cdot}243}{3}$ = 39,747 tons, tare.

Hence, 119·243 — 39·747 = 79·496 tons, net paying load.

	Tons.		lb.		lb.	
Gross load	119·243	×	37·3	=	4,451·8	gravitation of load.
	119·243	×	12	=	1,430·9	friction do.
					5,882·7	resistance do.
Add resistance of engine and tender =					2,117·3	
					8,000·0	resistance of train.

Friction of load 9 lb. per ton.

	lb.	
Gravitation per ton ...	=	37·3
Friction of load per ton	=	9
Resistance per ton ...	=	46·3

Then, $\frac{5.882{\cdot}6}{46{\cdot}3}$ = 126·964 tons, gross load, exclusive of engine and tender.

And $\frac{126{\cdot}964}{3}$ = 42·321 tons, tare.

Hence 126·964 — 42·321 = 84·643 tons, net paying load.

	Tons.		lb.		lb.	
Gross load	126·964	×	37·3	=	4,740	gravitation of load.
	126·964	×	9	=	1,142·7	friction of do.
					5,882·7	resistance of do.
Add resistance of engine and tender =					2,117·3	
					8,000·0	resistance of train.

Again, suppose friction of load 6 lb. per ton.

	lb.	
Gravitation per ton ...	=	37·3
Friction of load per ton	=	6
Resistance per ton ...	=	43·3

Then, $\frac{5.882{\cdot}6}{43{\cdot}3}$ = 135·753 tons, gross load, exclusive of engine and tender.

And $\frac{135{\cdot}753}{3}$ = 45,251 tons, tare.

Hence 135·753 — 45·251 =90·502 tons, net or paying load.

	Tons.		lb.		lb.	
Gross load	135·753	×	37·3	=	5,068·2	gravitation of load.
	135·753	×	6	=	814·5	friction of do.
					5,882·7	resistance of do.
Add resistance of engine and tender =					2,117·3	
					8,000·0	resistance of train.

Tons. Tons.
Then, 119·243 : 126·964 : : 100 : 106·4, and 106·4 — 100 = 6·4 per cent. increase of load by reduction of friction from 12 lb. to 6 lb. per ton.

Tons. Tons.
And, 119·243 : 135·753 : : 100 : 113·8, and 113·8 — 100 = 13·8 per cent. increase of load by reduction of friction from 12 lb. to 6 lb. per ton.

On the Stockton and Darlington Railway there is an inclined plane, called Sunnyside incline, the steepest part of which consists of gradients of 1 in 13 and 1 in 16. On the 9th of June, 1859, when Captain Tyler came to examine a new line, about to be opened, called the Waskerley deviation, a powerful new engine, No. 125, called the Gazelle, being in excellent order, and the rails dry, and in good repair, was tried up this questionable gradient, the load being only one carriage and twelve people. Now, suppose we take the gradient near the top of the incline, 1 in 14, and work it out, as in the preceding examples, thus:—

Gradient 1 in 14

Gravitation $\frac{2,240}{14}$ = 160 lb. per ton.

Friction of load = 9 lb. do.

	Tons.	lb.	lb.	
Then,	28 ×	160 =	4,480	gravitation of engine.
	28 ×	18 =	504	friction do.
	12 ×	160 =	1,920	gravitation of tender.
And.	12 ×	10 =	120	friction do.
			7,024	resistance of engine and tender.
Carriage,	6 ×	160 =	960	gravitation of load.
And,	6 ×	9 =	54	friction do.
			8,038	total resistance.

The engine accomplished the ascent at about five or six miles an hour, and showed that it was as fully taxed with itself, tender, and one carriage, up this gradient, as with 820 tons upon a level.

Or, with 450 tons up a gradient of 1 in 330, or 16ft. per mile.
" 247 " " " 1 in 125, or 42ft. "
" 206 " " " 1 in 100, or 52·8ft. "
" 127 " " " 1 in 60, or 88ft. "
" 66 " " " 1 in 35, or 151ft. "

(To be continued.)

Plymouth.—The works connected with the fortifications on the western side of Plymouth Sound have been considerably damaged by the late storms. The contractor's road, tramway, and landing-place, under Picklecombe Fort, Mount Edgecumbe, have been washed away. Some of the blocks of granite for sustaining the road weighed three or four tons each.

ON THE USE OF MECHANICAL HYPOTHESES IN SCIENCE,

AND ESPECIALLY IN THE THEORY OF HEAT.*

By Prof. Wm. J. Macquorn Rankine, L.L.D., F.R.S., E. and L.

The object of the present paper is to illustrate the use of mechanical hypotheses in physical science, by giving a short account of the results which have been derived from that hypothesis which ascribes the mechanical action of heat to the centrifugal force of certain supposed molecular motions.

That hypothesis, like the wave-theory of light, the hypothesis of atoms in chemistry, and all other physical hypotheses whatsoever, substitutes a supposed for a real phenomenon, viz., invisible motion for tangible heat, the object being to deduce the laws of the real phenomenon from those of the supposed one. If the supposed phenomenon were more complex, or less completely known in its laws, than the real one, the hypothesis would be an encumbrance, and worse than useless. But this is not the case with the hypothesis of molecular motions as applied to heat. The laws of motion are at once simpler and more thoroughly known than those of any other phenomenon; and as the hypothesis in question enables the known laws of the mechanical action of heat to be deduced from the laws of motion, it tends towards the simplification of science, just as the hypothesis of undulations does, by enabling all the phenomena of reflection, refraction, diffraction, interference, polarisation, and dispersion whether of light or of radiant heat, to be deduced from the same laws of motion.

A hypothesis is absolutely disproved by any facts that are inconsistent with it. For example: the corpuscular or projectile hypothesis regarding light is absolutely disproved by the fact of the less velocity of light in the more highly refracting media, which is contradictory of one of its necessary consequences. The hypothesis of the substantial existence of "caloric," or the "subtle fluid" of heat, is absolutely disproved by the fact, established by the experiments of Rumford, Davy, Mayer, and Joule, of the production of an unlimited quantity of heat from a limited quantity of matter by means of friction; by that of the constancy of the specific heat of air at all densities, established in 1853 by M. Regnault; and by that of the almost total disappearance of the cooling effect of the expansion of gases, when they expand without performing work, established about 1851-2 by Messrs. Joule and Thomson. On the other hand, no hypothesis is capable of absolute proof by any amount of agreement between its results and those of observation: such agreement can give at best only a high degree of probability to the hypothesis.

In order to establish that degree of probability which warrants the reception of a hypothesis into science, it is not sufficient that there should be a mere loose and general agreement between its results and those of experiment,—any ingenious and imaginative person can frame such hypotheses by the dozen; the agreement should be mathematically exact, to that degree of precision which the uncertainty of experimental data renders possible, and should be tested in particular cases by numerical calculation. The highest degree of probability is attained when a hypothesis leads to the *prediction* of laws, phenomena, and numerical results, which are afterwards verified by experiment; as when the wave-theory of light led to the prediction of the true velocity of light in refracting media, of the circular polarisation of light by reflection, and of the previously unknown phenomena of conical and cylindrical refraction; and as when the hypothesis of atoms in chemistry led to the prediction of the exact proportions of the constituents of innumerable compounds.

It is unnecessary to enter into any lengthened explanation as to the hypothesis of the radiation of heat consisting in the transmission of a vibratory or oscillatory movement, for that hypothesis forms in fact one theory with the corresponding hypothesis regarding light, the principles of both being identical, and the facts to which they are applied analagous in every respect. The perfect accordance of the results of that hypothesis with the phenomena of radiant heat, and the fact of the production of heat by the friction of solids and fluids, naturally suggest the probability that some similar hypothesis may be found to agree with the phenomena of the mechanical action of heat. And, in the first place, it may be remarked, that the loose and general agreement with the observed laws of the phenomena, which has already been mentioned as not being of itself sufficient to warrant the reception of a hypothesis, is possessed by every supposition which ascribes heat to the minute motions of the particles of bodies, of what kind soever the motions may be supposed to be; for every kind of internal motion would make the particles tend to fly asunder and occupy more space, and hence expansion by heat, and the evaporation of solids and liquids, which is an extreme case of expansion; it would make them press outwards against the boundaries of any space in which they were confined, and hence the increase of elastic pressure by heat; it would be communicated from particle to particle, and hence the transmission of heat; it would tend to dislodge the particles from any regular arrangement, and hence the softening and melting of solids, and the occasional decomposition of chemical compounds by heat; it would be increased in rapidity by the expenditure of mechanical power in the body, whether through friction, percussion, compression, or the exertion of electric, or chemical, or other molecular forces amongst the particles, and hence the production of heat by these means: the heat produced would also bear a constant ratio to the mechanical power exerted, the molecular motion would be weakened by the enlargement of the space occupied by the particles, and by their removal to greater distances apart, against external pressure and neutral attraction, and hence the disappearance of heat in expansion, evaporation, and chemical decomposition; and in this case the heat which would disappear would bear the same constant ratio to the work performed against the forces resisting the expansion.

As an example of a hypothesis presenting this general agreement with the phenomena, there may be cited that proposed by Mr. Herapath and Mr. Waterston, which may be called the "hypothesis of molecular collisions," and which supposes particles to fly about in all possible directions with velocities, the mean of whose squares is proportional to the quantity of heat in a given weight of the substance. It is defective, however, in the agreement of its numerical results with those of experiment, inasmuch as it gives a fixed value—5 : 3, or $1\frac{2}{3}$—for the ratio of the specific heat of a gas under constant pressure to its specific heat at constant volume; whereas that ratio is certainly known to be 1·408 for those gases in which it is greatest, and much smaller in others. Other defects of the same kind were pointed out by Professor Clerk Maxwell, in a paper read to the British Association at Aberdeen in 1859.

The hypothesis to which I have to call your attention as presenting the requisite precision of agreement with the results of experiments, and as having also predicted some of those results, is that which may be called the "hypothesis of molecular vortices," or the "centrifugal theory of elasticity," in which the elastic pressure produced by heat is ascribed to the centrifugal force of invisibly small whirls or eddies amongst the particles of bodies, the energy, or living force, of such whirls being the *quantity* of heat. The first idea of a supposition somewhat resembling this appears to have been put forth by Sir Humphrey Davy; but, so far as I know, no reduction of it to a definite form, nor investigation of its consequences on strict mathematical and mechanical principles, was published before the appearance of a paper which was communicated by me to the Royal Society of Edinburgh, in December, 1849, and which was read in February, 1850, and printed it the 20th volume of the "Transactions" of that body. The nature of the hypothesis, as set forth in that paper, will be best explained by the following extracts from the printed abstracts of that paper:—

"The hypothesis of molecular vortices is defined to be that which assumes, that each atom of matter consists of a nucleus or central point, enveloped by an elastic atmosphere, which is retained in its position by attractive forces, and that the elasticity due to heat arises from the centrifugal force of those atmospheres revolving or oscillat-

* Read to the Philosophical Society of Glasgow.

ing about their nuclei or central points. According to this hypothesis quantity of heat is the *vis viva* of the molecular revolutions or oscillations."

* * * * * * * *

"The author introduces into the hypothesis of molecular vortices a supposition peculiar to his own researches, for the purpose of connecting it with the undulatory hypothesis as to radiation. It is this: that the vibration which, according to the undulatory hypothesis, constitutes radiant light and heat, is a motion of the atomic nuclei or centres, and is propagated by means of their mutual attractions and repulsions. The absorption of light and of radiant heat, according to this supposition, is the transference of motion from the nuclei or centres to their atmospheres, and the emission of light and radiant heat, the transference of motion from the atmospheres to the nuclei or centres. The author enumerates several advantages which he conceives that this hypothesis possesses over the common supposition of a luminiferous ether pervading the spaces between ponderable particles." . .

In the paper just referred to the application of the hypothesis was confined to gases and vapours; but in a series of subsequent papers, read in 1851, it was extended to substances in all conditions.* Amongst the consequences deduced by the application of the known principles of mechanics were *the two laws of thermodynamics*, by which, as is now well established by experiment, the results of all mechanical actions of heat can be computed with a precision limited only by the precision of the data.

The "first law" is the fact established experimentally by Mayer and Joule, about 1842-3, "that a given quantity of heat requires for its production, and produces by its disappearance, mechanical energy bearing a constant ratio to the quantity of heat."

This law forms, of course, an essential part of any theory which regards heat as a form of motion. The numerical relation between heat and mechanical energy could be determined by experiment alone. Mr. Joule's experiments, after eight years of perseverance, during which the precision of his methods of experimenting was continually increased, gave at last 772 foot-pounds of mechanical energy as the equivalent of a British unit of heat ("Philosophical Transactions," 1850); a result whose exactness has been confirmed by every subsequent experiment.

The "second law" of thermodynamics was arrived at independently, and published simultaneously by Professor Clausius, of Zürich, and myself. It was arrived at by Professor Clausius through the application to the first law, as demonstrated by Mayer and Joule, of a peculiar process of reasoning analogous to that which Carnot, in 1824, had applied to the hypothesis of fluid caloric, in his "Réflexions sur la Puissance Motrice du Feu;" it was deduced, in my investigations, from the mechanical hypothesis already stated by means of the general principles of dynamics. Its experimental demonstration was not effected until about 1852, through the labours of Mr. Joule and Professor William Thomson. There are various different forms of stating the second law. The following is, perhaps, the most easily intelligible:—"The mechanical equivalent of the quantity of heat which disappears during a given expansion, or appears during a given compression, of any substance at a given constant temperature, is the product of the following three factors:—The change of volume of the substance; the rate of variation of its elastic pressure with temperature when the volume is constant; the absolute temperature," measured from a point 493·2 deg. of Fahrenheit's scale below the melting point of ice.

Amongst the predictions made by the aid of those two laws were the following:—Up to 1850 the received value of the specific heat of air, under a constant pressure of one atmosphere, was ·2669; and, in accordance with the hypothesis of fluid caloric, it was generally believed that a diminution of pressure produced an increase of specific heat, and *vice versâ*.

In 1850 I ventured to predict that the true specific heat of air under constant pressure would be found to be 0·24, or thereabouts, and very nearly constant at all pressures. It was not until 1853 that M. Regnault's experiments appeared, proving the truth of both these assertions. It was by means of the second law of thermodynamics that tables of the densities of saturated steam at temperatures ranging from 32 deg. to 428 deg. were computed from the known values of the latent heat of evaporation in 1853 and 1854, five years before the experimental determination of those densities by Messrs. Fairbairn and Tate, and similar calculations were applied with equal success to some other vapours.

The preceding results are consequences of the two laws of thermodynamics, whether we regard those laws as demonstrated independently by experiment, or as consequences of a mechanical hypothesis. But the following are consequences peculiar to the hypothesis of molecular vortices, and not, so far as I know, deducible from any other supposition which has yet been put forth, as to the constitution of matter.

According to that hypothesis the elastic pressure of a gas or vapour consists of the centrifugal force of its whirling particles, partially counteracted by their neutral attraction. The pressure due to centrifugal force is the product of the density, the absolute temperature, and a constant quantity depending on the nature of the substance; and such is the law of the pressure of a *perfect gas*, or one in which the effect of molecular attraction in partially counteracting the centrifugal force is insensible; while the diminution of such pressure, produced by molecular attraction, is expressed by a series of terms increasing more rapidly than the simple power of the density, and proportional to the powers of the *reciprocal of the absolute temperature*. This last force, which may be called the *cohesion* of gases, is what distinguishes an imperfect gas from a perfect gas: it is very considerable in saturated vapours; less though still appreciable in the denser gases, such as carbonic acid gas; and very small in air. The cohesion of carbonic acid gas was found to be represented by the *square of the density, divided by the absolute temperature*, and multiplied by a co-efficient deduced from the experiments of M. Regnault on the rate of expansion of that gas. Experiments were afterwards made by Messrs. Joule and Thomson on the disappearance of heat in overcoming this cohesion; and the results closely agreed with those deduced from the above-mentioned expression.

The hypothesis of molecular vortices, when applied to the question of the relation between the pressure of saturated vapour and the boiling-point of its liquid, did not give a precise result, for want of experimental data, but showed it to be probable, that an approximate formula for the logarithm of the pressure of any vapour would consist of a constant, diminished by a series of terms proportional to the powers of the reciprocal of the absolute temperature. This conclusion was found to be completely verified by the vapours of water, alcohol, ether, sulphuret of carbon, mercury, and other fluids (see "Edinburgh New Philosophical Journal," July, 1849, and the "Philosophical Magazine," for 1854).

I think I am justified in claiming for the hypothesis, as a means of advancing the theory of the mechanical action of heat, the merit of having fulfilled the proper purposes of a mechanical hypothesis in physical science, which are, to connect the laws of molecular phenomena, by analogy with the laws of motion, and to suggest principles, such as the second law of thermodynamics, and the laws of the elasticity of imperfect gases, whose conformity to fact may be afterwards tested by direct experiment; and I make that claim the more confidently that I conceive the hypothesis in question to be in a great measure the development, and the reduction to a precise form of ideas concerning the molecular condition which constitutes heat, that have been entertained from a remote period by the leading minds in physical science; and, amongst others, by Galileo, Bacon, Boyle, Newton, Montgolfier, Seguin, Rumford, Davy, Leslie, and Young. As an example of the views held at the present time respecting it by eminent men of science, I may refer to Dr. Lloyd's opening address as President of the British Association, at the Dublin meeting in 1857, page 59. I may also refer to the fact that Professor Clerk Maxwell is now publishing in the "Philosophical Magazine" a series of papers, in which he shows how the laws of electricity may be deduced from the hypothesis of molecular vortices.

I wish it, however, to be clearly understood, that although I attach great value and importance to sound mechanical hypothesis as means of advancing physical science, I firmly hold that they never can attain the certainty of observed facts; and, accordingly, I have laboured assiduously to show that the two laws of thermodynamics are demonstrable as facts, independently of any hypothesis; and in treating of the practical application of those laws I have avoided all reference to hypothesis whatsoever.

* These papers were reprinted in the "Philosophical Magazine" for 1850 and 1851.

THE MANCHESTER ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

AT the last ordinary monthly meeting of the executive committee of this association, held at the offices, 41, Corporation-street, Manchester, on Tuesday, January 28, 1862, William Fairbairn, Esq., C.E., F.R.S., in the chair, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the past month the ordinary visits of inspection have been made, and the following defects discovered in the boilers examined:—Fracture, 3 (1 dangerous); corrosion, 17 (2 dangerous); safety-valves out of order, 5 (1 dangerous); water gauges ditto, 12 (1 dangerous); pressure gauges ditto, 13; feed apparatus ditto, 5 (1 dangerous); blow-off cocks ditto, 22 (1 dangerous); fusible plugs ditto, 7; furnaces out of shape, 6 (1 dangerous)—total, 90 (8 dangerous). Boilers without glass water gauges, 2; without pressure gauges, 1; without blow-off cocks, 6; without feed back pressure valves, 16.

"From the nature of the defects discovered during the last month, I would wish to take this opportunity of calling the attention of the members to the subject of corrosion, which is often stealthily eating away the strength of boilers entirely unsuspected; and I wish especially to put our members on their guard on this point, because I find that frequently when a boiler is discovered to be in a corroded state, even though it may have arrived at an advanced stage, and be on the point of rupture, still the discovery proves quite a matter of surprise to the owner, who expresses astonishment that his boiler should have been so affected. The fact is, however, that no boiler allowed to pass a whole year without being examined 'thoroughly' (*i.e.*, both inside and outside), so that the condition of all the plates may be ascertained on both their surfaces, can be pronounced as free from corrosion, or worked without risk—more in some cases, of course, than in others—in illustration of which I may state the following:—

"An ordinary internally fired boiler had been thoroughly overhauled, re-seated, and left in good repair two years ago, the association not being afforded the opportunity of making the regular annual 'thorough' examinations during that time. This boiler was set on a mid-feather, and on being scaled a few days since a hammer was sent through the plate at the bottom, which, on examination, proved to have been so eaten away as to have become at that part as thin as a sheet of paper. On going up the flues I found that the plates were affected not at one place only, but throughout the whole length bearing on the mid-feather, and on removing some of the bricks the plate was seen to be quite crumbling away, and at least a quarter of a pint of oxide was readily collected from a small surface only. In one or two places, where there had been small leaks at the ring seams (which so commonly happen when the feed without being previously heated enters the boiler immediately at the bottom), the mid-feather had ponded the water and held it in contact with the plates, in which it had cut complete channels, as well as eaten away surfaces of considerable area, while, internally, the plates were quite 'hogged' in places over the mid-feather, and the boiler was evidently in a most unsafe condition, so that a thorough repair (now in progress) was necessary. The danger of setting boilers on mid-feathers has, for years past, been pointed out by this association, and the practice, I trust, will soon be entirely discarded. Explosions caused by mid-feathers are likely to be of the most destructive character, since the rent would not confine itself to a single plate, but extend throughout the whole of the weakened part, and nothing 'skies' a boiler more effectually than a longitudinal rent at the bottom.

"I should add that it is by no means intended that the service rendered by this association should diminish the exertions of the steam users' own engine attendants; but, on the contrary, that it should stimulate them to greater care. Thus the fact of our inspectors getting inside each boiler annually, as well as going up the flues to make 'thorough' examinations, should by no means stand in the place of this being done by the owners' own engineers at least twice a year in addition. To leave the detection of corrosion to the sweeps who clean the flues, although sometimes allowed to be the case, is, I think, what no engineer would do, either having his master's interest at heart or regarding his own safety as he should.

"Three explosions have occurred during the last month to boilers not under the inspection of this association, each of which has been attended with fatal consequences; in one case as many as four men being killed, and several others wounded. One of these explosions happened to the boiler of a portable agricultural engine; another to a bath or kitchen boiler, in which the taps in the inlet and outlet pipes were both foolishly closed at the same time, so that, there being no safety valve, the pressure was bottled up, as in the case of the Great Eastern water heater, and explosion became inevitable. A third explosion occurred to a colliery boiler, of plain cylindrical egg-ended construction, 40ft. in length, 5ft. 3in. in diameter, the plates being $\frac{7}{16}$in. in thickness, and the working pressure 30 lb. per square inch. The boiler was fitted with two sufficient safety valves, and two floats, one of which had a low water alarm whistle; the explosion was occasioned by the plates over the furnace becoming overheated (although there was no evidence of deficiency of water), the boiler being rent into four pieces, each of which was blown a considerable distance. The cause of the overheating was attributed to the sedimentary character of the water, and I call the attention of our members to this fact as another illustration of what has been previously stated, that 'incrustation should not be regarded merely as a matter of inconvenience, but frequently of positive danger.' There are other points of interest connected with this explosion, the consideration of which space compels me to defer to another opportunity."

THE AMERICAN NAVY.—The Americans are resolved not to be behindhand in the race which the Western Powers are running in iron shipbuilding, as we hear, upon good authority, that inquiries are now being made on the part of the Federal Government in this country for plans of the most approved character; and, as the Lords of the Admiralty have decided upon constructing a vessel on Captain Coles' method, we believe that it is not unlikely that this may also be adopted by our friends on the other side of the Atlantic. We have heard thirty gunboats mentioned as the number likely to be required by Mr. Lincoln.—*Army and Navy Gazette.*

THE GALWAY LINE.—A Galway correspondent says that the present directors of the Atlantic Company are fast preparing to have everything ready for a good start when the proper time arrives. Mr. Maugles, chairman of the West India Royal Mail Company, and deputy-chairman of the Atlantic Company, visited Galway some time ago, and sailed down the bay, making himself thoroughly conversant with every matter pertaining to, or likely to affect, the company. The Hibernia has been double-plated and raised 6ft. A hurricane deck has also been added to her, and the sponsons, being now much higher and larger, give her a noble and commanding appearance over the water. She will be out of the builder's hands in a few weeks, and the Columbia and Anglia will soon follow, after having undergone the same alterations. When these boats are fairly out of the builder's hands the company need not fear a minute inspection from even the most inveterate opponents of the Galway line.

CAMERON'S APPARATUS FOR MEASURING AND REGULATING THE FLOW OF FLUIDS.

THIS invention, by Paul Cameron, of Glasgow, relates to the arrangement and construction of apparatus suitable for registering or indicating the pressure of the atmosphere, as well as of steam, gas, or water. Under certain modifications the instrument is also applicable as a means of regulating the pressure and flow of steam, gas, or water, so as to cause it to flow in a regular and uniform manner, or to give an audible or visible signal upon a given or predetermined pressure being exceeded.

Under one modification or arrangement, as adapted for indicating the pressure of steam in boilers, the apparatus consists of a metal box or case, which has a ring of metal either cast on or secured to a suitable base plate. This ring has screwed to it a second and corresponding ring, between which and the face of the lower ring is interposed a disc of mica. This arrangement forms an air-tight chamber, which is however put in communication with the boiler by means of a pipe which opens into the chamber. The disc of mica is connected, by means of a central universal joint, with a lever extending across the chamber, and centred on a pillar piece at the upper part of the case. The lower end of the lever extends on each side in a lateral direction, forming a T-piece, the extremities of which are soldered to helical springs, which are connected by end discs to the base plate. These springs serve to keep the lever in a horizontal position, and the index to zero when there is no pressure on the disc. Upon steam being admitted to the chamber the mica is pressed or bulged outwards, and, being connected to the lever, this motion is imparted to the indicating mechanism. A slot is made in the T-end of the lever to admit of a traversing link being fitted therein; this link is jointed to a projecting arm formed on a small metal sphere which traverses to and fro on a horizontal screw. This screw is carried in a bracket piece fixed to the lower part of the base plate, and it has fast to it a milled head, the turning of which causes the little sphere to traverse along the screw in either direction as required. The sphere has fixed in the front part of its periphery a pin which passes out through a slotted arm, that forms a part of the spindle on which the quadrant for actuating the external index is fitted. This quadrant or segmental wheel extends upwards towards the centre of the instrument where it gears into a pinion, the spindle of which projects out through the graduated dial plate, and has fast to it the index or pointer. When the steam presses on the mica it lifts the primary lever, which, being linked to the sphere, causes it to turn about its supporting screw; this motion is imparted through the quadrant to the index. The arrangement of the sphere on the screw admits of the pin which passes through the slotted arm being moved to or from the spindle of the quadrant, and thus imparting more or less motion to the spindle. In this way the instrument may be adjusted as to cause the indicator to traverse more or less over the dial, and thus admit of its ready adjustment to suit dials graduated either for low or high pressures. The instrument also forms a highly susceptible barometer; a thin film of mica is used for the vacuum chamber, which is made air-tight and exhausted, so that the atmospheric pressure on the exterior of the film is rendered visible by the arrangement of the indicating mechanism.

Under another modification the apparatus is adapted for regulating or controlling the pressure or flow of fluids. A spring is arranged to press on the mica disc in such manner that its pressure can be regulated to any required force by means of a screw or other equivalent. The disc of the chamber is so arranged that the bulging of the mica shall cause the valve which controls the flow of the fluid to be more or less closed. Thus, when the pressure of the fluid from the source of supply exceeds the predetermined amount, the bulging of the mica actuates the controlling valve, and partially closes it, so that the pressure or flow of the fluid is rendered uniform. By modifying this arrangement the pressure of the fluid on the disc may be caused to open a suitable jet or orifice, and so give either a visible or audible signal.

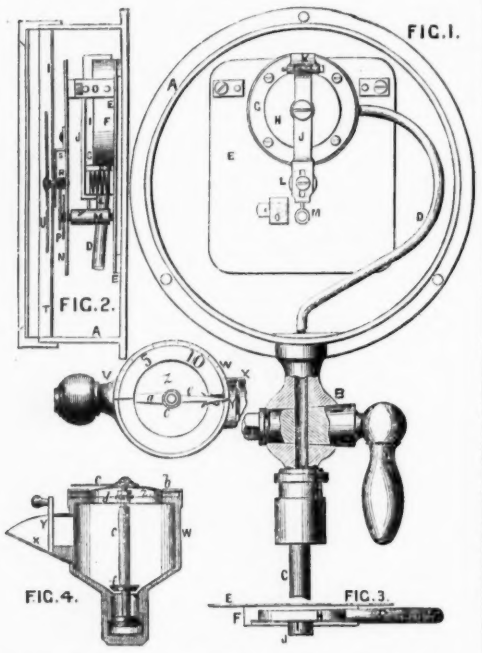
Another mode of arranging the pressure chamber is to form both the sides of films of mica, which are arranged in the retaining frame with a certain degree of curvature. Upon admitting the fluid to this chamber its pressure tends to straighten the mica, the motion of which is communicated to the index or other movable detail.

Fig. 1 is an elevation, with the front index plate removed; Fig. 2 is a vertical section of the gauge taken at right angles to Fig. 1; and Fig. 3 is a sectional view of the steam chamber to show its arrangement; Fig. 4 is a partially sectional elevation, and Fig. 5 is a plan of a lubricator, constructed according to the improvements.

The mechanism of the gauge is contained in a box A, to the lower part of which is attached the cock B, which is connected to the steam pipe C. The lower extremity of the pipe C communicates with the boiler, and conveys the steam up through the cock B to the tube D, which is arranged within the gauge box A. To the back of the box A is attached the metal plate E, and to the face of this plate is screwed a brass ring F, which is more clearly shown in Fig. 3. The face of the ring F is made with an annular groove, in which is fitted the ring G; before screwing down the ring G a leather washer is put in the annular recess of the part F, and upon this washer is placed a film or disc of mica H. A second washer or ring of leather is put on the mica and the ring G is screwed down, the arrangement now forms a steam-tight chamber, into which the steam pipe D opens. It follows from the construction of this part of the apparatus that when steam or other similar elastic fluid is admitted to the chamber formed by the ring F and the parts connected thereto, that its pressure acting upon the film of mica H will cause it to bulge outwards more or less. If, therefore, the film be connected to suitable indicating mechanism, this varying motion will correctly indicate the pressure on the dial plate. To the centre of the disc of mica H is attached by means of a nut the stud piece I, the outer part of which is shaped to a wedge-like figure, as shown in profile in Fig. 2. The edge of the stud piece I is in contact with the lever J, which is jointed at one end to the elbow piece K, so that the lever is free to move up and down with the motion of the mica disc H. Near the lower end the lever J, is connected to the helical spring L, by means of which the lever is brought back to the normal position when the pressure on the disc is removed. The extremity of the lever J is bent inwards towards the back of the box A, and this part carries a downwardly projecting pin, which takes into a curved slot which is formed in the hollow cylinder M. The journals of this cylinder are carried in the plates E and N, the latter of which is supported on bracket pieces O screwed to the back plate E. The front part of the spindle of the cylinder M carries the fine spiral spring P, and also the segmental rack Q which gears with the pinion R. The spindle of the pinion R is carried in the front plate N, and in the overhanging bracket piece S; the extremity of the spindle projects out through the graduated dial plate T, and has attached to it the index or pointer U. Upon admitting steam or other similar elastic fluid to the chamber F its pressure upon the mica H causes the lever J to be moved outwards, and this motion is communicated through the cylinder M to the pointer U, and in this manner the pressure of the steam is accurately indicated on the graduated plate T. The front part of the box A is enclosed by means of a plate of glass in the ordinary manner. The helical spring is shown as of the same diameter throughout, but it is preferred in most cases to make it of a conical figure, the smaller part being in front next the lever J. This arrangement admits of a kind of differential compensation for the range of movement of the lever J, so that when the mica is acted upon by high pressures the spring acts with a uniform resistance, in place of the resistance gradually increasing as the lever J is moved outwards. In arranging this apparatus as a vacuum gauge the same general arrangement of the parts is observed; the pipe C is connected with the vacuum chamber to be indicated. In this way the pressure of the external atmosphere upon the disc of mica causes it to be pressed inwards, the concavity of the disc being proportioned to the amount of vacuum obtained in the chamber formed by the ring F and its connected parts. The motion of the disc is imparted to the cylinder M, and thence to the pointer U, the index plate T being suitably graduated for the purpose. The apparatus is also

equally adapted for indicating the diurnal variations of the atmospheric pressure. For this purpose the chamber formed within the ring F is completely sealed, and is carefully exhausted of air, so that as the atmosphere presses with more or less force upon the surface of the mica it is more or less depressed, and the pointer indicates the same upon a dial plate graduated to correspond practically with the inches of the ordinary mercurial column.

In applying the principle of this invention to the purpose of a lubricator for the purpose of lubricating the interior of a steam cylinder, preference is given to the arrangement shown in Figs. 4 and 5. The grease cock V is screwed into the cylinder cover or other part in the usual way, and to this is attached the grease cup W, which is supplied from time to time with oil or grease that is poured into the hopper feed X. The aperture which opens into the cup W, from the hopper is closed by a vertical slide Y, when the cup is properly supplied. The upper part of the lubricator is fitted with a mica disc Z in manner similar to the corresponding part in the steam gauge already described. Extending across the disc Z is a blade spring *a*, the ends of which are passed into lateral slots formed below the face of the graduated ring *b*. The valve spindle *c* passes up through the disc Z, to which it is connected by the double nuts *d*; the upper extremity of the spindle projects out above the spring *a*, and carries on its screwed end the pointer *e*. By turning this pointer round the spring *a* is depressed, and a greater amount of force is



required to raise the disc Z, so that the engineer regulates its position according to the pressure required. At the lower part of the spindle *a* are arranged the duplex valves *f* and *g*, the seats of which are formed on the tubular part of the cup W. When the steam is admitted to the cylinder, the cock V being open, its pressure on the valve *g* shuts the tubular passage; the grease now flows below the valve *f*, and fills the space between the valves. Upon the steam being exhausted the valve *g* opens and the valve *f* is closed, which allows the oil contained in the tubular part to flow into and lubricate the cylinder and piston. In this way a suitable and predetermined quantity of oil is admitted at each stroke of the engine.

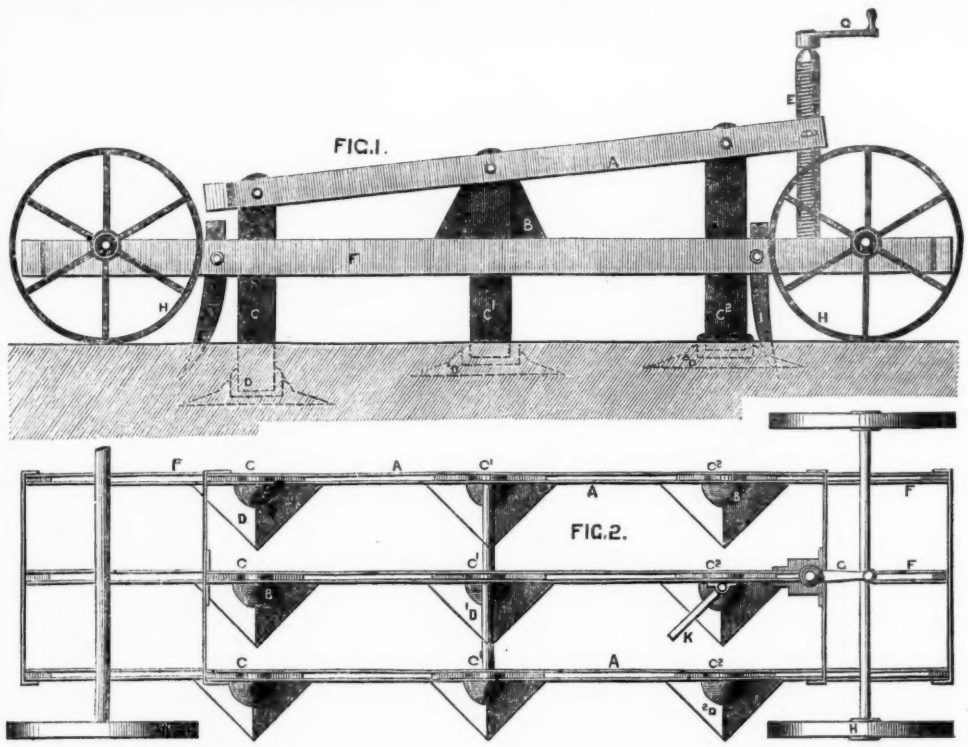
A modification of this apparatus may also be used for regulating and controlling the passage of steam from the safety valves of steam engines. In this arrangement the spindle *c* and valves *f* and *g* are dispensed with; the steam from the boiler having free access to the chamber W presses upon the disc Z. To a snug or projecting part on the ring *b* is jointed a lever, which extends across and beyond the ring, so as to admit of its being connected to the slide Y. A pointer *e* is connected by means of a screwed stud to the transverse lever, so that by turning this pointer round any required amount of pressure is exerted on the mica to prevent its rising. When, however, the pressure of the steam exceeds that of the lever the mica is pressed upwards, which motion lifts the lever, and raises the slide Y; this allows the steam to escape laterally into a chamber in which the safety valve is fitted. With this arrangement the safety valve is more easily adjusted, and is operated with greater certainty and effect than by ordinary means.

THE ROAD ACROSS HYDE PARK.

THE Society of Arts have at last come forward with the offer to raise £35,000, in 5 per cent. debentures, for the construction of a sunk road, three-fourths of a mile long, from the Bayswater-road, across Kensington Gardens, west of the Serpentine, to a point opposite the north entrance of the Horticultural Gardens. This road will afford direct access to the Great Exhibition for visitors north of Hyde Park. Its length is to be just three-quarters of a mile, and it interferes with none of the views in the gardens, as it is carried across at a uniform level of 12ft. below the surface. It passes beneath the carriage drive and Rotten-row by means of two short tunnels. The total width of the roadway is to be 40ft., of which about eight will be devoted to a footway on one side. Both sides of the cutting will be formed of gently sloping banks of turf, and none of the grown timber will be interfered with. By this short route a circuit of two miles is saved on the eastern side, and a mile and a quarter on the western. The cost of the whole road is estimated at only £35,000, the Commissioners of Public Works undertaking to pave and light it. The tolls are to be the same as at Kensington-gate—3d. for one horse, 6d. for two, and a halfpenny for each foot passenger along the pathway. The road is to be open day and night. Every holder of a £100 debenture will receive an ivory, or ticket, which will pass himself and his cab or carriage toll-free. Mr. Cowper is to apply to Parliament at once upon its meeting for the necessary powers, and the Act is not to come into operation till £30,000 out of the £35,000 have been subscribed for. So far, therefore, this most difficult question as to thoroughfares has been in a great measure solved, for the road is to be opened for traffic by the 1st of May, or if, from any unforeseen causes, it is not complete by that time, Mr. Cowper guarantees the use of a temporary road till the permanent sunk way is ready. We believe, however, that the road will be open in time, and that it will not be long before it fully remunerates its spirited promoters.

A FOREMAN of the Messrs. Kennard, contractors for erecting the railway viaduct at Velletri, in the Roman States, was assassinated on the 18th inst. The foreman's name was Jeremiah Smith, and the assassin is believed to be an Italian workman whom he had discharged on the same day.

HANCOCK'S IMPLEMENTS FOR PULVERISING AND PLOUGHING.



THESE improvements, by J. L. and F. L. Hancock, of Pentonville, consist in the following arrangements:—First, in order to provide for ploughs, pulverising and grubbing implements, after having performed one course, performing on the return course without the frame or carriage carrying the implements being turned round, the implements are connected to a bar or bars, beam or beams, in sets in such manner that the set of implements having acted on one course can be raised out of the soil by a lever or otherwise, and, by simply giving the bar a partial turn over, the other set of implements may be brought so as to act on the return course, and so on.

The implements may be of the ordinary construction, or they may be arranged stepwise, according to letters patent granted to the Messrs. Hancock, October 11th, 1858 (No. 2,261), and in some cases there may be applied at the rear of the implement a double mould board to turn a furrow on both sides of such mould board. Again, for operating upon the soil at different depths, tools are connected stepwise to a longitudinal oscillating beam, which tools work in conjunction with a fixed central tool or not; the tools are made to cut in both directions, and by adjusting the beam the depth of cut is regulated. Again, for the purpose of ploughing in "butts" or "lands," the first shares are arranged from left to right or *vice versâ*, and the next in the opposite direction, and in whatever direction the second slice or furrow is turned the following share or shares turn the furrow in the same direction. On travelling the reverse course the shares turn the furrow in the same direction as that in which the first shares turned it in the first course. The leading shares are adjustable.

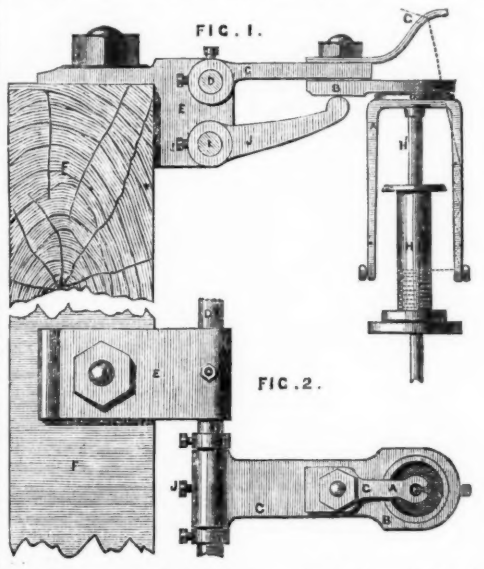
Fig. 1 is a side elevation, and Fig. 2 a plan of so much of plough as will be necessary to illustrate the manner in which this part of the invention is carried into effect.

A, A, A, are longitudinal bars or beams, connected at their ends by cross bars, and mounted on brackets B, B, B, about which they are free to move at certain times, as will be hereafter explained. Each bar A is composed of two longitudinal bars bolted together at suitable intervals, having a space between in which the stems or rods carrying the implements are inserted. C, C^1, C^2, are these rods depending from the beams A, and carrying at bottom plough-shares D, D^1, D^2, or other implements for cultivating the soil. These shares are made double, or with two cutting edges, as seen at Fig. 2, so that they will work in either direction backward or forward. E is a screw working in a nut on one end of the central beam A, and bearing at bottom against the frame F of the implement; G is a handle at the upper part of the screw for imparting motion to it; H, H, are the bearing wheels of the implement, and I, I, are the coulters. The central rods C^1, with their shares D^1, are always maintained at an equal depth in the ground, while the depth of the other, C, C^2, is regulated by means of the screw E. Now, supposing the implement is to be prepared to travel in the direction indicated by the arrow, the screw E is turned so that the fore part of the beam A is raised, and with it the rod C^2 and share D^2; the rear end of the bar is depressed, and with it the rod C and share D. The shares D and D^2 are now at the respective depths of, say, 4in. and 12in., the central share being always maintained at one constant depth, say 8in.; this can, however, be varied, if required, by increasing or diminishing the height of the rod C^1 for the share D^1, or by the screw E for the shares D, D^2, according to the soil to be operated on. When the implement reaches the headland the rope from the engine by which it is propelled is disconnected from one end and connected to the other, or in any other convenient manner; the screw E is turned, and the position or relative depth of the shares reversed. The shafts on which the bearing wheels are mounted are connected to turn-tables provided with steering apparatus, not shown, so that the implement may be turned or follow the track of the furrows with facility; or the standards of the wheels may be mounted in independent sockets with steerage levers attached. K, K, are mould boards, one only of which is shown hinged to the rods C, C^1, C^2, in such manner that they will turn in the necessary direction as soon as the implement is in motion.

MASON'S FLYERS AND SPINDLES.

THIS invention, by Mark Mason, of Manchester, consists in forming a neck on the head of the flyer, suitable to run or rotate in a bracket or bearing fixed on a rail attached to the framing, by which means the flyer is kept steady, and may be run at greater speed than heretofore.

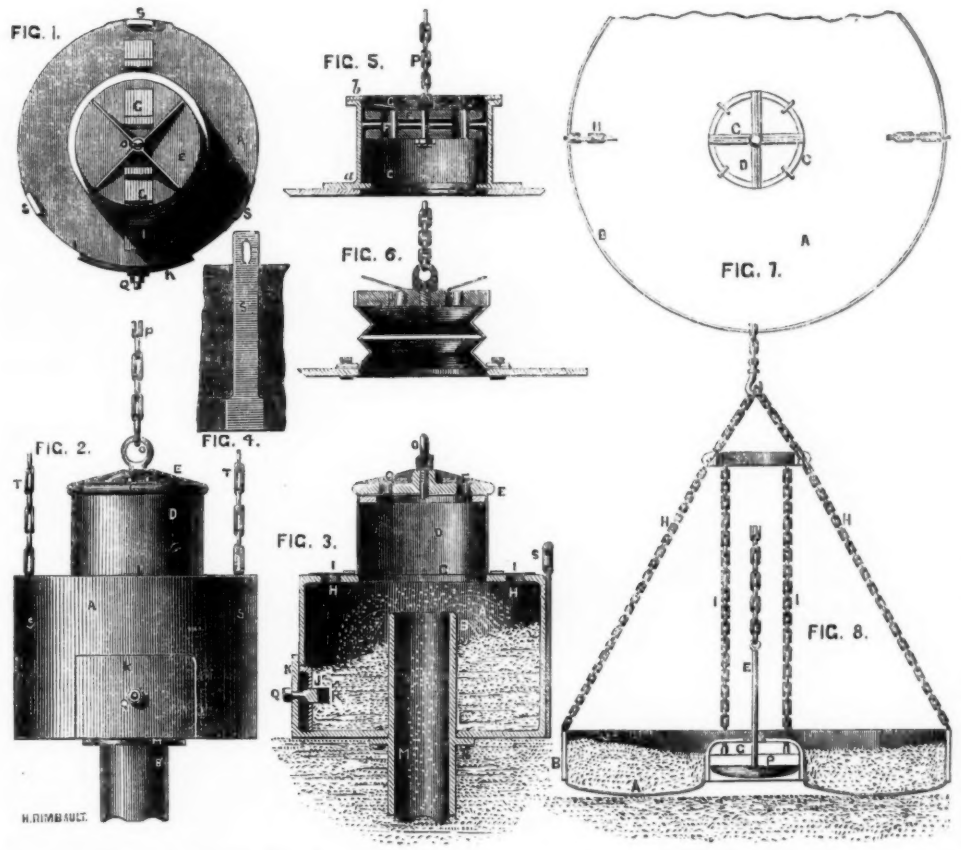
Fig. 1 is an elevation of a flyer with bracket or bearing for steadying the same, constructed according to this invention, and Fig. 2 is a plan. A is an ordinary flyer, on the head of which is attached by soldering or brazing a ring *a*, forming a neck, which is turned up true or made as near as possible perfectly circular; B is a loop, collar, or bearing, which is made to fit the neck so as to allow or admit of rotation therein. This bearing is attached and capable of adjustment to a bracket C, which is hinged on a rod D, extending the length of the frame, and supported at intervals by fixings E to the stretch rail F; the flyer has the boss formed on the underside to give more room for passing the end of yarn through the openings of the ring from the guide eye G to the bobbin H, which is placed on the spindle H^1 as usual. It will be seen that the bearing can readily be removed or lifted off the neck of the flyer by the attendant to allow the flyer to be removed from the spindle for doffing in the ordinary manner. And if it be required to lift the whole series of



bearings on one side of a frame at once, a shaft I is provided, with fingers J placed under each bearing, which on being operated at one end will lift or raise the whole series of bearings off their respective necks. By means of this invention the spindles are kept steady at their top ends, and may consequently be run at much greater speed, and thereby produce more yarn than heretofore in the same time.

THE ERICSSON IRON BATTERY.—As required by the terms of contract with the Government, the hull of the iron battery, and the battery now in process of construction at Greenpoint, by C. S. Bushnell and Co., under direction of Captain Ericsson, will be finished by the middle of the present month, the work on the hull being in a very forward state. The hull is sharp at both ends, the bow projecting and coming to a point at an angle of 80 deg., the sides inclining at an angle of 51 deg. to the vertical line: it is flat-bottomed, 6½ft. in depth, 124ft. long, 34ft. wide at the top, and is built of light 2in. iron. Another or upper hull rests on this with perpendicular sides and sharp ends, 5ft. high, 40ft. 4in. wide, 174ft. long, extending over the sides of the lower hull 3ft. 7in., and over each end 25ft., thus serving as a protection to the propeller, rudder, and anchor. The sides of the upper hull are composed of an inner guard of iron, a wall of white oak 30in. thick, covered with iron armour 6in. thick, When in readiness for action the lower hull is totally immersed, and the upper one is sunk 3ft. 6in., leaving only 18in. above the water. The interior is open to the bottom like a sloop, the deck which is bomb-proof, coming flush with the top of the upper hull. No railing or bulwark of any kind appears above the deck, and the only things exposed are the turret or citadel, the wheelhouse, and the box crowning the smoke-stack. The inclination of the lower hull is such that a ball to strike it in any part must pass through at least 25ft. of water, and then strike an inclined iron surface at an angle of about 10 deg. In the event of the enemy boarding the battery they can do no harm, as the only entrance is at the top of the turret or citadel, which cannot easily be scaled, and even then only one man at a time can descend into the hull. The battery draws but 10ft. water. This battery will not be accepted by the Government if, on being subjected to the enemy's guns at the shortest range, it fails in any way to sustain the pledges of impregnability made in regard to it by the inventor. The test will be made in front of some one of the largest rebel batteries upon the Potomac or elsewhere, and if its offensive and defensive capabilities prove satisfactory it will be turned over to the Government. All haste is being made to complete it, and the work now gives employment to about 200 men. The engines have already been placed in the vessel, and two columbiads will be mounted on the turret.—*New York Tribune.*

KENNARD'S EXCAVATING APPARATUS.



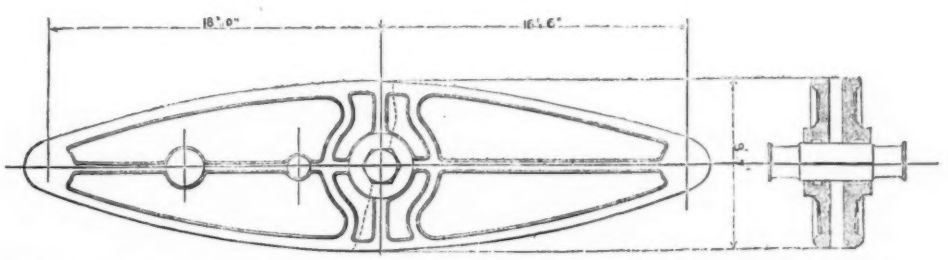
THE first part of this invention, by Mr. Howard J. Kennard, of 36, Great George-street, Westminster, has for its object the excavation of sand or gravel situated under water in places where excavations of any description are desired to be made for foundations or other structures, and consists of an apparatus, which is placed on the surface of such sand or gravel, and into which the same is drawn by means of suction. When full of sand or gravel this apparatus is raised out of the water, and is emptied in any convenient place.

In Figs. 1, 2, 3, and 4 is shown an arrangement of the apparatus or sand pump; Fig. 1 shows a plan of the same; Fig. 2 an elevation; Fig. 3 a transverse section; and Fig. 4 a front view of one of the handles.

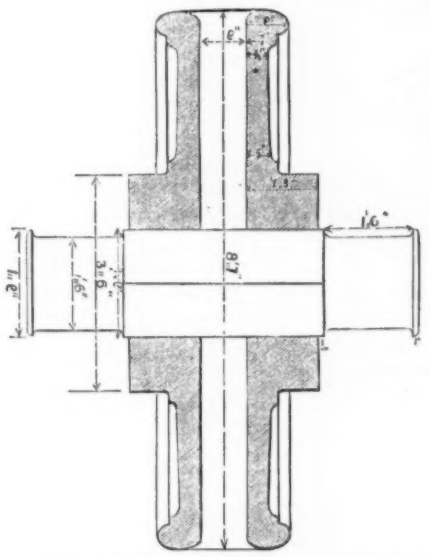
A is a box, which is here shown cylindrical, but which may be of any other suitable shape, and is constructed of cast iron or other suitable material closed at top and bottom. In the bottom is formed a circular or other shaped hole L, through which is inserted the pipe B, which is fixed to the bottom of the box A in a water-tight manner by means of the flange M and bolts N. This pipe B passes upwards, nearly to the top of the box A, and is continued downwards outside to an extent which is regulated by the nature of the soil to be excavated, its length being increased for very loose sand, or decreased when the soil is of a denser nature. In the top of the box A is formed a large opening C, over which is fixed in a water-tight manner a cylinder of leather D. This is closed at the top by having a heavy metal disc E attached to it in a water-tight manner, in which disc are two openings F, F, furnished with flap-valves G, G. The cylinder D with disc E is alternately distended, by being pulled upwards from above by means of the chain P attached to the eye O, and then allowed to collapse, as shown by the dotted lines in Fig. 2, the disc E descending by its own gravity. Other small apertures H, H, are formed in the top of the box A, which are also provided with flap valves I, I, of any suitable construction; J is an opening in the side of the box for the purpose of emptying the same, which opening is closed by means of the door K in a watertight manner, the latter having a ring of leather round its edge, and being pressed tight against the box by means of the screw Q and bar R; S, S, S, are loops of wrought iron, attached to the box A, as shown in Fig. 4, to which are made fast the chains T, T, for raising or lowering the apparatus. The manner of operating is as follows:—The apparatus is lowered on to the bed of the river or other locality under water where it is desired to excavate; in the first instance it becomes filled with water, and the tube B penetrates into the sand or gravel to the extent of its projection below the bottom of the box A. The collapsed flexible cylinder D is then distended by the disc E being drawn up by means of the chain P and the valves G, G, and I, I, being closed from the pressure of the water from without; a vacuum or partial vacuum would be found were it not that sand or gravel mixed with water is at the same time forced by the pressure of the surrounding water to enter through the bottom opening of the tube B, and pass up into the box A Here the sand or gravel subsides by gravity, and the cylinder D collapsing by the disc E being allowed to descend by gravity, the water that penetrated into the box along with the sand or gravel escapes or is forced out through the valves G and I. The disc E is then again pulled up by the chain P, more sand and water penetrate through the pipe B into the box A, the sand subsiding in the box whilst the water is forced out by the sinking of the disc E, as before described; and this is continued until sand or gravel has accumulated in the box to about the level of the top of the tube B. The apparatus is then drawn up above the level of the water, the door K is removed, and the sand or gravel is emptied out of the box A in any convenient place.

The second part of the invention has the same object as the first part, but the apparatus that is to be lowered down upon the sand or gravel below the water consists of a strong circular or other shaped bag, into which the sand or gravel is driven by the water when in an agitated state, and in which bag the sand or gravel subsides by gravity. In Figs. 7 and 8 is shown an arrangement of this part of the invention. Fig. 7 shows a part plan, and Fig. 8 a sectional elevation. A, A, is a flexible disc or bag of strong canvas, leather, or other suitable material, attached at its outer circumference to the ring B of iron, or other suitable material, while in the centre is formed a hole, round which is fixed the ring C, of iron, or other suitable material, and which is of only a slight depth. In the space inside this ring a heavy disc or agitator D is placed, capable of being worked up and down in the same by means of the rod E and chain F, which passes up to above the surface of the water. This disc or agitator is guided in its motion so as to insure its always falling fairly into the central ring, either by the guide G, as shown, through which the rod E passes, or by having short ropes or chains attached to it, and to the large outside ring. It is made of such a weight as to fall, after having been raised, with some considerable force, and thus drive the water and sand or gravel over the edge of the central ring C, and into the bag A, in which the sand or gravel subsides by gravity. To the rings B and C are attached chains H, I, for the purpose of lowering the apparatus down on to the bed of the river or other locality, and raising it out of the water when the bag A is full of sand or gravel. It is evident that the shape of the bag may be varied: thus, it may be of an oblong form, and the agitator made of an inclined shape below, so as to drive the water and sand or gravel in one direction only into the bag, or the agitator may be hinged or jointed at one side, and be made to vibrate up and down, or sideways, being actuated by a rope from above, as will be readily understood. We shall probably have occasion ere long to illustrate some practical applications of this apparatus.

THE ENGINE BEAM AT HARTLEY COLLIERY.



* WE are enabled, through the kindness of a correspondent, to present to our readers an accurate sketch of the beam which lately broke, with such calamitous results, at Hartley New Pit, in Northumberland. The beam was 34ft. 6in. long from one end centre to the other, the engine end being 18ft. and the pump end 16ft. 6in. The beam was made in pairs, each 6ft. 7in. deep at the centre, and averaging 4¾in. thick, exclusive of flanges. The steam cylinder is 7ft. 2½in. in diameter, and the boilers work at a pressure of 10 lb. on the square inch. The stroke of the piston was 10ft., and that of the pump 9ft. 2in. The metal does not appear to have been well distributed. It is impossible to say whether the beam was originally strained owing to the unequal contraction of the boss and flanges after casting. The main centre appears to have been formed to a hexagonal section where it went through the



beam, and the fracture started at two opposite angles of the hexagonal hole in the casting. Full particulars as to the casting and fitting of the beam will doubtless be elicited on the inquest.

RAILWAY BILLS.

DURING the week the barristers of the Houses of Lords and Commons have declared the following bills as having complied with standing orders:—

GREAT WESTERN.—For power to construct new railways, the first commencing by a junction with the Birmingham, Wolverhampton, and Dudley at the Handsworth station, and terminating at Smethwick; the second beginning at Bromwich, and terminating at Tipton; and the third commencing at the Hatton station, and joining the Stratford-on-Avon Railway, with power to raise £110,000 on shares and £36,000 on mortgage.

LONDON, CHATHAM, AND DOVER.—For a line from Clapham to Battersea, also for tramways to the piers and harbour at Dover. Power to consolidate the sum of £800,000 as second preferential capital of the general undertaking, to raise £800,000 on account of the Farnborough Extension and other works, to form the third preferential capital, to raise £900,000 for the Metropolitan Extensions and £750,000 for the general purposes of the undertaking, the company having incurred, and being about to incur, a very large expenditure for terminal passengers and goods stations and factories, and laying down additional lines on the Metropolitan Extensions.

LONDON AND BLACKWALL.—For widening the existing line in Whitechapel, Cannon-street-road, and Cross-street, and to raise £300,000 by new shares.

BRISTOL AND SOUTH-WESTERN JUNCTION.—To authorise the London and South-Western to make eight new lines to unite with the Salisbury and Yeovil, the Midland and the Somerset Central, and to raise a further capital of £750,000.

VALE OF NEATH, AND SWANSEA AND NEATH.—By this Bill the Vale of Neath purpose to acquire the Swansea and Neath, and to lay down on their own line the narrow gauge, in addition to the broad gauge, the cost of the latter being estimated at £100,000, and the remainder at £60,000.

BRITON FERRY AND DOCK COMPANY.—For a lease of the undertaking to the South Wales and Vale of Neath Railway Companies, to raise £30,000 and to borrow £45,000.

STOCKTON AND DARLINGTON.—To make new lines to Towlaw and Crook; to convert the company's existing capital into stock, and apply any portion of it to the new works.

NORTH BRITISH AND CARLISLE AND SILLOTH BAY COMPANIES.—For leasing the latter to the former.

MARKET DRAYTON AND NEWPORT JUNCTION.

GREAT NORTHERN.—To make a line from Rossington, near Doncaster, to Gainsborough, and alter levels from the latter place to Saxelby, with power to raise £330,000 in new shares, and to borrow £110,000

NORWICH AND SPALDING.—To extend the line from Sutton, in the Holland division of Lincolnshire, by a double junction; to issue new shares to the extent of £75,000, and borrow £25,000.

WEST CHESHIRE.—For a new line from Mouldsworth to Chester, and branches to the Birkenhead Railway, with power to raise £200,000 and borrow £60,000.

VALE OF CLWYD.—To extend their line to the river Clwyd at Foryd, and to raise £13,000.

LAUNCESTON AND SOUTH DEVON.—For a railway from Tavistock to Launceston at an estimated cost of 180,000, and power to borrow £60,000.

MORETONHAMPSTEAD AND SOUTH DEVON.—From the Newton station of the South Devon to Moretonhampstead, at a cost of £105,000, and £35,000 on loan.

EDGWARE, HIGHGATE, AND LONDON.—For a railway from the Great Northern to Highgate and Edgware. The Great Northern undertakes to subscribe £73,300 towards the proposed capital of £220,000.

TEWKESBURY AND MALVERN.—To enable the company to raise a further sum of £120,000 by preference shares, and 40,000 on loan, and to lease the line to the Midland Railway Company.

BIRKENHEAD.—For a railway from Hooton to Park-gate, and to apply the Birkenhead surplus moneys towards its cost of construction.

WEST RIDING, HULL, AND GRIMSBY.—To make a line from the Bradford, Wakefield, and Leeds, at Wakefield, to the South Yorkshire at Barnby-upon-Don, with branches, at a cost of £360,000.

The other cases disposed of were those of

THE ABINGDON.—To raise a further capital of £6,000.

THE REDDITCH.—To raise £20,000.

THE BERWICKSHIRE.—To make branch railways.

FROSTERLY AND STANHOPE.—For deviations, and to raise £6,000.

THE BALA.—For a line between Corwen and Bala, at £80,000.

THE DENBIGH, RUTHIN, AND CORWEN.—For subscribing £30,000 to the Bala line.

EDEN VALLEY.—For extensions at a cost of £65,000.

ABBEY HOLME AND LEE GATE AND BOLTON.—At a cost of £48,000.

CARLISLE AND SILLOTH BAY.—To raise a further sum of £100,000.

NORTH BRITISH, FOR THE MONKTON-HALL AND ORMISTON AND DALKEITH BRANCHES.—To raise £173,000, and to lease the Port Carlisle and Dock

GREENOCK AND WEYMISS BAY.—To make a railway, at a cost of £160,000.

SCOTTISH NORTH-EASTERN JUNCTION.—For branches and increased capital of £200,000.

THE RADSTOCK AND KEYNSHAM.—For a line between these places.

THE DUNDEE, PERTH, AND DUNDEE AND NEWTYLE.

NORTH BRITISH AND GLASGOW AND SOUTH-WESTERN.

West Cheshire Junction.—To make railways from the Birkenhead Docks to the West Cheshire Railway, at an estimated outlay of £600,000.

Alford Valley.—For deviations.

Great North of Scotland.—To subscribe £100,000 to the Formantine and Buchan, and £48,000 to the Alford Valley, and to raise £300,000.

Weymouth and Portland.—To construct a railway from Weymouth to the Isle of Portland, and to extend the Wilts, Somerset, and Weymouth Railway to the harbour, and raise £100,000.

Eastern Union.—To raise £250,000, and to subscribe to the Waveney Valley line.

Bristol and Clifton.—For a railway from Bristol to Brandonhill, near Clifton, with tramways to the quays of Bristol, and to raise £250,000.

Midland.—For new railways in connection with the Rowsley and Buxton line, and to raise £380,000.

London, Brighton, and South Coast.—To enlarge the London Bridge-station on its south-western side in Horselydown; to enlarge the accommodation of their Bricklayers' Arms station; to provide steamboats between France and England, and raise £350,000 by new shares, and borrow £116,000.

Mid-Kent.—To vest in the Mid-Kent part of the Farnborough Extension and the whole of the Crays line.

Great Northern.—To acquire additional lands for station accommodation at Doncaster.

East Gloucestershire.—For new railways from Cheltenham to Faringdon and Bourton-on-the-Water; to raise £600,000 and borrow £200,000.

London, Chatham, and Dover.—For an extension of the line to Walmer and Deal, for which it is proposed to create new shares to the amount of £150,000, and to borrow £50,000.

Andover and Great Western, and Andover and Redbridge and Southampton.—To connect the Andover and Redbridge Railway near Andover with the Great Western at Newbury, and to raise an additional capital of £340,000. The second project is to extend the Andover and Redbridge to Southampton Harbour, and carry tramways along it, at an estimated cost of £85,000.

Tottenham and Hampstead.—For a line from the Hampstead Junction Railway to the Eastern Counties at Tottenham, and a branch from the Great Northern at Hornsey, to raise £160,000 in shares and £53,000 on loan.

The other bills passed were for the Kettering and Thrapston, and a capital of £106,000, in which case the standing orders were declared not complied with; the Whitchurch, Wrexham and Mold, and Connah's Quay Junction, at a cost of £240,000; the Leadburn, Linton, and Dolphinton, in the county of Peebles, at a cost of £53,000; the North British and Carlisle and Siloth Bay, to lease the latter to the former; the North Devon and Okehampton, at the estimated cost of £130,000 and £43,000 loan.

The other railway bills were Bala and Dolgelly, for a railway between those places, to cost £112,000; Lostwithiel and Fowey, at a cost of £50,000; Bridge of Weir, for lines from Johnstone to Bridge of Weir, at £33,000; Corwen, Bala, and Portmadoc, to connect these towns, at a cost of £120,000. Wellington and Cheshire Junction, to unite the counties of Shropshire and Cheshire, at an estimated cost of 420,000. Bradford, Wakefield, and Leeds, for completion of the Orsett branch and deviation at Dewsbury; Dartmouth and Torbay to complete line and raise £72,000; Lancashire and Yorkshire, for new lines near Rochdale and Wigan, and power to provide steamboats and purchase additional lands, requiring a further capital of £333,000 in shares and £111,000 on mortgage; Ceylon, to dissolve the company; Kington and Eardesley, for a line between these places, in Breconshire at a cost of £100,000; Stockton and Darlington, South Durham and Lancashire, Eden Valley and Frosterley, and Stanhope Amalgamation; Stamford and Essendine, to unite their lines with the London and North-Western and Midland Railways, and raise £60,000; Andover and Redbridge, to raise a further sum of £20,000; Wycombe, to borrow £80,000 for carrying out extensions; the Midland Wrexham, for extension in Denbigh and Flint, at a cost of £120,000; Birkenhead, Flintshire, and Holyhead, for lines from Hooton to Queen's Ferry and Chester and Holyhead, at a cost of £160,000; South Leicestershire, for deviations; Leeds, Bradford, and Halifax Junction, deviation and extension of Batley branch, and £200,000 new capital; Cromford and High Peak, for lease to the the London and North-Western; West Hartlepool, to increase the dock accommodation, and power to raise £900,000, and subscribe £40,000 to the Cleveland Railway; Oldham and Ashton, for lease to Manchester and Sheffield and London and North-Western; Much Wenlock and Severn, to raise £42,000; Merthyr and Tredegar, to lease to the London and North-Western; Hull and Hornsea, for a line between those places; Dundalk and Enniskillen. The South Yorkshire to extend their line to Hull, and to raise £400,000 by new shares; Trent, Ancholme, and Grimsby—to enable the South Yorkshire and Manchester and Sheffield Companies each to contribute £40,000 towards the Trent and Ancholme line, and also to acquire it; Caledonian—to construct new lines from the Granton branch to Leith, with connecting branches, and to raise £150,000 by new shares.

The Bill of the Cannock Mineral Extension for further railways in the Potteries, at an estimated cost of £120,000, was withdrawn.

The Bill of the Swansea, Neath, and Brecon, for extensions, was withdrawn.

The Bognor, Chichester, and Midhurst Bill was withdrawn.

The cases of non-compliance included the Nantlle Railway, to alter line and levels, and make five new branches in the slate districts, at £260,000; and the South Staffordshire and Central Wales, for extensions from Dudley to Bridgenorth, and branches to the South Staffordshire and West Midland Railways and Great Western at Swindon, with a proposed new capital of £200,000, and £66,000 loan. Wellington, Drayton, and Newcastle at a cost of £270,000; West Midland, for an extension to the Brecon and Merthyr Railway, lease of Merthyr and Tredegar Railway, and additional capital of £33,000; and Great Northern and Western of Ireland. Scottish Northern Junction, for extensions from Limpett Mill to the Great North of Scotland at Kintore, and to raise £200,000; and the London and Midland Junction for the construction of a railway from the Metropolitan Railway at King's-cross to the Midland Railway at Hitchin, with a branch to the cattle-market at Copenhagen-fields, with power to raise a capital of £1,200,000 and to borrow £400,000. The undertaking is promoted by the Metropolitan Railway Company, and opposed by the Great Northern, and the non-compliances chiefly had reference to omissions in the books of reference and notices to owners and occupiers of property along the intended line. The Ellesmere, Ruabon, and Shrewsbury proposed extensions of the Oswestry, Ellesmere, and Whitchurch Railway, at an estimated expense of £170,000; and the Brecon and Merthyr, to make local extensions, and to raise £112,000.

Steam on Common Roads.—On Tuesday last a heavy marine boiler was successfully removed from the works of Messrs. John Laird, Sons, and Co., Birkenhead, to the large crane situate on the margin of the Great Float, by means of Taylor's (Britannia Engine Works) "steam elephant," and a second boiler was removed on Friday. This is the first instance in this neighbourhood in which steam on common roads has been employed for such a purpose. Judging from the easy manner this machine was guided over the roads it promises to become a most useful agent for transporting heavy loads, and it is equally applicable for discharging timber out of ships and afterwards drawing it upon the quay or from place to place, as required. One of these engines, manufactured by Messrs. J. Taylor and Co., of Birkenhead, has, we understand, been at work for this purpose in her Majesty's Dockyard at Devonport, for upwards of two years, with great success.

NOTES FROM NEW SOUTH WALES.

We resume our notes from this important colony in continuation of the details furnished last week in The Engineer. It appears that the Sydney street-railway has been opened for traffic. The line is a mile and three-quarters in length, and is at present carried as far as the end of Argyle-street, at the Circular Quay. A shed for the storage of goods is about to be erected on the site of the old Commissariat Stores. It is intended ultimately to carry the line round to the east side of the quay, but this will probably not be commenced until some experience of the working of the tramway has been obtained. The tramway is laid along the centre of the street, and in as direct a line as was practicable. Near the terminus the tramway makes a curve round the Benevolent Asylum, and, turning into the railway enclosure, meets the line at right angles. Upon approaching the terminus two lines branch off from the tramway; the one, which is intended for the goods trucks, meets the railway at a turntable; the other, which will be used for the passenger-cars, is carried up to the station, the rails being on the same level as the floor of the platform. As the tramway cars are entered at either ends, and as their bodies are lower than those of the railway carriages, they could not have been so conveniently entered if placed on the same rails as the railway carriages as they will be by the tramway being on a level with the platform. At several points along the line the rail curled upwards, lifting the longitudinal sleepers on which it rests. The cause of the flexion was at first attributed to the scantling having been machine-cut instead of cut by hand, but this was shown to have been a mistake, as the defect occurred both where the timber had been machine-cut and where it had been hand-cut. It has since been evident that in laying down the rails sufficient allowance was not made for the expansion of the iron, and that during some very hot days the rails not having sufficient play at their ends rose in the middle. In one or two places, too, the timber "cambered," owing to the great heat communicated through the rails. It would, no doubt, have been desirable for the iron bark to have been thoroughly seasoned before it was used, but the short time allowed by the Government for the performance of the work, and the scarcity of seasoned scantling of the required lengths, rendered it necessary that the timber should be obtained direct from the bush.

During November—for Australian dates do not at present extend further—the question of railway extension in the colony was debated at great length in the House of Assembly, but little actual progress was made towards the realisation of a defined and practicable policy. The scheme of the Government was to proceed with the southern line as far as Goulburn, and, in the place of continuing the western and the northern lines to Bathurst and to Muswellbrook, to construct tramways or horse railways from Mudgee to Singleton, and from Tenterfield to Grafton. The opposition to this proposal was led off by one of the members for the western districts, the chief objections to it being the preference shown to the southern district. The western members contended that their part of the country was superior, or at all events quite equal, in richness and importance to the southern part, and claimed an equal amount of railway extension. Strong opposition was expressed by nearly every member to tramways, and no information was afforded by Mr. Arnold to the Assembly as to the data upon which his estimate for horse-railways had been based. It will be remembered that Mr. Whitton in his late report most unequivocally condemned the proposed tramways, as requiring to be as substantially made as locomotive lines, and as being far more expensive to work. It was alleged that in thus setting aside the opinion of their engineer-in-chief, the Government had admitted his incompetence, and that they ought not to retain in office a professional man upon whose opinions they placed so little reliance. Some strong censures were also directed at Mr. Whitton, on account of his having reduced his estimates of the western and southern extensions from £25,728 and £18,765 to £10,000 and £8,500 per mile, the different conditions under which the two sets of estimates were given being entirely ignored. The defeat of the amendment for referring the railway estimates back to the Government did not indicate their approval by the Assembly, but merely amounted to a postponement of the question, to be renewed when the railway estimates come on for consideration. The Government have admitted that the further the existing lines have been carried the less they paid, and upon that basis the Government declined to propose at present the continuation of the three lines, believing that the traffic upon them would not, after paying the working expenses, yield an adequate return upon their cost, which would have to be paid by a loan.

The works on the extensions actually in progress had reached a forward stage, and in December a further section of the western line was to be opened for traffic. This was one of the extensions contracted for by Messrs. Peto and Co. The *Sydney Morning Herald* of November 21 observes upon this subject and upon railway extension in other parts of the colony:—"The Government have determined on at once opening the line as far as Rooty Hill, about five miles beyond the Blacktown station. The latter being a considerable distance off the western road, it has received none of the western traffic. The station at Rooty Hill will, however, be within a mile of the road. A good thoroughfare is being made to connect the station with the western road, and with this accommodation it is expected that the teams as well as the coaches will make use of the railway, which will then save twenty-five miles of the journey between Bathurst and Sydney. The line has been laid and ballasted considerably beyond that point, and the delay in opening to Rooty Hill is owing to the necessity for widening the embankment in order to lay down a siding, and for forming an approach from the western road to the station. The remainder of the western line is in a very forward state. The permanent way is laid for nearly six miles; the only remaining work of any magnitude is the Rope's Creek Bridge, which is nearly finished. The contractors have till the 1st of May to complete the western extension, but there is reason to believe that it will be ready for opening early in the year. The northern extension is also in a very forward state. It is also expected that, early in January next, the line will be open to Black Creek, the permanent way being already laid for half that distance. Beyond Black Creek nearly all the earthwork and bridgework is completed; three large cuttings have to be got through, and a long embankment near Singleton has to be formed. It is believed that the extension to Singleton will be completed in June or July next. On the southern extension, though the works are in a less advanced condition than on the other lines, they appear likely to be finished before the viaduct across the Nepean at Menangle can be erected. This structure is to be of iron upon stone piers; as the girders, which are being made in England, had not at the late dates been shipped, they cannot arrive before the end of this year. Progress has been made with the piers: the first is up to within fifteen feet of its top; the second is nearly the same height, and the foundations for the third and fourth are being got in. The sandstone for the piers is obtained about a mile from the viaduct. All the culverts on the southern extension and the works under the line are finished. The cuttings are considerably advanced, and the permanent way is laid down for about two miles."

Some improvements in railway construction, recommended by Mr. Bell, engineer, had formed the subject of a debate in the Assembly upon a motion that they should be tested by the Government. An invention, for which Mr. Bell obtained a patent a year ago, consisted in the combination of wood and iron in the construction of both rails and wheels, the wooden wheels to traverse the wooden rails, and the iron wheels the iron rails. Another system adapted to the existing railways has been brought forward by Mr. Bell, the principle of which is, such an application of the motive power of the locomotive engine as to drive the wheels which carry the cars and the loads instead of drawing them. An application was made by Mr. Bell for a patent for the invention, but the answer of the engineers to whom the application was referred was to the effect that a similar invention was described in The Engineer of January last; and consequently the patent was refused. An amendment was carried by the Assembly, for referring the question to a select committee, who were also empowered to report upon an invention by a Mr. Caporn, for stopping locomotives or other engines, upon inclines, by means of iron frills or ratchet wheels upon their axles. The labours of the committee will probably extend to the general question of cheap railways, and a mass of evidence will be taken. A committee of the Assembly, however, was felt to be an incompetent body to decide on matters of railway construction.

While wasting time in discussing railway projects, which there appears to be no earnest desire to carry out at present, the colonial Government must be accorded credit for its strenuous exertions to improve the ordinary roads of the colony, upon which it is proposed this year to expend no less a sum than £100,000. The largest work in progress under the Engineer for Harbours was the construction of the harbour at Wollongong. A large portion of the excavation is completed, and the new basin will shortly be commenced. The superintendence of the works is entrusted to Mr. Gibbons, who receives a percentage commission upon the original estimate, and a further commission on the amount saved upon the estimate. The harbour works at Kiama are also being carried out by Mr. Gibbons under a similar arrangement. At the Moruya River works for the improvement of the navigation are in progress. A stone dyke is being constructed at the south side of the entrance to the river, for the purpose of directing the channel. Timber rails are laid down for the conveyance of the stone, which is quarried at a short distance. The work is being carried on by Messrs. White and Co., and will cost about £4,000. Works preliminary to carrying out a breakwater from the north head of the harbour at Newcastle are in progress. A wharf is being erected within the harbour, from which, to the sill of the breakwater, a line of rails will be laid down to convey the ballast deposited at the wharf by the vessels arriving at the port for coal. The sum of £5,000 has been voted for the work, and on its expenditure further votes will be required. The effect of the breakwater will be to check the constant indraught of sand from the northern bank, which has, for many years, been filling up the harbour. Tenders were to be received on the 5th of December for works for improving the navigation of the Clarence River. The total cost of these improvements is estimated at £117,237, only £20,000 of which has at present been voted. The work to be first proceeded with is the construction of a breakwater 1,000ft. in length, to run from the south head in a north-easterly direction. Ultimately another 1,000ft. is to be added; after which another breakwater is to be run out from the north head. Similar improvements are proposed to be carried out in the Richmond and Macleay Rivers, surveys having been made by the Engineer for Harbours for that purpose.

A company has been formed, under the name of the Bellambi and Bulli Coal Company, for the purpose of working a coal mine in the Illawarra Mountains, and of bringing it to the port of Bellambi. The company have purchased about 600 acres of land from Dr. O'Brien and Messrs. Somerville and Black. Surveys are now being made for a locomotive railway four miles in length; the rails, which will weigh 40 lb. to the yard, were sent for from England by the last mail. The line will be constructed under the direction of Mr. Weaver.

After considerable delay telegraphic communication was established between Sydney and Brisbane, the capital of Queensland, on Saturday, November 9th. The four colonies of New South Wales, Victoria, South Australia, and Queensland, are now united by the telegraph, the distance between the extreme ends of the chain being no less than 2,005 miles. That is also about the aggregate length of the wires stretched in different parts of the colony. The line to Brisbane was opened by his Excellency Sir John Young, who sent a telegram to Sir George Bowen, congratulating the two colonies on the completion of the communication, and trusting that the wire might be an emblem of the congenial feeling entertained between the two colonies. A reply was sent by Sir George Bowen reciprocating the congratulations conveyed by the governor of this colony. The wire between Goulburn and Braidwood, which connects the latter town with Sydney, was finished, but not yet placed in circuit when our advices left. The experience of telegraphic extension, with that of railway extension, has shown that the further the wire is carried the smaller is the percentage of return. The works proposed by the Government this year are, therefore, of less extent than those of previous years. Short extensions are proposed to be carried from the southern line to Wollongong and Kiama; the western line is to be extended from Mudgee to Wellington and the Burrangong gold-fields; and perhaps also the new diggings on the Lachlan will be connected with Sydney, the wire being probably carried from Bathurst.

LAW INTELLIGENCE.

COURT OF CHANCERY, Lincoln's-inn, Jan. 29.
(*Before the* Lord Chancellor.)

HILLS *v.* EVANS.

It will be recollected that this motion for a decree, which has so recently been before this Court, involved the question as to a patent right claimed by the plaintiff for purifying gas. The patent was granted to the plaintiff on the 28th of November, 1849, for an invention which (as modified by subsequent disclaimer) is entitled "an improved method of manufacturing gas." The infringement was alleged to have been committed by the defendant, Frederick John Evans, in the process patented by him on the 27th of August, 1858, for an invention entitled "an improvement applicable to gas purifying." This process has been in use by the London Gaslight Company and other companies, and has given rise to repeated litigation, which has been duly reported in The Engineer. The plaintiff, Frank Clark Hills, of Deptford, the well-known manufacturing chemist, by the specification in his letters patent claims, first, the purifying coal gas from sulphuretted hydrogen, cyanogen, and, more or less perfectly, from ammonia, by passing it through the precipitated or hydrated oxides of iron, or the sub-sulphates, or oxy-chlorides of iron, from whatever source obtained, and either by themselves or made into a more porous material; and, secondly, the repeatedly renovating or reoxidising the purifying materials by the action of the air, whenever they cease to absorb sulphuretted hydrogen, so that they may be used over and over again to purify the gas; with a third claim, which is not material. In the month of June, 1856, Mr. Hills commenced an action in the Court of Exchequer against the London Gas Light Company for an infringement of his letters patent. This action came on for trial at the sittings after Michaelmas term in the same year, when, at the end of the second day of trial, the plaintiff was nonsuited. A rule *nisi*, however, was obtained for a new trial, which was ultimately, in November, 1857, made absolute. A new trial was accordingly had at the Guildford Summer Assizes, 1858. This trial lasted five days, and resulted in a verdict for the plaintiff upon all the issues, leave being reserved to the defendants to move on several points of law. The defendants afterwards moved for and obtained a rule *nisi*, calling upon the plaintiff to show cause why the verdict should not be set aside and a verdict for the defendants or a nonsuit entered, or why a new trial should not be had. The argument of this rule occupied the attention of the Court of Exchequer seven days, and ultimately, on the 25th of February, 1860, the Court gave judgment, discharging the rule. The effect was to establish Mr. Hill's patent against the defendants so far as the Court of Exchequer was concerned, and the plaintiff signed final judgment in the action. The defendants, however, proposed to appeal on the points of law involved to the Court of Exchequer Chamber, under the right of appeal given by the Common Law Procedure Act, 1854, upon which the plaintiff instituted the present suit to restrain the defendants, by injunction, from infringing his letters patent, and for other relief. The London Gas Light Company admitted that they had infringed Mr. Hill's letters patent if valid, but contended that for some time past they had used the process patented by the defendant, Frederick John Evans, and which they insisted was essentially different from the invention of the plaintiff. The Vice-Chancellor made an order declaring that the process in use by the defendants, the London Gas

Light Company, and the purification of gas by the material described in the patent of Frederick John Evans, was an infringement of the letters patent of the plaintiff; and, the plaintiff undertaking to abide by any order of the Court as to damages, it awarded an injunction restraining the defendants from the manufacture and purifying of gas according to or in imitation of the patent of the plaintiff, or for other purposes. In the month of March last the case came on by way of appeal before the Lords Justices. On that occasion their lordships interposed, and the following order was agreed to:—"The plaintiff to serve a notice of motion for a decree forthwith, and the defendant to have six weeks before the injunction commences; and the plaintiff to give an undertaking to be answerable in damages as from the expiration of that period." The case came on for hearing before their lordships in the month of July last, upon a motion for dissolving the injunction, when an important point was raised, whether Mr. Hills was entitled to have the injunction granted by the Vice-Chancellor made perpetual at once, considering the amount of litigation that had passed during the last ten years, in which the validity of his patent had been in contest, or whether the condition of the affirmance of the Vice-Chancellor's judgment ought not to depend upon the establishment by Mr. Hills of the validity of his patent by a new action at law. Their lordships took time to consider their judgment, but, as they differed in opinion, a suggestion was made that the case should be reheard before the Lord Chancellor, and it accordingly came on for hearing before his lordship last term. The arguments had not proceeded far when his lordship expressed a wish to have the points of law which were intended to be raised on appeal in the Exchequer Chamber argued before him. The case stood over for that purpose, and was argued before his lordship during five days of this term. At the conclusion his lordship said that he was of opinion the plaintiff had established conclusively his patent at law, and at the same time intimated he would give his reasons on a future occasion. He also gave the defendants an opportunity of considering whether they would wish to argue the question as to the infringement of the patent. On Friday last the defendants, through their counsel, declined to proceed any further with the question as to the infringement of the patent, and his lordship then stated that he would give his formal judgment this day.

Mr. Bovill and Mr. G. Denman (both of the common law bar), with Sir H. Cairns and Mr. Druce, were for the defendants; Mr. Grove and Mr. Hindmarsh (of the common law bar), and Mr. Rolt and Mr. Marten, were for the plaintiff.

The Lord Chancellor this morning delivered his judgment, and the reason for it, *in extenso*, and commented upon the various authorities bearing on the subject. His lordship, in substance, said that the construction to be placed upon the specifications of patents, like the construction of other written instruments, belonged to the Court, but the explanation of the technical terms used in the specifications were by law deemed matters of fact to be decided by a jury upon the evidence adduced before them. Moreover, the direction to the jury by a judge respecting the construction of the other portions of the specification must be contingent upon the meaning placed by the jury upon such technical terms, and, in addition, the drawing a comparison between two specifications exclusively belonged to a jury. Under such circumstances, if the matter had gone by way of appeal to the Court of Exchequer Chamber in error, the judges must have held that the question was one of fact, which had already been determined by a jury, and not one of law, over which they had jurisdiction. The case had been argued before him (the Lord Chancellor), as if it were before the Exchequer Chamber, and for the reasons above stated the judgment must have been in favour of the plaintiff. His judgment, however, would not rest upon that ground alone, for he had allowed the question, whether the matters in the specification of the plaintiff's patent had not been made *publici juris* by specifications of patents anterior to the patent of the plaintiff. His lordship then went most carefully through the various prior specification referred to in the arguments, and, after commenting upon the technical phraseology of each, said that he had come to the conclusion there was nothing in any such specifications in the smallest degree forestalling, anticipating, or rendering unnecessary the plaintiff's patent, or disentitling him to the benefit of his invention. Another point had been raised against the plaintiff's specification, that it was indefinite in its terms, and bad on account of their generality and inaccuracy, but he (the Lord Chancellor) was of opinion that this objection entirely failed, and that the plaintiff had conclusively established the validity of his patent at law. With respect to the remaining question as to the infringement of the plaintiff's patent by the defendants, the defendants had themselves declined to test the point, and therefore the Court had only to make a declaration that the plaintiff's patent had been finally established at law, and to grant a perpetual injunction in the terms of the prayer of the bill. There would also be a direction for taking the account according to the prayer, and the plaintiff's costs as between solicitor and client would have to be paid by the defendants, except the costs incurred before the Lords Justices. That part of the bill relating to the agreement of 1860 would be dismissed.—Ordered accordingly.

(*Before the* LORDS JUSTICES *of* APPEAL.)

CROSSLEY *v.* DIXON.

This appeal from a decision of Vice-Chancellor Wood (part heard yesterday) was continued to-day, Sir Hugh Cairns and Mr. Cracknall appearing for the plaintiff, and Mr. Rolt, with Mr. W. R. Fisher, for the defendant, the respondent. The object of the litigation is to obtain relief against the defendant, Mr. Dixon, a carpet manufacturer at Kidderminster, for alleged infringements of the patents of the plaintiffs, Messrs. Crossley, carpet manufacturers, at Dean Clough Mills, in Halifax. The facts, complicated and involved, were little aided by a voluminous correspondence. The bill stated that Dixon and Co. applied to Messrs. Crossley, in 1852, for a license to use their patent inventions for the manufacture of Brussels and velvet pile carpets; that no actual license was granted, but, after negociation, the plaintiffs supplied the defendant with some looms upon the principle of their several patents, on the terms of the defendant paying the price of the looms and a royalty on every yard of carpet made from them; that the defendant had also bought carpet-looms from Messrs. Sharpe, Stewart, and Co., of Manchester, alleged by the plaintiffs to be constructed so as to infringe their patent rights; and that the plaintiffs had sued that firm at law, and on reference the plaintiffs were awarded a large sum for damages. The prayer of the bill was either that it might be declared that the looms sold by the Manchester firm were constructed on the principle of the plaintiffs' patent, and that the defendant was bound, by the terms of his constructive license, to account for and pay the royalties; or that, if the license did not extend to those looms, the defendant might be restrained from infringing the patents of the plaintiffs. The Vice-Chancellor held that the defendant was a licensee from the plaintiffs, and was bound to pay the royalties, and the defendant appealed, alleging that there was no license at all nor any application for one, but only an agreement for a license, and only, in any case, an agreement to pay a royalty for the machines actually sold by the plaintiffs. He also contended that he was at liberty to question at law the validity of the plaintiffs' patent, and that, at all events, if there were a license or agreement for a license, the whole affair had terminated in 1854, when Messrs. Sharpe, Stewart, and Co. openly offered their machines for sale, made in conformity with their patent, which they alleged to be free from any objection by the plaintiffs or any other persons holding any patents.

Sir Hugh Cairns was heard in reply.

Their lordships reserved judgment.

MR. JOSEPH HALEY, of Moss Side, Manchester, who died on the 22nd inst., was buried, on Tuesday, at Withington Church.

LETTERS TO THE EDITOR.

(*We do not hold ourselves responsible for the opinions of our Correspondents.*)

FORCE OF IMPACT.

SIR,—In answer to your correspondents "C." and "N." I beg to give the following; and, as they wish to be favoured with a general rule, I shall treat a general example.

I suppose two bodies running one against the other with different velocities; I suppose, also, a movement of translation so that every point of the two bodies will have the same velocity; I call M and v the mass and velocity of one body; M′ and v' the mass and velocity of the other; u the velocity that the two bodies will take after the blow, so that we shall have for a first equation—

$$M\,v + M'\,v' = (M + M')\,u$$

$$u = \frac{M\,v + M'\,v'}{M + M'}$$

The time that elapses before the bodies take this velocity u depends upon their relative velocity and upon their hardness; to find it by calculation we shall suppose that the equal forces F and F′, which act to the contact of the two bodies, are constant during the whole time of the blow. Suppose x to be the space that the centre of gravity of the body M goes through from the beginning of the blow until the two bodies have the same velocity; x' the same quantity for the other body, and t the time between those two instants.

We know that a constant force gives to a body a movement that has for its equation—

$$x = v\,t \pm \tfrac{1}{2}\frac{F}{M}\,t^2$$

And as we have supposed that the two forces F and F′ are constant, we shall have the two following equations:

$$x = v\,t - \tfrac{1}{2}\frac{F}{M}\,t^2$$

$$x' = v'\,t + \tfrac{1}{2}\frac{F}{M'}\,t^2$$

$x - x'$ is the quantity by which the two bodies have come nearer together. We have

$$x - x' = (v - v')\,t - \tfrac{1}{2}\,F\,t^2\,\frac{(M + M')}{M\,M'}$$

A theorem of mechanics gives also

$$M\,u - M\,v = -\,F\,t$$

$$M'\,u - M'\,v' = F\,t$$

These equations give the following:

$$F\,t\,(M + M') = M\,M'\,(v - v')$$

If we substitute this expression in that of $(x - x')$ we find $(x - x') = (v - v')\,t - \tfrac{1}{2}\,(v - v')\,t$, whence

$$t = \frac{2\,(x - x')}{v - v'}$$

This formula will give us:

$$F = \frac{M\,M'}{M + M'} + \frac{1}{x - x'}\,\frac{(v - v')^2}{2\,g}$$

or if we call P and P′ the weights of the bodies and $\delta = (x - x')$ we find at last

$$F = \frac{P\,P'}{P + P'}\,\frac{1}{\delta}\,\frac{(V - v')^2}{2\,g}$$

This formula and those preceding show the influence of the hardness (from which depends the quantity δ) on the intensity of the force F, and the rapidity of the blow.

For non-elastic bodies, that is to say, those which stop together after the blow, I must add another consideration, that is to say, the loss of *vis viva* or living force. It will be seen easily, firstly, that there is diminution of living force, because, during the compression, until the moment where the velocities are equal, the molecule near the point of contact have come nearer together, notwithstanding the force of repulsion that the contact itself creates: from that results a negative work. Secondly, that as this work for the same bodies only depends on their relative velocity we can suppose one at rest, and the other animated with a certain velocity that we shall call V.

The living force of the two bodies will be—

$$\tfrac{1}{2}\,M\,V^2$$

After the blow

$$\tfrac{1}{2}\,(M + M')\,u^2 \text{ or}$$

$$\tfrac{1}{2}\,(M + M')\left(\frac{M\,v}{M + M'}\right)^2 = \tfrac{1}{2}\,\frac{M^2\,v^2}{M + M'}$$

The difference of living force will be

$$\tfrac{1}{2}\,M\,v^2\left(1 - \frac{M}{M + M'}\right) =$$

$$\tfrac{1}{2}\,\frac{M\,M'\,v^2}{M + M'}$$

If we suppose a mass M falling from a certain height h against a mass M′ we shall have

$$P\,h = \tfrac{1}{2}\,M\,v^2 \text{ living force before the blow,}$$

$$\tfrac{1}{2}\,\frac{M^2\,v^2}{M + M'} = P\,h\,\frac{M}{M + M'} = P\,h\,\frac{1}{1 + \frac{P'}{P}} \text{ living force after the blow.}$$

This formula shows that for the same work done P h there will be a greater effect gained as P′ increases. Of course h will diminish in the same ratio.

T. ELWELL, Jun.

Paris, 24th January, 1862.

WATER TUBE BOILERS.

SIR—"V. P." speaks well of a horizontal square water tube boiler I want a boiler that can be easily got at when required to be cleaned, the water in our river being so muddy. I can understand what an ordinary upright fire-box boiler, square or round, is, but I do not see how "V. P." would construct his horizontal one. [Will he give us a sketch?] Up to within a short time ago we had a little steamer on our river with the best upright square boiler I ever saw. It would begin to show steam in ten minutes, the fire-box was 22in. square, and was crossed by twenty 2in. tubes, in four alternating rows, two transverse and two longitudinal, with five tubes in each row. There was a plug screwed into the outer shell opposite each end of each tube. By taking out these plugs the tubes could be got at. The great fault of this boiler was that the water space was too small, the water was "soon up and soon down," and one day, when the engineer was sea-sick and blowing-off was neglected, the bottom row of tubes "came to grief." On examination they were found to be full of mud and salt. Larger water-spaces and occasional blowing-off would have prevented this. This boiler was stayed every 6in., was worked at 70 lb., and used very little fuel.

TYRO.

20th January, 1862.

P.S. "V.P." must suggest some easy way of getting at the ends of the water tubes. I have thought of having two of the sides of the outer shell made loose, and to be bolted instead of rivetted to the other sides. These two loose sides could be strengthened with angle iron up and down on their inside, and placed horizontally on the outside, rivetted through and through. This would compensate for the absence of stays. The tubes would prevent the fire-box from collapsing. The tubes in this boiler should all run one way, and could, by removing the loose sides, easily be got at. The other tin sides could be stayed to the fire-box. Pray give your opinion on this.

MISCELLANEA.

MR. PRENTICE, engineer to the Peruvian Government, is expected shortly to arrive in England to order a floating dock at a cost of £75,000.

THE application of the Galway Town Council to the Loan Commissioners for the loan of £75,000 for the improvement of the harbour of Galway has been refused.

IN a case, tried the other day, of libel upon Mr. Samuel Smiles, Mr. Bovill, the eminent counsel, referred to him as the author of "The Life of Sir Robert Stevenson!"

THE prospectus has been issued of the General Steam Fuel Company, an undertaking with a capital of £30,000, formed for the manufacture and sale of a patent fuel applicable for marine and other steam engines.

THE traffic receipts of railways in the kingdom amounted, for the week ending the 18th of January, on 10,059 miles, to £460,619, and for the corresponding week of last year, on 9,846 miles to £459,338, showing an increase of 213 miles and £1,281.

THE breakwater at Falmouth has been carried out to a length of 1,028ft. The excavation for the second graving dock, 400ft. long, with entrance 65ft. wide, and to have 16½ft. of water over the sill at ordinary spring tide, is being rapidly proceeded with.

THE Electric and International Telegraph dividend is to be 3½ per cent. for the last half year. The new and improved four-wire cable, to be put down by Messrs. Glass, Elliot, and Co., between England and Holland, is to cost £56,000 for making and laying.

A GENTLEMANLIKE person jumped, on Saturday last, from an express train going at full speed near Taunton. He was scarcely injured, and could only account for the act by stating that he had gone to sleep in his seat, and jumped out of the window while dreaming.

A SPECIAL court of the Court of Common Council was to have been held yesterday to consider the report of the Bridge House Committee recommending for adoption a design of Mr. Thomas Page for an iron bridge of three arches at Blackfriars, at the estimated cost of £245,000.

THE patent for the screw pile, originally granted to Alexander Mitchell, of Brickfield, Rallymacarratt, County Down, Ireland, July 4th, 1833, and subsequently extended for 14 years from July 4th, 1847, expired last July, and the screw pile may now be freely used by any one.

MR. SPENCER'S surface condenser, as fitted on board the frigate Arethusa, has nearly 9,000 joints, not one of which leaked on trial. On a four hours' trial of the Arethusa the vacuum was maintained steadily at 26½in. It is expected that others of these condensers will be introduced into the navy. Several have been made for land engines in the north.

IN consequence of the peculiar species of charge required for the proof trial of the huge 300-pounder Armstrong-gun, recently received at Woolwich from Elswick, and which still lies on the wharf, a considerable delay has been occasioned. The first trial, however, as a smooth-boro will take place at Woolwich in a few days, at the proof-butt, with a charge of 38 lb. of powder, and a round 10-in. shot, after which (if successful), the gun will be rifled on Sir W. Armstrong's principle, and undergo a second proof for service.

ORDERS have been given for the removal of the engineer officers' berth in the Black Prince, 40, iron frigate, in dock at Portsmouth, from the compartment in which it was originally fitted by Messrs. Napier to another compartment 260ft. forward of the engine compartment. This measure has been under the consideration of the authorities for some time, and the order now given for its execution has created the greatest dissatisfaction among the engineer officers generally in the port, who complain of what they term premeditated and degrading treatment.

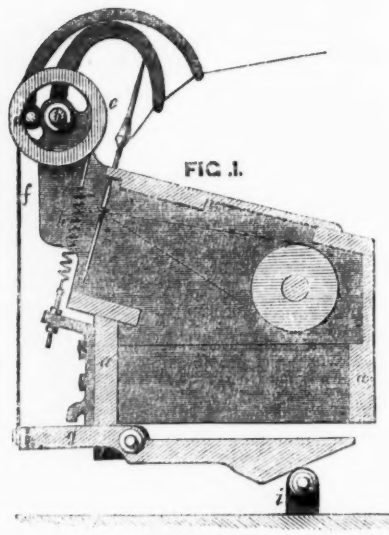
THE official report of the trial made on board the 51-gun screw frigate Arethusa, 3,141 tons, for the purpose of testing the engines supplied her by Messrs. Penn and Sons, Greenwich, has been forwarded to the Admiralty. The Arethusa is fitted with a pair of expansive trunk engines of 500-horse power (nominal), with all the latest improvements, Mr. John Frederick Spencer's surface condensers, and superheated steam. In working her full boiler power (four boilers) with 20 lb. pressure of steam, the screw made 61 revolutions per minute, vacuum 26·5in., temperature of steam, 300 deg. At half boiler power, with two boilers at work, the screw made 42 revolutions per minute; pressure of steam, 19 lb., vacuum, 25in.

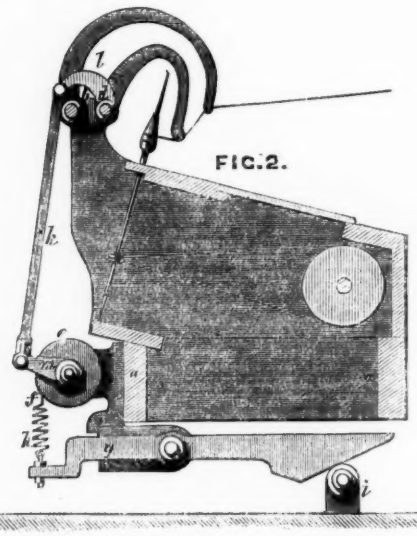
THE Collingwood, 80 guns, late sailing vessel, constructed from plans made by Capt. Symons, has been fitted with a pair of horizontal double-piston rod engines, and has since been twice tried at the measured mile off Maplin Sands. The engines are of 400 nominal horse power, the diameter of the cylinder being 63¾in.; stroke, 3ft.; and nominal revolutions, 50. On the first trial the vessel attained an average speed of 10·415 knots per hour, against a force of wind of 3. On her second trial she attained, with full boiler power, an average speed of 10·462 knots; force of wind, 6; pressure of steam, 20; actual revolutions, 65; vacuum, 26½; indicated horse power, 1,660; temperature in engine-room, 64; draught of water forward, 17ft. 6in.; aft, 21ft. 5in.; and, with half boiler power, 8·294 knots; revolutions, 52; the pitch of the screw being 19ft. 3in., and the diameter 17ft.; the results showing that the second trial is of a much more satisfactory character than the preceding one.

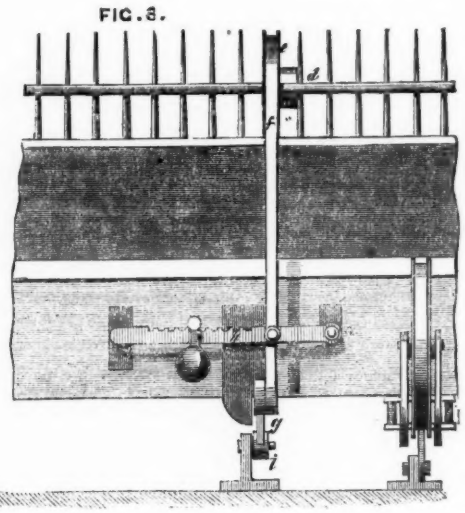
THE following appointments of naval engineers have been made since our last:—G. Metcalf, promoted to the rank of first-class assistant-engineer in the Jackal; L. J. Croome, promoted to the rank of first-class assistant-engineer in the Cygnet; W. H. Wivil, promoted to the rank of first-class assistant-engineer in the Indus; G. T. Allison, promoted to the rank of first-class assistant-engineer in the Revenge; John Clift, promoted to the rank of first-class assistant-engineer in the Asia; A. Stewart (A), promoted to the rank of acting first-class assistant-engineer in the Algiers; C. Lund, promoted to the rank of acting first-class assistant-engineer in the Mutine; J. S. Smith, promoted to the rank of acting first-class assistant-engineer in the Forward; J. Hopwood, promoted to the rank of acting first-class assistant-engineer in the Odin; John Francis, second-class assistant-engineer, to the Shannon, vice Hyde; H. W. Hart, acting second-class assistant-engineer, to the Impérieuse; George Treveas, chief-engineer; George M. Dooley, engineer; R. W. Meiklejohn, acting first-class assistant-engineer; and Joshua Bamford, acting second-class assistant-engineer, to the Euryalus, commissioned.

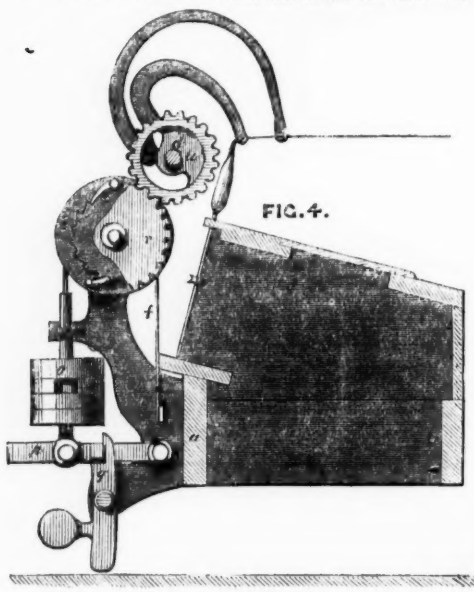
IN the Court of Queen's Bench, sitting at Westminster, on the 25th inst., a Mr. Harrison, who had appealed from a conviction made under the following circumstances, obtained judgment in his favour:—The case was stated for the opinion of the Court under the 20th and 21st of Victoria, c. 43, and which raised a question as to whether the appellant had been rightly convicted by the magistrates of an offence against the 70th section of the Highway Act (the 5th and 6th of William IV., c. 50). The section in question made it an offence to erect any steam engine within 25 yards of a public highway unless it were within some building, or so fenced as not to be dangerous to passengers. In the present case the appellant had sent his man with a steam threshing machine to the premises of a farmer, who directed the servant to set the machine at work near a rick, within 12 yards of the highway; the steam engine startled some horses on the highway, and they ran over their driver. It was objected, first, that the Act did not apply to engines of this class, which, it was said, were not in existence when the Act passed; secondly, that it was not erected; and, thirdly, that the appellant had not the control of it at the time. The magistrates overruled the objections and convicted the appellant. Mr. Fitzjames Stephen supported the conviction. Lord Chief Justice Cockburn said this was a criminal case, and the appellant could not be convicted unless there was the *mens rea*. His lordship thought the master was not liable for the illegal act of his servant. The other judges concurred.

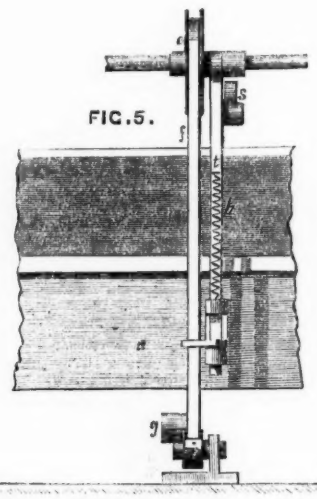
PITFIELD'S SELF-ACTING MULES.

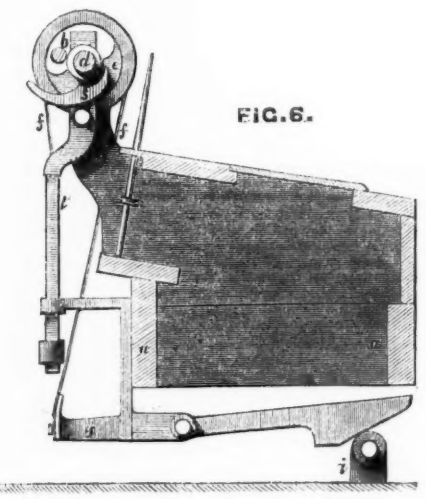












This invention, by R. W. Pitfield, of Bolton, relates, first, to that part of the self-acting mule known as the "fallers," and is designed to prevent the loose winding of the yarn at the upper end of the "cop," and the formation of "snarls" caused by too sudden rising of the "fallers."

The second part of the invention consists in the novel use and application of the well-known differential motion, called the "jack-in-the-box," to the throwing in and out of gear the scroll governing the running in of the spindle carriage, by means of a sliding rod acting upon the brake of the said differential motion, instead of effecting the same by means of catch boxes, as heretofore employed.

Fig. 1 is a side view of that part of the mule to which the invention is applied, showing the spindle carriage in section, and exhibiting the two "fallers," brake wheel, and other connected apparatus; Fig. 2 exhibits a modification of the same, wherein a connecting rod is used between the "faller rod" and brake wheel; Fig. 3 is a simple modification for tightening the brake strap by means of a lever and adjustable weight; Fig. 4 representing another method of governing the "fallers" by the use of toothed and ratchet wheels; Figs. 5 and 6 are respectively a front and side view of a method for tightening the spring connected to the "brake strap or band" by means of a cam.

In Fig. 1 *a*, *a*, is the spindle carriage; *b* the copping shaft and "faller;" and *d* the counter or second "faller;" *e* is the "brake wheel" upon the faller shaft, around which the strap or band *f* passes, and is connected to the lever *g* at one end, and to the spring *h* at the other; the bowl *i* acts upon the lever to tighten the said strap upon the brake wheel, and thereby to govern the rising of the fallers. Fig. 2 is of a similar construction, but having a rod *k* connecting the link *l* upon the "faller shaft" to the lever *m* on the brake wheel. These methods are similar in action, that is, when the "fallers" are about to rise (the carriage being run in), the incline upon the lever *g* comes into contact with the bowl *i*, and so draws the strap tightly upon the brake wheel, and so permits of the fallers rising at a certain required speed, and that with a regular and even motion, instead of with a sudden jerk, as hitherto. In Fig. 3 one end of the strap or band *f* is secured to a lever *n*, upon which there is an adjusting weight to increase the friction of the strap upon the "brake wheel" as the "winding on" of the cop proceeds. In Fig. 4 the weights *o* are employed instead of the spring or lever and weight *n*, and are raised by the lever *p*, and maintained in position by the catch or trigger *q* during the "winding on," at the termination of which the stud *r* strikes the lever *q*, liberating the lever *p* and the friction of the strap is exerted upon the pulley to regulate the rising of the fallers. The pinion *u* upon the faller shaft gives motion to the spur wheel *v*, which drives the brake wheel through the ratchet wheel, and when winding on the pawls slip and the "brake wheel" is not acted upon; but when the fallers are rising the pawls take into the ratchet wheel and the brake wheel revolves, creating the necessary friction against the strap or band. In Fig. 5 a similar method is employed to that seen in Fig. 1, but a cam *s* is used on the "faller" shaft to increase the tension and force of the spring as the winding on proceeds, acting by depressing the sliding rod *t* attached thereto.

RAILWAY MATTERS.

The Lynn and Hunstanton proprietors have held their first general meeting. The line, of which Mr. Valentine is engineer will be 14 miles, 7 furlongs long. Out of 85,000 cubic yards of embankment, 45,000 have been already executed. The line is expected to be opened by the end of June. The contracts for the whole cost of the railway, including land and all other expenses, amount to £80,000.

The report of the Brighton directors states that the amount of capital raised to the 31st of December last was £10,147,786, consisting of £4,620,000 ordinary stock, £3,235,765 preferential stock and shares, £1,537,315 mortgage debt, and 754,706 debenture stock. The amount of capital expended during the half-year was £233,492. The gross revenue for the half year had been £526,741, showing an increase of £21,472 over the corresponding half of 1860. The revenue for the year 1861 had been £948,120, or £52,240 in excess of that of 1860. 2,771,117 train miles were run in the whole year 1861, and 10,593,655 passengers were carried. The total working expenses and renewals amounted for the past half year to £242,474, against £231,914 for the corresponding half of 1860, showing an increase of £10,560. The renewals for the past half year amounted to £22,560, against £29,643 for the corresponding half of 1860. The average cost per train mile amounted to 3s. 2½d., against 3s. 3d. for the corresponding period. The working expenses amounted to 46¾ per cent. against 46½ per cent. in the same period of 1860.

The directors of the North-Eastern Company have agreed to recommend to the shareholders that the following dividends should be declared upon the ordinary stock and shares in this company for the half-year ending the 31st of December last, viz.:—On the Berwick stock at the rate of 5 per cent. per annum; on the York stock at the rate of 4½ per cent. per annum; and on the Leeds stock at the rate of 2¾ per cent. per annum.

The Eastern Counties Company has reduced the hours of labour of the pointsmen on the railway, as it has long been felt that men intrusted with such responsible duties should not be overtasked. It is stated that the new lines in Suffolk for which the company obtained Parliamentary powers last session are to be at once proceeded with.

The shareholders of the Furness Company have authorised the directors to purchase the undertaking, property, and effects of the Ulverstone and Lancaster Railway Company, for the sum of £298,000 preferential stock of the Furness Railway Company. Such stock is to bear in perpetuity a preferential dividend at the rate of 6 per cent. per annum, payable half yearly. The Ulverstone proprietors have met and sanctioned the arrangement.

The report of the Manchester, Sheffield, and Lincolnshire directors states that the total revenue from all sources amounts for the past half-year to £354,882, and the total expenditure to £190,056, leaving a balance of £164,826, which, with the balance of £1,395 from the preceding half-year, gives a total sum of £166,221 available for interest and dividends. The debenture and preference charges amount to £140,896, leaving £25,325, out of which a dividend at the rate of £1 5s. per cent. per annum will absorb £24,500, and leave £824. The local traffic on the line for the half-year amounts to £161,059, and the foreign traffic to £139,329, making together £300,388. The dues and wharfage of the Grimsby Docks for the half-year ending December 31 amount to £4,384, against £4,898 for the corresponding half of 1860. The company's share of net profit in connection with the South Junction Railway amounts to £7,894, against £7,467 in the corresponding period. The receipts on the company's canals amount for the half year to £36,941, against £37,160 in the same half of 1860. The total working expenses of the railway for the half year amount to £163,626, against £160,169 for the corresponding period of 1860, showing an increase of £3,457. The cost of the locomotive department showed a decrease of £3,666, notwithstanding that an increased tonnage has been carried. The directors assure the proprietors that the whole of the rolling stock is in a more satisfactory condition than at any former period. The canal expenses amount for the half-year to £26,430, against £27,968, showing a decrease of £1,538 as compared with the corresponding period of 1860. The capital account shows an increase of £161,335, including £157,721, for land, works, stock, &c. The directors propose to raise new capital to the amount of £981,500, by the creation and issue of a perpetual 5 per cent. preference stock, and to borrow the usual amount in respect thereof, making a total of £1,263,000 for new lines, stations, &c. The whole amount of the stock is to be called up during a period of three years. The capital account shows that £9,716,051 had been received to the 31st of December, and £9,434,162 expended, leaving a balance of £281,889.

Locomotive Statistics.—In working the trains on the Manchester, Sheffield, and Lincolnshire Company's line during the half-year ending the 31st of December last the locomotive engines were in steam 180,881 hours, of which 94,083 were occupied in running, 61,656 in shunting, and 25,142 standing. The engines consumed 61,837 cwt. of coke and 439,238 cwt. of coal. The cost of fuel per hour was 16·82d., and per mile 1·90d. The train miles run by the engines amounted in the aggregate to 1,287,299; in assisting trains, 13,436 miles; and in conveying empty trains, 79,246 miles; making the total miles run by the engines during the half-year 1,379,981. The number of passenger trains run during the half-year was 26,477, of which 17,339 arrived in time, and 9,138 above five minutes after time. The number of goods trains run was 8,901, of which 5,304 arrived in time, and 3,597 above five minutes after time; and the number of coal trains run was 7,405, of which 5,186 arrived in time, and 2,219 above five minutes after time. The average number of carriages in the passenger trains was 6¼, of wagons in the goods trains 36¼, and in coal trains 25½.

Death of Col. Colt.—The New York papers report the death, on the 9th inst., of Col. Samuel Colt, at Hartford, Connecticut. Mr. Colt was born in the city in which he died on the 19th of July, 1814. He was the inventor of the celebrated revolving pistol, the wooden model of which, it is stated, was made on board a vessel while the inventor was on a voyage to Calcutta in 1829. He received his first patent in 1835, and established a factory in Paterson, New Jersey, but met with indifferent success. He subsequently disposed of his right to manufacture revolving fire-arms, and, as it was generally understood at the time, expended the proceeds in a vain attempt to clear his brother, John C. Colt, of the charge of homicide, of which he had been found guilty for killing a printer named Adams, at his (Colt's) rooms, at the corner of Broadway and Chambers-street. Colonel Colt afterwards invented a submarine torpedo, which was intended for the destruction of vessels. He gave two exhibitions of the power of his new invention in the bay off Castle Garden by blowing up first a schooner, and afterwards a large brig. He then established a line of telegraph between New York and Sandy Hook and Montauk, which was intended to announce the arrival of vessels, and to facilitate the dispatch of important foreign news; but this enterprise failed, and Mr. Colt became very much reduced in circumstances. A year or two later he again got possession of his patent for the revolving pistol, and, with the assistance of a few capitalists who joined him, a company was formed, and a manufactory was established, at Hartford, which has proved very successful, not only in the making of pistols, but in the manufacture of a revolving rifle, which was also the invention of Mr. Colt. The factory, at the present time, is supposed to be worth nearly 5,000,000 dols. Mr. Colt also leaves a large landed estate, and was no doubt one of the most wealthy men in New England.

TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

ERRATUM.—*In our abstract, last week, of the report of the Steam Boiler Assurance Company it was stated that "897 the rough examinations" had been made. It should have been "thorough examinations," the error being in the printed copy sent us from Manchester.*

J. P. (Norton).—*Received.*

W. S. (Chancery-lane).—*Too late for this week.*

J. B. (Sheffield).—*We should prefer the longer stroke.*

A. A. (Perth).—*We are unable to perceive the force of your complaint.*

A SUBSCRIBER (Yarmouth).—*The two books named by you are the best.*

M. (Aberdeen).—*We do not think that you have demonstrated your case.*

J. W.—*You will find your question answered in our column of* Miscellanea.

A YOUNG BEGINNER.—*We will see if we can look up something of the kind.*

G. D.—*There is nothing novel in the suggestion, but we agree with you that the change ought to be made.*

J. J. K.—*Your arrangement will certainly work, but we are unable to discover the advantage of it. Shall we return the tracing?*

H. R. H.—*There is no work which will serve your purpose so well as Dr. Thomson's Encyclopædia of Chemistry. The price is* 12*s.* 6*d.*

A READER.—*We cannot recommend you such works as you seek. Dr. Scoffern's book, published by Messrs. Longmans, may be of some service to you.*

H. C. D.—*By referring to pages* 220 *and* 254 *of the ninth volume of* THE ENGINEER *you will obtain all the information we can give you on the subject.*

S. F. (Wandsworth).—*By visiting the Free Library of the Patent Office in Southampton-buildings, Chancery-lane, any week day between ten and four, you will have every facility for obtaining the information you require.*

J. C. (Bury).—*It may be that the best for your purpose is Mr. Murray's work on the Marine Engine (price, we think,* 2*s.* 6*d.*), *published by Mr. Weale,* 59, *Holborn. What "examination" do you refer to? There are no "forms of problems" in the navy or merchant service.*

W. R.—*Pray let us know how you are to obtain a vacuum in a gun without closing the muzzle and inviting the bursting of the piece? Then, too, what would be the use of exhausting the air from the bore while the air had to be met by the ball the moment it left the muzzle?*

T. M.—*We do not think you could obtain any rotation of the shot worth mentioning by such an arrangement. As for the other question, a body once put in motion around any axis tends to continue in motion around that axis, just as does a top. It might take some space to explain exactly why.*

A WORKING MAN.—*We have no experience which would enable us to give the size of a fan to be driven by hand to melt* 2 *cwt. of iron. But any fan of* 18*in. or* 12*in. ought to do, if driven long enough. We presume more than one man is to be put at the winch.* 9 *copper to* 1 *tin makes the best bushing for mill work.*

G. E. B.—*No patent has ever issued in this country to any person of the name of Rimington or Remington, for flour mills, unless such a patent has issued within the last six months. Mr. Rimington obtained a patent in* 1846 (*No.* 11,066) *for "obtaining motive power." We cannot say if, as he was allowed to do under the old law, he included a flour mill in such a patent. If he did so the patent has expired.*

W. G.—*You have raised a point which has never been quite clearly settled—never, as far as we are aware, by law. Mr. Tooth obtained a second provisional protection upon which he completed his patent for a puddling machine, the second provisional being taken one day before the expiration of the first one, and, therefore, before any publication could have been made. Now Mr. Tooth's patent has not been contested, at least on this ground, but there is great difference of opinion as to the matter. If your partner's patent be good you clearly can make him account to you for your share of the invention as recorded in the first provisional, which should prove that you were a joint inventor.*

FURNACES.

(To the Editor of The Engineer.)

SIR,—Can you inform me of the safest method of keeping in its place the wall of a furnace at the springing of the arch (fired and cooled every week), the furnace having a second and similar one above it?

A SUBSCRIBER FROM BEGINNING.

TRACTION ENGINES.

(To the Editor of The Engineer.)

SIR,—As I see, by the specification of Messrs. Aveling and Rawlinson's patent, which appeared in your impression of the 10th inst., that they claim the arrangement of a steam cylinder or cylinders within the steam dome of a portable, traction, or roadway engine, I should feel obliged if you would allow me space in your columns to assert my priority in so arranging these parts. I beg to enclose for your inspection two tracings, the original drawings from which they are traced having been made by me as early as December, 1860, and shown at that period to several persons, whom I can produce as reliable evidence that such were designed by me at that time. I, therefore, consider that this arrangement of parts having been made known to the public long before the date of Messrs. Aveling and Rawlinson's patent, is become public property, and cannot be patented by one individual. Tracing No. 1 represents the outline of a portable traction engine, the steam cylinder of which is cast within the steam dome; and on tracing No. 2 the cylinder is placed in a casing, which forms the up-take or connection between the smoke box and the chimney.

New-cross, January 27th, 1862. A. PULLAN.

[*We cannot see that the facts mentioned by Mr. Pullan in any way invalidate Messrs. Aveling and Rawlinson's patent.*—ED. E.]

MEETINGS NEXT WEEK.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, February 4th, at 8 p.m., Discussion upon Mr. Samuda's paper "On Iron-Plated Ships."

SOCIETY OF ARTS.—Wednesday, at 8 p.m., "On the Improvements and Progress in Dyeing and Calico Printing since 1851." By Dr. F. Crace Calvert, F.R.S.

SOCIETY OF ENGINEERS.—Monday, February 3rd, at 7 p.m., "On Horse Railways." By C. L. Light.

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THE ENGINEER.

FRIDAY, JANUARY 31, 1862.

STEAM ENGINE ECONOMY.

THE "Manchester School" of steam engineering (by no means remarkable for its perfection, either) exercises much influence upon the selection and working of steam machinery in almost every part of the kingdom. Whatever a "Monchester Mon" may happen to do in connection with the motive power of a mill, is sure to be quoted, criticised and, very likely, imitated, not only throughout Lancashire, but, in many cases, from the Solway to the Humber, and from the Tyne to the Severn. We are glad to know, therefore, that a powerful agency is at work in Manchester to promote economy in the raising and using of steam. This agency is that of the Manchester Association for the Prevention of Steam Boiler Explosions, an association which has now been in existence for upwards of seven years, and which, we believe, has been the means of saving more lives, in that period, than the Royal Humane Society—we will not say the Royal National Life Boat Institution. Not occupying itself wholly with the diagnosis of, and prescription for, diseases of steam boilers, the Manchester Association also employs itself and, more especially, its inspectors, in "indicating" the steam engines within the sphere of its operations, and in the advisory functions of a consulting engineer to its subscribers, now 430 in number. These members have 1,454 boilers on the books of the Association, and now pay nearly £1,300 yearly for their inspection, a sum which, we regret to learn, falls nearly £300 short of the present annual expenses of the Association, which, at the date of its last report, had overdrawn some £340 at its bankers, although, happily, it has already invested nearly £800 in 6 per cent. Midland Railway preference shares. We mention these facts, not from any bearing which they can have on steam engine economy, but to show that, in seeking to promote that economy, the Manchester Association is already confronted with the prospect of possible bankruptcy. Its operations already extend from Darlington, on the north east, to Chester and Wrexham, on the south west, and from Preston, Scorton and Longridge, on the north west to Sheffield and Rotherham on the south east, and we sincerely hope that, to the present list of subscribers may be added a thousand more in the same extensive district, already pulsating with the measured strokes of ten thousand steam engines.

In the late annual report of the chief engineer of the Manchester Association we find the results of indications of engines comprising 66 cylinders, and working at pressures ranging from 18 lb. to 64 lb. per square inch. Unfortunately there is no explanation of the circumstances under which these indications were made, nor whether they give average or exceptional performances of the engines indicated. From the highly practical habits, however, and utilitarian views of the officers of the Association, we cannot doubt that the indications were made to represent, as nearly as might be, the average working of the engines. In the majority of cases, furthermore, the boilers supplied steam, not only to the engines, but to the heating pipes, sizing machines, and dressing cylinders in the mills to which they were attached, and, thus, the cases in which the working economy of steam engines was really ascertained were but few in number. We cannot say that the results are especially encouraging. In one case, it is true, a condensing and a high pressure engine, compounded together, and worked by steam at a pressure of 40 lb. per square inch in the boiler, gave an hourly indicated horse power with but 2·7 lb. coal. In another case, a similar combination of engines working up to 140 indicated horse power, and with 64 lb. steam in the boiler, consumed 3·6 lb. coal per horse power per hour. A condensing beam engine, working at 32 lb. steam, gave off 72 indicated horse power at 3½ lb. per horse power per hour, and two other condensing engines working up to 367 and 339-horse power respectively, and at 25 lb. pressure, gave off an hourly horse power with 3·7 lb. coal, "Green's Economiser," whatever that may be, being used in connection with the engines. In other cases where "Green's Economiser" was employed, condensing engines of 429, 348, and 570 indicated horse power, were worked respectively with a consumption of 4·9, 5·4, and 6 lb. coal per horse power per hour. The latter rate, viz., 6 lb, appears to be common in the Manchester mills, even when the steam is not used after it leaves the engine, whereas, when the steam is thus used, the rate rises to 7½ lb., and even 9 lb., and, in one case, even to 11·8 lb. per indicated horse power per hour. One horizontal non-condensing engine, worked with steam at 58 lb. and giving off 65 indicated horse power, consumed 7 lb. coal per hourly horse power, none of the steam being used in the mill.

As to pressures, 599 of the 1,454 boilers are working at 45 lb. and upwards, and yet, contrary to what we might expect, the best "duty" is had from steam of less than 40 lb. pressure. At least, this is the case in respect of the few engines "indicated" by the inspectors of the Association, for, we regret to say, since the exaction of the trifling fee of half-a-crown per cylinder for the application of the indicator, comparatively few engines have been indicated at all, unless privately by their owners, with indicators of their own.

In the last report of Mr. L. E. Fletcher, the chief engineer to the Association, he urges upon the members the advantage derivable from steam jacketting and superheating, improvements which, as yet, have not made great headway in Lancashire. Upon this subject we think it best to give the conclusion of Mr. Fletcher's report in his own words:—

"If our members would open a debit and credit account between their engines and boilers, crediting the boiler with the water evaporated, or pounds weight of steam delivered to the engine on the one hand, and debiting the engine with the steam supplied to it by the boiler on the other, they would find that the engine, as shown by the indicator diagrams, would render but a poor account of the steam delivered to it, and that there would be a heavy deficit balance. I have known this tried in several cases, when an average loss of 33 per cent. has been found, and in some cases much more. It is a mistake to suppose that this would be prevented by any extent of external clothing alone, however perfect, since it has been found that the loss does not arise from the external surface only, but also from the internal, and is caused by the alternating connection of the cylinder, on each stroke of the engine, with the boiler at a high temperature, say 300 deg., and the condenser at a low one, say 100 deg., which sets up on the internal surface of the cylinder, as well as on that of the piston, an alternate action of condensation and re-evaporation, by which means a considerable percentage of steam passes from the boiler to the condenser right through the engine without doing any work. This action is so silent and subtle in its operation that it had for years escaped detection, and we are much indebted to the late Dr. Haycraft, of Greenwich, among others, for investigating and calling attention to this subject. The remedy for this is, either to adopt the steam-jacket or to superheat the steam. There is nothing new, untried, or dangerous in either of these. The steam-jacket was first applied nearly a hundred years ago, by James Watt, and in his original engine, which effected such a revolution in the use of steam; it was one of the fundamental principles, and for it a claim was made in his patent; while superheated steam is now in very general use in other parts of the country, especially in marine engines. The subject of superheated steam has, however, been sadly bugbeared; it has been reported that its use would destroy the surface of the cylinder, piston, and slides by preventing lubrication; also, that it would corrode the metal, that it was highly explosive, productive of great pressure, and altogether dangerous and difficult to deal with. Actual experience, however, has proved that these objections are entirely visionary, and I find that, where superheated steam has been fully tested, no difficulty is experienced in its use, and no alteration whatever is required in the old engines beyond the introduction of a slightly better description of packing for the glands, while not a trace of corrosion is found.

"It only now remains, therefore, for the manufacturing engineers of this district to bring out a simple and efficient superheating apparatus adapted to mill engine boilers, by which they will not only benefit themselves, but at the same time render essential service to the steam users of the district. I shall soon have an opportunity, of which I shall readily avail myself, of laying before our members a statement of the practical economy derived from the application to mill engines, both of the steam-jacket and of superheated steam; and in illustration of their commercial value may state that the Peninsular and Oriental Steam Navigation Company have, in many of their engines, realised an economy of upwards of 30 per cent. by the introduction of superheated steam alone; while, in a new vessel lately built, of 2,600 tons burthen, with engines of 400 horses' power, in which steam-jackets, aided by surface condensation, have been adopted, the consumption has been reduced to rather less than one-half the usual amount. The practical value of this to the company will be seen when it is stated that its coal bill has amounted to £800,000 in one year only; and from which may readily be inferred the monetary importance of the application of this principle to the whole of this district.

"I may also add that to steam users having cooling ponds of limited area superheating has a farther advantage, since, by the vacuum being improved, the temperature in the hot well is reduced, and less injection water required. It is found most advantageous to superheat the steam to about 100 deg. above the temperature of plain steam when no difficulty is experienced in lubricating; also that the utmost care must be taken in maintaining the temperature of the steam when once it has been superheated, or the virtue will be lost before it gets to the engine. I found in one case that, although the temperature immediately on leaving the superheater was as high as 600 deg., yet it had fallen to nearly 300 deg. on its arrival at the engine. I understand that some parties entertain the idea that superheating may be advantageously applied where steam is used for heating purposes. I am convinced, however, that such would not be the case, and that disappointment will inevitably ensue wherever superheating is adopted with this view.

"It may be of assistance to our members in judging of the economy of their engines to have the following figures at their disposal as a standard of comparison. These figures are extracted from a complete diagram of the economic duty of steam expanded down to a pressure of 5 lb. above zero, before leaving the cylinder, with an average vacuum behind the piston of 12½ lb. The curve, in this diagram, is that due to true expansion, which can only be attained where condensation is entirely prevented, and is calculated from the relative volume of steam at various pressures compared to the water from which it was evaporated. Space prohibits the introduction of the diagram complete, and only admits of the following table:—

"One indicated horse power requires per hour—

17·9 lb.	weight of steam,	at 10 lb.	pressure.	
15·5	,,	,,	20	,,
14·1	,,	,,	30	,,
13·2	,,	,,	40	,,
12·6	,,	,,	50	,,
12·1	,,	,,	60	,,

"The value of coal varies in different cases—1 lb. of some coals being able to evaporate upwards of 10 lb. of water, while others only 6 lb. Although 8 lb. might not be too high a value for Lancashire coal, yet, making allowance for the losses from radiation, it may not be safe to assume it as higher than 6 lb. in actual practice; with which it will be seen that, according to the preceding table, there would be required per indicated horse power per hour:—

2·98 lb.	of coal with	steam at	10 lb.	pressure.
2·58	,,	,,	20	,,
2·35	,,	,,	30	,,
2·20	,,	,,	40	,,
2·10	,,	,,	50	,,
2·02	,,	,,	60	,,

"The subject of the economic use of steam is so ample that the limits of this report quite prevent my entering on other points, as I had hoped to do, or even doing full justice to the one I have touched on, and I have been induced to confine my remarks to the use of steam-jackets and superheating, since I consider their general adoption by the members the most important step they can take at present in the economic use of steam.

"Allow me, in conclusion, to remark that it will always be to me a pleasure to circulate among the entire body of members reliable information on all points relating either to the safety of boilers or the economic use of steam, carefully avoiding the recommendation of anything untried and experimental. In this way I am convinced that the association will continue to be a source of wealth to its members, as well as to the surrounding district, and I am desirous that no year should pass without a decided mark of engineering progress being clearly stamped upon it by this association."

THE NAVAL ENGINEERS.

The "authorities," or, in other words, the Admiralty, have been pleased to order the removal of the berths of the engineer officers of the Warrior and Black Prince from the compartments in which they were originally fitted by the builders of those vessels, to the forecastle. We presume none of our readers are ignorant of the manner in which officers, guests, passengers, crews, and live stock are usually quartered, according to certain considerations of precedence, on board vessels of all kinds. The passenger by a steam ferry boat does not look for the chief cabin forward of the funnel, nor are sailors usually accommodated with berths below the quarter-deck. Practically, if not exactly, the rank of every one on board a first-class ship—at least a ship of war—is inversely as the distance, or the square or cube of the distance, of his quarters from the stern-post. This rule applies, without substantial exception, in the vessels of all civilised nations, and even among the Chinese, whose notions and habits are, in almost everything else, so exactly opposed to our own, it is not customary, we believe, to stow the admiral in the steerage. Once familiar with the order of rank in a ship of war, no one can be at a loss to comprehend the immense importance of the distinctions which rank implies. The consideration accorded to each officer or man is graduated with scrupulous nicety, according to his relative rank. Two or three centuries of naval organisation had definitively settled all questions of rank in sailing ships, and not only did each officer and man know his exact place, but he knew, too, what were his chances of promotion. The midshipman might, as he was himself aware, become an admiral, and even First Lord of the Admiralty.

But steam introduced a new class of men. To the cap-

tains of the old school, the hissing boilers and thundering engines were bad enough in all conscience, but the grimey, greasy lubbers, who came tumbling on board to look after all this new-fangled gear, were almost intolerable, and could they have been really dispensed with, great would have been the joy of all, from the admiral down, to see them kicked over the gunwale. No one who knows anything of the feelings of the older officers in the navy will pretend that we have materially overstated their original dislike of the "engine-tenters, stokers, and pokers." No genuine old salt ever looked upon a huge boiler and a lumbering steam-engine as an appropriate part of a ship. After a considerable time, however, and in the face of much prejudice, "engineers," for so they are at last designated, have been placed on something like a footing corresponding to their indisputable importance in the working of our present class of steam-driven ships of war. Yet the old jealousy has never completely died out. True, while many of the "officers" are men of more or less education, and, it is usual to believe, of corresponding cultivation of manners, the engineers are seldom "educated" in the sense in which that term is commonly understood, and, beyond that natural courtesy which is inborn with the man who, knowing his proper sphere of duty, devotes himself to it, to the sacrifice of everything like presumption, the engineers are not remarkable for social graces and accomplishments. They can never become admirals—that they well know, nor do we see how they are ever to be represented at the Admiralty. Notwithstanding all this, however, there is, just now, a strong feeling of indignation among the naval engineers at the manner in which they have been degraded in the two best ships in the service, vessels, moreover, which are particularly dependent upon steam and engineers for anything like the results expected from them. It is assuredly worth the while of the Admiralty to carefully consider whether, at a time when the navy is becoming, more and more every day, dependent for its practical efficiency upon the resources of steam engineering, and the skill and devotion of the naval engineers, it be prudent, not to say fit, to degrade, as they are now doing, so important a class of officers, for officers the engineers are by appointment. We are well aware that the patronage of the Admiralty is an important object in the eyes of young engineers and machinists, most of whom never think of ascertaining whether the position to be accorded them on board ship will be as good as that which they occupy on shore. So, too, there are some thousands of engineers already in the service, most of whom may be reasonably regarded as dependent upon their appointments for their own support, and perhaps that of their families. Whoever is appointed to the Warrior or Black Prince must of necessity go, or do worse, but no engineer, with a common care for his rank, can feel otherwise than demeaned by being sent forward to berth and mess among, or immediately contiguous to, the sailors. If this arrangement is to be adhered to, and adopted in other ships, none whom we would care to recognise as engineers can be expected to seek the naval service. We do not suppose that the present engineers will resign, or, if they did, that it would be difficult to fill their places by persons who could start and stop an engine; but we do suppose that men really qualified for the most responsible duties of naval engineers would remain on shore, from which, indeed, it is almost a matter of wonder that the low scale of pay and scant consideration, which they obtain in the service, ever induces them to depart.

THE ADMIRALTY AND IRON-CASED SHIPS.

Some wonder has been expressed during the present week at the silence observed by Lord Clarence Paget, in his speech at Deal on Saturday last, concerning our iron-cased fleets. There is really, however, no ground for wonder in the circumstance, as any one will observe who considers how little the present Board of Admiralty have lately accomplished in this respect. We shall not misrepresent them, we think, if we say that since the last Parliamentary Session closed, they have done nothing beyond designing a coast defence vessel on Capt. Coles' plan, and even that is to be in many respects a very imperfect vessel. She is to be without sail power of any kind, to carry but 12 guns (under six cupola shields), to steam at about 10 knots only, and to carry coal for only three or four days, and yet is to be of a tonnage approaching to 3,000 tons burden. We hear a great deal at various times, and through various channels, of the Defence and Resistance, and it is very evident that the best possible character is to be attributed to these ships, which were the first designed under Lord Clarence Paget's control; but it is not possible, in our judgment, ever to justify their construction. The limitation of the armour has been carried to so great an extent in them, and that which has been applied has been placed so badly, that their chances of keeping afloat under the fire of an enemy are little greater than any uncased iron ship, well divided by water-tight bulkheads, would possess. Of their 280ft. of length only about one-half is protected even at the water-line, so that shot, and Armstrong shell, too, are free to pass in between wind and water throughout the other half. From the same cause (the small extent of armour) the number of guns with which these vessels are able to defend themselves is but seven of a side, regarding those only that are protected by the armour—as we have a right to do in comparing these with other ships; and the ports from which these guns are fired are down within 7ft. or 7ft. 6in. of the water. Moreover, with a rig which is likely to prove at least as inefficient as the Warrior's, these vessels have a speed of only about 10 to 11 knots under steam (whatever the *Times* may say to the contrary) and carry coals for six or seven days at the outside: and yet they are of nearly 4,000 tons burthen, and of nearly 6,000 tons displacement. How the Admiralty ever came to build such a class of vessels as this—manifestly unfit, as they are, to perform any service proportioned to their size—it is very difficult to conjecture.

But it is even more astonishing to find that nothing has lately been done, or, so far as we can learn, is being done to produce new and more efficient classes of iron-cased ships. We know very well that the five wooden ships building in the Royal Dockyards to receive iron armour are being urged forward, and that some progress (although very little, we fear) is being made with the three largest class vessels, for which the Thames Ironworks Co., Messrs. Laird, and Messrs. Mare and Co., respectively obtained contracts. But these all belong to last year's works, and it is concerning the works for the present year that we feel some anxiety. In what way is the money which will be asked for the estimates for 1862-63 to be spent? Upon what descriptions of vessels is it to be expended? So far as our present observation extends we are unable to discover any prospect of much building work going forward in the Royal Dockyards; in fact, it is not at all likely that any more wooden line-of-battle ships will be laid down—at any rate, for some time to come—and the preparations which are being made in those establishments for iron shipbuilding are on no very extensive scale. The most of what is done, therefore, will have to be done in private building yards, under the contract system. The first contract issued will, probably, be that for Captain Coles' ship, already referred to; but what will follow that we are at a loss to conceive.

The great question which has to be settled—and which must be settled before any further progress in this matter can be made—is that of the degree of protection which is to be afforded to these iron-cased vessels. If they are to be plated from end to end, like the Minotaur, Captain, and Northumberland, then no departure from the drawings and specifications of those ships will, we presume, be made, as there is no reason for supposing that the Admiralty contractors have acquired any fresh knowledge of importance since they were designed. But it is exceedingly doubtful whether either the Government will recommend, or the House of Commons permit, the construction of many more of these colossal ships, each of which has a displacement of very nearly 10,000 tons, and requires engines of 1,400 or 1,500-horses power in order to secure a speed of 14 knots an hour. When equipped for sea, each of these ships will, probably, cost considerably more than half a million of money, and will, nevertheless, be fit for little else than the line-of-battle. It seems certain, then, that the chief available strength of our iron-cased fleets must be secured by means of much smaller, handier, and more economical vessels than these. And it is because we feel the truth of this that we are anxious to see some wise determination made as regards the kind and extent of protection with which we shall have, practically, to content ourselves. That the arrangement adopted in the Defence and Resistance must not be repeated, is certain, for it is unattended by any one even of the many good qualities which the designer has to ensure. The modifications introduced in the Hector and Valiant—viz., a great increase in the length of the side plated between the wind and water, and the continuation of the plating over the entire length of the main deck—are obvious and commendable improvements. But they do not, in our judgment, remedy all the defects of the former vessels. There are two qualities which they do not ensure, viz., impregnability at and immediately beneath the water-line throughout the whole length of the ship, and a thoroughly efficient height of port above the water. The former of these qualities would prevent the water being admitted to the interior of the ship at all during action, and would so preserve her trim and steaming powers unimpaired, and the latter would preserve her fighting powers in rough weather. The day for ships with ports within wash of an ordinary wave is gone by. We have not, for some months past, had a single week during which these iron-cased ships of ours could have fought an action in the English Channel, unless they had chosen a day for the purpose—a fact which ought not to be without weight in influencing our views of this question. It is a great error to keep the ports low in these long ships which we now build, and which cannot possibly lift with every wave like the dumpy craft of olden times; and, for this reason, we urge the combination of a lofty battery with impregnability between wind and water. If, in addition to these two qualities, good steaming and sailing powers are secured in vessels of moderate dimensions, but little to be desired will then be wanting. These are the points to which the Admiralty should have given their best attention during the recess; but we regret to say that we are without any hope that they have done so, or are even doing so, with earnestness. The time will speedily arrive when our readers will be able to judge for themselves whether we are correct or not in this.

It is some sign of enlightenment on the part of the Admiralty, however, let us say in justice to them, that they have broken through their routine sufficiently to adopt the plan of Captain Coles. We are, certainly, somewhat surprised to find that they can do no better with the system than is indicated in what we have previously stated concerning the ship which is to be built. Nor are we by any means prepared to admit that nothing better can be done with it. On this point, however, we desire to speak with reservation, because it is only in the light of a close and strictly professional investigation of such a subject that a sound conclusion can be reached. If Captain Coles is himself satisfied with the Admiralty's attempt to give effect to his views—and we believe he is—it is scarcely necessary for us to disapprove of it, nor ought we to withhold an expression of our satisfaction at seeing an invention, in favour of which we have spoken more than once, sanctioned by the Admiralty, and applied under its auspices.

Another act of the Board of Admiralty, which is closely connected with this iron-cased ship question, deserves praise. They have just increased the pay and position of their Inspecting Officer considerably. The duties of this officer, who has responsible charge of all her Majesty's ships building under contract, and who has to survey all mail and transport steamers employed by the Government, are of an importance which cannot well be exaggerated. Upon him and the staff engaged under him the country depends absolutely for the excellence of the material and workmanship put into its ships of war built by contract, and as so many of our most costly ships are now built in that way, it is evident that the Inspecting Officer should be a man of the highest ability, character, and position. Mr. J. Luke, who has held this post for several years, seems to have gained the entire confidence of the Board—a circumstance which will not be surprising to those of our readers who recollect the evidence given first before the Gunboat Committee, and afterwards to the Galway Steamship Committee. To that evidence we directed attention at the time, and bore testimony to the great ability and integrity of the Inspecting Officer. We are much pleased to learn now that Mr. Luke has been raised to a rank equal to that of a Master Shipwright of one of her Majesty's Dockyards, with a salary of £650 per annum—a very fitting testimony to the value of his services. It is not, of course, on his account only or chiefly that we mention this promotion, but rather because we see in it one of the best possible means of keeping up the character of our contract shipbuilding. We know very well that private shipbuilders are only too ready to aver that the Government Inspectors are already much more scrupulous than they need be as regards the workmanship and material put into their vessels; but, knowing what we do of contract work, we have no hesitation in saying that the strictness of these inspectors is as a rule extremely necessary, and that it is really a great benefit to the contractors in the long run. If the Inspecting Officer were either careless or powerless, the contract work would soon become so imperfect as to induce the Admiralty to dispense with it altogether; and it is because we hope that this result may never be brought about that we are glad to see that officer's pay and position—and, therefore, his influence—very much improved.

THE GREAT EXHIBITION.

It may be unfair to judge of the new exhibition building before it is completed, but we cannot withhold our conviction that the nearer it approaches completion the uglier it looks. The design was an imposing one on account of its vast proportions; but its merits now appear chiefly in respect of its feet and inches, or, rather, its furlongs and acres. That the building will be admired for itself, and thus form, as did the Crystal Palace in Hyde-park, a most important attraction to visitors, we cannot believe. It will house the goods deposited within it, no doubt, and, it may be, keep out the rain. The sunk floors of the principal parts of the buildings, 5ft. or so below the contiguous streets, will hardly produce a pleasing effect in the eyes of visitors. The great nave, we fear, will be a particularly gloomy apartment, whatever Mr. Crace may do for it in the way of decoration. The roof, as our readers are aware, is without lights, and the bottoms of the clerestory windows are about 50ft. above the floor. When we last visited the building a great number of gas burners were alight under the roof to enable the men to pursue their work there, and had we had occasion to examine anything below, more delicate than a pyramid of coal, or a block of Cheesewring granite, we should have wished for lights there also. For cheerfulness, and even, we fear, for good effect, the interior of the exhibition building will never compare favourably with the railway station at King's-cross. The castings in the building are, generally, very rough, and, therefore, discreditable to British founders. French founders, and many others from abroad, will conclude that England cannot produce such clean and handsome castings as those which support the roof of the *Halles Centrales*, or those of the tower over the artesian well at Grenelle, in Paris. The columns under the picture gallery (to remain there permanently, too) are not only particularly rough, but are in the way, and altogether spoil what might otherwise have been a tolerably—no, no, we cannot say that—the room below the picture gallery, even without the columns, must strike the visitor very unfavourably indeed, being lighted only from one side, where the windows are great shapeless holes, their lower edges far above the visitor's head, while, at the top, they appear to extend into the picture gallery above. It is somewhat strange that the floor of the picture gallery, with a span of only 50ft., cannot be supported without two rows of columns. The floor of the vestibule of the picture gallery is supported over a span of about 35ft. without columns. In our eyes the rooms below the picture galleries are altogether very much below the mark, and there need be little fear that they will ever be overcrowded, whatever objects the commissioners of the exhibition may see fit to stow—we beg pardon, to place in them. They would make excellent lumber-rooms, even with the double row of columns in the way.

The "courts," with their lofty glass roofs, are really pleasant, and that appropriated to France will, we think, become the favourite resort for visitors.

The "annex," large as it is, will fail to meet the wants of our engineers, yet, if it is to be occupied, as we trust it will, not for advertising, but for displaying the intrinsic merits of the engine and machine work of this and other countries, it will prove abundantly large. We must say, however, that we have some slight fears that the whole of the principal "annex" may tumble into Prince Albert's Road. Many of our readers have heard of Captain Fowke's wonderful "roof," the roof of the annex. This roof is a contrivance in sawn plank, bolted together so as to form nearly a semicircle, but without anything like tie-rods. As might have been expected, this roof, in four bays, is spreading under its own weight, and while the wall along the Horticultural Gardens forms one firm abutment, the whole affair has gone over towards the west, and the columns, or plank posts, on that side are already some eight or ten inches out of plumb. Even if the whole affair does not tumble down it will provoke some ridicule among visitors, and cause much mortification to British engineers and workmen, unless tie rods are put in in season.

NEW PHYSICAL THEORIES.

It is to be regretted that so painful, and, nevertheless, so simple a matter as the disaster at the Hartley New Pit should furnish the occasion for hardly less than wilful deception as to the cause of that catastrophe. "The *Times* correspondent," and what, therefore, is the same thing, the *Times* itself has explained that the engine beam at Hartley broke—not because it was, as the evidence on the first inquest proved, "honey-combed," or spongy with air spaces near the main centre—but because (of which there is thus far no evidence) the pump "spear" first broke, thus

liberating a weight or strain of some 40 tons at the end of the beam, whereby, we are informed, "the sudden release "of this great strain destroyed the equilibrium between "the two ends of the beam, *and* the casting snapped immediately at the axis like a rotten stick." Indeed! "This," we are furthermore told, "is the explanation favoured by "the most experienced men who have examined into the "matter upon the spot." If this latter statement be true, although we conclude it is only an embellishment of the *Times'* correspondent, the "experienced men" who "examined into the matter upon the spot" might as well have kept away. Iron castings, iron rods, bolts, wheels, &c., do not break because of the sudden removal of their ordinary and proper strain. Neither the beam nor the piston rod of a steam engine is broken every time the steam is exhausted from the cylinder, albeit that the exhaustion takes place more instantaneously, so to speak, than a wooden pump spear can break away and detach itself from the driving power above. Neither do the cams of tilt-hammers break, "like a rotten stick," thirty or forty times a minute, or as often as the great weight of the hammer lifted is suddenly dropped. Nor does the rope of a pile-driving engine break at every fall of the "monkey." In short, no rod, or bar, or beam of iron, sufficiently strong to lift or to support a given weight, will break, however suddenly that weight may be detached. Why, let us ask, is the *Times*, in the face of the most conspicuous evidence of unsoundness in the casting in question, busy in the attempt to explain away the matter in such an absurd manner? Had we reason to know that the hypothesis had been put forward by the owners of the fatal pit we could understand their motive, but we cannot see why the *Times* should thus travel out of its way for nothing. More than a week ago it took pains to state that such accidents as that at Hartley could not be prevented, and now, on the eve of an inquiry, it is ready, with its roundabout explanation, tending to support that erroneous statement.

It may be, however, that a more charitable view may be taken of the course of our contemporary in this matter. The singular aptitude which it has exhibited for blundering in the treatment of mechanical and scientific subjects may, possibly, account for such a decided case of amaurosis in the face of the clearest evidence. Thus the *Times* either concocted or borrowed the most improbable and clearly fallacious explanation of the explosion on board the Great Eastern, which explosion, it informed its readers, was precisely equal to that of 400 cubic feet of gunpowder —it might as well have said to the hundreds of tons which blew up the best part of Rhodes! Not long ago the *Times* described steam jackets as an improvement whereby steam was first made to act in one working cylinder and afterwards discharged into another. And again, on another occasion, it explained that the cylinders of a new steamship had "water jackets" around them! If to the same blundering we might attribute its perversion of the clearest facts in the case of the disaster at Hartley, we would gladly do so.

LOCOMOTIVE POWER.

SOME of the recent extensions of the Stockton and Darlington Railway present gradients of unusual steepness, and in determining the class of locomotives for working them, Mr. John Dixon, the chief engineer of the line, was led to make several experiments on the friction of railway trains, and to go into extensive calculations of the power of locomotives at different speeds. Although there is already much available data upon this important subject, it is interesting to verify, as far as possible, the records of previous experiments, and most engineers, we think, would prefer, as Mr. Dixon has done, to repeat such experiments for themselves wherever the result would in any way determine the class of engines for working a given line of railway. Mr. Dixon's experiments may have disclosed nothing new, but their results will nevertheless interest many of our readers, and the extended, although generally simple, calculations of resistance and locomotive power into which Mr. Dixon has also gone will prove serviceable to those who, although practically engaged in working railways, have not familiarised themselves with the arithmetical treatment of such questions. The trucks, of a class probably equal in construction to the average in use on our leading railways, were found to run, when loaded, with a friction of from 8 lb. to $8\frac{3}{4}$ lb. per ton, at speeds of from 11 to $11\frac{1}{2}$ miles an hour, and, when empty, with a friction of upwards of $11\frac{1}{2}$ lb. per ton at a speed of no more than 6 miles an hour. The old "chaldron waggons" weighing, including load, but about $3\frac{1}{2}$ tons each were in the same manner found to run with a friction of from 11 lb. to $13\frac{3}{4}$ lb. when loaded, and at speeds of about 7 miles an hour, whereas, empty, the friction was 15·4 lb. per ton at less than 4 miles an hour.

The resistance of trains increases, in some degree, with the speed. The friction of the axles, it is known, opposes a constant resistance at all speeds, in other words, if a cord were attached to the periphery of any axle, and force were applied to the cord to revolve the axle on its journals, the same pull or tension would require to be transmitted through the cord at 50 revolutions per minute of the axle as at 150 or 250 revolutions. In the latter case, however, the pull upon the cord would be exerted through five times the distance per minute, in making 250 revolutions per minute, that would be traversed with 50 revolutions, and, therefore, although the resistance remained constant, the absolute mechanical power required, per unit of time, to overcome it would vary exactly as the speed. All railway resistances, other than those of axle and rolling friction, are, there is no room to doubt, due to concussions, more or less severe, between the wheels and the rails, also between the ends of the brasses and the collars of the journals, and finally to the atmosphere. All these resistances must vary as the square of the velocity, the mechanical power required to overcome them, per unit of time, varying as the cube of the velocity. Thus a railway wheel passing over a rail with a velocity of 32ft. per second, or rather more than 21·8 miles an hour, has the same velocity as that acquired by a body after falling freely *in vacuo* from a height of 16ft., whereas if the velocity be 64ft. per second, or 43·6 miles an hour, it is the same as that similarly acquired by a body in falling from a height of 64ft., the mechanical force, *vis viva*, and force of impact of all moving bodies, being as the squares of their velocities. As far as the force of concussion is concerned it is immaterial, therefore, whether the velocity of the moving body be obtained from a locomotive engine or by falling in space, the concussion in either case being four times as severe at any one speed as at one half that speed,—four times greater at 30 miles, and nine times greater at 45 miles, than at 15 miles an hour. The resistance of the atmosphere, whether from the motion of a train through still air, or from the blowing of a wind against a train at rest, is necessarily governed by the same law. Experiments made upon a large scale, upon the Great Western Railway, supplied the data for the following rules, which are to be found in "Railway Machinery," published by Messrs. Blackie and Sons. The line of railway was nearly straight and, at the time of the experiments, in good order, the air being calm.

To find the total resistance of an engine, tender, and train, at a given speed:—Square the speed in miles per hour, and divide the product by 171, add the constant quantity 8 lb. to the quotient, and the sum is the total resistance in lb. per ton, at the level of the rails. Thus, at 20 miles an hour, $20 \times 20 = 400$, and $400 \div 171 = 2{\cdot}33$, and adding 8 lb. we thus have 10·33 lb. per ton of total resistance.

To find the resistance of the train alone at any given speed:—Square the speed in miles per hour, divide the product by 240, adding the constant quantity of 6 lb. to the quotient. The sum is the resistance in lb. per ton.

To find the resistance of the engine and tender alone, with a given train at a given speed:—First find the resistance which the engine and tender would have if considered as carriages, by the preceding rule; next, square the speed, divide the product by 600, and add 2 to the quotient; multiply the sum thus found by the total weight of engine, tender, and train, and divide the product by the weight of the engine and tender, the quotient expresses the total machinery friction. Then add together the two results thus obtained. The sum is the whole resistance at the rails, in pounds per ton weight.

We give these rules in the belief that many of our readers will find them useful. Many have, doubtless, stored away in their memory the erroneous formula of Mr. Scott Russell, which regards friction as constant, concussions as increasing directly as the speed, and the atmospheric resistance as the square of the speed. The hypothesis as to concussions is altogether untenable, and should no longer be received. Mr. Dixon has assumed, strangely enough, that the resistance from friction and concussions is but 12 lb. per ton at 30 miles an hour, whereas 15 lb. would be a low estimate. The experiments of Mr. Scott Russell showed that the average resistance, exclusive of gravity, was 22 lb. per ton of engine, tender, and train, at 37 miles an hour on the Manchester, Sheffield, and Lincolnshire Railway, and this average is not a high one on any railway at the speed in question. Mr. Dixon's paper does not give the length of the incline of 1 in 131 up which a $24\frac{1}{2}$ ton engine takes its train, weighing, including tender, 113 tons 14 cwt., at a speed of 30 miles an hour. If it is for 10, 15, or 20 miles, it is an exceedingly good performance, but if for but $\frac{1}{2}$ mile, 1 mile, or even 2 or 3 miles, it is in no respect remarkable. An engine which will run its steam out on a long gradient, may go up one of 2 or 3 miles and have plenty of surplus steam left.

Mr. Dixon makes a singular mistake in assuming, as he does, that the horse-power of any given locomotive engine is a fixed quantity, the mean pressure upon the pistons being, he supposes, always inversely to their velocity of motion. We should have hardly thought it necessary to say that this is not so. The same locomotive will generally generate for itself much more steam in a given time when running at high than at low speed, and thus, the Great Britain locomotive, on the Great Western line, was found, in the course of fifty experiments, to exert from 90 up to 242 effective horse-power at speeds of 17 miles an hour and under, from 219 to 437 effective horse-power at speeds of from 36 to 40 miles an hour, and from 263 to 763 effective horse-power at speeds of from 50 to 63 miles an hour.

Mr. Dixon employs a roundabout rule for the calculation of the tractive force of a locomotive, and a roundabout rule also for the calculation of the horse-power exerted by a locomotive. To find the tractive power of a locomotive Mr. Dixon ascertains, carefully, the total pressure on the two pistons, and reduces this in the proportion of the length of a double stroke to the circumference of the driving wheel. This process is unquestionably correct, but it can only give the same result as the following:—Multiply the diameter of one cylinder, as measured in inches, by itself; multiply the product by the average pressure of steam upon the piston, in lb. per square inch. This product is to be multiplied by the length of stroke, and the final product divided by the diameter of the driving wheel, the length of stroke and diameter of wheel to be taken either in feet or inches, according to whichever may be most convenient. This process will give precisely the same results as Mr. Dixon's rule and with hardly one-half the number of figures, unless, perhaps, the diameter of the cylinder be given in minute fractions of an inch, in which case it would be more tedious to square such a number than to consult a table of circles for the area of piston. So, too, to find the horse-power of a locomotive Mr. Dixon may either multiply the total resistance of the train drawn, in pounds, by the speed of the train in feet per minute, dividing the product by 33,000, or he may multiply the total average pressure on the two pistons (as ascertained by an indicator), by the speed of one piston in feet per minute and divide by 33,000 as before. In either case, the calculation will prove useful to railway engineers, and we commend Mr. Dixon's paper to them as an excellent starting point for a consideration of the whole subject.

BOILER EXPLOSIONS.

THE seventh annual report of the officers of the Manchester Association for the Prevention of Steam Boiler Explosions throws a great amount of light upon the infirmities of steam boilers and upon their proper hygienic treatment. The chief engineer to the Association reports 1,454 boilers on his list, and to these 2,049 professional visits were made during the year. Alarming symptoms were detected, and prompt surgical treatment recommended in 52 cases, of which 6 were fractures of plates and angle irons, 21 were cases of corrosion, 5 of defective safety valves, 4 other boilers being altogether without safety valves, 7 were cases of defective blow-out apparatus, and 9 were injuries resulting from deficiency of water. Milder stages of the same and analogous diseases were prescribed for in nearly 1,000 cases, 194 of which were cases of disordered blow-out apparatus, 173 of corrosion, 163 of disordered safety valves, 127 of disordered water gauges, 101 of furnaces out of shape, 97 of disordered pressure gauges, 80 of fracture, and 24 were disorders of the organs of deglutition, otherwise of the feed-water apparatus. In addition to the advice given in these cases of positive disease, 226 recommendations were made in cases of congenital weakness, where the boilers could not safely stand up to their work, notwithstanding that they had not yet given way in any part. The result of all this professional vigilance has been that not one boiler under the inspection of the Association has exploded during the year. Boilers, of course, like human beings, must wear out some day or other, and the Association does not profess to prevent, although its officers may retard, the decay to which all boilers are alike subject. It seeks chiefly to prevent their violent dissolution, and here its labours have been attended with remarkable success. Those who have heard so much of the explosion of boilers by electrical action, the decomposition of steam, "over pressure," &c., may well ask how it is that the boilers under the care of the Manchester Association do not generate electricity, decompose their steam, or increase their pressure to that excessive point at which only a well-made, well-proportioned, and entirely sound boiler would be torn open. The Association does not deal in the notable "preventor rod," with which the American electrician has, according to his own report, succeeded in conducting away all "explosive matter" from the interior of boilers, the "proof" of the success of his contrivance being that a boiler, fitted with it, had not yet blown up. Neither does the Manchester Association test for hydrogen, nor quote chemistry to its members, unless it be in the report of Dr. Angus Smith, on the use of caustic soda to neutralise the corrosive action of some of the waters supplied to the Manchester boilers, waters which, we apprehend, do not come from Woodhead, and which may either be the equivocal liquid which maintains the flow of the Irwell, or the not less questionable contents of some of the city wells. Neither do the inspectors of the Association supervise the firemen who feed the 1,454 boilers, and who are thus left to their own recklessness or prudence, as the case may be. Moreover, Mr. Fletcher, the chief engineer, who has collected particulars of twenty explosions which occurred, among others, last year, in various parts of the kingdom, has, in several of these cases, satisfied himself, by actual and careful examination, that "due care and periodical inspection, with the "application, where necessary, of the hydraulic test, would "have prevented everyone of these explosions, and thus "that the word 'accident' could not be applied to any "one of them. I meet every day with increasing evidence "that the mystery in which boiler explosions are often "shrouded should be dispelled, and consider that by due "attention to correct principles in the construction of "boilers, in the first place, and by care in their working "in the second, the recurrence of explosions would be prevented." Mr. Fletcher's opinions are not authoritative on such a point, but they are entitled to considerable weight, and facts and probabilities are greatly in favour of their soundness. Mr. Fletcher, however, does not himself show why an unsound boiler must necessarily explode, and, on the other hand, he must be frequently meeting with cases where boilers are actually broken or torn open without any real explosion at all. It is but little more than two years ago since it was first explained *how* a boiler exploded subsequently to, and in consequence of the occurrence of a local rupture, provided that rupture suddenly liberated the steam pressing upon the water in the boiler. That explanation, which first appeared in THE ENGINEER, was immediately adopted by Mr. Fletcher's predecessor, Mr. Harman, in his report to the Association, and since its subsequent appearance over Mr. Colburn's own name, and its adoption by a considerable number of engineers and scientific authors, Mr. Fletcher is doubtless willing to leave those who read his report to apply the explanation in question for themselves.

No boiler, sound or unsound, can, by the mere pressure of steam contained within it, be exploded with results like those which attend a violent boiler explosion. For no sooner has a plate or seam commenced to yield than the steam escapes with such rapidity that enough is not left to produce any violent consequences. If an opening a foot square were suddenly made in a boiler filled only with steam or compressed air of a pressure of 100 lb. per square inch, an unbalanced pressure of $144 \times 200 = 14{,}400$ lb., or nearly $6\frac{1}{2}$ tons would be exerted against the opposite side of the boiler, but this pressure could neither lift a boiler heavier than $6\frac{1}{2}$ tons, nor could it tear open the plates against which the pressure was exerted, provided only that they were ordinarily sound. This unbalanced pressure, furthermore, would be exerted for an almost inconceivably short space of time, at the end of which the boiler would be relieved from all pressure whatever, the steam escaping, at first, with a velocity of about 2,000ft. per second, a rate at which a boiler 8ft. in diameter and 30ft. long would discharge its steam through an opening a foot square, in three quarters of a second, the pressure of the steam falling off most rapidly in the first portion of this brief interval. It is not easy to understand how even so large an opening as one of a foot square could take place absolutely simultaneously over its whole area, and hence before an opening, large enough to lead to the projection of a heavy boiler, could take place, the pressure would almost certainly be so far reduced as to remove all chance of violence. Steam cylinders, certainly, although made of brittle cast iron, and although not unfrequently

cracked, are never violently exploded, which, upon the mere steam-pressure notion of boiler explosion they ought to be whenever they happen to be unable to bear the pressure within them. Neither would any engineer fear the violent explosion (although he might count upon the fracture), of steam cylinders if made of but one-fifth or one-sixth their present thickness. We have seen locomotive cylinders which, their cores having been originally out of place, in consequence of carelessness on the part of either the pattern-maker or founder, were, after being once or twice re-bored, reduced to a thickness of $\frac{3}{16}$in. on one side, at which thickness they had finally cracked, without anything like explosion however.

Neither can an empty red-hot boiler be exploded by pumping cold water rapidly into it. Any one who has mulled a bottle of stout by thrusting a white-hot poker into it, will understand that all the heat of the boiler plates can only warm up a few gallons of water to blood heat. There is no doubt, however, that iron loses much of its strength when heated, and if, by pumping in cold water at the bottom of the boiler (the fire being still active), the already boiling water in the boiler is gradually raised over an exposed crown plate, an additional quantity of steam will certainly be disengaged, and the pressure suddenly raised. This, in connection with the already weakened condition of the plates, might result in their being torn open, but then, without further explanation, we should have only arrived at the case of a boiler overcharged with steam alone, and the violent explosion of which, as we have shown, is most improbable. As for M. Boutigny d'Evreux's spheroidal theory, which applies to small quantities of water thrown upon hot plates, we consider that, if it be in any way applicable to the circumstances of steam boilers, it should go, not to account for their explosion, but to show that, when water is thrown upon hot boiler plates, there should be no explosion at all. For we believe there is no evidence to show that any considerable depth or body of water can be repelled, in the spheroidal state, by a hot plate of iron; and even if it could be, the comparatively small quantity of heat in the plate would at last be taken up in so large a body of water that no considerable accession of temperature and production of steam could result, whereas, if the spheroidal state was maintained, as, probably, it only can be when the water is in small quantity only, and therefore of very shallow depth on the plate, the bursting of such a small quantity of water into steam could add very little to the pressure already existing in a large boiler. Indeed, since the first announcement of M. Boutigny d'Evreux's spheroidal theory, somewhere between fifteen and twenty years ago, we have never perceived that it had any bearing upon steam boiler explosions.

Unless the boiling water in the boiler is reckoned among the agencies of explosion, and its effects duly considered, it would be difficult indeed to say why boiler explosions ever happen at all. As it is, Papin's "digester," a contrivance of the seventeenth century, affords an instance of the manner in which heated water—when the restraining pressure under which it has been heated is suddenly removed—bursts in part into steam, while the rest is carried along with the steam, and had Mr. Fairbairn, in his many essays upon boiler explosions, taken this action into account, and had he ever pointed out the occurrence of harmless ruptures of steam boilers, unattended with their violent explosions he would have been certain to have hit upon the only explanation by which the destructive effects of boiler explosions can be reasonably accounted for. This explanation is now, however, so well understood that we need hardly more than refer to it here, although we may summarise it for the convenience of those who may be taking up the subject at its present stage.

A large proportion of all the steam boilers in use are, as is proved by careful examination, occasionally in a state in which a rupture of a plate or seam of rivets is likely to occur under the ordinary working pressure. If such a rupture take place well below the water line, it will discharge heated water, the steam generated from which will rise in the open air outside of the boiler, and explosion will be unlikely. If, however, the rupture, under water, be very large and sudden, the unbalanced pressure on the upper side of the boiler may be sufficiently great to overturn the boiler, in which case steam will afterwards rush out of the rupture. If, too, the rupture is originally above water, the steam will rush out with a velocity of 2,004ft. per second for steam of 130 lb. pressure, 1,957ft. per second for steam of 100 lb. pressure, 1,877ft. for steam of 70 lb. pressure, 1,791ft. for 50 lb., 1,643 for 30 lb. pressure, and 1,504ft. per second for steam of 20 lb. pressure, these velocities being calculable from well-established rules, independent of the explanation in question. The suddenness with which the steam escapes represents, of course, the rapidity with which the pressure on the heated water in the boiler is liberated. As soon as the pressure (under which, alone, it is possible to heat ordinary water to much above the boiling point in the open air) is suddenly removed, the water will commence disengaging a large quantity of additional steam, although it is evident that, with the resistance opposed by the water itself, this additional steam cannot rise absolutely simultaneously with the escape of the free steam above it, and thus an exceedingly short space of time will intervene, in which but little, if any pressure, will be exerted upon the heated water. This water, therefore, on the expansion of its nascent steam, will be carried along with it, and the steam and water, striking together upon the sides of the boiler, will be almost certain to break through sound iron of a strength five or six times greater than that required to resist the ordinary working pressure of the boiler. The boiler once broken into large fragments, the pressure of the still expanding steam, now acting on the whole internal surface of each fragment, will sufficiently account for the subsequent results.

To prevent explosion in this manner—the only manner in which a steam boiler is likely to be exploded at all—it is necessary only to preserve the full proper surplus of strength in all its parts, for those who have paid much attention to these matters are aware that, except the safety valve sticks, it is seldom that the pressure within a boiler is ever raised to a point at all approaching the calculated bursting limit. It may be trite to say that, to prevent rupture is to prevent explosion, but the latter, so far from being identical with the former, is distinct from it, and may or may not occur in consequence of it, according to the circumstances already pointed out.

LITERATURE.

Metallurgy: the Art of Extracting Metals from their Ores, and Adapting them to Various Purposes of Manufacture. By John Percy, M.D., F.R.S., Lecturer on Metallurgy at the Government School of Mines;—Fuel, Fire-Clays, Zinc, Brass, &c. With Illustrations chiefly derived from Original Drawings, carefully laid down to scale. London: John Murray, Albemarle-street, 1861.

We have now before us a volume for which we have been looking with much interest for many months, feeling assured, from the moment we first heard of it in anticipation, that it would take the very highest position in metallurgic literature. We inferred this from our knowledge of the author, who, in the performance of his duties at the Government School of Mines, has given abundant proof both of his great attainments as a metallurgist and of his powers of exact and lucid description of scientific processes. On a careful examination of the comprehensive book before us—which will be followed by another similar to it—we have found our expectations fully realised. Dr. Percy has unquestionably produced the best work on the extraction and preparation of metals ever written.

The present volume treats, as will be observed, of fuels, fire-clays, copper, zinc, and brass; the succeeding one, which is well advanced, and will probably be published by the end of the present year, will embrace iron, lead, silver, gold, platinum, nickel, cobalt, arsenic, bismuth, antimony, tin, mercury, &c. We hope no unforeseen delay in the production of this second volume will occur, for the changes and modifications which the iron manufacture in particular has undergone during the last four or five years are so momentous and so little understood that a scientific exposition of them by Dr. Percy will be inexpressibly valuable. Our desire to obtain it is further stimulated by the author when, in speaking of the exquisite illustrations (by James Cooper and R. W. Mallett, wood-engravers) of the present volume, he says, "the illustrations for the second volume, especially those relating to iron, will exemplify the skill of these artists in a far more striking manner than any contained in this." We may add that the wood-cuts in this volume are among the very best ever produced, and must have cost both the author and the engravers extreme care and trouble. They are drawn to a scale wherever that was necessary, and are so exactly done as to be measurable with the greatest nicety. Another circumstance that greatly enhances the value of the work, and shows with what pains the author has produced it, is that the descriptions of nearly all the processes explained in it have been revised in type by the managers of the various works in which they are performed. Of the gentlemen who have thus liberally assisted him Dr. Percy makes special and grateful mention.

In the very first paragraph of his preface the author exemplifies the good sense which he has brought to bear upon his subject. While admitting that, although the operations of metallurgy are conducted on a vaster scale in Great Britain than in any other country, the contributions which have been made to the literature of the subject are few and scanty in the extreme, he nevertheless strenuously denies the injurious inference that some have drawn, viz., that our smelters are too ignorant of chemistry to understand the theory of the processes under their direction, or too illiterate to be able to record the results of their experience. On the contrary he says (and many of our readers will also be able to say from their own experience) that, knowing many of these men intimately, "I will venture to affirm that, with respect to knowledge, both of the theory and practice of the special departments of the art in which they are engaged, they are not excelled by any metallurgists in Europe." This testimony, although but just in itself, is highly honourable both to the author and to the class of persons of whom it is spoken. It is all the more valuable from the circumstance that Dr. Percy is not a mere laboratory metallurgist, but one who has accustomed himself for many years past to visiting the great metallurgical works of the country, and to minutely acquainting himself with the persons by whom they are particularly conducted.

The first fifty pages of this volume are occupied with introductory matter treating of the physical properties of metals, and of ores, metallurgical processes, and slags. In defining the word "metallurgy" as at present understood the author very properly limits it to "the art of extracting metals from their ores, and adapting them to various purposes of manufacture," as stated in the title page. The Greek derivation of the word would seem to claim for it a meaning broad enough to include all the arts by which metals are in any way worked; but its meaning is now certainly limited in the way shown in Dr. Percy's definition. It will be observed, however, that even when used in that sense the word is not very clearly defined, since it necessarily partakes of whatever ambiguity or indefiniteness belongs to the word "metal;" and, as many of our readers know, that word has of late years lost very much of its original exactness. In former days, prior to those developments of chemistry which have changed so much of our science, metals were identifiable without difficulty in virtue of certain physical properties, such as lustre, fracture, colour, and so forth. Every metal, for example, was supposed to possess a lustre peculiar to bodies of its class. But that lustre is now known to be possessed by several non-metallic elements, such as graphite and crystallised silicon. Again, a high specific gravity, as compared with other bodies, was formerly attributed to all metals; but we now possess metals—sodium and lithium—which are of less specific gravity than water. It is exceedingly difficult in fact to say what a metal really is in the present state of science; so difficult that Dr. Percy evidently avoids everything like an attempt to define the word, contenting himself with the vague, but certainly safe, remark that "the term metal, like the term acid, is rather conventional than strictly scientific." Perhaps the best of all guides for the classification of minerals into metallic and non-metallic groups is to be found in their crystalline structure—a feature to which Dr. Percy certainly draws attention, but in which he does not seem to recognise the basis of a definition. Strange to say, Werner, whose attempt to systematise the language of mineralogy was worthy of great praise, also attached but little importance to this, but framed his distinctions mostly out of minute differences (such as those of colour, lustre, fracture, &c.) which really are non-essentials, but with which his intimate acquaintance with minerals made him exceedingly familiar. The tendency which Werner thus exhibited, although more excusably exercised, was in fact the same as that to which Berzelius yielded when he proposed to name a certain mineral *Eschynite*, from the Greek word for *shame*, because he thought it a shame for chemists not to have separated its elements more distinctly than they did at first! Haüy, again, in his "Mineralogy," attempted to get rid of the words "metallic" and "non-metallic" altogether, and to substitute for them "*autopside*" and "*heteropside*," on the ground that all bodies have, he thought, a metallic basis, so that the word "unmetallic" must be inaccurate.

Dr. Percy, in expounding the physical properties of metals, treats successively of their "physical state," "specific gravity," "crystallisation," "varieties of fracture," "malleability," "ductility," "tenacity," "toughness," "softness," "conduction of heat and electricity," "capacity for heat," "expansion by heat," "opacity," "lustre," and "colour;" and his remarks afford abundant examples of those exceptional conditions which cause so much embarrassment whenever an attempt is made to improve or reconstruct our scientific nomenclature and terminology. When we begin to observe even their most obvious properties we are pretty sure to meet with an exception. Thus, while all the known metals, *save one*, are solid at the ordinary temperature of the atmosphere, we have that one—mercury—fluid. In like manner, when we proceed to class them, as Dr. Percy does, according to their degrees of fusibility, we are obstructed, in the first place, by an absence of everything like a reliable measure of exalted temperatures, and, secondly, by the frequent discovery of new modes of obtaining such temperatures,* and are consequently driven to very artificial, and even superficial, distinctions. We have already mentioned the exceptional character of some metals as regards their specific gravity; it may be interesting to add here that Dr. Percy carefully dwells upon the important fact that the treatment to which a metal is subject affects its specific gravity after as well as before fusion, so that the results of different observers cannot be compared unless the prior treatment of the metal is recorded along with its specific gravity. It may be noted that Marchand excepts bismuth from this law, alleging that great pressure diminishes its specific gravity! Dr. Tyndall, however, has in vain endeavoured to verify this assertion of Marchand's. As regards crystallisation, again, exceptional circumstances are observed. The brittle metals in common use always exhibit a well-marked crystalline structure; and the soft metals, such as lead and tin, may also be readily obtained well crystallised. But if melted lead is allowed to solidify slowly and without disturbance it presents no visible evidence of crystallisation. A metal may also be precipitated in the state of amorphous powder by an electric current of great intensity. With regard to the varieties of fracture in metals, again, it has been found that appearances are often likely to mislead. The fibrous fracture of copper is especially delusive, as the author very ably shows. When a small piece of tough copper is broken by nicking it slightly on one side, and then bending it backwards and forwards until it breaks, the fractured surface will appear finely fibrous and present a silky lustre. The fibre in this case appears to be entirely produced by the repeated bending which is necessary to cause rupture; for, when a large bar or ingot of tough copper is broken in the usual manner by nicking it sufficiently across one surface, supporting it at its ends with the nick downwards, and then striking it with a sledge hammer on the part opposite the nick, the fractured surface is granular and not fibrous. But, in the case of bar iron, it may be shown that a fibrous structure pre-exists, and, therefore, that the fibrous appearance of its fractured surface can only be partially due to the process of bending backwards and forwards. If a bar of wrought iron is exposed to the action of dilute sulphuric or hydrochloric acid, it will be dissected, and will present the appearance of a bundle of fibres; but if the bar is melted, and the melted metal acted upon by similar means, a crystalline, and not a fibrous, appearance will be produced.

The extent to which the malleability of metals is affected by varying circumstances is known to most of our readers. Changes of temperature, for instance, have a great effect. Copper, which is malleable enough when cold, or even heated to a certain extent, becomes so brittle as to be readily pulverised if made too hot. Changes of molecular condition, again, such as those produced by hammering and rolling, modify the malleability of copper, iron, and other metals, and render "annealing" necessary, the rate at which the cooling that follows annealing is allowed to proceed materially, modifying their character. The molecular changes which take place in metallic mixtures or alloys likewise affect their malleability. "An alloy of tin and lead, which is used in pattern-casting for

* M. Despretz has published some interesting experiments on the production of intense heat by employing in conjunction the heat derived from the solar rays, the oxy-hydrogen blowpipe, and a powerful voltaic battery. By this triple source of heat magnesia, it is stated, was immediately volatilised in the form of white vapour, and anthracite melted. By the action of a very powerful Bunsen's battery alone even carbon was melted, volatilised, and condensed in the state of black crystalline powder; silicon, boron, titanium, and tungsten were melted; and 250 grms. (3,858 grs.) of cuttings of platinum were melted in a few minutes. Deville and Debray have recently succeeded in melting not less than 25 kilogrammes (55 lb. avoirdupois) of platinum at a time by the heat resulting from the combustion of coal-gas by oxygen.—P. 3.

brass-foundry work, and which, at first, is comparatively hard, becomes, after a time, so soft as to be no longer fit for use." Brass wire, it is well known, will occasionally become very brittle, especially when kept in a state of tension, so that tension also affects malleability. In respect of ductility, again, we are told that since the recent examination of many metals by Deville and others our views will have to be considerably modified. Nickel, for example, has been prepared in a state of great purity, and was then found to possess greater ductility (and greater malleability too) than was before believed. Tenacity, again, or the power of resisting rupture by traction, is much affected by molecular condition, especially by crystalline structure. "The presence of foreign matters, even in very minute proportion, may affect the tenacity of a metal in a material degree. This circumstance, and that of difference of molecular condition consequent on previous treatment, mechanical or other, will explain the variations which apparently the same metal may present in respect to tenacity." Variations of temperature likewise greatly affect tenacity, iron presenting a very remarkable exception to the law of variation; for while at 100 deg. its tenacity is less than at 0 deg., at 200 deg. it is greater than at 0 deg. Mr. Fairbairn, as our readers know, assigns the maximum tensile strength of iron bars to a temperature of 320 deg. The "toughness" of a metal is so nearly allied to its tenacity that we need not dwell upon it. As regards "softness" (in its general, not its technical metallurgical sense) we have the greatest possible differences presented by metals. At the ordinary temperature mercury is fluid, lead extremely soft, potassium the same, while chromium is hard enough to cut glass, and the native osmium-iridium alloy is much harder than the hardest steel.

With regard to the powers which the metals possess for conducting heat and electricity, we know that they are neither exclusively endowed as metals, nor uniformly endowed among themselves. It seems highly probable that Professor J. D. Forbes' speculation (made so long ago as 1833), that the order of conducting power of the metals for heat and for electricity is the same—will be proved to hold good. At any rate Dr. Percy follows Professor Tyndall in saying that, whatever the quality may be upon which calorific conduction depends, it is exceedingly likely that the same quality influences in a similar manner the transmission of electricity, "for the divergences of the numbers expressing the conductivity for heat from those expressing the conductivity for electricity are not greater than the divergences of the latter alone, exhibited by the results of the different observers." But this conductivity itself is seriously modifiable by heat, by molecular condition, and probably also by the presence of foreign matter. If the last be true it is, as the author justly observes, not unlikely that the investigation of this part of the subject may yield important practical results; and that, not only in the way in which he suggests, viz., by influencing the manufacturer of steel in his selection of iron for his purposes, but also by facilitating the production of electrical conductors of a more durable and reliable character than have hitherto been employed.

We need not pause to speak of the capacity of metals for heat, or of their expansion by it; but their opacity is deserving of a word or two. If there is any one quality of metals which we might expect to find unfailing it is, one would think, this opacity, or the property of intercepting light. But Faraday has found that when gold is reduced to extreme thinness it is traversed by a greenish light; and that a thin leaf of gold and silver alloy transmits a purplish light. Silver leaf, on the other hand, he found to be perfectly opaque. It may at first thought be considered that the greenish light which traverses the gold leaf is filtered through the metallic pores, or minute holes produced in the gold-beating process; but this conjecture is negatived by the circumstance that the light is found to be polarised, and must actually have passed, therefore, through the substance of the metal.

In order to complete this review of the principal physical properties of metals it only remains to mention their "lustre" and "colour." As regards the former, which in early days formed one of the most certain evidences of the metallic nature, and the absence of which evidenced a non-metallic nature, we now know that there are states in which it is altogether wanting. "Metals in a state of fine division, like copper precipitated from solution by iron, do not present their characteristic lustre." And as to colour, Dr. Percy starts by saying that it is difficult to frame any classification of the metals founded upon colour which shall be quite satisfactory; we know, indeed, that a "quite satisfactory" classification upon this basis is impossible.

After this review we are disposed to think that few of our readers will venture to attempt a scientific definition of the word "metal," especially if we have succeeded in adding to their stock of knowledge concerning the qualities of metals. For it is the very increase of our knowledge that in this, as in so many other cases, has unsettled our nomenclature. The alchemists when they obtained a piece of pure metal, free from all admixture of every kind, looked upon it as a little king, and hence named it a *regulus*. The discovery of any impurity in a metal supposed to be pure led to its dethronement, and a regulus it ceased to be. The word metal, in coming down to us from the old Greek days, has by other means lost its purity and eminence of meaning. But we do not wish to see it superseded. It will serve our purpose quite as well as any other during these revolutionary days of science; by and by, when our knowledge is more complete and definite, we will invest it with new powers, and endeavour to make its reign perpetual.

(To be continued.)

WILL there ever be such a thing as an inodorous steam engine? Mr. Rimmel, the perfumer, mentions in his advertisements of his "Perfume Vaporisers," that they were successfully employed on board her Majesty's yacht, on the occasion of her visit, last year, to Ireland, to counteract the unpleasant smell proceeding from the engines.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

2208. TIMOTHY MORRIS, ROBERT WEARE, and EDWARD HENRY CRADOCK MONCKTON, Trafalgar-square, London, "Improvements in batteries for obtaining electric currents and the products therefrom."—*Petition recorded 14th September*, 1861.

2324. JOSEPH GIRTON BRIGGS, Earl-street, Blackfriars, London, "An improved method of making fire-proof buildings, ships, and other constructions."—*Petition recorded 18th September*, 1861.

2431. THOMAS SMITH, Aberdeen-street, Sheffield, "Improvements in the construction of umbrellas adapted to purposes of self-defence, some of which improvements are also applicable to other purposes."—*Petition recorded 30th September*, 1861.

2643. GEORGE HENRY BIRKBECK, Southampton-buildings, Chancery-lane, London, "Improvements in processes or means employed for separating or extracting silver from lead."—A communication from Jules Frederic de la Batie, Paris.—*Petition recorded 23rd October*, 1861.

2763. THOMAS SPENCER, Prescot, and Thomas Robinson, St. Helen's, Lancashire, "Improvements in machinery or apparatus for making pipes and other articles of earthenware, and in the form of pipes for gas, sewage, and other purposes."—Partly a communication by Alfred Delafal, Paris,—*Petitions recorded 2nd November*, 1861.

3113. WILLIAM LIGHTFOOT, Harwell, Berkshire, "An improved bridle."—*Petition recorded 12th December*, 1861.

3175. CHARLES EDWARD SYMONDS, Stone's-end, Southwark, "Improvements in the treatment and application to various useful purposes of light spirituous liquids."

3177. JEAN MARIE HOSPICE AUGUSTE TAURINES, Paris, "Improved modes of constructing balances, weigh bridges, and other weighing machines."—*Petitions recorded 18th December*, 1861.

3183. ELI STOTT, Ashton-under-Lyne, Lancashire, "Improvements in apparatus used for collecting and removing the waste and dirt which occurs in the process of spinning cotton and other fibrous materials."—*Petition recorded 19th December*, 1861.

3203. DUDLEY CHARLES LE SOUEF, Twickenham, Middlesex, "An improvement in cylinders used in printing calicoes and other textile fabrics."—A communication from Henry Kundig, George Bertschy, and Joseph Porges de Pertheim, Prague, Austria.—*Petition recorded 20th December*, 1861.

3207. FILIPPO GRIMALDI, Manchester-buildings, Parliament-street, London, "Improvements in rotatory steam boilers."—*Petition recorded 21st December*, 1861.

3229. JABEZ JONES, Liverpool, Lancashire, "Improvements in the manufacture of lead, tin, and other metals, or amalgamation of metals of a like nature, fusible at a low temperature into sheets of any thickness or length, and in the apparatus connected therewith."

3231. LOUIS JULIEN TAULIN, Rue St. Appoline, Paris, "An improved wind and musical instrument."—*Petitions recorded 26th December*, 1861.

3255. JAMES GORTON, Park House, and BARTHOLOMEW HENDERSON, South Shore, Gateshead, Durham. "Improvements in the manufacture of ropes."—*Petition recorded 30th December*, 1861.

3265. NEIL MCHAFFIE, Summer-street, Mile-end, Glasgow, "Improvements in ventilators or valves for regulating the passage of air or other fluids, whether of a gaseous or liquid form."

3275. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in revivifying animal black or charcoal, in collecting ammoniacal gases generated in the revivication, in the clarification of saccharine liquors, and in apparatus employed in the revivification of the black, and in the filtering of saccharine liquors."—A communication from Absalon Hippolyte Lepiay and Jules Francois Jo-eph Cuisinier, Paris.

3276. ALEXANDER EDWARD and JAMES EDWARD, Dundee, Forfar, N.B., "Improvements in machinery or apparatus for spinning fibrous materials."—*Petitions recorded 31st December*, 1861.

2. NICOLAS CHARLES SZERELMEY, Park-terrace, Brixton, Surrey, "Improvements in the manufacture of leather cloth or imitation leather, and in rendering certain fabrics waterproof."

4. THOMAS HALL, Odiham Wharf, Odiham, Hampshire, "An improved apparatus for removing weeds from canals, rivers, and lakes, after such weeds have been cut with a chain, scythe, or other machine or implement applicable to that purpose."—*Petitions recorded 1st January*, 1862.

20. WILLIAM ATKINSON FELL, Troutbeck Bridge, Windermere, Westmoreland, "Improvements in the manufacture of bobbins and in the means or apparatus employed therein."—*Petition recorded 2nd January*, 1862.

28. JAMES WHITTON ARUNDELL, Gresham House, Old Broad-street, London, "An improved method and improved apparatus for treating and dressing ores and minerals, particularly applicable to tin, lead, copper, zinc, and iron ores."—A communication from Mr. Martin Neuerburg, Kalk, Rhenish Prussia.

30. JAMES WHITTON ARUNDELL, Gresham House, Old Broad-street, London, "An improved method of, and apparatus for, communicating motion to fan ventilators, particularly applicable to ventilating mines."—A communication from Mr. Martin Neuerburg, Kalk, Rhenish Prussia.

32. RICHARD HENRY COTTER, Cambridge-heath, Middlesex, "An improved apparatus for instantaneously lighting certain lamps, and, when desired, extinguishing the same."—*Petitions recorded 4th January*, 1862.

38. JOHN CORYTON, Rolls Chambers, Chancery-lane, London, "An improved type machine."

42. WILLIAM THOMAS KITE, Mongewell Mill, Wallingford, Berkshire, "Improvements in the manufacture of starch, and in apparatus employed therein."—*Petitions recorded 6th January*, 1862.

52. SAMUEL JESSON, JAMES BATSON, jun., and JAMES ROBERTS, Smethwick, Staffordshire, and JOHN MOORE, jun., Langeley, near Oldbury, Worcestershire, "Improvements in the manufacture of gun barrels and wrought-iron tubing."

54. JOSHUA BARBER, Preston, Lancashire, "Improvements in hand mules, consisting of a brake and backing-off motion."

56. HENRY BESSEMER, Queen-street-place, New Cannon-street, London, "Improvements in the machinery and apparatus employed in the manufacture of malleable iron and steel."—*Petitions recorded 8th January*, 1862.

60. JAMES SMITH and STEPHEN WELLSTOOD, Glasgow, Lanarkshire, N.B., "Improvements in cooking stoves or ranges."

62. THOMAS ALDRIDGE WESTON, Birmingham, "A new or improved multiplying gearing for transmitting and multiplying power, which said gearing may be applied to cranes, windlasses, capstans, and presses, and to other purposes where it is required to transmit and multiply power."

64. HENRI CHARVET, Lille, Nord, France, "Improvements in the spinning of cotton and in its various applications."—*Petitions recorded 9th January*, 1862.

80. WILLIAM CLARK, Chancery-lane, London, "Improvements in apparatus for generating and applying steam as a motive power."—A communication from Mr. Louis Arnier, Boulevart St. Martin, Paris.—*Petition recorded 10th January*, 1862.

82. HENRY CHARLTON, Birmingham, "Improvements in the manufacture of certain kinds of shoes for mules and horses."—*Petition recorded 11th January*, 1862.

90. FERDINAND CHARLES WARLICH, Alma-terrace, New-cross, Kent, "Improvements in the manufacture of artificial fuel."

92. JOHN PARKER, Ivy House, Bradford, and JOSEPH WELLS and BENJAMIN WELLS, Bowling, near Bradford, Yorkshire, "Improvements in steam engines, boilers, furnaces, and apparatus in connection therewith or applicable thereto."

94. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in the manufacture of cups, bowls, saucers, and other dished articles and cases." A communication from Frederic Wilhelm Marx, Paris.

96. GEORGE HEWITT, Ipswich, "Improvements in apparatus used in the manufacture of drain tiles."

100. CHARLES NEALE MAY, Devizes, Wiltshire, "Improvements in the manufacture of pastry, and in apparatus for the same."—*Petitions recorded 13th January*, 1862.

109. WILLIAM GORSE, Minworth, Warwickshire, "An improvement or improvements in machinery for manufacturing the cut nails called brads."—*Petition recorded 14th January*, 1862.

Invention Protected for Six Months by the Deposit of a Complete Specification.

162. WILLIAM TOZER, Gracechurch-street, London, and ARCHIBALD READ, Walworth, Surrey, "Improvements in boots and shoes."—*Deposited and recorded 21st January*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

193. JAMES CHILDS, Windsor House, Windsor-road, Putney, Surrey.—Dated 21st January, 1859.

206. THOMAS WEBSTER RAMMELL, Spring-gardens, London.—Dated 22nd January, 1859.

249. HENRY RAWSON, Leicester.—Dated 27th January, 1859.

252. GEORGE FRANCIS BRADBURY, Oldham, Lancashire, and JOSEPH JACKSON KING, Glasgow, Lanarkshire, N.B.—Dated 27th January, 1859.

291. MICHAEL LOAM, Treskerby House, Truro, Cornwall.—Dated 1st February, 1859.

291. DAVID MOSELEY, Chapel Field Works, Ardwick, Manchester.—Dated 22nd January, 1859.

267. CHRISTIAN SHARPS, Philadelphia, Pennsylvania, U.S.—Dated 22nd January, 1859.

258. CHARLES EDWARD AMOS, The Grove, Southwark, and JOHN FRANCIS, Bangor, N.W.—Dated 28th January, 1859.

265. JOSIAH LANE, Westbromwich, Staffordshire.—Dated 29th January, 1859.

372. WILLIAM EDWARD NEWTON, Chancery-lane, London.—A communication.—Dated 9th February, 1859.

443. HENRY YOUNG DARRACOTT SCOTT, Brompton Barracks, Chatham, Kent.—Dated 17th February, 1859.

216. JOHN FOWLER, jun., Cornhill, ROBERT BURTON, Kingsland, Middlesex, DAVID GREIG, New-cross, Kent, and JEREMIAH HEAD, Newcastle-on-Tyne.—Dated 24th January, 1859.

238. DAVID GRAHAM, Wapping, Middlesex.—A communication.—Dated 26th January, 1859.

242. JAMES KERR, Bedford-terrace, Trinity-square, Southwark, Surrey.—Dated 26th January, 1859.

262. HENRY WATSON, High Bridge Works, Newcastle-upon-Tyne.—Dated 28th January, 1859.

242. HENRY OWEN, Portswood, Southampton.—Dated 24th January, 1859.

236. ISAAC HAMMOND, Winchester, Hampshire.—Dated 26th January, 1859.

266. JAMES MACKENZIE, Saint Martin's-le-Grand, London.—Dated 29th January, 1859.

Patents on which the Stamp Duty of £100 has been paid.

301. GEORGE FERGUSSON WILSON and GEORGE PAYNE, Belmont, Vauxhall.—Dated 8th February, 1855.

181. CHARLES WILLIAM TUPPER, Mansion House-place, London.—Dated 24th January, 1855.

236. GEORGE PRICE, Wolverhampton, Staffordshire.—Dated 31st January, 1855.

Notices to Proceed.

2298. TIMOTHY MORRIS, ROBERT WEARE, and EDWARD HENRY CRADOCK MONCKTON, Trafalgar-square, London, "Improvements in batteries for obtaining electric currents and the products therefrom."—*Petition recorded 14th September*, 1861.

2303. JOHN REEVES, New York, U.S., "Improvements in electric magnetic engines for obtaining and applying motive power."

2312. FREDERIC MAITLAND RANSOME and ERNEST LESLIE RANSOME, Ipswich, Suffolk, "Improvements in treating stone, bricks, and other surfaces, and in the manufacture of filters."—*Petitions recorded 16th September*, 1861.

2345. FRANCIS WRIGLEY, Manchester, "Improvements in the construction, manufacture, and mode of securing armour, for the protection of ships and fortifications against projectiles."

2317. JOHN EASTWOOD and JOHN BARNETT JOYCE, Bradford, Yorkshire, "Improvements in machinery or apparatus for combing wool and other fibrous substances."—*Petitions recorded 17th September*, 1861.

2324. JOSEPH GIRTON BRIGGS, Earl-street, Blackfriars, London, "An improved method of making fire-proof buildings, ships, and other constructions."

2331. EDMUND SUCKOW and EDWARD HABEL, Manchester, "Improvements in machinery or apparatus for opening and cleaning cotton and other fibrous materials."—*Petitions recorded 18th September*, 1861.

2333. LOUIS GABRIEL AUGUSTE CONDROY, Douai, France, "An improved centrifugal apparatus intended for purifying, washing, drying, moulding, or extracting from liquids, substances, or materials of various kinds, which are deposited or poured for this purpose in movable baskets or boxes fitted in the said apparatus."

2340. WILLIAM CLARK, Chancery-lane, London, "Improvements in machinery for the manufacture of fishing and other nets."—A communication from Messrs. Felix Marie Baudouin and Achille Baudouin and Jean Baptiste François Jouannin, Boulevart St. Martin, Paris.

2348. THEOPHILUS REDWOOD, Montague-street, Russell-square, London, "An improvement in the manufacture of paper."—*Petitions recorded 19th September*, 1861.

2353. JOSEPH CHRISTIAN DAVIDSON, Yalding, Kent, "Improvements in thrashing machines."

2350. FRANCIS WILLIAM WYMER, St. Ann's-row, Newcastle-on-Tyne, "Improvements in apparatus used in sounding the holds of ships or vessels." *Petitions recorded 20th September*, 1861.

2362. CHARLES BOARD, Bristol, "Improvements in veneering presses."

2363. HENRY COCKEY and FRANCIS CHRISTOPHER COCKER, Frome Iron-foundry, Somersetshire, "Improvements in apparatus employed in the manufacture of gas."

2364. JAMES FENTON, Low Moor, Yorkshire, "An improved method of causing the water to circulate in steam boilers."

2365. WILLIAM STABLEFORD, Oldbury, Worcestershire, "Improvements in the manufacture of wheels and in securing tyres on or to wheels."—*Petitions recorded 21st September*, 1861.

2371. HIPPOLYTE PLANTROU, jun., Passage des Petites Ecuries, Paris, "Improvements in washing and scouring wools by the introduction of air into the water, using an aciform washing apparatus."

2375. ALFRED AUGUSTUS HELY, Forest-hill, Surrey, "Improvements in the construction of portable fire-arms."—*Petitions recorded 23rd September*, 1861.

2382. THOMAS DAVEY, Tucking Mill, Camborne, Cornwall, "Improvements in the manufacture of safety fuses, parts of which are applicable to the manufacture of pipes and tubes of lead and other soft metal, gutta-percha, caoutchouc, bitumen, and earthenware."

2384. JAMES FAWCETT, Wakefield, Yorkshire, "An improved material, particularly adapted for the scouring, cleansing, and fulling of woollen or other cloths."—*Petitions recorded 24th September*, 1861.

2387. JAMES BANKS, Salisbury-street, Adelphi, London, "Improvements in electro-magnetic telegraph printing apparatus or marking instruments, and the instruments or apparatus to be used in connection therewith."

2390. THOMAS BRIGHT and ROBERT MILLS, Rochdale, Lancashire, "Improvements in apparatus or means employed in the printing of yarns for carpets and other fabrics."

2392. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in apparatuses for letting off water from, and for admitting oil or other lubricating matter into, steam cylinders."—A communication from Isidore Duballe, Paris.

2398. GODFREY RUSSELL, Swan-hill, Shrewsbury, Shropshire, "Spring stretchers or bedsteads for camp hospitals or general use."—*Petitions recorded 25th September*, 1861.

2402. JAMES OPENSHAW, WILLIAM ENTWISTLE, and JAMES LORD, Bury, Lancashire, "Certain improvements in mules for spinning cotton and other fibrous substances."—*Petition recorded 26th September*, 1861.

2416. JAMES KIMBERLEY, Birmingham, "A new or improved machine for morticing, tenoning, sawing, boring, drilling, and grooving wood."

2417. DUNCAN MCCALLUM, Greenock, Renfrewshire, N.B., "Improved arrangements for filling and closing bottles and other vessels."—*Petitions recorded 27th September*, 1861.

2426. DENNY LANE, Cork, "Improvements in apparatus, whereby to regulate the passage or flow of gas, water, and other fluids."—*Petition recorded 28th September*, 1861.

2431. THOMAS SMITH, Aberdeen-street, Sheffield, "Improvements in the construction of umbrellas, adapted to purposes of self-defence, some of which improvements are also applicable to other purposes."

2440. FREDERICK WALTON and RICHARD BEARD, jun., British Grove Works, Chiswick, Middlesex, "Improvements in the manufacture of varnishes, applicable to the waterproofing and coating of fabrics and other uses."—*Petitions recorded 30th September*, 1861.

2444. OSCAR OCTAVE LESOURD, Paris, "Improvements in joining pipes and tubes, or in forming or securing the joints thereof."—A communication from Jules Lemoine, Rue Saint Paul, Paris.—*Petition recorded 1st October*, 1861.

2495. WILLIAM CLARK, Chancery-lane, London, "An improved gas regulator and purifier."—A communication from Messrs. Jean Baptiste François Maliquet Allegret and Lucien Victor Teste, Rue Ferrandière, Lyons, France.—*Petition recorded 5th October*, 1861.

2511. SAMUEL BREMNER, Belle Sauvage Works, Ludgate-hill, London, "Improvements in the construction of printing machines, and in driving or actuating the same."—*Petition recorded 8th October*, 1861.

2536. WILLIAM EDWARD NEWTON, Chancery-lane, London, "An improved apparatus for heating the feed water of steam engines."—A communication from Francis Bowes Stevens, Weehawken, New Jersey, U.S.—*Petition recorded 10th October*, 1861.

2542. THOMAS BUTTERWORTH COLLINGWOOD and ABRAHAM BUTTERWORTH, Rochdale, Lancashire, "Improvements in throstle and doubling frames for spinning and doubling fibrous materials."

2543. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in the condensers and condensing apparatus of steam engines."—A communication from Francis Bowes Stevens, Weehawken, New Jersey, U.S.—*Petitions recorded 11th October*, 1861.

2560. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in the condensers and condensing apparatus of steam engines."—A communication from Francis Bowes Stevens, Weehawken, New Jersey, U.S.—*Petitions recorded 15th October*, 1861.

2635. FREDERICK OLDFIELD WARD, Hertford-street, Mayfair, London, "Improvements in hydraulic presses, and in the machinery and apparatus appertaining thereto, and requisite in working the same, parts of such improvements relating to the pumping machinery attached to hydraulic presses, and this part being applicable to pumping machinery employed for other purposes."—*Petition recorded 22nd October*, 1861.

2636. BARTOLOMEO PREDAVALLE, Fleet-street, London, "A new mode of, and apparatus for, producing and obtaining an hydro-pneumatic motive-power."—*Petition recorded 23th October*, 1861.

2912. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in machinery or apparatus for cutting irregular and curvilinear forms in wood or other similar substances."—A communication from Robert Marcher, New York, U.S.—*Petition recorded 20th November*, 1861.

2959. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in machinery or apparatus for preparing oval picture frames."—A com-

munication from Robert Marcher, New York, U.S.—*Petition recorded 25th November*, 1861.

2965. AUGUSTUS WILLIAM WILLIS, Great Russell-street, Bloomsbury, London, "Improvements in the construction of pencil cases or holders."—*Petition recorded 29th November*, 1861.

3012. ROBERT CRAWFORD PERRY, Manchester, "An improved infant's feeding bottle."—*Petition recorded 29th November*, 1861.

3096. THOMAS HIGGINS, Bow, Middlesex, "Improved machinery for filling dipping clamps with tapers, match stems, and splints."—*Petition recorded 10th December*, 1861.

3114. WILLIAM WIGGINS GODFREY, Whiskin-street, Clerkenwell, London, "An improved fastener or protector for Albert guards."—*Petition recorded 12th December*, 1861.

3172. MORRIS HANFF, Tottenham-street, Tottenham-court-road, London, "Improvements in the manufacture of boxes and cases."—*Petition recorded 18th December*, 1861.

3188. JOHN SMITH, jun., and JOHN BIRCH HIGGS, Coven, Staffordshire, "Improvements in thrashing machines, and in mills for grinding, and in apparatus for raising or moving grain in granaries and other places."—*Petition recorded 20th December*, 1861.

3250. ALEXANDER ISAAC AUSTEN, Millwall, Middlesex, "Improvements in the manufacture of night lights."—*Petition recorded 30th December*, 1861.

3275. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in revivifying animal black or charcoal, in collecting ammoniacal gases generated in the revivification, in the clarification of saccharine liquors, and in apparatus employed in the revivification of the black, and in the filtering of saccharine liquors."—A communication from Absalon Hippolyte Leplay and Jules François Joseph Cuisinier, Paris.—*Petition recorded 31st December*, 1861.

51. ANTHONY HEATH, Union-square, Islington, Middlesex, "Improvements in the construction of inkstands."—*Petition recorded 8th January*, 1862.

60. JAMES SMITH and STEPHEN WELLSTOOD, Glasgow, Lanarkshire, N.B., "Improvements in cooking stoves or ranges."—*Petition recorded 9th January*, 1862.

80. WILLIAM CLARK, Chancery-lane, London, "Improvements in apparatus for generating and applying steam as a motive power."—A communication from Mr. Louis Armier, Boulevart St. Martin, Paris.—*Petition recorded 10th January*, 1862.

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 25th January, 1862.

1502, 7d.; 1503, 11d.; 1504, 5d.; 1505, 10d.; 1506, 3d.; 1507, 3d.; 1508, 3d.; 1509, 3d.; 1510, 4d.; 1511, 11d.; 1512, 10d.; 1513, 3d.; 1514, 5d.; 1515, 3d.; 1516, 3d.; 1517, 5d.; 1518, 10d.; 1519, 7d.; 1520, 1s. 4d.; 1521, 10d.; 1522, 6d.; 1523, 6d.; 1524, 9d.; 1525, 2s. 3d.; 1526, 6d.; 1527, 3d.; 1528, 10d.; 1529, 3d.; 1530, 7d.; 1531, 1s. 1d.; 1532, 6d.; 1533, 1s. 4d.; 1534, 10d.; 1535, 9d.; 1536, 3d.; 1537, 3d.; 1538, 10d.

*** Specifications will be forwarded by Mr. Bennett Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5*s.* must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

(Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.)

1702. W. E. NEWTON, *Chancery-lane*, "*Engines for obtaining motive power by the electric force of steam and air combined.*"—*A communication.*—*Dated 4th July*, 1861.

By means of the present invention, whereby the apparatus is made self-acting, or nearly so, in its operation, the air is introduced and commingled with the steam through the agency, and by the power, of the current of steam itself on its way from the generator to the working cylinder of the engine, and by the vacuum produced in the working cylinder during a certain portion of the stroke of the piston.

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

1657. M. LANE, *Reading*, "*Permanent-way of railways.*"—*Dated 28th June*, 1861.

For the purposes of this invention longitudinal bearers of wrought iron are used, and they may be of any desired length, and they may be employed at intervals along the rails of a railway, but it is preferred that they should be continuous. The lengths of which the longitudinal bearers are composed, and the lengths of rails supporting and held thereby, may, when desired, be so laid as to break joint. The bearers are each composed of two separate parts, one outside and one inside of the rail, and the two parts are both rolled or formed to a similar section. Each of the two parts of a bearer consists of a plate, by preference of about six inches in width, but this may be varied; and the plates may be of any desired length. These plates rest on the ground at a slight inclination from the side of the rail which they support. That edge of each plate which comes next the rail is turned downwards to the extent, by preference, of about three or four inches. At the sides of the turned down parts of the two plates, and near the upper surface where the rail is received between them, grooves are formed, one in each plate, and, by preference, angular grooves, so that, when the two grooves of the two parts of a bearer come opposite each other, they will form a dovetailed space between the two turned down parts of the plates of which a bearer is composed. These plates are connected together at intervals by screw bolts and nuts, the bolts passing through the turned down parts of the plates. The rails used with these bearers are rolled with an under web or projecting rib, which is of a dovetailed section, or of such other section as will correspond with the space produced by the grooves in the two parts of which a bearer is composed. The under surfaces of the rail, near the outer edges, press on, and are supported by, the plates of the bearer, the under surface of the rib or projection under the rail not coming quite down to the bottom of the dovetailed space. It will, therefore, be understood that a rail will be held securely between the two plates of a bearer, which press the rail on each side, and, by reason of the dovetail or other section of the under part of the rail corresponding with the undercut or dovetail form of the space between the two plates or parts of which a bearer consists, the rail will be prevented from rising; and it will be also understood that pressure on the rail will, by pressing down the bearer, tend to cause the rail to be held more and more tightly between the two parts of the bearer.

1660. R. N. EAGLE, *America*, "*Riding stirrups.*"—*Dated 29th June*, 1861.

The stirrup is, according to this invention, suspended so as to incline the tread or bottom of the same inwards and upwards towards the body of the horse when pressed upon by the foot of the rider. For this purpose the point of suspension of the stirrup is made inside a line perpendicular to the centre of the tread thereof, and this point of suspension is adjustable, as required, by means of an adjusting screw, or other mode of fixing the loop to the strap on the pin or axis for connecting the lower part of the loop with the upper part of the stirrup. The stirrup is also suspended from an eye forming such an angle with the body of the stirrup as will obviate the tendency to twist the strap, and give a ready entrance to the foot when the toe is directed towards the shoulder of the horse. The stirrup is also suspended from a horizontal axis, in a line parallel with a line which would cross the foot diagonally from the little toe to the instep.—*Not proceeded with.*

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

1680. A. HILL, *Bamford Mills, Derby*, "*Spinning and doubling machinery.*"—*Dated 2nd July*, 1861.

For the purposes of this invention the bobbin remains stationary or fast on the upper end of the spindle, and the lower part of the bobbin is drilled or cut out so as to leave a space all around between it and the spindle, in order that a tube connected with the flyer may move up and down and turn freely within the lower end of the bobbin. The two limbs of the flyer rise up on either side of the bobbin, and the limbs of the flyer are fixed in a cylindrical tube, the lower end of which, where the limbs are affixed thereto, is of larger diameter than the upper part of the cylindrical tube which rises into the lower end of the bobbin. The interior of the cylinder, which carries the limbs of the flyer, is of larger diameter than the spindle, excepting at the upper end of such cylinder where it touches the spindle. The rail by which the flyer is raised and lowered is actuated as heretofore, and where each spindle passes through it there is a bearing for the lower end of the cylinder of the flyer, and such bearing is made slightly concave on its upper surface where the end of the tube or cylinder of the flyer rests. In the centre of such bearing there is a fixed tube, within which the spindle revolves; this fixed tube enters the lower end of the cylinder of the flyer, and the same is capable of turning on such fixed tube. In some cases the interior diameter of the lower end of the cylinder which carries the limbs of the flyers is not of larger diameter than the spindle, in which case there is no fixed tube to the bearing or part which supports the end of the cylinder to which the limbs of the flyer are affixed.—*Not proceeded with.*

1712. R. LAKIN *and* J. WAIN, *Ardwick, Lancashire*, "*Machines used in preparing to be spun, and in spinning cotton, wool, &c.*"—*Dated 5th July*, 1861.

This invention consists, First, in the application of vertical levers, in combination with other suitable parts, for the purpose of forming a connection between the fallers of two or more mule carriages, when driven from one headstock, only in the manner commonly called double decking, triple decking, or the like, according to the number of carriages connected, so that the motion given from the headstock to the faller of one carriage may be communicated to the faller or fallers of the other carriage or carriages. Secondly, in constructing the cap bar slides and cap bars used to retain the top rollers in the mule or throstle in their places in such manner as to act as strippers in removing the fibres of cotton or other material which are apt to gather round the pivots of such rollers. Thirdly, in the improved construction of the cap bars and cap bar slides in such a manner that the ordinary saddles may be dispensed with when fluted top rollers are used in any of the machines of the several kinds before mentioned, and the parts used for weighting the top rollers may be attached to the cap bars or cap bar slides, whereby the parallelism of the top and bottom fluted rollers is less liable to be disturbed. Fourthly, in the application in or to any of the machines of the several kinds aforesaid of a click and ratchet wheel, in combination with pulleys of unequal diameters to produce different speeds in the same shaft. Fifthly, in a combination and arrangement of mechanism whereby the scrolls or equivalent parts used in putting up the mule carriage, and also the friction wheel for performing the backing off, are driven by gearing attached to a counter shaft, and through intermediate parts, instead of being driven from the headstock in the usual manner. Sixthly, in the application of a spring or brake to prevent the rotation of the winding on barrel or drum, in mules constructed on the principle of Roberts' mules, during a short period before the carriage has completed its outward run, and also after the carriage has commenced its inward run, and thereby to allow an interval between the commencement of the inward run and the commencement of the winding on. Seventhly, in the application of a catch box and incline in combination with a snail and other suitable parts, for the purpose of moving the mule carriage inwards at a slow rate whilst twisting at the head, the motion being determined by the form of the snail, which acts when the catch box is in gear, the time of which is regulated by the incline.

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

1735. A. PRIEST *and* W. WOOLNOUGH, *Kingston-upon-Thames*, "*Machinery for drilling and hoeing land.*"—*Dated 5th July*, 1861.

This invention consists, Firstly, in turning drills and hoes at the headlands, in order to bring the travelling wheel into its former wheel track, and prevent the young plants from being cut up by the turning of the wheel; the patentee provides a turntable upon which the wheel may be placed and turn. Secondly, in raising or lowering the horizontal bar or bars which carry the fixed ends of the levers of drills and horse-hoes, and in the facility afforded for taking the implement out of work while in motion. Thirdly, in making the wearing part of drill coulters loose or detached from the body of the coulter itself. Fourthly, in drilling or sowing compost or artificial manures. The box of the drill has hitherto been made whole, the manure being carried to the barrel that delivers it by stirrers placed inside. This last improvement consists in making the front part of the box nearest the bottom to oscillate by means of eccentrics or cranks driven by gear wheels, or other suitable machinery, so that, at each motion of this vibrating door, a regular quantity of manure is continually supplied to the barrel that delivers it into the spouts or distributing stool.

1742. R. HORNSBY, *jun., Grantham*, "*Thrashing machines.*"—*Dated 9th July*, 1861.

In carrying out this invention the patentee does not, as heretofore, work the cranks at the two ends of the shaker in unison, but he connects the cranks at the further end of the shaker to the bars or boxes by means of connecting rods, and he drives the two crank axles at different speeds, usually by a band and pulleys. When this arrangement is made the action of the bars at the entrance of the shaker, where the straw is first thrown upon it, is precisely as heretofore; but at the further end of the shaker it is only occasionally that the motion of the bars is suitable for carrying the straw forward, that is to say, it is only from time to time that the forward motion of the bars or boxes takes place; when they are raised from this cause the straw is detained on the shaker, which, consequently, may be made shorter than heretofore.

1752. T. REEVES, *jun., Button Westbury, Wiltshire*, "*Apparatus for applying salt or other material to the roots of weeds.*"—*Dated 11th July*, 1861.

For these purposes an instrument is used, by preference a hollow cutter, suitable for being forced into the earth, and to cut or bruise the roots of weeds. This instrument or cutter is fixed to the end of a suitable handle, and above it is applied a hopper, or other suitable form of vessel, to contain salt or other material used to destroy the roots of the weeds, and below such hopper or vessel there are two valves or sides or plugs, applied at such a distance apart that the space between them may contain a suitable quantity of the salt or other material, and these valves or sides or plugs are connected together by being pin-jointed to projections on the upper end of a weighted lever, which, when the cutter or instrument is out of the ground, will having in such a position as to close the lower valve or slide, and to open the upper slide or valve; but, when the instrument or cutter is pressed into the earth, the lower end of the lever, by resting on the surface of the earth, and being resisted thereby, will cause the lower valve or slide to open, and the upper one to close, when the salt or other material which was previously in the space between the two valves or slides will descend down the instrument or cutter.

CLASS 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

1750. F. WARNER, *Jonin-street, and* T. CLARK, *Baldwin-street, City-road, London*, "*Supplying water to water-closets.*"—*Dated 8th July*, 1861.

For the purposes of this invention, and in order to secure that only a determined quantity of water shall be supplied to the basin of the water-closet each time the water-closet is used, the following combination of apparatus is applied. The water from the source of supply is received into a small vessel, which is preferred to be of a semi-cylindrical form, with axes or necks at the ends which turn in suitable bearings in an outer cistern or vessel of somewhat larger dimensions than the inner one, which receives the water from the source of supply. At the bottom or lower part of the outer vessel is an outlet with a pipe communicating with the basin of the water-closet, and it is preferred that this at the bottom of the outer vessel should be conical. The inner vessel which first receives the water is arranged to be tilted by the ordinary handle of the water-closet, or by other means, by which the contents of such inner vessel will be emptied into the outer vessel, and such water will descend into the basin of the water-closet so soon as the inner vessel has again assumed its horizontal position; but the water will not flow from the outer vessel to the water-closet before the inner vessel assumes its correct position, by reason of there being a valve in the outlet which is in connection with the inner vessel, and which is closed till that vessel assumes a position again to receive a fresh supply of water. The water is supplied to the inner vessel from the main or other source of supply by means of a valve, which is, by preference, regulated by a float in such manner that, as soon as there is a proper supply of water in the inner vessel, the float shuts off the further supply; and when such inner vessel is tilted the float, when used, is retained in such position as to prevent the valve or plug on the supply-pipe opening till the inner vessel has emptied its contents, and has again assumed a horizontal or correct position, to be again supplied with water.—*Not proceeded with.*

1738. F. S. BAKER, *Dublin*, "*Preservation of stone and other analogous absorbent substances*"—*Dated 9th July*, 1861.

This invention consists in employing for the said purposes solutions of the alkaline silicates, combined with the aluminate of potash, or other suitable re-agent, in such proportions as to allow sufficient time to elapse for manipulating the said solutions, and thus enabling it, when applied to the surface of the stone, or otherwise, to enter into and effectually penetrate the same. The said solutions, in combination with powdered pumice stone, or other like material, are also employed for producing or manufacturing artificial stone for attrition, building, or other purposes.

1745. W. COOKE, *Spring-gardens*, "*Wind-guard for curing smoky chimneys.*"—*Dated 11th July*, 1861.

For the purpose of this invention the inventor constructs a cylinder or shaft, of perpendicular or other form, of iron, zinc, or other suitable material, open at the top, so as to permit the smoke to freely ascend through inner cylinders of perpendicular, or it may be irregular, shape, at the same time preventing the outer current of air from descending into the chimney shaft by reason of certain openings in the outer cylinder which permit the air to go out at the sides.—*Not proceeded with.*

CLASS 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defences, Gun Carriages, &c.

1729. J. SNIDER, *Paris*, "*Utilising old or smooth bore cannon.*"—*Dated 5th July*, 1861.

This invention is carried into effect by first reboring the cannon, to be converted to a sufficient extent to rectify any inaccuracies arising from wear and tear or long exposure, and then inserting in the said cannon a hollow close-fitting metallic cylinder, preferably of steel, whereby greater strength is given to the piece, and the diameter or calibre of its bore proportionally reduced. The said cylinder is secured in the gun by any adequate mechanical means; after which the bore can be completed and the piece rifled.—*Not proceeded with.*

CLASS 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

1661. J. DYER, *Islington*, "*Ornamentation of certain cabinet furniture.*"—*Dated 2nd June*, 1861.

This invention has reference to the ornamentation of certain cabinet furniture, known as deal or pine furniture, whereby an effect similar in appearance to a superior class of polished ornamental furniture may be produced, and consists in producing upon the surface or surfaces of the same stained patterns or devices, in imitation of the ordinary marquetry, inlaid, moulded, or banded work, in coloured fancy woods.

1675. W. BARBER, *Stockport*, "*Hats.*"—*Dated 2nd July*, 1861.

According to this invention the inventor "cuts," "shapes," or "tips off" hats, of whatever materials made, by means of a mould of the form of the intended brim, and he forces the brim of the hat into contact with this mould by means of an elastic bag, into which bag he forces water, air, or other fluid.—*Not proceeded with.*

1682. M. HENRY, *Fleet-street, London*, "*Pianofortes.*"—*A communication.*—*Dated 2nd July*, 1861.

The object of this invention is to provide performers on pianos and other musical instruments with means for "transposing" pieces of music, that is to say, for playing the same air or piece of music in various different keys.—*Not proceeded with.*

1708. J. HUTSON, *Richmond, Surrey*, "*Cornices, laths, and panels for bedsteads.*"—*Dated 5th July*, 1861.

The cornices are, according to this invention, made of metal, for which purpose the patentee prefers to use thin sheet metal, forming the large sweeps, or curves, or angles, by passing the said metal between rollers of corresponding size and form, and the smaller sweeps, or curves, or angles, by stamping or pressing the same into form, and afterwards soldering or suitably securing together the parts of the said cornices by the method commonly adopted in metallic constructions. In the construction of the cornices the rounded corners, when used, are formed of stamped or cast metal, which is soldered, rivetted, or secured to the other parts of the said cornices, the weight of the cornice being supported by the invisible or reversed brackets before described. The short laths for iron bedsteads have one stud hole punched out in a line with the laths' length, as heretofore, but the other stud hole is punched out at right angles, or nearly so, with it; and, in addition, one or all of the long laths, and (if thought necessary) one of the short laths used in each bedstead, may be provided with tongues punched out and turned under at the point where the said laths pass over or cross each other, and, when fixed in position, the said tongues are slid under each of the laths, and retain the same in position. And, in order to enable laths secured together in this manner to be tightened or slackened, as may be required, the patentee attaches to the long laths a ring lever or annular fastener, or other adjusting fastener. The panels aforesaid are constructed of corrugated metal.

CLASS 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

1704. T. WILSON *and* J. G. TATTERS, *Felling, near Gateshead-on-Tyne*, "*Treating tank refuse or soda waste.*"—*Dated 4th July*, 1861.

For the purposes of this invention the inventors take the residue commonly called tank or soda waste, lixiviate it with hot water, and boil it if necessary. They then filter the liquor and into the filtered liquor they pour muriatic acid till all the sulphur is precipitated. They then decant, draw off, or filter the liquor, and thus separate the sulphur, which they wash in order to remove the acid; the sulphur is then dried.—*Not proceeded with.*

1709. O. WILLIAMS, *Darsley*, "*Liquid for extinguishing fire,*" *&c.*"—*Dated 5th July*, 1861.

The patentee claims combining into a mixture water, soda of commerce, alum of commerce, roach alum (or mineral salt), common salt, borax, oil of vitriol, and chloride of zinc, and the use and application of the said mixture for extinguishing fire, and for rendering materials and fabrics non-inflammable.

1717. R. A. SMITH, *Devonshire-street, Manchester*, "*Purifying gas.*"—*Dated 6th July*, 1861.

The patentee claims the purifying of gas from sulphur and its compounds, except sulphuretted hydrogen, by treating it with alkaline solutions of certain metals, in the manner described.

CLASS 9.—ELECTRICITY.—NONE.

CLASS 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

1605. P. H. A. C. SAPIA, *Paris*, "*Instruments for measuring angles and distances.*"—*Dated 22nd June*, 1861.

For the purposes of this invention the inventor applies the indicator of the alkidade, or of the telescope, in an eccentric manner on a circular limb or dial plate; a second indicator or pointer works in a concentric manner on the dial plate, and is connected to the first indicator by an appendix of its axis acting against the latter, so as to make the motion of both indicators dependent on each other, while the pointer or second indicator will mark on an amplified or multiplied scale (on the dial plate provided with curved lines circulated in such manner as to mark suitable geometrical spots) the angle taken by the telescope or alkidade. This principle of amplifying or multiplying the observed angle may be applied to an instrument for measuring distances.—*Not proceeded with.*

1619. J. LAFON, *Bordeaux*, "*Production of chromo-lithographic impressions upon glass, porcelain, &c.*"—*Dated 25th June*, 1861.

In carrying this invention into effect all the parts of the drawing or design are first executed upon stone, exactly as they are to be reproduced upon bottles or other objects. The impression is taken dry upon coarse paper, sized, glazed and previously coated, on the side which is to receive the impression, with a solution of gum arabic, or other very homogeneous gum or adhesive. On the gum side all the black of the design is first impressed; this black, which is the same as that used in lithography, is prepared for the operation in question with a varnish or glaze composed of alcohol and melted white resin. This impression in black is then powdered either with carmine, bronze, crimson, or other colour. The impression of the other colour is obtained by reversing the process of chromo-lithography upon paper, that is to say, which is to remain upon the paper; consequently the last colour but one must be printed after the black, and in all cases immediately powdered with the desired colour, and so on to the end; but the third impression must, however, always be gold or silver (in leaf or powder), and must entirely cover the preceding powdered colour. The fourth impression is taken in the same way, and must also cover all the design; in other words, all the colours must be covered with gold or silver. Further, all these colours must be printed with a transparent mordant. When the chromo proof has arrived at this point to be enabled to counter-draw it on to the glass or other object a new impression or ground must be made, completely covering the design; this ground is printed with a transparent mordant composed of extra strong copal and white resin varnish. The counter drawing:—Immediately after the impression of the ground the back of the paper is moistened with a sponge suitably soaked with water; this side of the proof is then placed upon damped paper, and, when the humidity has sufficiently penetrated it, this proof is placed by hand directly on the glass or other object which is to be labelled with the design. The proof is first fixed by a slight rubbing with the palm of the hand, and an equal and sufficient pressure is then brought upon the entire surface by means of a roller covered with caoutchouc. The paper thus gummed or fixed to the glass or other object is again moistened with the sponge, and when it begins to crease or fold it is carefully withdrawn. The design is then allowed to dry for a moment, and the object is then washed with a fine sponge moistened with water to remove the preparations left by the gumming of the paper, and the excess of the mordant which has served in the impression of the colours, the gold, or the silver. The chromo-printing is then provisionally ended, or there remains but to permit it to dry thoroughly upon the object; and when it is ascertained to be dry the operation is finally completed by applying, with a very fine badger hair brush, a coat of drying varnish composed of sugar or caramel and alcohol well rectified.

1612. J. *and* J. COLE, *Coventry*, "*Watches.*"—*Dated* 22*nd June*, 1861.

The object of this invention is to obtain, by a simple arrangement of driving gear, an independent dead centre seconds movement. In adapting the invention to an ordinary watch the inventors mount an extra pinion of twenty teeth on an arbor that projects through the pillar plate. This pinion gears into the fourth wheel, and receives motion therefrom for the purpose of driving the arbor which carries loosely at its upper end a second pinion of twenty teeth. This second pinion is made hollow to receive a collet and spring, by which the pinion is secured to the arbor, in such a manner that, whereas the rotation of the arbor is continuous, that of the pinion may be intermittent.—*Not proceeded with.*

1616. R. HOWSON, *Middlesbro'-on-Tees*, "*Barometers.*"—*Dated* 25*th June*, 1861.

This invention consists in employing a tube similar to that of the common straight barometer, except that, in the place of the entire bore of the tube being filled with mercury or other fluid, the central part of it is occupied by a light stalk or closed tube, leaving only a comparatively small concentric space for the mercury or other fluid; and instead of making the cistern for the surplus mercury or other fluid fixed, as in the ordinary barometer, it is attached to the said stalk or closed tube, so that the stalk cistern and fluid are held in suspension and rendered free to rise or fall by every increase or decrease of pressure. The object of the invention is to add to the sensitiveness of the well-known Torricellian column, by giving it a comparatively increased range, or greater extent of rise and fall; also to obtain barometric readings on an extended scale, otherwise than from the top of the column, if desired.

1632. E. A. LINGARD, *Birmingham*, "*Fastenings for jewellery, &c.*"—*Dated* 26*th June*, 1861.

This invention consists in the adaptation of one or more bars of gold or other metal or other suitable material (which bars may or may not be hollow, in the form of tubes or otherwise), the said bars being so fixed to a bridge, span, or bow of metal or other material as to leave an aperture to admit the article or articles to which it is desired to attach the fastener, and inside or outside of the said bars it is intended that a bolt or bolts should work or slide, so as to close the said aperture, and which bolt or bolts or slide or slides may be fitted with or without propelling or retaining springs; or, for greater security, may have a securing or locking action applied thereto.—*Not proceeded with.*

1634. J. R. TUSSAUD *and* F. C. TUSSAUD, *Marylebone-road, London*, "*Improvements in obtaining the separation of feathers, hair, or other covering from the skins of animals, and in securing such in position when separated.*"—*Dated* 26*th June*, 1861.

For the purposes of this invention the patentees introduce in a liquid form on the outside of the skin a solution of some matter, adapted when the solvent thereof has evaporated or the matter employed has solidified, to form an artificial skin close upon the natural one, by which to hold the feathers or hair or other covering thereof at or near the roots, and in their desired relative position, in order to the skin being removed without its necessarily being destroyed. They first lay the skin inside downwards upon a board or other suitable surface, and apply thereon the solution of matter, which, after the evaporation of the solvent, or the solidification of such matter, will, by acting as a temporary artificial skin, serve to hold the feathers, hair, or other covering in position during the removal of the natural skin, taking care that such matter be introduced amongst the feathers, hair, or other covering of the skin as near as possible to their roots. A solution of shellac in alcohol answers well for the production of the artificial skin. When the shellac has become dry by the evaporation of the solvent the skin may be drawn off the inner ends of the feathers, hair, or other covering, leaving such held by the shellac. They then cleanse the projecting roots of any remaining fatty or animal matter, and apply upon such inner ends a coating or solution of india-rubber or other suitable adhesive matter. To facilitate the removal of the natural skin from the roots they prefer to steep it for a time in lime water, as is practised by tanners.

1639. A. LION, *Paris*, "*Fastening of bracelets.*"—*Dated* 26*th June*, 1861.

For the purposes of this invention the patentee employs a screw, which he fits on either of the two portions forming the fastening, that is to say, either on the spring bolt or male portion of the fastening, or else on the other or opposite portion of the fastening, that is to say, the mouthpiece, socket, recess, or female portion that receives and retains the spring or first named portion. By employing this screw in combination with the fastening the portions of the latter are held firmly together, and the bracelet can be effectually and securely fastened.

1638. S. A. BELL, *Epping-villas, Stratford*. "*Arranging and securing splints, tapers, or matches in frames, preparatory to dipping.*"—*Dated* 26*th June*, 1861.

In carrying out this invention the splints or wax tapers, having been cut up into lengths suitable for matches, are placed in a box, which is capable of holding a considerable number. Openings are made at one end of the box from and through which the splints or matches are pushed endwise into the grooves or holes made in the dipping frames to receive them. The splints of matches are pushed out of the box by means of a series of wires or pistons, the ends of which are inserted at the opposite end of the box, and will abut against the ends of some of the splints, and, by pushing forward these wires or pistons, the splints will be forced out of the box into the frames, as already explained. In combination with this pushing apparatus may be combined a cutting apparatus, so that the wax matches may be cut off in suitable lengths from long lengths of taper wound upon reels, and of which there may be any convenient number adapted to one machine. The lengths of matches, when cut from the long taper, may be pushed through guides into the holes or grooves in the dipping frames, in which they must be secured by clamping bars or other convenient contrivances for holding them in securely while being dipped in the igniting composition.—*Not proceeded with.*

1640. J. COWAN, *Barnes*, "*Apparatus for reburning animal charcoal.*"—*Dated* 26*th June*, 1861.

An important object in reburning animal charcoal consists in preserving it from the atmospheric air when it is to be removed from the cylinder or retort. For this purpose, instead of having to remove the whole end or cover (of the cylinder or retort) in order to withdraw the contents, as is usual, thereby allowing a full and continuous rush of air, the patentee forms in the front or discharge end or cover an opening, which only occupies a limited or restricted portion thereof, and is closed as required by a door, lid, or plate, which, when the charcoal is to be discharged, is opened, thereby only exposing a small portion of the interior, preserving the mass from being decomposed by the rush of air, and only allowing a small quantity of air, if any, to get access to the products to be discharged. He supports the cylinder or retort on wheels or rollers on which it turns; and he prefers to have two such wheels or rollers at each end of the cylinder, and to form the front end or cylinder cover with a flange broader than the rim of its supporting wheels (to allow for expansion); and he also prefers to cause the flange at the back end of the cylinder to turn in a groove in its supporting wheels to keep that end in gear with the driving arrangements. He drives or turns the cylinder or retort by forming or fixing teeth, or a cogged or toothed wheel, rim, or flange, on the end which he drives, by a pinion or equivalent on a driving shaft, so that, by having a number of pinions or wheels at intervals on a main driving shaft lying horizontally along the back ends of a row of cylinders or retorts placed side by side, and having toothed wheels or flanges on such ends, any desired number of cylinders may be driven by the same shaft. The cylinders or retorts are mostly formed with double flues or covers at the ends, having a space between those of each ends, and he fills such space with fire-brick or other non-conducting media, to prevent radiation of heat at that part.

1642. M. A. F. MENNONS, *Paris*, "*Improvements in cocks or taps for drawing off liquids, and in gauging apparatus connected therewith.*"—*A communication.*—*Dated* 27*th June*, 1861.

These improvements consist, Firstly, in the application to taps or cocks of a cast shoulder piece, forming a hammer face, and situated behind the key in such a position as to be easily struck when the tap is being sunk in a barrel or other vessel. The object of this arrangement is to avoid the straining and other injuries to which ordinary cocks or taps are liable when forced into their settings by hammer strokes applied in front. Secondly, in the application to such cocks or taps of a lever key set horizontally, with its free extremity towards the barrel, in such a position as to be beyond the reach of accidental contact. Thirdly, in a movable gauging apparatus applicable to stop cocks constructed as above, and serving as indicator of the contents of the vessel to which it may be applied.—*Not proceeded with.*

1646. J. C. SMART *and* A. AITCHISON, *Scarborough*, "*Manufacture of charcoal.*"—*Dated* 27*th June*, 1861.

In carrying out this invention the patentees place within suitable retorts of metal or earthenware bark knots, or the refuse bark of tan pits, or produce of other trees, and burn them, while in the retorts, until they are reduced to ashes, which are to be quickly withdrawn into an air-tight box, or receiver, composed of wood, metal, or other such material as may be found most suitable in practice. The ashes are then to be left to cool in the box, or receiver, whereby the charcoal will be produced, which may then be powdered, if required for foundry work, or left in lumps it for ordinary use.

1654. H. J. ROUSE, *Alexandria, Egypt*, "*Hand-lamps.*"—*Dated* 28*th June*, 1861.

This invention refers to those hand-lamps in which coloured glasses are placed capable of being revolved to show a different colour for signalling purposes. The invention consists in carrying a ring, a stud, or other appliance connected to the frame in which the coloured glasses are fitted, through the bottom of the lamp frame, in order that the turning of the glasses may be effected from the bottom of the lamp frame. A shield in the form of a deep ring protects the appliance for turning the glasses, and, at the same time, forms a stand for the lamp to rest upon when not carried.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

CONTINUED DEPRESSION IN THE IRON TRADE: *Masters Resigning Themselves to "Fortune's Stream:" The Improvement: When to Arrive*—THE DESCRIPTIONS OF FINISHED IRON IN DEMAND: *Prices Firm, though Low*—PIG IRON: *Sales in Birmingham Yesterday*—COAL TRADE—GENERAL MANUFACTURING TRADES: *Unimproved Condition: Branches Specified*—BOARD OF TRADE AND THE WOLVERHAMPTON CHAMBER OF COMMERCE—FAILURE OF PITT AND FLETCHER—CRIMINAL PROCEEDINGS AGAINST A METAL BROKER—ROLLING STOCK COMPANY: *Nine per Cent. Dividends*—HOW TO DISSIPATE FOUL AIR IN A PIT SHAFT.

WE are utterly unable to report anything more favourable of the iron and general hardware trades of Birmingham and South Staffordshire this week than we did last. The conviction which has been induced by a most careful survey of what is now being done by the workers in the respective departments of this busy hive of industry is, that really less of the honey peculiar to the West Midlands is being produced at the present than any former period for many years past. And the reduction is perceptible if a comparison is made with even a much shorter period. There has been decidedly less iron made in this district this week than there was last, or than there was in any week last quarter within seven days of the holidays with which the quarter closed. It would be folly to think of there being any extensive improvement until the cessation of hostilities in America. On that account the trade would have been glad if the speech of the Emperor of the French had indicated an intention of that monarch to interpose in the civil strife. But as the reason for expecting any vigorous intervention from France or from any other quarter of the old world are now so very faint, scarcely other indeed than Shakspere's description of ambition—"a shadow's shadow"—the trade have thrown themselves back upon the stream, and are floating upon its surface—they hope into a propitious haven—but they will not be surprised if they find themselves where the

"Winds are rude in Biscay's sleepless bay."

The demand for the Canadian market will give rise to some slight improvement when the orders are given out, as will also those for the Baltic trade; but all this will be of little worth comparatively with the resuscitation of the general home and foreign trade that would soon follow upon the declaration of peace in America. In Birmingham yesterday (Thursday) a hue of improvement was reported in the Liverpool market; and some good orders for boiler plates are being executed for use in the west of England. General merchant iron continues to be forwarded to the warehouses in the neighbourhood of the London Docks, but the metropolitan market proper is still very quiet. The rolling of ship plates is affording employment for the mills, of several works, but as a rule the plate and sheet mills of the district were scarcely ever so quiet. Buyers of finished iron continue to require that their orders shall be accepted on very low terms. Prices that are considered by makers to be very low are accepted; but a large quantity is being made by small makers that might have been produced by first-class houses if they would only accept a reduction upon their present prices, which are, nevertheless, almost universally below those fixed by the "association." On the whole the prices of good finished iron and of most brands of pig iron may be regarded as firm.

Amongst the sales of pig iron in Birmingham yesterday was that of 1,000 tons of cinder pig, which went at 50s. a ton—an advance of 5s. a ton upon the prices at which some contracts for that description of iron are even now being executed. Excepting in cinder pigs to mix with the rich hematites there is very little of the pig-iron of this district changing hands.

Coal still continues in good request; large quantities are being sent off daily, by rail, to various parts of the country, and the demand by water is of a satisfactory nature. The colliers continue quiet, and are more regular at their work than they were.

The state of the general hardware trades of Birmingham and Wolverhampton are very dull. Of specific trades we may speak thus—the tube manufacturers and gun-makers are busy, but in few other instances are there any signs of animation. The brass-founders, electro-platers, jewellers, button and pen makers—all leading trades—are each of them depressed; not partially so, but the tenor of the reports from all the large firms is the same. The rolling mills are not in operation more than two-thirds time. For iron wire there are scarcely any orders in, and have not been for many weeks. In brass wire there is a better demand, and the men engaged are working full time. In japan goods there is not much doing at present, and the same may be said of the tin-plate and the hollow-ware trades.

An instance of correct and kindly-feeling in connection with this fearful accident has been evinced in Wolverhampton that is deserving of all praise and of the widest publicity. If the example should be followed as widely as it might be not only would the bereaved women and children be amply provided with the means of temporary support during the period of their dependency, but a warmth of sympathy would be evoked among the different operative classes that would be productive of the best results, inducing the conviction that in the suffering of one all are interested. Last Saturday evening Mr. J. Armstrong, the manager of the Stafford-road Works connected with the Locomotive Department of the Great Western Railway, in the town named, called together all his clerks, managers, and workpeople, and having laid the case of the survivors before them, they all agreed to have half a day's pay stopped from their wages, that that amount might be forwarded to Shields. The course which Mr. Armstrong took we commend to other employers, who, as he did, might gracefully head the movement with a contribution proportionate with that of their workpeople. Subscriptions are being extensively made at the different manufactories in Birmingham, and the people are contributing liberally. In Wolverhampton a similar course is being pursued at the iron-works of the Chillington Company, and at the holloware manufactory of Messrs. T. and C. Clark.

Messrs. Pitt and Fletcher, boot tip manufacturers, of Willenhall, have been made bankrupts in the Birmingham Court. The failure at this particular period is doubtless owing to the exposure of the cruel frauds which have been perpetrated upon the depositors in the Bilston Savings' Bank, by the father of the member of the firm who bears the name of the man whom society is now justly execrating. The son had borrowed £1,000 from the father, handing him in return a security. Now that the father's assets are being realised by the trustees of the Bilston Savings' Bank, of which he was the defaulting treasurer, the banking company, who had advanced money to Pitt and Fletcher, at once required that Fletcher should make himself bankrupt; for it happens that Fletcher is now the sole member of the firm. A short time ago Pitt, it is understood, took current bills which bore the Rev. H. S. Fletcher's name, and were of the presumed value of £700, for his interest in the concern, which, although preserving the name of Pitt and Fletcher, yet has since had for its proprietor Fletcher only. Pitt's liability to the creditors last mentioned did not, however, cease with the termination—such as it was—of the connection between him and his former partner. Reflecting upon this fact these creditors are understood to have taken from the file of the Bankruptcy Court the petition which Fletcher, at their instance, lodged there, and in its place lodged one which made Pitt and Fletcher bankrupts. The petitioning creditors were encouraged to advance money to the firm by the liability to the extent of £1,500 which the Rev. H. S. Fletcher took upon him for help to that extent in the event of its being necessary. Of course the value of the security is now very problematical. The trustees of the savings' bank have obtained a judge's order, whereby they have succeeded in getting transferred to themselves, in the interest of the depositors, the security for the £1,000, which the father of Fletcher held; but that it is of a character that will give the depositors a preference for that amount upon the Willenhall assets over other creditors is open to question. The liabilities beyond those to the father and the petitioning creditors cannot be much. The precise amount has not, however, been stated.

On Tuesday afternoon last our annual meeting of the Rolling Stock Company was held in Wolverhampton. The report showed that the profits on the year had been £5,000 3s. 4d. At the meeting in July last year it was recommended that the dividend should be raised to 9 per cent. from 8 per cent., at which it then stood. The profits of the year enabled that recommendation to be carried out, and a considerable sum to be carried to the depreciation and reserve funds. The last year had been a period of considerable depression, therefore the realisation of so large a profit during such a time was, the directors rightly conceived, a subject for much congratulation. One hundred and seven wagons had during the year been purchased, and fifty sold, which left 1,927 in the possession of the company. After £4,655 1s. 11d. had been set on, side for the payment of the dividends on the ordinary and preference shares, and the carrying forward of a balance to the depreciation fund, £345 1s. 5d. would be left to be carried to the reserve fund, which, after that addition, would amount to £3,700 7s. 5d.

A dividend of nine per cent., free of income-tax, on the amount paid on the ordinary shares, and six per cent., less income-tax, on the amount paid on the preference shares was declared.

The following important reminder, relative to certain remedial measures that may be used in dispersing the foul air in a pit shaft, in the event of such an accident as that which has recently happened at Shields, we are only too glad to reproduce in this place. We find them in a leader upon that catastrophe which appeared in the *Birmingham Daily Post* last Monday. The writer says, "We confess to no slight degree of astonishment that, of all the medical men in attendance, no one seems to have been acquainted with a very simple and thoroughly effectual means of enabling the workmen to breathe freely and safely in the foulest atmosphere. It is a common practice to throw quantities of quicklime into pits and other places charged with carbonic acid, and this appears to have been done at Hartley. But lime of itself absorbs the gas so slowly as to be next to useless when it is desired to effect an immediate purification of the air; for the lime, when it has absorbed a certain quantity of gas, becomes coated with a hard covering of carbonate of lime, which prevents, or greatly retards, the further process of absorption. This difficulty some years ago suggested to Mr. Graham, the Master of the Mint (then Professor of Chemistry at University College, London), a series of experiments which established the important fact that the absorbent power of lime can be so augmented as to render the worst atmosphere perfectly safe. If to quicklime is added an equal weight of crystallised sulphate of soda (or in other words, glauber salts), both in fine powder, the water of crystallisation contained in the latter so operates upon the lime as to immensely increase the rapidity with which it absorbs carbonic acid. If each of the men sent down to clear the shaft had previously placed over his mouth a pad containing a small quantity of this mixture, the work of mercy need not have been suspended for an instant; for a man thus protected might, with perfect safety, enter and remain in an atmosphere which would otherwise prove instantly fatal to human life. The fact that this simple precaution was neglected affords a lamentable proof of how little the discoveries of science are known to, or appreciated by, those who ought to make them a leading portion of their professional studies."

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

LIVERPOOL: MERSEY DOCKS AND HARBOUR BOARD: *Improvement in the Public Health: Successful Use of Traction Engines*—SIR CHARLES BRIGHT'S TESTIMONIALAGE: *Interesting Review of Telegraphic Progress*—STATE OF TRADE: *Sheffield: South Yorkshire*—NORTHERN TOPICS: *Manufacture of Steel at Maryport: Testing the Armstrong guns: Street Railways in Newcastle: Letter from the Home Office on the Shafts of Mines.*

WE will commence this week with Liverpool. At the last weekly meeting of the Mersey Docks and Harbour Board it was moved by Mr. Laird that the engineer should be instructed to proceed with the construction of a third graving dock at Birkenhead. This was rejected by 5 to 3, as was another motion by Mr. Laird that the board should be recommended to contract for the entire completion of the graving docks at Birkenhead, and that plans and specifications for this purpose should be prepared by the engineer. It was resolved that the engineer should prepare plans and report upon the cost of dividing each graving dock at Birkenhead into two parts. It was also resolved, in accordance with a resolution adopted on the 2nd November, that a chief-assistant-engineer should be appointed at a salary not exceeding £800 per annum. An animated discussion took place on the subject, which was only carried by the casting vote of the chairman. Mr. Boult complained that the appointment of an assistant-engineer had been brought forward without a single word of explanation to show the necessity of it, and opposed the motion on various grounds. He spoke highly of the able manner in which Mr Lister, the engineer, had grasped his duties, and said it appeared to him much in the light of a slight and a reproach to Mr. Lister to appoint a man independent of him to take from him the supervision of the works at Birkenhead. Mr. Brocklebank thought it would be better to postpone the appointment in question for some lengthened period, and that an immediate appointment was premature. Mr. Bushell denied that the appointment of an assistant-engineer could in any way be regarded as a slight upon Mr. Lister. Mr. Hartley had broken down with the existing works; and now they were going to Parliament to provide for an additional million for works. Was it reasonable, then, under these circumstances, that they should object to the appointment of an assistant-engineer? Mr. Arnold considered that the appointment might be taken to imply a want of confidence in the engineer, and that it was premature at present to make it. Mr. Laird supported the motion. Mr. Tobin believed that they would most promote the interest of the estate by not taking a step which might bring into the estate two engineers who might clash; they should not be too hasty in carrying out the resolution, but he should support it as it stood, leaving its carrying out to the discretion of the Works' Committee. Mr. Turner recommended that whenever the appointment did take place it ought to be made by the chief-engineer himself, if he were to have that authority which was essential to the proper working of the estate. He did not mean that the engineer should have the absolute appointment, but that he should make the recommendation. Other proceedings of the Works' Committee being read, Mr. Laird again brought forward the subject of graving dock accommodation at Birkenhead, moving that a third dry dock there should be at once proceeded with. Mr. Laird observed that if the works at Birkenhead had been pushed forward with the same vigour they had been at Liverpool the cry for increased graving dock accommodation would have been met by the accommodation on the Cheshire side of the water. A most important feature was, that at Birkenhead ships would not have to wait for the tides before docking in the dry docks there, as was the case at Liverpool, but would be able to dock on any day in the year. According to the shipowners the pressure on the present graving dock accommodation at Liverpool was great, and if the board got an act of Parliament this year—which bill Mr. Bold said would be strongly opposed—it could not be passed before July or August, and the further accommodation at the north end of Liverpool could not be had for three or four years hence. Besides all this the shipowners, who were the parties most interested, stated that the accommodation was required at the south end. There the board could give it very much quicker than in any other part of Liverpool. The engineer had been directed to report on the Toxteth Dock, which, as it could be got ready in six months, could be made to afford great accommodation for the trade of the port. That dock would make a most efficient graving dock; and the Herculaneum Estate, without going to Parliament, could be worked up. The

engineer had reported that he wanted stone and fillings for the works at Birkenhead, and there was nothing to prevent the board from ordering him to proceed with the excavations there—to quarry stone instead of going to Runcorn or the Birkenhead Commissioners for it. The result would be that the want of graving docks could be supplied at once, the stone from the excavations could be taken to Birkenhead for building and backing walls, the money could be applied out of Birkenhead money, and a place of deposit advantageously secured at Birkenhead, instead of having to pay for one hereafter at Liverpool. Mr. Brocklebank said he thought it right to inform the board that what Mr. Laird had said about the Herculaneum Estate had been under the consideration of the Works' Committee during the past week, and they were awaiting the report of the engineer as to the character of the stone and probable expense of constructing graving docks on that site. With respect to the third graving dock at Birkenhead, the board were aware that there were two such docks being constructed there of a total length of 1,500ft., and that one of those docks, on the same principle as Mr. Laird's large dock at Birkenhead, would do double as much work as any other graving dock in Liverpool. Therefore he could not see at present any necessity for a third graving dock over the water. Although some of the gentlemen who waited upon the Works' Committee recently boggled at having graving docks at the north end of Liverpool, they did not seem very unanimous about sending vessels over to the graving docks at Birkenhead. With respect to the carriers' docks here, the board were well aware that the foundation of those works was stone, which was a good foundation; whilst at Birkenhead the site of the graving docks was on a bad foundation, and that was the reason why the delay had occurred over the water. Mr. Littledale asked if some of the excavations from the third graving dock at Birkenhead would not be required to back up the walls of the two other docks. The engineer replied that the excavations from the two docks now in course of construction would be sufficient to back up the walls of those docks. After further discussion the proposition made by Mr. Laird was put and negatived by a decisive majority.

The improvement in the sanitary state of Liverpool appears to be fully maintained. The report of the local medical officer of health shows that, in the week ending the 18th inst., the deaths were 238, being 23 less than the corrected average of the same week in the preceding ten years. A heavy boiler was last week removed from the works of Messrs. Laird and Co. to a shed on the quay of the Great Float. The removal was effected by one of Taylor's (Britannia Works) traction engines; and the weight moved, the distance traversed, and the indifferent state of the roads, all tended to test severely the powers of the engine, which, nevertheless, accomplished its work in a satisfactory manner.

Sir Charles Bright has relinquished his position as engineer-in-chief to the British and Irish Magnetic Telegraph Company, and on Saturday evening was presented by his old friends and associates with a handsome silver candelabrum of the value of 140 guineas. The presentation was made at the George Hotel, Dale-street, Liverpool, and Mr. Leyland was spokesman on behalf of the subscribers. Sir Charles Bright, in expressing his acknowledgments, stated that he should still continue to act as consulting engineer to the company. Sir Charles added:—"It may be interesting in considering the subject from the view of telegraph progress to remember that at the time Mr. Leyland and I first became connected with this undertaking—some ten years ago—the number of miles worked by the company was something under forty, while the present mileage is upwards of 4,000. The staff employed at that time did not exceed, or much exceed, a score in number, while probably 1,500 would not be far off the present number. At that time there was only one telegraph in existence in this country, and, whilst the charge for a message from London to Liverpool was 8s. 6d., the messages were frequently re-transmitted at Rugby and Birmingham. A tthe present time we have in Great Britain and Ireland something like 15,000 miles of line, and the annual receipts for telegraphic messages may possibly surprise some even of you, who may not have thought of the amount of the traffic. The total amount received in this country for telegraph messages at the present time is something as nearly as possible about £350,000 a year, a very large amount to be taken in such small sums. The extension of the land system throughout the world has been equally rapid during the same period. There is now, in addition to the 15,000 miles of line in Great Britain, some 48,000 miles of line in America, some 80,000 miles in Europe, and a smaller but very rapidly increasing mileage in Australia; the total amount of land lines of telegraph in the world being not far off, at the present moment, 150,000 miles. That has been the growth of a very few years. Looking forward to the future (a subject which must be interesting to all of us who are actively engaging ourselves in the extension of telegraphic communication) although we were unfortunate in the first Atlantic enterprise—a line, the carrying out of which, from its very nature, could not be dictated by experience—yet, looking forward to the extension of a line across the Atlantic, we have now the certainty that, in a very short period, all difficulties will be overcome, and we shall have a line working direct from Ireland to Newfoundland again upon a permanent basis. Not only is that undertaking being actively pushed forward at the present moment, but careful surveys have been made for the northern *route* by Iceland, Greenland, and Labrador, the result of which, in my opinion, very greatly warrants the projectors of that line in going forward with a view of shortening the circuits to be worked, and so reducing the risks and costs of such a line. Again, in the South Atlantic, active endeavours are being made—in fact the Spanish Government are initiating the arrangements for a line to be carried from Cadiz to the Canaries, thence to the Cape de Verd Islands, and from there to the island of St. Paul, in the South Atlantic Ocean. There is only one stretch of 800 miles from St. Paul to the island of San Fernando-de-Noronha, and thence to the Brazilian coast is a comparatively short distance. From the Brazilian coast the line will pass along the shores of British and French Guiana to Trinidad, and thence by the train of West India islands to the Spanish possessions of Porto Rico and Cuba. From Cuba a line will be carried to Jamaica and Florida, with another branch to Panama. Going south from the Brazilian coast a branch line will extend to Rio and Buenos Ayres. On the opposite side, looking towards the east, we are actively engaged in prosecuting a substantial line to India. The line made by Government from Malta to Alexandria continues in excellent working order, and its receipts so far encouraging—which, looking at the progress of these undertakings in a commercial point of view, interests all of us very greatly—the receipts upon the Government line of submarine cable from Malta to Alexandria, which opened in October with the returns of £200 per week, have steadily increased, until, at the present time, the weekly income is little less than £600 per week. That is a most important thing when we consider that the electrical communication is at present stopped towards the east at Alexandria, and that no return messages have yet been received from Australia, China, or India. But we are also busily engaged in pushing forward a line in continuation of the Alexandrian line, and we hope within six weeks from this time to have opened a station at the island of Jubal, at the mouth of the Gulf of Suez, where the Peninsular and Oriental Company's steamers will call, by an arrangement made with the Post-office, to receive and carry on telegraphic messages to India. We have also a vessel recently equipped and sent out from this country, with 200 miles of cable, to repair the eastern section of the original line, which failed soon after it was laid between Aden and Kurrachee. Throughout India the telegraph has been extended with scarcely any limit—as, indeed, there is hardly any limit to the construction of any land line. From Kurrachee the circuit is complete to Rangoon. From Rangoon the line will eventually be carried by Singapore and Batavia to Australia. On the other side a line will be taken to Japan, thence to Kamschatka, where the Russians are pushing their lines eastwards, and onwards by the small chain of the Aleutian Islands to the western coast of the continent of North America. Thence it is an easy step along the coast to Vancouver's Island, which is already connected by telegraph with San Francisco. From San Francisco there is the most extraordinary line of land telegraph ever constructed in the world which passes *viâ* Sacramento by the Salt Lake City to Fort Kearney, and thence to St. Louis, through an entirely uninhabited country, and by means of which the merchant in New York can now communicate directly with Francisco. Another line will also be carried entirely on British ground through the Punchbowl Pass of the Rocky Mountains to British Canada. And thus when these different enterprises, in some of which I am concerned, are accomplished, we shall not have a girdle round the earth, but two girdles completely round the world. I have alluded, gentlemen, thus to what is taking place at present in the extension of telegraphic enterprises, because it is one which very much affects all of us. The telegraph, as we know, had its rise altogether in this country. The first telegraph invented by Cooke and Wheatstone, in 1837, was the forerunner of all telegraphs of all countries. Whether it be Professor Morse's telegraph of 1843, or others at a later period, the type of all the instruments has been taken from the inventions at an earlier date in this country. The first submarine telegraph was laid from this country, and all the different cables have been sent out from this country. We may therefore look upon ourselves to some extent as being the nursery of telegraphs for the world."

Trade matters at Sheffield continue in an unsatisfactory state. Some of the principal firms in the French and German trades have fair orders on hand, but their busines is far from brisk. The orders which reach Sheffield from America continue to be for small quantities of goods, and are in most cases executed for cash payments. Some of the engineers and machine tool makers are fully employed, but the activity is far from being general. New rates imported for the carriage of minerals on the various lines connected with the South Yorkshire coalfields have caused dissatisfaction amongst the colliery proprietors. On Friday a meeting of the colliery owners who are connected with the Great Northern was held at the King's Head Hotel, Barnsley. Nearly every firm on the line was represented, and a unanimous opinion was arrived at as to the course to be taken. On the Manchester, Sheffield, and Lincolnshire line the new rates have also met with strong opposition, notwithstanding that the company have thrown the trade open, their own contract with the Birley Vale Collieries having expired. The increase has been as much as 6d. per ton for 20 miles, but in some instances the owners have been successful in obtaining a return to the old rates.

As regards other northern matters, it may be stated that there are prospects of works being opened at Maryport for the manufacture of Bessemer steel. Some "proof buildings," which have been for some time in progress on the south side of the Tyne a little above the King's Meadows, are now completed, and in future the guns manufactured by the Elswick Ordnance Company will be tested there previous to their delivery at Woolwich. The proof establishment is a Government one, being under the charge of an officer of Royal Artillery; and there is no doubt that the testing the guns in the immediate neighbourhoood of the works will prove a judicious proceeding. The application of Messrs. Samuel and Bruce to establish a street railway in Newcastle from Neville-street to Scotswood-road has been favourably entertained by the Town Council; and the terms offered Messrs. Samuel and Bruce, which have already appeared in THE ENGINEER, have been accepted. The works are expected to be carried out without delay.

The great colliery disaster at Hartley continues the absorbing topic of the northern district; and it may be interesting to state that Mr. Dunn, District Inspector of Mines, has received the annexed letter from the Home Office:—

"Whitehall, Jan. 24, 1862.

"SIR,—I am directed by Secretary Sir George Grey to request that you will transmit to him, at your earliest convenience, a return showing the number of single bratticed shafts in the several collieries in your district, and their depth, diameter, and the mode in which they are subdivided, and also of the number of collieries in your district with more than one separate and distinct shaft, and stating in each case whether ventilating furnaces are used below ground.

"I am further to request that you will state your opinion as to the practicability of requiring that in all large collieries there should be two distinct shafts.—I am, sir, your obedient servant,

"H. WADDINGTON."

There is still a good demand at Leeds for the best descriptions of iron, and the ironworks are fully employed. The machine establishments, however, are stated to be scarcely so busy as formerly. Continental orders having fallen off; a good deal, however, is being done on Government account.

DRAINAGE IN IRELAND.—A meeting of landed proprietors of the district affected by the drainage of Lough Corrib has taken place at Galway, and adopted resolutions, and a memorial to the Lords of the Treasury, expressing dissatisfaction at the way in which the Board of Works performed the drainage. They are charged with the sum of £28,000, and interest at four per cent., and yet they say they are in a position to prove on oath, before any impartial engineer, perfectly independent of the Board of Works, or of memorialists, that the lands charged with this £28,000 have been rendered almost useless, and in several instances back-water has flowed over the lands hitherto dry, and the seed has been washed out of the land by the overflow of the lake, thereby rendering both capital and labour a total loss. That several of the memorialists, acting on the faith that the arterial drainage was perfected, had extensive drainage done on their estates, but, in consequence of the defect above complained of, their labour and capital are also lost. Therefore they pray their lordships will immediately institute an inquiry into the truth of those allegations, and appoint an impartial engineer to examine into the condition of the lands, in order either to make the drainage effective or to render the memorialists such other relief as the justice and fairness of the case demand.

THE COAL TRADE FOR 1861.—The total shipments of coal foreign and coastwise last year are estimated at 19,161,615 tons, as compared with 18,159,488 tons in 1860, and 17,218,972 tons in 1859. Newcastle last year shipped 1,916,588 tons of coal and 128,773 tons of coke oversea, and 2,345,017 tons of coal and 20,972 tons of coke coastwise; Sunderland, 1,023,495 tons of coal and 39,319 tons of coke oversea, and 1,881,299 tons of coal and 268 tons of coke coastwise; the Hartlepools, 595,674 tons of coal and 18,566 tons of coke oversea, and 1,402,258 tons of coal and 6,508 tons of coke coastwise; Liverpool, 650,106 tons of coal and 9,582 tons of coke oversea; Cardiff, 1,123,557 tons of coal and 5,153 tons of coke oversea, aud 880,961 tons of coal and 7,976 tons of coke coastwise; Swansea, 411,377 tons of coal and 1,398 tons of coke oversea, and 190,612 tons of coal, 53 tons of coke and 51,902 tons of culm coastwise; Newport, 213,585 tons of coal and 22 tons of coke oversea, and 711,225 tons of coal and 2,040 tons of coke coastwise; Shields, 56,589 tons of coal and 2,133 tons of coke oversea, and 23,746 tons of coal coastwise; Blyth, 147,440 tons of coal oversea, and 133,065 tons of coal coastwise; Seaham, 60,837 tons of coal oversea, and 620,465 tons of coal coastwise; Middlesborough, 106,506 tons of coal and 37,159 tons of coke oversea, and 198,958 tons of coal and 3,082 tons of coke coastwise; Hull, 129,849 tons of coal and 422 tons of coke oversea, and 10,262 tons of coal coastwise; Llanelly, 106,376 tons of coal and 4,797 tons of coke oversea, and 262,201 tons of coal and 11,922 tons of culm coastwise; Glasgow, 81,171 tons of coal and 1,542 tons of coke oversea; Port-Glasgow, 16,852 tons of coal oversea; Greenock, 65,245 tons of coal and 899 tons of coke oversea; Grangemouth, 71,045 tons of coal and 377 tons of coke oversea; Alloa, 58,635 tons of coal and 37 tons of coke oversea, and 9,534 tons of coal coastwise; Whitehaven, 2,498 tons of coal oversea, and 182,146 tons of coal and 1,203 tons of culm coastwise; Maryport, 374,801 tons of coal and coke coastwise; St. David's, 55,898 tons of coal oversea, and 5,166 tons of coal coastwise; Ardrossan, 35,800 tons of coal oversea, and 79,906 tons of coal coastwise; Charlestown, 60,305 tons of coal oversea, and 53,632 tons of coal coastwise; Inverkeithing, 24,499 tons of coal oversea, and 8,295 tons of coal coastwise; and Borrowstonness, 28,645 tons of coal and 234 tons of coke oversea, and 53,476 tons of coal coastwise.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£ s. d.	Dis. p. ct.
IRON, English Bar and Bolt:—			
in London	pr tn	5 15 0	2
in Wales	„	5 0 0	„
in Liverpool	„	5 10 0	„
Staffordshire Bars (Deliv. into boats at wrks; Nom. rates last qr. day for favourite brands)	„	7 0 0	1½
Sheet, Singl.	„	8 10 0	„
Dbl.	„	10 0 0	„
Hoop	„	8 0 0	„
Rod, round	„	7 0 0	„
Nail Rod, sq	„	7 5 0	„
SHIPPING IRON, Staffordsh. Bars (Delivered in Liverpool 10s. per ton less)	„	7 0 0	2
Sheet, Single	„	8 15 0	„
Double	„	10 5 0	„
Hoop	„	8 5 0	„
Rod Round	„	7 [illegible] 0	„
Nail Rod. Square	„	7 5 0	„
IRON, Rails, in Wales, cash	„	5 7 6	nett
„ „ 6 months	„	5 10 0	„
Old, to cut up	„	0 0 0	„
Railway Chairs, in Wales	„	4 0 0	„
„ in Clyde	„	3 15 0	„
Pig No. 1, in Clyde	„	2 9 0	„
3-5ths No. 1 & 2-5ths No. 3		2 9 0	„
No. 1, in Wales	„	3 8 9	„
No. 1, in Tyne and Tees	„	2 12 0	„
Ditto, Forge	„	9 0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	„	3 10 0	„
Welsh Forge Pig (all Mine), at the Port	„	3 5 0	„
Acadian Pig, Charcoal	„	7 10 0	„
Scotch Pig, No. 1, in London	„	3 0 0	„

		£ s. d.	Dis. p. ct.
IRON, Swedish, Indian assortments	pr tn	11 15 0	2
Russian C C N D to arrive	„	16 0 0	„
STEEL, Swedish Keg, ham.	„	16 0 0	2½
Ditto, rolled	„	15 0 0	„
Fagot	„	17 0 0	„
SPELTER, on the spot	„	18 7 6	nett
To arrive	„	18 12 6	„
Hard, remelted	„	17 0 0	„
ZINC, in sheets	„	24 0 0	„
COPPER, Tile, 14 to 28 lb.	„	107 10 0	2
Tough Cake	„	107 10 0	2
Sheathing and Bolts	pr lb.	0 1 0	„
Sheet	„	0 1 0	„
Bottoms	„	0 1 0½	„
Old	„	0 0 10	„
Yellow Metal	„	0 0 10	„
Burra	„	103 0 0	„
Russian do.	„	105 0 0	„
LEAD, British Pig	„	20 10 0	„
Spanish	„	19 10 0	„
W. B.	„	21 0 0	„
Sheet	„	21 10 0	„
TIN, English Block, nom.	„	120 0 0	„
Bar	„	121 0 0	„
Refined	„	122 0 0	„
Foreign Banca	„	124 0 0	„
Straits	„	120 0 0	„
TIN PLATES, Cha coal, IC	pr bx	1 8 0	„
Ditto IX	„	1 14 0	„
Coke, IC	„	1 2 0	„
Ditto IX	„	1 8 0	„
Do. at Newport, 1s. pr bx less		—	„
Do. at L'pool, 6d. „		—	
CANADA, Plates	pr tn	12 0 0	2
QUICKSILVER	pr bt	7 0 0	3

RAILS.—There has been a moderate inquiry this week, and prices are firm.

SCOTCH PIG IRON.—During the past few days there has been more animation in the market, and a fair amount of business done at improved prices. The closing rates in Glasgow yesterday were 48s. 11d. buyers, and 49s. sellers, showing an advance of 9d. per ton since our last report, at which the market was very firm.

SPELTER declined to £18, but has since recovered, and is now firmly quoted on the spot £18 7s. 6d., with an upward tendency.

COPPER dull of sale this week.

LEAD very firm, and in good demand.

TIN.—The demand for English continues pretty good. Foreign maintai its price, and is firm at £123 to £124 for Banca, and £119 to £120 for Straits.

TIN PLATES inactive.

Jan. 30th, 1862. MOATE AND Co., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Teak	15 10	17 0	15 0	16 0
Quebec, red pine	3 10	4 10	3 5	4 0
yellow pine	3 0	4 0	3 0	3 15
St. John, N.B., yel.	5 0	5 10	5 0	5 10
Quebec, oak, white	5 0	5 10	5 0	5 10
birch	3 10	4 0	4 0	0 0
Memel	0 0	0 0	0 0	0 0
elm	3 10	4 15	3 10	4 15
Dantsic, oak	3 10	6 0	3 10	6 0
fir	2 15	3 10	3 0	4 0
Memel, fir	3 10	4 0	3 10	4 0
Riga	3 5	3 10	3 10	3 15
Swedish	2 10	2 15	2 15	3 0
Masts, Queb. rd pine	5 0	6 0	5 0	6 0
yl. pine	5 0	6 0	5 0	6 0
rd pine	0 0	0 0	0 0	0 0
Lathwood, Dantz, fm	6 0	6 10	6 0	7 0
St. Peters.	8 0	8 10	9 0	9 10
Deals, per C., 12 ft. by 3 by 9 in.				
Quebec, wht. spruce	13 0	18 0	15 0	19 0
St. John, wht. spruce	13 0	16 0	15 0	17 10

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Yel. pine, per reduced C.				
Canada, 1st quality	17 0	18 10	17 10	19 0
2nd do.	12 0	12 10	12 0	13 0
Archangel, yellow	13 0	14 0	14 0	15 0
St. Petersbg. yel.	12 0	12 10	12 10	13 10
Finland	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	15 0
Gothenburg, yel.	10 0	11 10	10 0	12 10
white	9 10	10 0	9 10	11
Gefle, yellow	10 0	11 0	11 0	12 10
Soderhamn	10 0	10 10	11 0	12 10
Christiania, per C 12 ft. by 3 by 9 in. yellow	22 0	25 0	22 0	24 0
Deck plank, Dntz per 40 ft. 3 in.	0 14	1 4	0 14	1 4
Staves, per standard M				
Quebec, pipe	60 0	70 0	50 0	55 0
puncheon	16 0	18 0	16 0	18 0
Baltic, crown pipe	160 0	170 0	170 0	180 0

SCOTCH PIG IRON REPORT.

		s.	d.	
No. 1	Gartsherrie	55	0	f.o.b Glasgow.
„ 1	G.M.B.	48	3	„ do.
„ 3	Do.	47	3	„ do.
M. Nos.	Do.	47	9	„ do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths „ 3 G.M.B.	Cash prompt	49	0	per ton.
	1 mo. open	49	3	do.
	2 mos. „	49	6	do.
	3 „ „	49	9	do.

MANUFACTURED IRON.

	£	s.	d.	
Bars, Govan	7	0	0	
„ Common	6	17	6	
Drumpellar, Common	6	17	6	
Do. Best	7	17	6	
Plates and Sheets	9	0	0	to £10.
Rails	7	5	0	
Pipes	5	0	0	
Chairs	4	0	0	

GLASGOW, 29th January, 1862.

Our market during the past week has been more animated, and a good amount of business has been done. It appears probable that several furnaces will be put out of blast during the next ten days, until prices advance.

The demand for shipping iron has improved, and is in good request at our quotations.

Exports last week were 8,915 tons, against 9,771 tons in the corresponding week of last year.

SHAW, THOMSON, AND MOORE, Metal Brokers.

INTERNATIONAL EXHIBITION.—It is incumbent upon intended exhibitors to see that they do not fall into the error which proved so annoying to many of them during the season of 1851, when by their procrastination in giving their orders to the case-makers and stall-decorators, they either had to put up with defective arrangements, or, through the demand upon the needful class of artizans being so great, to exhibit their goods almost unprotected. We learn that Mr. Sage, of Hatton-garden, the well-known glass case maker, has prepared against a recurrence of disappointment, but it is only fair towards this and other firms to make as early an arrangement as is possible.—*Globe.*

BLAKELY RIFLED CANNON *v.* 8IN. COLUMBIADS.—The *New York Tribune* of the 7th inst. contains the diary of Captain J. G. Foster, of the United States Corps of Engineers, as kept by him, with much minuteness, during the attack, made last April, on Fort Sumter, in Charleston Harbour. The following extract from this diary affords a useful comparison of the effects of the Blakely rifled cannon and 8in. Columbiads at 1,250 yards' range: "A part of the guns from Cumming's Point essayed to dismount the barbette tier on the gorge, and the remainder to breach the gorge, or rather the pan-coupé at the right gorge angle. At this latter point two Columbiads and a Blakely rifled gun fired almost constantly. The effect of this fire on this day was was to breach around the embrasures of the first tier at the pan-coupé to a depth of 20in., and to put one shot through the filling, consisting of brick and blue stone combined, with which the embrasure opening of the second tier had been filled. One shot was also put through the top of a loop hole window on the second tier, another through the top of the main gate, and a third through the magazine ventilator at the right of the gorge, falling between the pier and the inner wooden ceiling. Three of the embrasure check irons that I had placed in the second tier loop-holes were struck, but owing to the lead run in around them to hold them in place, none were broken. The penetration of the 8in. Columbiad balls from Cumming's Point was 11in. at the first shot, and that of the 12-pounder bolt from the Blakely gun was the same, as ascertained by measurement. The latter, however, threw its shot with greater accuracy, and with less time of flight than the former. The distance was about 1,250 yards."

INSTITUTION OF MECHANICAL ENGINEERS.

THE fifteenth annual general meeting of the members of this institution was held on Thursday, the 30th ult., in the Lecture Theatre of the Midland Institute, Birmingham; James Fenton, Esq., Vice-President, in the chair.

The Secretary (Mr. W. P. Marshall) having read the minutes of the previous meeting, the annual report of the council was then read, which showed the very satisfactory progress of the institution during the past year, and its prosperous condition, with a considerable increase in the number of members, referring also to the highly successful annual provincial meeting held in Sheffield last summer. The annual election of officers then took place, Sir William G. Armstrong being re-elected president of the institution for the ensuing year; several new members were also elected.

A paper was then read, "On a Regenerative Gas Furnace, as applied to Glass-houses, Puddling, Heating, &c.," by Mr. C. William Siemens of London. In this furnace, which is specially applicable where great heat is to be maintained and a pure clean flame is required, the fuel, which can be of very inferior quality, is first converted into a crude gas in a separate furnace or gas producer, and the heating power is greatly increased by the gas and air being both of them heated to nearly the temperature of the furnace itself, previous to entering and mixing in the furnace. This is accomplished by means of regenerators, by which the waste heat passing off from the furnace is intercepted on its way to the chimney and transferred to the gas and air entering the furnace. Each regenerator is composed of a mass of open brickwork, exposing a large surface for the absorption of heat, through which the products of combustion are made to pass from the furnace, and are thus gradually deprived of nearly all their heat previous to escaping into the chimney. The end of the regenerator nearest the furnace becomes gradually heated to nearly the temperature of the furnace itself, while the other end next the chimney remains comparatively cool. The direction of the draught through the furnace is now reversed by means of dampers, which cause the air and gas entering the furnace to pass through the heated regenerator in the contrary direction, and direct the products of combustion through a second cold regenerator. The gas and air entering the hot regenerator encounter first the cooler portions of the brickwork, and acquire successive additions of heat in passing through the regenerator, until they issue into the heating chamber of the furnace at nearly its own temperature, filling it with a pure flame of equal intensity throughout the whole chamber. As the hot regenerator becomes gradually cooled by the abstraction of heat, the second cold regenerator becomes gradually heated at the same time by the products of combustion from the furnace, until the direction of the draught is again reversed by the dampers; and by thus alternating the currents of gas and air through the two regenerators, a very high degree of temperature is maintained constantly in the furnace. The gas used for heating in the furnace is supplied by a separate gas producer, in which a very thick layer of fuel is placed upon a sloping fire-grate and ignited from the bottom, whereby the gaseous portion of the fuel is volatilised, and the combustible gases are increased in quantity by the decomposition of steam supplied gradually from a water trough at the bottom of the fire-grate. By this mode of employing the fuel in the form of gas, and keeping the fireplace separate from the furnace itself, the most inferior descriptions of fuel can be employed for heating purposes, such as the refuse slack of collieries and coke dust, without interfering with the purity of the flame in the heating furnace, since all solid fuel is kept at a distance. The gas, and the air required for burning it, are each heated in separate regenerators, being kept entirely distinct until they issue through adjoining openings into the heating chamber, when an intense and perfect combustion immediately takes place, the quantity of each being adjusted by separate dampers, so that the flame is regulated with great facility and maintained steadily at the exact heating power required, while smoke is altogether prevented; and by closing the dampers the flame is at once reduced to any extent desired.

These regenerative gas furnaces are at work successfully for glass making at Messrs. Chance's, Messrs. Lloyd and Summerfield's, and Messrs. Osler's glass works, near Birmingham, the one at Messrs. Lloyd's having been in constant work for nearly a year; and the furnaces are now being applied extensively for a variety of purposes with highly satisfactory results in the heating effect obtained, and with an important economy of fuel. They are also in use for heating and welding wrought iron tubes, and for other heating purposes in ironworks, and several are now in course of erection for puddling; in the latter case the saving of room by doing away with the fireplaces, chimney stacks, and stores of fuel required with ordinary puddling furnaces, is a point of considerable importance, enabling the furnaces to be arranged closer together, and nearer to the hammer. For steel melting, which requires the highest heat used in the arts, the regenerative furnaces are being applied extensively in Germany, where one of them has been in satisfactory operation for a considerable length of time, being worked with lignite, a fuel little superior to peat in heating power. In the South Staffordshire district, and other districts where good coal is scarce or expensive but where an inferior fuel abounds, the economy of the regenerative gas furnace is the greatest, as it renders available for heating purposes the refuse slack and coal dust, at present of no commercial value, but which, on being converted into gas, will acquire a heating value in the regenerative furnace equal to that of the same weight of the best coal as at present used in ordinary furnaces.

In the evening a number of the members dined together in celebration af the fifteenth anniversary of the institution.

SOCIETY OF ENGINEERS.

February 3, 1862.

J. AMOS in the Chair.

ON THE ACTION OF PEATY WATER CONTAINING COPPER ON A BOILER.

By E. RILEY.

SOME time since the author's attention was drawn to the corrosion of a boiler used at one of the pits of a large ironworks in South Wales, a portion of the plate of which was exhibited.

The first point to be ascertained was the composition of the water used for the boiler. An accurate analysis made on an imperial gallon gave the following results:—

Silica	·405
Peroxide of iron	·240
Sulphate of iron	·201
Alumina	·126
Phosphate of lime	·127
Sulphate of lime	·350
Sulphate of magnesia	·360
Alkaline chlorides	·487
Sulphate of soda	·258
Inorganic constituents per imperial gallon	2·554

Traces of copper and a large quantity of peaty matter.

The water when taken was slightly turbid, due to a little clay held in mechanical suspension. This accounts for the chief part of the silica and the alumina in the analysis, the peroxide of iron being held in solution most probably by the large amount of peaty matter. The sulphate of iron is produced by the oxidation of iron pyrites, the trace of copper also by the oxidation of copper pyrites, the two latter minerals being frequently found in peat, more especially the former.

Before drawing any conclusions as to the action the water had on the boiler an examinaton was made of the interior. It was found that from the water-line to the bottom that the action gradually increased, having the appearance of wave-like undulations at the surface, and at the bottom presenting, more or less, the appearance of the piece of the plate exhibited. The plate originally $\frac{9}{16}$in. thick is reduced to less than $\frac{1}{4}$in., and presents a pitted appearance, with holes completely through the plate, some as much as $\frac{1}{4}$in. in diameter, and six or eight occurring in the square piece (6in. square) exhibited. The boiler had been in use for about four years, and it was always found that a large quantity of red oxide of iron was blown off at the gauge-cocks, when they were opened, to such an extent as to colour all objects red for some yards. The pressure at which the boiler worked was 60 lb.

On examining the deposit at the bottom of the boiler which had been left, when most of the sludge had been washed out, it was found to contain small particles of metallic copper in some quantity, also pieces of oxide of iron, in the centre of which was a small scale of copper, the above being mixed with pieces of rounded coal, small pieces of wood shale, and other matters which were introduced in the feed-water, as little care was taken in the supply, which was drawn from a pond, the water being collected from the higher part of the hill on which the pit was situated.

The author then proceeded to give his opinion as to the cause of the action mentioned. He considered that it was chiefly galvanic; that the sulphate of copper in the water was immediately decomposed, the copper being deposited in a metallic state, the sulphuric acid liberated from the copper at the same time dissolving an equivalent quantity of iron; also that the sulphate of iron in the water would be decomposed into a basic persulphate and free sulphuric acid, which would again act on the iron, and its action be much facilitated by the presence of the copper; also that the peaty matter formed organic acids which acted on the iron; being favoured by the presence of the copper and the galvanic current established, the action would possibly be aided by the concentration of the other salts in the water.

The amount of inorganic constituents in the water is so small that no incrustation would form on the boiler, and most probably, if the boiler had been supplied with a harder water, no injurious effects would follow. Although the use of lime was suggested, no extensive application of it was made, the proprietors thinking it better to replace the boiler than to adopt a simple remedy, and the action is still going on in the new boiler, or was, until a recent date.

The question would naturally arise how a boiler, working with such a plate, withstood the pressing, and was at all water-tight? It was found that the small pieces of coal, shale, &c., filled up the holes, and, although the boiler leaked, it could be worked, although not without great danger.

The author concluded by stating that he thought it questionable if a very pure water was adapted for supplying boilers, as he considered a slight incrustation would preserve the iron; or if a slight incrustation was formed first, then, possibly, a pure water might be advantageously used. The subject had been brought before the society with only two or three hours' notice, in consequence of the serious indisposition of Mr. Light, who had been unable to complete his paper on horse railways. The object in presenting it to the society was to elicit discussion on the important point of the action of waters on boilers, and the incrustation of boilers.

A long and animated discussion followed.

SOCIETY OF ARTS.

January 29th, 1862.

JOHN HAWKSHAW, F.R.S., in the chair.

ON SOME RECENTLY-EXECUTED DEEP WELLS AND BORINGS.

By GEORGE R. BURNELL, C.E., F.G.S., F.S.A.

THE remarkable success of the operations carried on at Passy, for the supply of the artificial waters of the Bois de Boulogne by means of an artesian boring of unusually large diameter, has lately revived the public interest in that class of operations, both on the Continent and in England. It has been proposed, indeed, to apply that system, on even a larger scale than was tried at Paris, to our own metropolis; and the scheme for sinking a series of deep wells in the various parts of London has been revived by some enthusiastic admirers of the results obtained by our neighbours. Experience has already decided the problem of the possible success of such attempts here, and it may, therefore, be desirable, at the present day, to review briefly the history of artesian wells at home and abroad, in order to prevent the waste of money and the disappointment which may arise from ill-advised imitation of the measures proved to be successful in some cases, but by no means universally applicable.

The term "artesian well" means, strictly speaking, only a well sunk to a considerable depth, through a dry and impermeable upper stratum, to a lower stratum charged with water, under such conditions of pressure as to cause the water to flow over the surface of the ground. The first wells of this description mentioned in modern works on hydraulics were executed in the province of the Artois, in France, where they were sunk in the chalk formation, and were supplied by the streams running between the fissures of that deposit, which were fed by the infiltration from the higher ground of the great north-eastern chalk plateau of France. It is said that some of these wells in the Artois have been used for nearly a thousand years, without any perceptible diminution in their supply; but it must also be added that the ancient Egyptians and the Chinese had, from the remotest antiquity, been acquainted with this method of obtaining water, and that the inhabitants of the plains of Lombardy have long used the waters rising from the deep-seated strata of the valley of the Po, for the irrigation of their "marcite," or winter meadows. Be this as it may, and without dwelling upon the locality where this description of well was first made, it seems that about the beginning of the present century great attention was drawn to them by the success of a number of borings, through the London clay into the sands of the basement beds of that formation made in the valleys of the Lea, near Broxbourne, Waltham, and Tottenham, and of the Wandle, near Mitcham, Garratt, Wandsworth, &c. In the low-lying alluvial islands at the mouth of the Thames, some very deep wells were also sunk through the London clay, and a copious supply of fresh soft water was obtained; and, in fact, so many wells have been sunk into the water-bearing strata of the tertiary sands, that they have been nearly exhausted. Whilst these operations were being carried on in England the French engineers had energetically adopted the system upon which they were founded, and numerous artesian wells had been sunk at Epinay, Stans, and St. Denis, with similar results to those obtained near and in London; that is to say, that in the earlier wells the water, generally speaking, overflowed the surface, whilst in the latter ones it rarely attained the level of the ground; and the water-line sank in the older wells in proportion as new ones were opened.

In 1833 M. Arago induced the Conseil Municipal of Paris to undertake the execution of a deep boring, in the hopes of obtaining a supply of water from the lower green sand formations, which he supposed to form a continuous bed under the chalk basin, underlying, in its turn, the tertiary strata of the neighbourhood of Paris. This lower green sand, in fact, outcrops from under the chalk on the whole of an irregular oval, passing from the north-east through the south, nearly to the north-west of Paris, and it approaches that city the most nearly at the point where the Seine forces its way through the overlying recent formations near Troyes, in Champagne. At Lusigny, the precise point of outcrop, the surface of the green sand is about 300 or 350ft. above the level of the plain of Grenelle, where it had been resolved to make the first attempt to traverse the tertiaries and the chalk. From this fact, MM. Arago and Walferdin inferred that the water from the green sand would flow over the surface at Grenelle, and they were encouraged in that opinion by the existence of numerous artesian wells carried through the chalk into that stratum from which they expected to obtain their supply at Elbœuf and Rouen. The depth it would be necessary to sink the new well constituted the unknown conditions of their undertaking; but not only MM. Arago and Walferdin, but also M. Mulot, calculated from the first that they would find the chalk extend to at least 1,300 or 1,400ft. from the surface. So little, however, was known of the probable cost, or of the dangers and risks of these deep borings, at the time the well of Grenelle was commenced, that the municipality of Paris only voted a sum of 18,000 francs (£720) for boring three such wells.

On the 29th of November, 1833, the works of the Grenelle well were commenced by M. Mulot, and after encountering many serious difficulties from the nature of the ground, and from the fracture of the tools made to work at so great a distance from the surface, the able and scientific men who had supported M. Mulot through evil report and bad report, were rewarded by finally obtaining a copious jet of water from the lower green sand on the 26th February, 1841. The depth then reached was 1,806ft. 9in., of which 1,378ft. were in the chalk; the water rose at first, at the rate of 800,000 gallons per day, to the height of about 122ft. (the level of the distributing reservoir of Grenelle), and its temperature was about 82 deg. Fah. When it first rose to the surface, it contained large quantities of sand, clay, and other matters in mechanical suspension, and it was nearly twelve months before the water passages of the subterranean strata were sufficiently cleared to allow the water to rise in a state fit for distribution. On several subsequent occasions, also, the sand has accumulated in such quantities, in the pipes lining the bore, as to render it necessary to draw and clean them.

This boring operation had been watched very carefully by English engineers, and even during its progress similar works had been attempted in our own country. As might naturally have been expected, the success of the Grenelle well, under these circumstances, induced our countrymen to continue their work with redoubled ardour, but unfortunately they have displayed less perseverance, and, it is to be feared, less skill, than our neighbours; for hitherto none of the borings undertaken avowedly for the purpose of obtaining a supply of water from the subcretaceous beds in either the London or the Hampshire basins have completely succeeded. In the case of the Kentish Town well, it is true that some very extraordinary and anomalous conditions of the strata have been found to exist, which have totally deranged all the scientific calculations of the able geologists and well-borers consulted during its execution; but it has too often happened in England that works of the kind we are now considering have been undertaken solely on the recommendation of amateur geologists, or of "practical men," as it is the fashion to call those who are totally ignorant of recorded science; and the consequence has been that several very costly wells have been undertaken, carried on at great expense, and subsequently abandoned in despair, perhaps just at the moment when success was within grasp.

One of the earliest of the attempts made in England at sinking an artesian well to the lower green sand was the one made, almost unintentionally, by the town of Southampton. It was commenced by a preliminary boring through the London clay to the chalk, which was reached at a depth of 480ft. from the surface; the upper strata traversed consisting of the sands, clays, and plastic mottled clays of the Hampshire tertiary series. It seems that the well-borer employed carried the boring to a depth of 50ft. beyond the surface of the chalk already mentioned, and he then reported that an ample supply of water was to be obtained from that formation. A shaft was sunk, on faith of this report, commencing with a cast-iron lining of 13ft. diameter, which it was proposed to carry to a depth of 160ft., and then to commence boring with a hole of 30in. diameter, diminishing gradually to 20in. in the chalk. The cylinders used were, however, found to be too weak for the purpose they were intended to fulfil; they collapsed in places, and in driving they assumed a direction seriously out of the perpendicular. The contractor failed when the cylinders had been thus badly lowered to the depth of about 60ft., and the works were then taken out of his hands, and placed in those of Mr. Docwra, one of the most able well sinkers and water works contractors of our country and of our day. With great trouble he drove the shaft completely down to the chalk, finishing it with a clear external diameter of 9ft. 4in.; part of it was lined with cast-iron plates, and part of it with brickwork in cement. The brickwork lining was carried three feet into the chalk, and below it the shaft was continued to the total depth of 562½ft. from the surface, in the solid chalk, without any lining, and with a clear diameter of about 7ft.; a boring was then commenced of 7¼in. diameter, and was carried down eventually to a total depth of 1,317ft. from the surface. The chalk formation was found here to have a thickness of 851ft., and the works were suspended when the boring had traversed only 12ft. of the chalk marl. Now at Chichester, where Mr. Gatehouse had also sunk a deep well to the upper green sand about the same period, the thickness of the chalk marl was found to be 61ft.; the upper green sand and gault are of variable thickness, but the greatest depth recorded for them was that of the new well at Passy, where they were about 274ft. deep. It is, therefore, very probable, that if the Southampton well had been carried down 330ft. further or to a total depth of 1,650ft. in round numbers, the problem as to the possibility of finding water from the lower green sand in the Hampshire basin might have been solved. In the well at Chichester this solution could be even more easily attained, for the boring had actually been carried about 130ft. nearer to the probable surface of the lower green sand, leaving only 200ft. still to be traversed.

It would be impossible to record all the important works undertaken of late years for obtaining water by means of artesian wells, but the circumstances connected with the history of those attempted at Calais, Kentish Town, and Harwich, are so singular that it behoves us to dwell upon them. At Calais the well was sunk through the chalk, and the whole series of the subcretaceous strata, to a total depth of 1,047ft. from the surface, but no water was obtained from it, and the boring passed, at the depth above-named, into the transition rocks, in which it was carried for a further depth of 103ft. At Kentish Town the Hampstead Waterworks Company endeavoured to secure an artesian supply, in order to comply with the provisions of the Metropolis Waterworks Act of 1851. They had very wisely consulted Mr. Prestwich upon the geological questions involved in the preliminary inquiries, and they employed MM. Degoussé and Laurent, the best known and the most successful well-borers up to that period on the Continent. Geologists and practical men alike in this instance reasoned that, because the lower green sand outcropped around the edges of the chalk basin containing the London tertiaries, in precisely the same manner that the lower green sand outcropped around the chalk basin containing the Paris tertiaries, therefore there was every *à priori* reason to believe that the subcretaceous formations would continue under London, and furnish, as had been the case at Paris, the water for a well carried down to them. Acting upon this belief, the company commenced boring in the chalk, at the bottom of a shaft previously sunk to the depth of 539ft. from the surface. The boring was commenced with a diameter of 12in., reduced to 10in. in the intermediate part, and finishing with a diameter of 8in. The work began on the 10th of June, 1853, and was carried on with every appearance of success for a considerable time. The strata traversed were found to occur in their regular order, and of the anticipated thicknesses, until the boring had traversed the gault formation at the depth of 1,113ft. 6in. from the surface; but when, as Mr. Prestwich said, every body believed that "a very few more turns of the auger would tap the water-bearing sands of the lower green sand formation," it was found that the borings passed at once into a series of beds consisting of alternate layers of red sandstones, red clays, conglomerates, red sands, and rounded pebbles, which geologists are now disposed to class amongst the new red sandstone series. It is very difficult to form any decided opinion as to the real nature of a deposit which has only been explored by the boring-tool, especially when the diameter of the bore was only 8in., as at Kentish Town; and I confess that for my own part, as I said before in this room, and shall have occasion again to repeat, I am disposed to regard the beds of red clays and sandstones rather as being members of the Wealden series than of the new red sandstone. But in either case it was evident that the water-bearing strata were interrupted under London, and that there was no probability of obtaining a supply of any description from them in that district. In fact, the Hampstead Waterworks Company, after the failure of this attempt, were compelled to sell their interests to the New River Company, and the well was stopped at the depth above quoted, added to the depth traversed in red sandstones and clays, or at a total depth from the surface of 1,302ft.

About the same time that this unexpected result was obtained at Kentish Town, Mr. P. Bruff, C.E., was employed upon an attempt

to obtain water for the town of Harwich, either by a deep well in the chalk, or by traversing, if necessary, the strata below the chalk. Several attempts appear to have been previously made at Harwich to obtain a supply from the chalk, but they had failed, in consequence of the infiltration of salt water into the wells sunk close to the sea-shore. Mr. Lankaster Webb, of Stowmarket, a town situated upon the high lands of the valley of the Gipping, the main affluent of the Orwell, had executed a well 895ft. deep, through the drift clays and gravels over the chalk, the cretaceous formations, and the upper green sands and gault. I do not know the level of the ground at Mr. Webb's factory, but, as a rough guess, I should say that it was about 240ft. above the high tide level at Harwich; and I am not, therefore, surprised that the persons connected with the well at the latter town should have expected that, upon traversing the chalk, they would meet with a supply of water under the true artesian conditions. It happened, however, that, after the Harwich boring had passed through the drift, the tertiary strata, the chalk, the upper green sand, and the gault, to the depth of 1,025½ft. from the surface, it passed, not into the lower green sand, but into black slaty rock, which Mr. Prestwich pronounced to be a common grey slate of the palæozoic series, whose precise position in the series could, however, hardly be defined on account of the absence of fossils. Thus, at Calais, and, I believe, also at Ostend, the lower green sand is wanting, and is replaced by a member of the carboniferous series; at Kentish Town the lower green sand is absent, and it is replaced, perhaps, by the new red sandstone beds, whilst at Harwich the lower green sand is replaced by the very earliest clay slate rocks.

Now there may be drawn, from these unexpected results of the deep borings in the tertiaries of what may be specially named the London basin, some valuable scientific and practical conclusions. These may be briefly stated as follows:—1st. That, at present, geology is only so far advanced as to enable us to state, with tolerable certainty, what we shall not find under the surface, but by no means to justify any positive assertion as to what we shall find: thus, knowing that the London clay is on the surface, we may be certain that the crag will not be found beneath it, but it by no means follows that necessarily the chalk, the lower green sands, the oolites, or the usually subordinate strata should be there. Secondly, that the first attempt to sink an artesian well through a previously untried stratum, is at all times a hazardous experiment, and that is, therefore, one which should never be tried by those who only work with the money raised by forced taxation. It was upon the latter ground that Mr. Ranger very properly recommended the town of Southampton to stop the philosophical experiment upon which they had already incurred so large an outlay; and it is certainly wiser to leave the solution of these problems to municipalities possessed of private resources, or to private enterprise, than to expend upon them the money wrung from the ratepayers. Thirdly, and possibly this may be the most important conclusion of all—it would appear to be proved by the occurrence of the earlier strata in the geological series at Calais, Kentish Town, Harwich, and, if I be not mistaken, at Ostend also, that Mr. Godwin Austin's theory of an upheaval of the carboniferous series existing between its extremity on the French coast, and its reappearance in the Bristol and South Wales coal field is correct. A full discussion of this important inquiry would be misplaced in this paper, but I cannot refrain from repeating what I myself have said before—viz., that from all which is at present known, it would be more rational to seek for coal under London, than for soft water. At the same time I would carefully guard myself against any appearance of encouraging an attempt of the former description, unless it were distinctly undertaken as a speculation, with great, nay, almost infallible, chances of loss.

The next important artesian borings executed of late years in chronological order were those undertaken under the superintendence of the French military authorities in the Desert of Sahara, avowedly for the purpose of forming stations for the caravans trading between Algeria and Central Africa. They were executed by means of tools made by MM. Degoussée and Laurent, who seem also to have occasionally acted as consulting engineers, but the works were actually performed by the soldiers, or the labourers employed by the "Corps du Génie Militaire." It appears that up to the month of June, 1860, no less than fifty of these wells had been sunk in the desert, and that they pour upon its thirsty surface no less than 7,920,000 gallons of water per day. Similar works were, according to Aimé Bey, executed in the deserts of Ancient Egypt, as was before alluded to, and there are good reasons for believing that the system of artesian borings might advantageously be applied in the deserts of north-western India, and of Australia.

Some interesting artesian wells and borings have also been executed in various parts of England and of the Continent, to a few of which I propose to return hereafter, but, in the meantime, I pass to the description of the great work lately completed at Passy, as being the one which has attracted the most universal attention. When the great works of the Bois de Boulogne were commenced, it was soon discovered that the pumps of Chaillot would not be able to furnish the quantity of water required for the lakes and waterfalls of the new park, and the Municipal Council of Paris, encouraged no doubt by the commercial results of the previous operation at Grenelle (which had eventually cost the sum of £14,000, and had repaid its cost several times over), resolved to execute a second boring to the lower green sand, in order to secure an independent supply. It was originally proposed to execute this well of the same dimensions as that at Grenelle—that is to say, to finish with an 8-in. bore; but before it was commenced, M. Kind, a German engineer (who had already carried out some very important works upon a system, and by the aid of tools patented by himself), offered to contract for the new well to finish with a bore of 2ft. in diameter, and to deliver the water at 92ft. above the level of the ground, at the rate of nearly 3,000,000 gallons per day. He undertook to complete the work for the sum of £14,000 within the space of two years. After some opposition, based principally on the doubts expressed by engineers, who had been consulted on the subject, with respect to the increased delivery over that of the well of Grenelle, this offer of M. Kind's was accepted, and on the 23rd December, 1854, the vote of the Municipal Council in favour of the contract with him was passed. The work was commenced shortly afterwards, and by the 31st of May, 1857, the boring had already reached the depth of 1,732ft. from the surface, when suddenly the upper portion of the tube lining collapsed, at a distance of about 100ft. from the surface, and choked up the bore-hole. This accident delayed the completion of the work for three years, and led to the rescinding of the contract with M. Kind; but the engineers of the city of Paris were so satisfied with his zeal and ability, that they confided to him the conduct of the remaining works. A new well was sunk to a depth of 175ft. 4in., and the boring was then cleaned out and resumed. Much trouble was encountered in traversing the strata below the distance of 1,732ft. above quoted, and at length, at the distance of about 1,894ft. from the surface, the first water-bearing stratum was met with, but the water after several oscillations, did not rise to the level of the ground. The boring was continued below this level, until, on the 24th September, 1861, at mid-day, at the depth of 1,923ft. 8in. the true artesian spring was tapped. When this spring rose to the surface, it discharged at the rate of 5,582,000 gallons per day. The yield has since then oscillated, but so long as the column had not been raised above the level of the ground, the total quantity does not seem to have fallen short of 4,465,600 gallons. The well of Grenelle (which by the way had been falling off in its yield for some time before the completion of the Passy boring, no doubt on account of some obstruction in its ascensional tube, but which for several days before the 24th September discharged regularly 200,000 gallons per day) fell, in about thirty hours after the Passy spring had been tapped, to a yield of about 173,000 gallons, at which rate it remained stationary, until the tube of the Passy boring was raised so as to allow the water to stand at the same height in the two wells, when the original rate of delivery of the Grenelle well was resumed, but the rate of delivery of the Passy well fell to 2,000,000 gallons per day. It is intended eventually to cause the column of water of Passy to rise to a height of 1,977ft. above the bottom of the boring, or about 54ft. above the surface of the ground.

(To be continued.)

ON THE RESISTANCE TO TRACTION UPON RAILWAYS FROM FRICTION AND GRAVITATION.

By Mr. John Dixon, C.E., Chief Engineer of the Stockton and Darlington Railway.

(Concluded from page 70.)

The following table shows that upon a *level* railway the force required to haul the load consists of the full tractive power of the engine, called 8,000 lb., minus the friction of the engine and tender, namely 624 lb., leaving 7,376 lb. available for hauling the load of wagons. This sum divided by the friction, say 9 lb. per ton for the trucks, gives 820 tons as the gross load (see sixth and eighth columns of table). The net or paying load will of course depend upon the proportion that the tare, or weight of the empty wagons, bears to the load.

But up a raising gradient, say 1 in 330, or 16ft. per mile (being the worst gradient between London and Birmingham on the London and North Western Railway), the case is altered. First, the available tractive power of the engine, namely, the 8,000 lb., becomes reduced by gravitation and friction of itself and tender to 7,104 lb., and, at the same time, the resistance of the load becomes increased—

By gravitation, ... 6·79 lb. per ton
In addition to the friction as before 9 „
Making together ... ... 15·79 per ton.

Then $\frac{7,104}{15·79} = 450$ tons, gross load, being little more than half the load upon a level, namely, 55 per cent.

TABLE I.

Comparative Statement of the effects of Gravitation and Friction on Loads upon different Gradients.

Locomotive Engine, 17-in. Cylinders, 20-in. Stroke; Diameter of Wheels, 4ft. 6in.; Weight, 28 tons; Steam Pressure, in the Boiler, 100 lb. per inch; Friction of Engine, 18 lb. per ton; Total Tractive Force called 8,000 lb. at 15 miles an hour; Tender, 12 tons; Friction, 10 lb. per ton.

LOCALITY.	Rise per mile in feet.	Gradient.	Gravitation in pounds per ton.	Resistance from gravitation and friction of engine and tender.	Tractive force remaining for hauling the load.	Friction of wagon in pounds per ton.	Gross load, exclusive of the engine and tender.	Paying load, if the tare be taken at one-third of the gross load.	Paying load, if the tare be 38 per cent. of the gross load.	Total gravitation of engine, tender, and gross load.	Total friction of engine, tender, and gross load.	Increased load per cent. by reduction of friction.
	Feet.		lb.	lb.	lb.	lb.	Tons.	Tons.	Tons.	lb.	lb.	per cent.
Level	0	0	0	624	7,376	12	615	410	381	0	8,000	
						9	820	547	508	0	8,000	33·3
						6	1,229	819	762	0	8,000	100
London and Birmingham Railway	16	1/330	6·79	896	7,104	12	378	252	234	2,839	5,161	
						9	450	300	279	3,327	4,673	19·0
						6	555	370	344	4,043	3,957	46·8
Bishop Auckland to Shildon, Stockton and Darlington Railway ..	21	1/250	8·96	982	7,018	12	335	223	208	3,358	4,642	
						9	391	261	243	3,859	4,141	16·7
						6	469	313	291	4,561	3,439	49·1
Thickley—Stockton and Darlington Railway ..	40	1/131	17·1	1,368	6,632	12	230	153	143	4,616	3,384	
						9	256	171	159	5,068	2,932	11·7
						6	282	193	179	5,638	2,362	26·1
Shincliffe — North-Eastern Railway..	42	1/125	17·92	1,341	6,659	12	223	149	138	4,705	3,295	
						9	247	165	153	5,150	2,850	11·1
						6	278	185	172	5,706	2,294	25·0
Eden Valley Railway ..	52·8	1/100	22·4	1,520	6,480	12	188	125	116	5,116	2,884	
						9	206	137	128	5,519	2,481	9·5
						6	228	152	141	6,097	1,903	21·2
South Durham and Lancashire Union Railway	88	1/60	37·33	2,117	5,883	12	119	79	74	5,945	2,055	
						9	127	85	79	6,233	1,767	6·4
						6	136	91	84	6,561	1,439	13·8
Crook Incline — Stockton and Darlington Railway	126	1/42	53·33	2,757	5,243	12	80	53	50	6,413	1,587	
						9	84	56	52	6,619	1,381	4·8
						6	88	59	54	6,846	1,154	10·1
Waskerley Deviation—Stockton and Darlington Railway..	151	1/35	64	3,184	4,816	12	63	42	39	6,616	1,384	
						9	66	44	41	6,782	1,218	4·11
						6	69	46	43	6,963	1,037	8·57
Sunnyside Incline — Stockton and Darlington Railway..	330	1/16	140	6,224	1,776	12	11·7	7·8	7·3	7,236	764	
						9	11·9	7·9	7·4	7,269	731	2·01
						6	12·1	8·1	7·5	7,393	679	4·11

TABLE II.

No. of Experiment.	Description of Train.	Weight of Train.			Distance run over.	Duration of run.		Difference of level.	Percentage of straight line and curve.		Friction per ton.
									Straight.	42 to 60 chs. radius.	
		tons.	cwt.	qrs.	chains.	min.	sec.	feet.	chains.	chains.	lbs.
I.	1 hoppered truck (laden)	9	11	2	118·61	8	10	30·68	31·69	68·31	8·78
II.	Do. do. do.		do.		120·67	8	0	30·23	32·84	67·16	8·50
III.	Do. do. do.		do.		121·74	7	50	29·89	41·44	58·56	8·33
IV.	Do. do. do.		do.		120·17	8	0	30·23	33·58	66·42	8·56
V.	Do. do. (empty)	4	16	0	93·13	11	45	31·79	24·81	75·19	11·58
VI.	20 laden trucks	191	6	3	121·06	8	0	30·11	33·00	67·00	8·44
VII.	Do. do.		do.		123·88	7	45	29·17	34·60	65·40	7·99
VIII.	8 chaldron wagons (laden)	10	9	0	74·43	7	30	27·69	14·77	85·23	12·62
IX.	Do. do. do.		do.		74·75	8	6	27·75	15·00	85·00	12·59
X.	Do. do. do.		do.		66·09	7	2	25·64	16·66	83·34	13·16
XI.	Do. do. do.		do.		98·91	8	0	32·00	29·19	70·81	10·98
XII.	Do. do. (empty)	—	—	—	44·08	8	30	20·01	24·99	75·01	15·40
XIII.	58 chaldron wagons (laden)	201	16	0	58·77	6	30	23·82	18·71	81·29	13·75

Note.—When the above experiments were made the air was calm, and the way dry and in good order. In Experiment XI. the axles were carefully cleaned and well oiled with olive oil. All trucks and wagons specified as laden were filled with coke. It must be observed that the proportion of straight line is very much in favour of the trucks.

Several more experiments were made, but I consider the above sufficient for the purpose.

It is not necessary to go through all the cases of different gradients shown in the table, but the same mode of calculation shows that, up a rising gradient of 1 in 131, being the steepest ascent between Redcar and the foot of Howden or Crook incline, on the Stockton and Darlington Railway, of which there are several miles, the load is reduced to 256 tons, being only 31 per cent. of the load upon a level, and 55 per cent. of the load up 1 in 330. And, as the inclination of the plane becomes steeper, the power of taking loads rapidly diminishes, as will appear by an inspection of the table. I will, however, point out the effect of a gradient of 1 in 60, of which there are several miles upon the South Durham and Lancashire Union Railway, between Bowes and Kirby Stephen.

The gravitation and friction of the engine and tender is 2,117 lb., showing that 26 per cent. of the power is absorbed in moving itself. There is then only left 5,883 lb. out of the 8,000 lb. available for hauling the load. And this 5,883 divided by the sum of the gravitation and friction, namely (37·33 lb. × 9 lb). 46·33 lb., gives a gross load of only 127 tons, which is only 15 per cent. of the load upon a level, or 49½ per cent. of the load up 1 in 131 (the gradient between Redcar and Howden).

In this example the entire resistance to be overcome by the steam power consists of

	lb.
Friction	1,767
Gravitation	6,233
Total	8,000

The resistance from gravitation being rather more than 3½ times as much as from friction.

Hence it appears that, as the rate of inclination increases, the loads diminish, until we arrive at such an ascent that the engine cannot move itself and tender.

For instance, up the steepest part of the Sunnyside incline, where the traffic is worked by a stationary engine and ropes, having a rising gradient of 1 in 14, the load becomes merely nominal. This was verified by actual experiment, as will be seen on reference to page 16.

The following calculation for a gradient of 1 in 12·14, or 434·9ft. per mile, will show that the whole of the tractive power of the engine is absorbed in hauling itself and tender.

Gravitation $\frac{2,240}{12·14} = 184·4$ lb. per ton.

tons.	lb.	lb.	
Then 28 ×	184·4	= 5,163·2	Gravitation of engine.
28 ×	18	= 504	Friction „
12 ×	184·4	= 2,212·8	Gravitation of tender.
12 ×	10	= 120	Friction „
		8,000·0	

The friction in the preceding table comprises both the attrition, or rubbing friction of the axles, and the resistance between the rails and the wheel tyres, or rolling friction, the axle friction being considered to be about three times as much as the friction on the rails.

Say—Rubbing or axle friction, 6¾ lb. per ton } = 9 lb.
Rolling or rail friction, 2¼ lb. „ }

But these proportions will vary according as the wheels are guttered or worn, so as to have flat places in them, as well as in the state of the axles and bearings, and also as to whether the axles are parallel and square to the line of draft.

I have not complicated my calculations by attempting to separate the two kinds of friction, neither have I taken any cognisance of the atmospheric resistance. In all experiments, even in a dead calm, this is in operation, and forms part of the ordinary friction, but in high winds it forms a very important feature, either in retarding or assisting the trains, according to the direction they may be travelling at the time.

A list of Gradients on the Stockton and Darlington Railway and Branches.

(Including the South Durham and Lancashire Union and Eden Valley lines.)

	Miles.	Chains.
Inclines worked by stationary engines having gradients varying from 1 in 8 to 1 in 53 ...	... 9	13

Gradients worked by Locomotive Power:—

	Miles.	Chains.
1 in 35½ to 1 in 50	5	32
1 in 51 to 1 in 60	8	36
1 in 61 to 1 in 80	24	40
1 in 81 to 1 in 100	22	46
1 in 101 to 1 in 200	39	68
1 in 201 to 1 in 1,000	48	24
1 in 1,001 to Level	13	54
Level	13	21
	176	1
	185	14

To find the Tractive Power of a Locomotive Engine.

Suppose the two cylinders to be each 17in. in diameter; diameter of wheels 4ft. 6in. or 54in.; length of stroke 20in.; and the average pressure of the steam on the piston 80 lb. per square inch.

Then 20 × 2 = 40in., travel of piston.

And $17^2 \times ·7854 \times 2 = 454$ square inches, area of the two pistons.

Also 54 × 3·1416 = 169·64in., circumference of wheels. Ratio of travel of piston compared with the progressive movement of the load will be $\frac{16,964}{40} = 4·24$ times, increase.

Hence $\frac{454 \times 80}{4·24} = \frac{36,320}{4·24} = 8,566$ lb., the tractive power of the engine, from which allow the 566 lb. for waste of steam at the pistons, and retardation or back pressure from the blast pipe, leaves 8,000 lb. available tractive power.

To find the Horse Power of a Locomotive Engine.

The dimensions, pressure of steam, and rate of motion being the same as the foregoing we have—

Two cylinders, each 17in. diameter, = 454 square inches, area of two cylinders.
Length of stroke 20in. = 40in. for each revolution of the wheels.
Diameter of wheels 4ft. 6in., or 54in., = 169·64in. circumference.
And one mile = 1,760 yards, or 63,360in.
Then 63,360 ÷ 169·64 = 373·5 revolutions of wheel per minute.

And time of travelling one mile, at 15 miles an hour, is 4 minutes.

Therefore 373·5 revolutions ÷ 4 = 93·37 revolutions of wheel, or strokes of the piston per minute; and as the piston travels 40in. per double stroke, 93·37 × 40 = 3734·8 in., or 311·23 ft. per minute, velocity of the piston.

Area of two cylinders 454 square inches × 80 lb., average pressure of steam × 311·23 velocity = 11,303,873 lb.; and 11,303,173 ÷ 33,000 lb. (Bolton and Watt's estimate of the power of a horse) = 342½ horse-power.

No allowance is here made for loss of power by the passage of the steam through the pipes and slide-valves, and resistance in the blast-pipe. See below, where this resistance appears to be about 6½ per cent.

The calculations in the foregoing pages have been made on the basis of the engine exercising a power of traction equal to 8,000 lb.; and actual loads prove the practicability of this being done. Now $\frac{8,000}{150} = 53{\cdot}3$ horse-power, at 2½ miles per hour. But, as the speed is to be 15 miles an hour, the resistance to be overcome is six times that of 2½ miles an hour; therefore 53·3 × 6 = 320 horse-power at that speed, which is less than the preceding calculation by 22½ horse-power, being a difference of 6½ per cent.

Or, 8,000 lb. moved 15 miles per hour, or 1,320ft. per minute.

And $\frac{8,000 \times 1,320}{33,000} = 320$ horse-power.

Or the Horse-power of a Locomotive Engine may be found without introducing the dimensions or steam pressure, as follows:—

By referring to table on preceding page it will be seen that an engine is able to take a load of 206 tons up a gradient of 1 in 100 at the rate of 15 miles an hour, the friction of the load being 9 lb. per ton.

Now, 15 miles an hour is 1,320ft. per minute, and the gradient being 1 in 100, the rise will be 13·2ft. per minute. Hence the engine will raise itself, tender, and load of 206 tons, or 461,450 lb., through this space each minute.

	lb.	ft.	lb.	
Therefore 461,440 × 13·2 =			5,991,008	raised 1 ft. per minute.
Engine 28 tons				
Tender 12 „				
40 =	89,600 ×	13·2 =	1,182,720	„ „
Friction of engine 28 ×	1,320 ×	18 =	665,280	„ „
„ tender 12 ×	1,320 ×	10 =	158,400	„ „
„ load 206 ×	1,320 ×	9 =	2,447,280	„ „
			10,444,688	

And 10,444,688 ÷ (150 × 220) or 33,000 = 316⅓ horse-power, or about 7½ per cent. less than by the preceding method.

The result of these three calculations, say about 300 to 320 horse-power, is scarcely half the power quoted by Mr. Fairbairn, p. 141, in his valuable book, called "Useful Information for Engineers," which is as follows:—

"Let us calculate the duty performed, and the force applied to one of our largest class of locomotive engines, travelling with a train at the rate of 45 miles an hour, and we shall find the power given out to exceed that of 700 horses, or as much as would be required to drive the machinery of some of our largest factories."

He, Mr. Fairbairn, gives no calculations to show how he arrived at that result. It may be noticed that my foregoing examples are all with heavy loads, at slow speeds. I will therefore try one more example with greater speeds, and lighter loads, namely, passenger trains.

An engine weighing 24½ tons (with tender 12 tons), takes a train of twelve coaches and guard's van, up a gradient at Thickley,* of one in 131, at a speed of 30 miles an hour; what is the horse-power of the engine, the weight of the train being 101 tons 14 cwt., including 300 passengers and their luggage?

Speed 30 miles an hour = 1 mile in 2 minutes, or $\frac{5280}{2}$ = 2,640ft. per minute.

Rise of gradient, 40ft. per mile in 2 minutes, or 20ft. in one minute.

Weight of train = Tons. cwts. lb. 101 : 14 = 227,808.

Weight of engine 24½ × tender 12 = Tons. Tons. Tons. lb. 36½ = 81,760.

lb.	ft.		lb.	
Then 227,808 × 20	..	... =	4,556,160	raised 1ft. high per minute.

Tons.	lb.	ft.		
And 101·7 ×	12 friction ×	2,640 =	3,221,856	friction.
Engine 24½ ×	18 „ ×	2,640 =	1,164,240	„
Tender 12 ×	10 „ ×	2,640 =	316,800	„
Engine and tender 81,760 ×		20 =	1,635,200	raised 1ft. high.
			10,894,256	

And $\frac{10,894,256}{30,300} = 330$ horse power.

There seems to have been a general opinion that the old-fashioned mode of describing the power of an engine as equal to so many horses, was not very applicable to the locomotive.

In such an opinion I cannot acquiesce; but, on the contrary, I think we can much more readily ascertain the work performed by a locomotive engine than we can that of engines grinding corn, driving spinning machinery, or steam-boats.

The area of the cylinder × the steam pressure × the velocity of the piston per minute, divided by 33,000 (being 150 lb. raised at the rate of 2½ miles an hour, or 220ft. per minute) is considered equivalent to a horse power. It is no matter whether this represents correctly the power of a great horse, a small horse, or an average horse, so long as mechanics agree in the 33,000 lb. as their unit of measure.

But, in my opinion, the number of horse power thus arrived at is only the measure by anticipation of what the engine should do, or may be expected to do: whereas my mode of calculating the horse power is founded upon the actual work performed in travelling with a full load up an ascertained incline, without taking cognisance of the size of cylinder, or steam pressure.

The weight raised so many feet per minute is a very plain matter of fact, and easily calculated.

Next the weight × the friction of the train or resistance to progressive motion, and then × by the space travelled in a minute. It may be observed that this said friction is not quite so manifest as the raising of the load above shown. This I admit; but, having tried several experiments in order to ascertain the friction, I feel confident there is no important error in this respect.

Moreover, it was a satisfaction to find there was no great discrepancy between the results, whether taken by the ordinary method, or, as I have said, what the engine might be expected to do, and the results arrived at from what the engine actually does perform.

* This load, at this speed, is the result of actual performances; but I consider them the maximum under favourable circumstances.

TABLE OF LOADS OFFERING EQUAL RESISTANCE TO TRACTION ON RAILWAYS.

N.B.—The loads are exclusive of engine and tender.

Speed in miles per hour		Miles. 10	Miles. 12	Miles. 15	Miles. 20	Miles. 25	Miles. 30	Miles. 40	Miles. 50
Tractive force in lb.		lb. 12,000	lb. 10,000	lb. 8,000	lb. 6,000	lb. 4,800	lb. 4,000	lb. 3,000	lb. 2,000
Pressure on piston		lb. 112	lb. 100	lb. 80	lb. 56	lb. 48	lb. 40	lb. 30	lb. 24
Locality.		Load in tons.	Load in tons.	Load in tons.	Load in tons.	Load in tons.	Load in tons.	Load in tons.	Load in tons.
London to Birmingham	Level.	1,264	1,041	820	597	464	375	264	197
Shildon Tunnel, &c., Stockton and Darlington	1 in 330	703	570	450	326	247	196	133	96
Thickley „ „	1 in 250	614	502	391	279	212	168	112	79
Shincliffe, North-Eastern Railway	1 in 131	409	333	256	180	133	103	65	42
Temple Sowerby, Eden Valley Railway	1 in 125	396	321	247	173	128	98	61	39
Winston, Barnard Castle Railway	1 in 100	333	270	206	142	104	79	47	28
Haggarleazes and Barnard Castle Railway	1 in 75·9			161					
Stainmore, South Durham and Lancashire	1 in 70	246	197	148	100	70	51	26	12
Kirby Stephen to Carras „	1 in 67·5	238	190	143	96	67	48	25	10
Clifton, Eden Valley Railway	1 in 60	213	170	127	83	58	40	19	6
Proposed Sunnyside (Nov. 1861) Stockton and Darlington	1 in 57·86			122					
Ormesby „ „	1 in 50	178	141	104	66	44	29	11	
Howden or Crook „ „	1 in 44	156	122	89	55	35	22	5	
Waskerley deviation and Normanby	1 in 42	148	116	84	52	33	18	4	
	1 in 35	120	93	66	38	22	11	0	

[Supplement.]

Darlington, January 22nd, 1862.

Having, in the preceding treatise, established the fact that our large engines, built by Stephenson, Hawthorne, Gilkes, Wilson, and other first-class manufacturers, with 17in. cylinders, 20in. stroke, 4ft. 6in. wheels, weighing 28 tons, pressure in the boiler, or rather load on the safety valve, 112 lb., possess a tractive force of 8,000 lb. at 15 miles an hour, I contend that the same engine will only possess a tractive power of 6,000 lb. at 20 miles an hour; 4,000 lb. at 30 miles an hour; 3,000 lb. at 40 miles an hour; and 2,400 lb. at 50 miles an hour. Any or all of these will give the same horse power.

Thus, at 20 miles an hour, or 1,760ft. per minute,

$$\frac{6,000 \times 1,760}{33,000} = 320\text{-horse power;}$$

and at 30 miles an hour, or 2,640ft. per minute,

$$\frac{4,000 \times 2,640}{33,000} = 320\text{-horse power;}$$

and at 40 miles an hour, or 3,520ft. per minute,

$$\frac{3,000 \times 3,520}{33,000} = 320\text{-horse power.}$$

Having established the tractive force of any engine at different speeds, the load for any speed, and up any gradient, may be easily calculated, thus—

Query the load on a level railway at 15 miles an hour, the friction of the wagons being 9 lb. per ton, and that of the engine being 18 lb. per ton, and that of the tender being 10 lb. per ton?

	lb.
Friction of the engine 28 tons × 18 =	504
Ditto of tender ... 12 „ × 10 =	120
Resistance of engine and tender	624

	lb.
Then the tractive power of engine at 15 miles an hour,	8,000
Minus the resistance of engine and tender, as above...	624
Force left available for drawing the load	7,376

Therefore $\frac{7,376}{9\,F} = 820$ tons as the load at 15 miles an hour, exclusive of weight of the engine and tender.

In this case the mean pressure of steam upon the piston will be 74·7 lb. per inch.

Again, query the load on a level railway at 40 miles an hour with the same engine?

	lb.
Tractive force at this speed	3,000
Minus force of engine and tender, as before	624
	2,376

Therefore $\frac{2,376}{F=9} = 264$ tons ex. engine and tender. Mean pressure of steam upon the piston 28 lb. per inch, and likewise for any other speed.

But in ascending inclined planes the division, instead of being merely the friction herein taken at 9 lb. per ton, must be increased by the gravitation due to the gradient.

Thus—What is the load for the same engine on one of 320-horse power up a gradient of 1 in 100 at 30 miles per hour?

	lb.
Tractive force, as before stated, for this speed	4,000
Friction of engine and tender, as before	624
Gravitation of engine and tender, viz., 22·4 lb. upon 40 tons	896
	1,520

Then 4,000 — 1,520 = 2,480 lb. remains available for drawing the load. Therefore $\frac{2,480}{g\ 22{\cdot}4 \times F\ 9.} = 78{\cdot}97$ tons load, exclusive of engine and tender. Mean pressure upon the piston, 37·35 lb.

Again, query the load of an engine of the same power up 1 in 60 at 15 miles an hour? Friction as before.

$\frac{2,240}{60} = 37{\cdot}33$ lb. per ton gravitation.

	lb.
Tractive force of engine at this speed	8,000
Friction of engine and tender, as before	624
Gravitation of do., 40 tons × 37·33 =	1,493
	2,117

Then 8,000 — 2,117 = 5,883 lb. available for drawing the load. Therefore $\frac{5,883}{g\ 373{\cdot}33 \times F\ 9} = 127$ tons load, exclusive of engine and tender. Mean pressure on the piston = 74·7 lb. per inch, and so for other speeds and gradients.

January 22nd, 1862. J. D.

N.B.—In all these calculations the resistance from the atmosphere has purposely been neglected.

MISCELLANEA.

THE Judicial Committee of the Privy Council have refused to extend the patent for Normanville's railway axles.

No trials of machinery or implements will be made this year by the directors of the Royal Agricultural Society.

THE Defence and Resistance, as well as four other screw frigates, the Arethusa, Aurora, Constance, and Octavia, are to be supplied with engine-room telegraphs.

THE Secretary of State for War has appointed Capt. T. A. Harrison, R. A., Secretary of the Iron Plate Commitee, of which Sir John Hay is president, vice Capt. Dyer, R.A., who has been appointed to the Department of the Inspector of Artillery.

A RAILWAY twenty-five miles long is open in Buenos Ayres, over which passengers are carried first-class for 1d. per mile, which is the charge also per ton per mile for goods. At the last advices Mr. Croskey, the director of the San Fernando Railway, had arrived out with Mr. Murray, the contractor for the line. They had not commenced the works.

AT the latefire at Pimlico the Messrs. Shand and Mason's steam fire engine threw 270 tons of water for 5s., while it cost £2 16s. to throw 54 tons from the hand engines; in other words, steam threw 54 tons for 1s., while hand labour threw less than one ton. This is entirely irrespective of the relative force of the two jets—a point of great importance considering the height to which new buildings are now being carried in the metropolis.

THE South-Eastern Railway Company, in anticipation of increased passenger traffic during the Exhibition, have given orders for a sister vessel to the steamer Victoria, which was put on the Folkestone and Boulogne station last season, and has proved to be one of the fastest steamers afloat. The new boat is to be built by Messrs. Samuda Brothers, the engines by Messrs. Penn and Son, the builders and engineers of the Victoria.

THE new Cunard screw steamer China, 1,540 tons register and 550-horse power, was tried on Tuesday between the Cloch and Cumbrae lights in the Clyde. From Cloch to Cumbrae, against a strong flood tide and strong S.W. wind, the run was made in 60min. 4sec., and from Cumbrae to Cloch, with a light drain of tide in the ship's favour, in 55min. 30sec., which latter gave a speed of 14·9 knots, which is equal to 17½ statute miles per hour.

THE members of the Select Committee of Woolwich Arsenal have decided on the expediency of carrying out the proof of Sir William Armstrong's huge 300-pounder gun at Shoeburyness, instead of at Woolwich, as formerly intended. The traversing platform and gun-carriage for that purpose weigh respectively 53 tons 1 qr., and 37 tons 5 lb. The gun itself weighs 12 tons, and, as already stated, will undergo a severe trial as a smooth bore preparatory to being rifled.

THE Pacific Steam Navigation Company's new steamship Peru, which left Liverpool on the 31st of December for St. Vincent, *en route* for the Pacific, arrived at that port on the 9th ult., all well, making the voyage in nine days and two hours, including a stoppage of six hours at Queenstown. Her consumption of coal was 264 tons, or 24 cwt. per hour for an indicated power of 1,200 horses, or about 2½ lb. per indicated horse power. This speaks well for the Peru's double cylinder engines.

THE Great Eastern will go on the gridiron at Milford Haven about the middle of this month, the time of spring tides, when besides the increased length of daylight there will be a full moon. The new paddle-wheels have arrived at Milford, the new rudder-head has been fixed in place, and the ship is expected to leave the gridiron before March. Allowing for coaling, the big ship is expected to be ready for sea by the first week in April, her destination being New York.

IN the Exchequer Chamber, on Monday, the case of Harwood *v.* the Great Northern Railway came on. The action was for the infringement of a patent for fish-joints to railways. The questions were whether the invention was new, and whether it was a good subject matter of a patent. The case was argued some time since, when the Court took time for consideration. Mr. Justice Willes now delivered the judgment of the Court, reversing that of the Court below, and that the verdict must be entered for the defendants, denying the novelty of the invention.—Judgment reversed. The Permanent Way Company are the real plaintiffs in the case.

THE prospectus of the Temple Bridge Company has appeared, proposing to erect a suspension bridge of three spans of 300ft. each across the Thames between Essex-street, Strand, and Princes-street, Upper Stamford-street, Borough. The capital is to be £70,000, with borrowing powers for £20,000. The contractors of the Lambeth Bridge are prepared to contract for the erection of the Temple Bridge for £45,000, taking one-third in shares. It is expected that the traffic will be little below that of Waterloo Bridge, which in 1861 was £22,000, but should it amount to only one-half of that sum, it will yield a return of 12½ per cent. per annum on the capital of the company.

THE Council of State of the canton of Geneva have granted a concession for the construction of horse railways in the canton to Mr. Charles Burn, C.E., the author of the treatise "On the Construction of Horse Railways for Branch Lines and for Street Traffic." A commencement is to be made by constructing a line from Geneva to the small town of Carouge, two miles distant. We understand that the works have already commenced, and that the first line will be opened for traffic on the 1st of May next. Mr. Burn will lay down his patent grooved rail. The cars will be constructed on the American system, and are now being built at the Street Rail Car Works, at Birkenhead.

A NOTICE has been issued of the proposed International Supplementary Exhibition Company, to be erected in immediate proximity to the Great Exhibition building, for the purpose of affording space for the surplus products for which it is impossible to obtain room at the latter, and also to furnish opportunities for the sale of the articles displayed at either place. The building is to be completed for opening on the 15th of May, and it is hoped that arrangements may be effected for the gratuitous admission of all visitors from the Great Exhibition. The charge for space will be 12s. per square foot for the floor and 6s. for the walls, being less than one-half of the annual rental of the London bazaars, and the period will be from the 15th of May to the end of October. The design and supervision of the structure will be by Sir Joseph Paxton, and the trustees are Sir Robert Carden, Alderman Finnis, and Mr. William Jackson, M.P. The company, before taking any steps, ascertained that the project would not be objected to by the Royal Commissioners of the Great Exhibition, and the spirit in which it will be conducted will be that of making it an agreeable and useful auxiliary.

THE following appointments of naval engineers have been made since our last:—J. Ross, engineer to the Hawke for the Lark; D. Leitch, first-class assistant-engineer to the Hawke for the Advice; T. M. Thompson, second-class assistant-engineer to the Blenheim for the Charon, vice Wood; G. R. Beer, acting second-class assistant-engineer to the Hawke for the Advice; Edwin Pearce, engineer to the Indus, for the Alert; Thomas Huard, first-class assistant-engineer to the Asia for the Jasper; J. A. Wilson, engineer to the Indus for the Lee gun-vessel; T. E. Millar, engineer to the Blenheim for the Amelia gun-vessel; J. Ross, engineer to the Indus as supernumerary; W. Ash, engineer to the Hawke for the Blazer gun-vessel; George Batchelor, acting-engineer, to the Blenheim, for the Britomart gun-vessel; James Bates, first-class assistant-engineer, to the Blenheim, for the Escort gun-vessel; J. Clift, first-class assistant-engineer, to the Blenheim, for the Raven gun-vessel, vice Sumner; J. G. Barrow, first-class assistant-engineer, to the Hawke, for the Rose gun-vessel; J. T. Page, first-class assistant-engineer, to the Hawke, for the Sandfly gun-vessel; A. Watt, first-class assistant-engineer, to the Hawke, for the Griper gun-vessel; A. Borthwick, first-class assistant-engineer, to the Hawke, for the Highlander gun-vessel; A. Wood, first-class assistant-engineer, to the Blenheim, for the Charon gun-vessel; D. Hughes, acting-first-class assistant-engineer, to the Blenheim, for the Clinker gun-vessel, vice Turner; and A. Forrest, acting second-class assistant-engineer, to the Blenheim, for the Julia gun-vessel.

HUMPHRYS' CONSTRUCTION OF IRON SHIPS, BATTERIES, AND FORTS.

This invention, by Edward Humphrys, of Deptford, consists in building iron ships, batteries, and forts, entirely or in part of solid plates or forgings of iron with internal flanges. The plates are so formed as to admit of their being bolted together on the internal surface, whereby, in the case of ships, the usual frames of angle iron may be dispensed with, and, in the case of batteries and forts, structures of great strength may be formed.

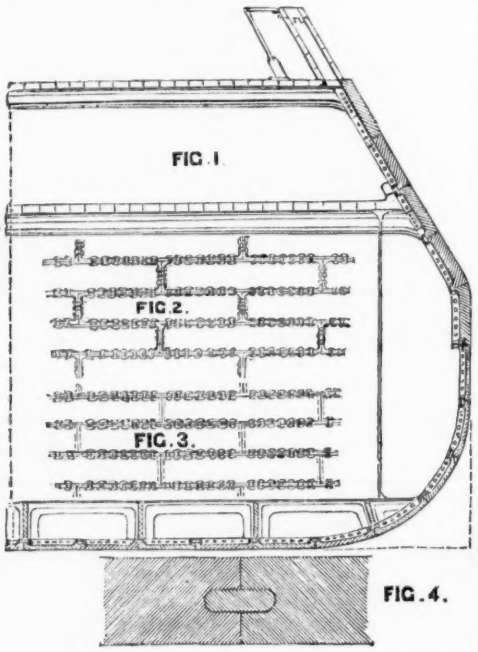
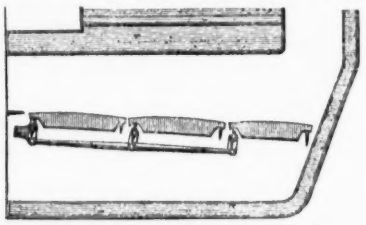


Fig. 1 represents in cross section one-half of a ship built on the plan in question; Fig 2 is an internal view of part thereof, showing the arrangement of the flanges all found the inboard edges of the plates (the long way of the plates may be placed vertical); Fig. 3 represents an arrangement where the internal flange is omitted on the vertical edges of the plates, each vertical edge being formed with a groove, into which a steel bar or tongue is fitted; Fig. 4 represents in section, on an enlarged scale, this groove and tongue. The flanges are formed on the armour or other plates, either all round their inboard edges or on their horizontal edges only, or on their vertical edges only, and where such flanges are omitted both plates are grooved, a steel bar or tongue being inserted into such groove.

COLQUHOUN AND THOMSON'S FIRE BARS.

The illustration represents an arrangement for moving fire bars, so as to break up and remove clinkers, &c., the invention of Messrs. Colquhoun and Thomson, of Laurence Pountney-place, Cannon street, E.C. By the insertion of a hand lever the alternate fire bars may be moved more or less to accomplish the desired purpose. With



this improvement, the fire bars are kept clear when impure or slaty coal is used, thus promoting the draught and prolonging the life of the bars. The invention has been already applied to a number of steamboat and stationary engine furnaces, and is equally applicable to locomotives.

FLETCHER AND FULLER'S PLANING MACHINES.

The nature of this invention of improvements in machinery for planing by James Fletcher and John W. Fuller, of Salford, consists in rendering such machines available for being used to plane two or more articles of different dimensions and shapes at the same time.

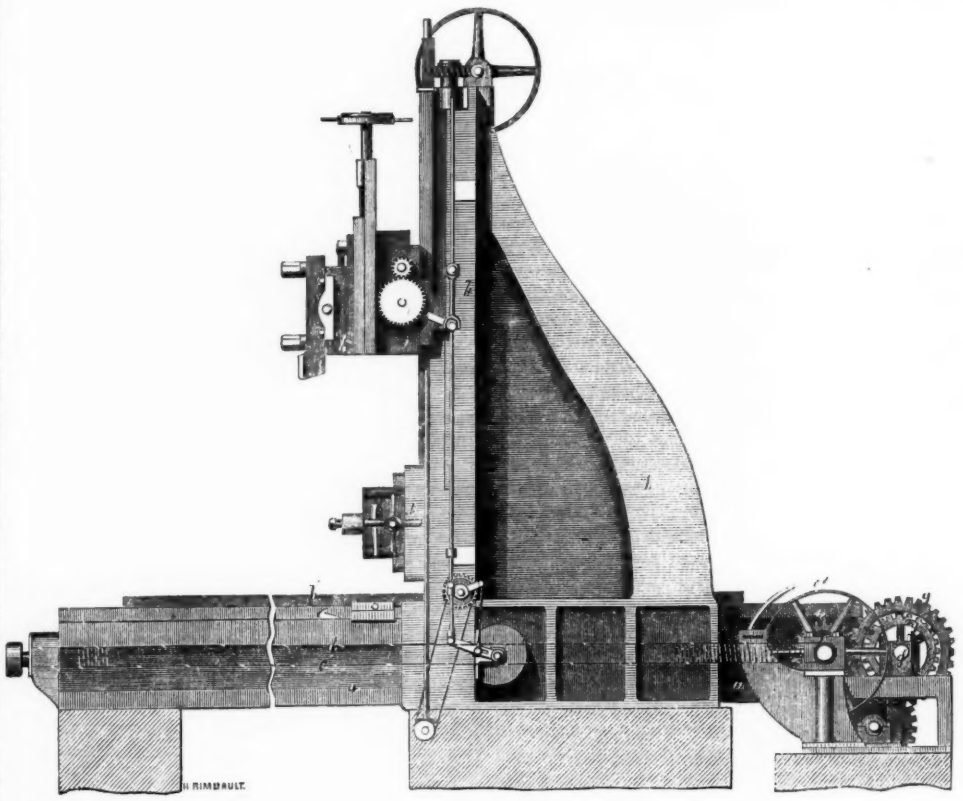
In order to accomplish this the bed is made with the required number of guides or grooves for two or more tables, each of which is furnished with a tool-holder and an independent starting, driving, and stopping apparatus.

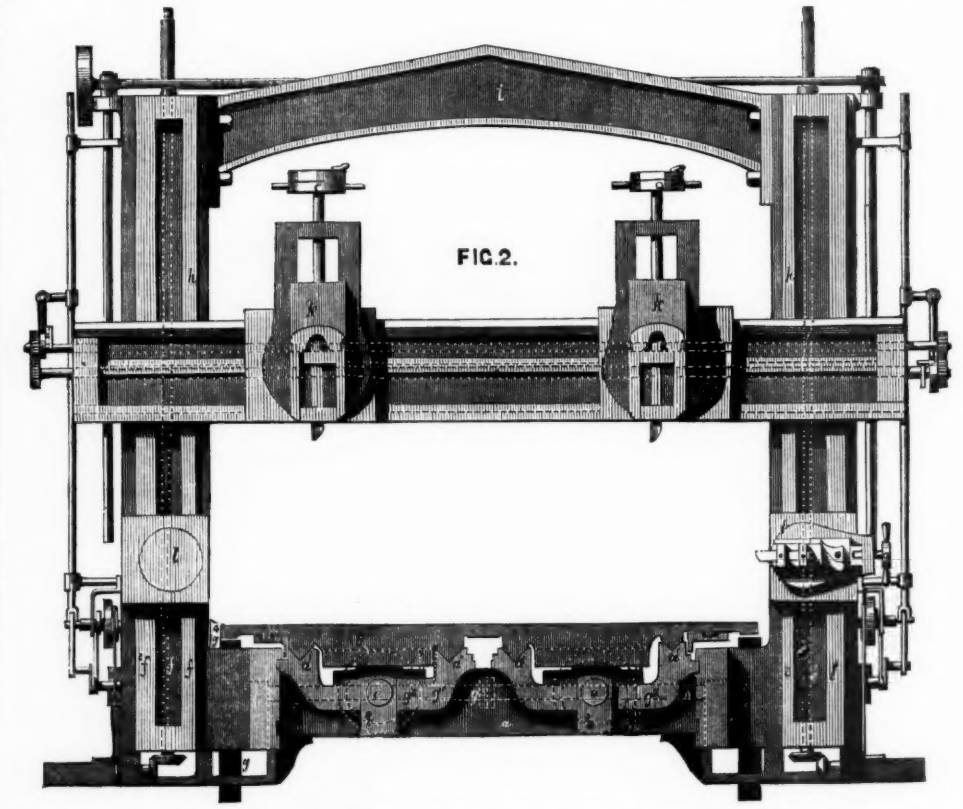
Fig. 1 is a side elevation of a planing machine constructed according to these improvements, and Fig. 2 is a front view of the same.

a is the bed, which is made with four guide grooves a^1, for the two tables *b* and b^1; each table is moved to and fro by a screw *c* or c^1 taking into a nut *d*, or by a pinion and rack, or other mechanism, in the usual manner. The driving apparatus for working the screws *c* and c^1, or other equivalent for giving motion to each table independently of the other, consists of the pulleys *e*, e^1, and e^2, shown to the right-hand side of Fig. 2, and the pulleys *f*, f^1, and f^2, on the left-hand side. The slow advancing motion is given to the table b^1 by the pinion e^3 gearing into the wheel *g* fixed on the shaft g^1, to which is also fixed the bevel pinion g^2 gearing into the bevel-wheel c^2 fixed to the end of the screw c^1. The quick return motion of the table *b* is effected by the wheel e^4 gearing into the carrier-wheel g^3, which gears into the wheel g^4 fixed to the shaft g^1. This driving apparatus is similar to that generally applied to planing machines, and a corresponding driving apparatus is applied to the other side of the machine for giving motion to the table *b*. The other parts of the planing machine, such as the standards *h*, entablature *i*, and cross slides *j*, are made as in other machines of large dimensions, but the cross slide must be provided with as many tool-holders *k* as there are tables, and the tool-holders are worked by self-acting machinery from one or both sides of the machine.

In planing very large castings the tables *b* and b^1 act simultaneously, the shafts g^1 being coupled at g^5, as shown in dotted lines in Fig. 2, but at other times the shafts g^1 are disconnected, and each table can then be traversed the required distance irrespective of the other, as the strap-fork of each driving apparatus is acted upon by an adjustable stud or reversing stop fixed to the table, as in ordinary planing machines where a single table is employed. The tool-holders *l* are connected by screws to the standards *h*, but they form no part of the present invention. Planing machines constructed according to the above improvements will be found advantageous in practice, as although it is necessary to have a planing machine sufficiently large to operate on the largest castings, such castings are comparatively seldom required, and at other times the machine can be employed on smaller castings and perform the work of two or more planing machines.

FLETCHER AND FULLER'S PLANING MACHINES.

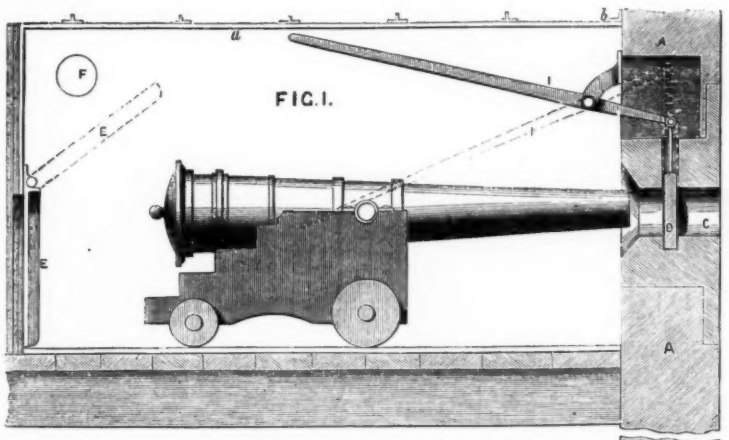


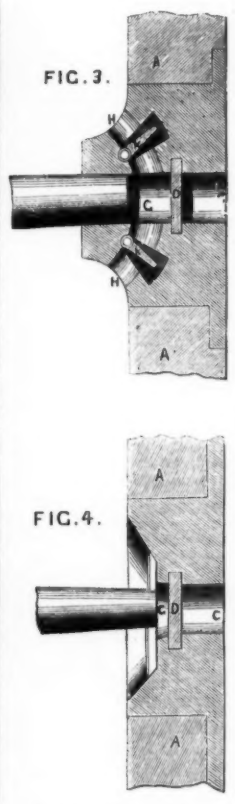


Repairing the Silvering of Looking-Glasses.—The repairing of the silvering on the backs of looking-glasses has hitherto been considered a very difficult operation. A new and very simple method, however, has recently been described before the Polytechnic Society of Leipsic. It is as follows:—Clean the bare portion of the glass by rubbing it gently with fine cotton, taking care to remove every trace of dust and grease. If this cleaning be not done very carefully, defects will appear around the place repaired. With the point of a knife cut upon the back of another looking-glass, around a portion of the silvering of the required form, but a little larger. Upon it place a small drop of mercury—a drop the size of a pin's head will be sufficient for a surface equal to the size of the nail. The mercury spreads immediately, penetrates the amalgam to where it was cut off with the knife, and the required piece may now be lifted and removed to the place to be repaired. This is the most difficult part of the operation. Then press lightly the renewed portion with cotton: it hardens almost immediately, and the glass presents the same appearance as a new one.—*Builder.*

The Royal Oak.—The return called for by the Admiralty from the officials at Chatham Dockyard, relative to the progress made in the armour-plated screw steamer Royal Oak, 51 guns, 1,000-horse power, under construction at that establishment, and the probable time by which she will be completed has resulted in an order being despatched from Admiral Robinson, the Controller of the Navy, directing 100 additional hands to be placed on board that vessel on Monday next, thus swelling the number of shipwrights and other workmen employed on the Royal Oak to 400 men, the greatest anxicty being experienced to have her completed and launched during the present summer. With the exception of a few tiers she is now planked from stem to stern, and in a few days will be ready to receive her armour-plates, which are being forged at the Thames Iron Company's works, Blackwall. To render her as compact as possible, the whole of her ribs, timbers, and uprights are bound together by means of enormous girders of iron, which are carried obliquely across every timber in the ship. In this respect the Royal Oak is constructed differently from the sister ship Caledonia, building at Woolwich, which has her iron girders carried outside her timbers. In planking the exterior the utmost care has been taken to have nothing but the soundest description of teak, the slightest flaw in the timber insuring its immediate rejection, it being of paramount importance that no repairs should be required to be effected in her planking for a considerable time to come, as the slightest alteration would require the removal of her armour-plates. The sides of the Royal Oak will present a solid wall of 29in. thickness of oak and teak, her exterior and interior planking being each 8in. thick and her timber 13in. Her armour-plates, which will completely encase her from stem to stern, will be of the toughest iron possible, and of an uniform thickness of 4½in. The contract price for each plate is somewhere about £120, and as nearly 500 plates will be required for her, their prime cost alone will amount to about £60,000. In addition to this, however, the plates will have to be bent to the shape of the ship's side, which will again add to the cost of each.

PAGE'S APPARATUS FOR WORKING AND DISCHARGING ORDNANCE BELOW WATER-LEVEL.





IN this invention, by Mr. Thomas Page, of Middle Scotland-yard, Westminster, a gun is placed in a chamber disposed below the water-level of a ship or floating battery, and into this chamber is forced air at a pressure greater than that due to the pressure of the depth of water at which the gun is placed. Each gun chamber is connected with a reservoir, in which a plentiful supply of condensed air is maintained. The gun being loaded, placed, and trained in position by suitable apparatus, a port is opened in the ship's side below the water-level, and the gun is fired through such port, which is again immediately closed. The pressure of air in the chamber causes a rush of air outwards, and prevents the ingress of water to any extent while firing. Batteries with the guns so disposed it is proposed to bring into sufficient proximity to an enemy's ship and to fire the guns below the water-level; the projectile will, therefore, pass through the water, strike, and enter the enemy's ship below the water-line and so contribute to its destruction. Guns so situated may be worked by the men in the ordinary way, they being also in the gun pressure chamber.

Guns worked and discharged in compressed air chambers according to this invention would in most cases be fired point blank, and would not in any case require to be elevated, but in very close quarters with an enemy might be depressed with advantage. In practice, however, the gun might always be maintained at a uniform level, in which case the port or hole in the ship's side may be made of a size to correspond somewhat in diameter to the muzzle of the gun. The gun having been loaded and brought into position, the supply of compressed air is admitted to the gun chamber. The port is opened and the gun discharged, watching the motion of the ship, and taking care that the gun is in a horizontal position at the time of the discharge, or it may have a slight depression from such motion if desired at such time. A projectile so discharged will enter the water at right angles thereto, traverse through it, and strike an object (say a vessel) below the water-line. The passage through the water will, of course, diminish the force of the projectile very rapidly as compared with air; it is, therefore, desirable to bring the gun within the closest possible proximity to the object to be hit in order to produce the greatest possible effects. By this means ships that are vulnerable below the water-line may be very easily destroyed, the effect of shot there entering will be readily understood.

Fig. 1 represents a portion of a ship's side A in section, and adjoining it a close or air-tight chamber B, with the gun enclosed; Fig. 2 is a plan of said chamber and horizontal section of the ship's side. The chamber is formed of iron or other suitable material, the metal sides *a* and other parts being supported by angle irons *b*, *b*, or other supports of a strength commensurate to the pressure of air to be introduced. In the ship's side is fixed a heavy casting of iron having a port or opening C of a diameter somewhat larger than the bore, or it may be the muzzle of the gun; in this is fitted a slide D, actuated by a hand-lever I, as seen, or suitable machinery, so that the port can be readily opened or closed by raising or lowering the slide D. This slide is suitably fitted so as to exclude water when closed. In the chamber B is formed a door E, hinged at the upper part, and tackle is provided for raising or lowering it as desired and as seen dotted. The gun may be withdrawn from the chamber by the door, loaded and returned to position for firing. Before firing the door E must be lowered and closed; if provided with suitable india-rubber packing all escape of air may be prevented. One or more gunners enter the chamber B at the time of firing, and either work the port-slide D from within or by signal from without. If the chamber B is small the gun may be confined by a suitable breeching to prevent excessive recoil or beyond a certain extent. Instead of the gunners entering the chamber at the time of firing, the gun may be placed in position, after which the gunners leave and close the chamber, and then fire the gun by electricity or other suitable means. Instead of chamber B being small, it may be of large dimensions and the gun worked within it, but this may be objectionable on account of the pressure of air required to be employed which may be made more available in the smaller chambers. There may be one, two, three, or more such gun chambers in each ship, for the purposes of which suitable air-pumps, worked by steam or other power, are employed, by which pumps air is condensed to a suitable pressure in a large reservoir. F represents the orifice of tube entering chamber B from such condensed air reservoir; this tube should be of an area sufficient to supply air as rapidly as it can escape by the open port; it is furnished with a suitable stop-valve. The gun having been brought up to the port with the muzzle entering it and fitting more or less closely, the chamber B closed, and the air supply valve opened, all will be in readiness for firing. The port-slide D is now raised, disclosing the opening, when the air confined immediately rushes out, forcing the water from the port, and preventing its ingress; the gun is then immediately fired and the port-slide again closed. Instead of the gun muzzle being brought up against the chamfered edge of the port-hole, it may be made to enter the port a considerable distance, and fit somewhat closely thereto. The air, instead of finding access to the port-hole around it, may be conducted by separate channels to a position between the muzzle and the slide, such channels having valves that permit the outward escape of the air for the purpose of blowing out and keeping out the water, but which shut against any pressure of the explosion that might be exerted against them to enter or return thereat.

Fig. 3 represents a section of a port-hole constructed according to the latter arrangement. C is the port-hole as before; G is the muzzle of the gun, fitting somewhat closely therein; H, H, are the air escape channels fitted with valves K, which close by springs or otherwise, and prevent the passage of air in a direction contrary to that of the arrows.

Fig. 4 represents a horizontal section of a port-hole, to be used with an air pressure chamber, in which the muzzle of the gun G fits into an india-rubber ring; this is supported against the pressure of the water by the air in the chamber, the water at the same time being kept out of the gun by a light tompion while firing. Air channels might be adapted between the india-rubber ring and the slide D, as in Fig. 3. If found practicable it may be of advantage to project the muzzle of the gun through the port-hole after opening it, to avoid any injurious effects of the explosion in the close chamber B.

ALSOP AND CHAUNCEY'S GUN STOCKS.

THIS invention, by J. W. Alsop and Henry Chauncey, jun., both of New York, U. S., of improvements in gun stocks, consists in a novel construction of the stocks of fire-arms intended to be fired from the shoulder, whereby a firmer grasp is obtained for the right hand in firing, and the piece is enabled to be held more steadily against the shoulder than heretofore, and with the elbow depressed, so as to be more out of the reach of an enemy's fire than with the ordinary construction of gun stock. Provision is also made for constructing the stock in two parts, which may be disconnected for more convenient carriage, and for the conversion of a piece from a gun into a pistol, and *vice versâ*.

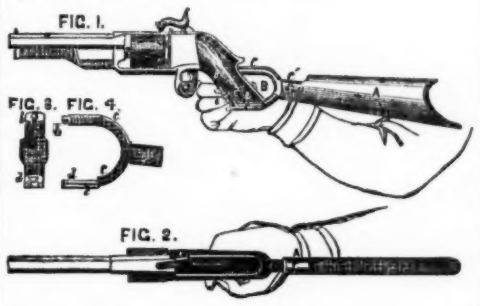


Fig. 1 is a side view of a combined pistol and carbine, having the stock constructed according to the present invention; Fig. 2 is a top view of the same; Fig. 3 is a front view of one of the connecting portions of the stock; Fig. 4 is a side view of the same.

The stock is represented as made in two parts, which may be connected or disconnected, so that the piece may be used as a carbine or pistol at pleasure; but the same form of stock that is produced by the connection of the two parts may be adopted without any provision for disconnection for rifles, fowling-pieces, muskets, or carbines.

The rear portion or butt A of the stock is of the same form as the rear portion of an ordinary gun-stock, but at about the point where a gun stock is ordinarily grasped by the right hand; in firing there is an opening B large enough for the thumb of the right hand to pass through, and for the reception of the ball of the thumb; the portion C of the stock, immediately in rear of this opening, being made in the form of a bow, as shown in Fig. 1, and the portion D, immediately in front of it, being nearly perpendicular to the line of the barrel, and of such form as to be capable of being grasped by the hand with the thumb through the opening.

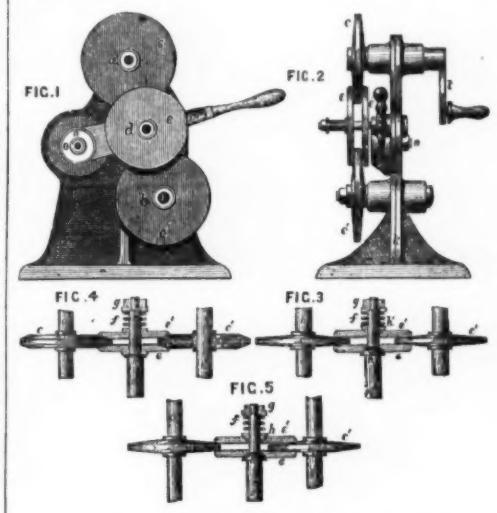
In constructing a stock of this form it will be more convenient to make the bow C of metal, but the butt A and part D may be made of wood. The bow C may be made with a tenon C^1 at its rear, as represented in Fig. 2, and in the detached view, Fig. 4. This tenon C^1 is made to fit the butt A, and it may be secured by screws *a*, *a*, passing through it and the butt A, as represented in Fig. 1; and tenons may be also provided on the front extremities of the bow C to fit mortices in the part D, or handle of the arm, and the tenons may be secured permanently in their respective mortices by transverse screws, or by any other mode of permanently attaching the bow to the butt A and to the part D.

In constructing the stock with the butt or rear part movable for the convenience of carriage, or for the conversion of the gun into a pistol, the bow C is to be connected permanently with the butt by a tenon C^1 and screws *a*, *a*, and the bow is to be constructed with a short round tenon *b*, Fig. 4, to fit a mortice in the top or upper part of the handle D, and with a tongue *c* of dovetail form in its transverse section to fit a dovetail groove in the bottom of the handle D. In the handle D there is also a small spring bolt E to slip into a hole *d* in the tongue *c*, for the purpose of holding the same. By pushing up the bolt E by means of its projecting knob *e* the tongue *c* will be liberated. The bow C, with the butt attached, may be disconnected from the handle D, and then the arm will resemble a pistol, and by replacing the bow in the handle D the piece will be again converted into a gun.

SELLERS' APPARATUS FOR TRANSMITTING MOTION.

THE object of this invention, by William Sellers and Coleman Sellers, of Philadelphia, U.S., is to effect the transmission of motion by frictional contact, so as, first, to insure the adhesion of the surfaces in contact, and to compensate for inequalities of surface arising either from wear or inaccuracy of workmanship, without affecting the positions of the centres of rotation; second, to furnish a ready means of changing the relative velocity of the driver and driven; and, third, to prevent the strain on the journals being increased much, if any, over what is due to the power transmitted, as in ordinary cog gearing.

To understand fully the nature of the invention it is necessary to briefly consider the forms of machinery now used for transmitting motion by frictional contact. Of these the most common form is the ordinary belt and pulley. In this the whole power transmitted tends to draw the two shafts together, thereby producing a strain on the journals at least equal to the power transmitted. The necessary amount of adhesion is obtained by tightening the belt, either by making it long and running it horizontally, so that its own weight will give the pressure on the contact surfaces, or the belt may be drawn very tight when its ends are first united, and the belt will be kept tight by the elasticity of the substance of which it is formed.



Another mode of causing friction of contact is by the use of an intermediate or tightening pulley, which, when pressed against the slack side of the belt, will keep up the pressure on the surfaces of the pulleys. This arrangement, considering the great lateral strain on the two shafts, does not accomplish the third object of the invention, viz., having little or no pressure on the journals or bearings from the force used in keeping the surfaces in contact.

The second object of the invention can be obtained, when using the belt and pulley, by making the well-known device of the two conical pulleys, with the belt so arranged as to shift over their varied diameters; but in practice this has been found to be very objectionable, owing to the tendency of the belt to climb up to the highest part of the pulley, and the unequal stretching of the substance composing the belt will be the result. Hence, although the belt and pulley furnishes a means of transmitting motion by friction of contact, yet it does not fulfil all the requirements stated as the objects to be attained by the present invention.

Passing from the belt and pulley the next device for transmitting motion by frictional contact is that which is usually called friction gearing; this in its simplest form consists of two wheels with their shafts parallel, and having their rims or edges forced together by pressure on their journals. This is not a good arrangement, for the surface in contact is so small, and the absorption of power from the pressure on the journals so great, that but little effective power can be transmitted. To obviate this difficulty a plan has long been in use, which seems to work well in practice, viz., grooving the faces of the two wheels with uniform grooves, having their sides slightly bevelled, so that when the tongues of one are forced into the grooves of the other they shall wedge in, and by that means have a great amount of adhesion with a diminished pressure on the journals. This answers the requirement of the third object of the invention, but is not applicable to either of the other objects, because, in order to force these tongues and grooves into one another, a change of position in the axis of one or the other is necessary, and at the same time it is not applicable to those cases where a change of velocity is desirable. The only way that friction gearing has heretofore been applied, so as to accomplish a change of velocity between two limits of speed, is where a wheel is pressed against a face plate whose axis is at right angles to the axis of the wheel, and the relative speed of the two shafts is governed by the position occupied by the wheel on the face plate at a greater or less distance from its centre. But this device fails also to meet the requirements above stated, as it is liable to all the objections urged against the plain friction wheels, besides the grinding motion due to the position of the axis of rotation.

The present improvements consist in the employment of disc wheels, which transmit motion by frictional contact upon their sides. The frictional surfaces are mounted on an intermediate shaft, and are pressed together by means of a coiled spring, so as to insure contact only upon the line of centres of any two wheels; the edges or peripheries of the driving and driven wheels are placed between the discs, and the pressure required to produce the necessary adhesion is applied by means of the spring upon the opposite surfaces. The desired result is obtained without producing much,

if any, pressure upon the journals upon which they revolve. The discs are fixed upon a kind of universal joint, and the side pressure will therefore follow up the wear and inequalities of surface without interfering with the position of the centres of rotation.

Fig. 1 represents a front elevation of a machine arranged on the principle of the present invention; Fig. 2 represents a side elevation of the same machine; and Figs. 3, 4, and 5 are various modifications of the same principle.

To accomplish the transmission of motion only *a b* (Fig. 4) represent two shafts placed parallel to each other, the one *a* being the driver, and the other *b* the driven. On these two shafts are placed discs *c* and c^1, having their diameters less than the distance between the two shafts. The sides of these discs are bevelled so as to make them thicker near their hubs than at their periphery, as is shown by the dotted line *x*, *y*. Midway between the edges of these discs and on the plain of their shafts is placed an immediate shaft *d*. Upon this shaft are two discs, *e* and e^1, of sufficient diameter to allow them to overreach the peripheries of the discs *c* and c^1. Their faces are bevelled to fit the bevel of the discs *c* and c^1, and hence they will bear on the line of centres between each two shafts respectively, and not over any extended area, as would be the case if the discs were all flat, and touched over the surface of the segments opposed to one another. The discs *e* and e^1 are loose upon their shaft *d*, and are forced together by a powerful spring *f*, which can be compressed to any required degree by a nut and washer *g*, thus keeping up the pressure on the contact surfaces to the amount necessary for adhesion, without requiring any adjustment of the centres of the shafts *a* and *b*. The strain to produce this pressure is a tensile strain on the shaft *d*, and hence is not applied directly against the bearings of the shafts *a* and *b*, as is the case in the belt and pulley, or the ordinary plain friction gearing. The only pressure from this cause is the slight tendency to wedge out during the rolling motion on the bevelled sides. This tendency is, however, diminished by making the sides of the discs with only enough bevel to give clearance. In the operation of this form of gearing it is evident that if the shaft *a* be made to revolve, it will (from the adhesion on the contact surfaces above described) transmit its motion to the shaft *b* through the intervention of the discs *e* and e^1, which act as idlers. This represents one application of the invention, and relates only to the transmission of motion fulfilling the requirements of the first and third objects of the present invention, but is not applicable to the second object, or the furnishing a ready means of changing the relative velocity of the driver and driven. To accomplish this there are two general modes, the same in principle, but differing in application, the first of which is represented in Figs. 3 and 5, where it is shown that the discs *c* and c^1 on the shafts *a* and *b* are in diameter about two-thirds of the distance between the two shafts. Their sides are bevelled as in the former case, not in a straight line, but in a curve, making their sides convex, but still keeping them larger near the hub than at their periphery. This curve is struck from a line midway between the two shafts, as is shown by the dotted line *x*, *y*, in Fig. 3. The discs *e* and e^1 are made large enough in diameter to overlap the edges of the discs *c* and c^1 to any required amount suited to the change of velocity required. The faces of the discs *e* and e^1 are convex, and of the same curvature as the faces of the discs *c* and c^1. They are dished out in their centres, leaving only a small rim for contact surface. They are provided with the same spring *f* and nut *g*, and washer, as in the former case, but with the addition of balls and sockets *h* and h^1 in their centres, to allow their plane of motion to deviate from a right angle to their axis, or so that they may be free to wobble on their shaft *d*. Now, it is evident, that when the shaft *d* is placed midway between the shafts *a* and *b* (the diameter of the discs *c* and c^1 being the same), the motion of the shaft *a* will be transmitted to the shaft *b*, through the discs *e* and e^1, as in the former case, and the speed of the two shafts will be the same. If, however, the shaft *d* be moved towards the shaft *b*, even so far as to allow the surface contact to be quite on the extreme edge of the discs *c*, as is shown at Fig. 5, the contact surface on the disc c^1 will be near the hub, hence the arrangement will represent a wheel of a given size driving a wheel of a much smaller diameter through the intervention of an idler or loose intermediate wheel, and the speed of the driven shaft *b* will be accelerated. The reverse of this, or a diminution of speed, will take place if the shaft *d* be moved near to the shaft *a*, and the speed can also be varied to any degree between the two extremes of velocity. The reason for curving instead of bevelling the surfaces in a right line, is to insure them fitting over the contact surface on the line of centres, which would not be the case if bevelled in a right line, except in the position to which the bevels were first adapted.

Figs. 1 and 2 represent a machine arranged on the principle of the present invention, which will show the mechanic a good method of applying the principle claimed. The shafts *a* and *b* are supported in a stand *k*, the driving shaft *a* being provided with a crank *l*. The shaft *d* has its bearing in a lever *m*, whose fulcrum *n* is provided with a broad surface, so that it may be tightened up in any required position by the bolt and nut *o*. The lever *m* is of such a length between the fulcrum and the shaft *d*, as to make the centre of the shaft *d* deviate as little as possible from the plane of the shaft *a* and *b* within the limits of its motion between them. To illustrate its operation, if motion be given to the driving shaft *a* by means of the crank *l*, the speed of the driven shaft *b* can be decreased or increased by moving the lever *m* to or from the driving shaft.

THE HARTLEY ENGINE BEAM.

At the inquest, on Wednesday, into the causes of the Hartley Colliery accident, Mr. John Short, the enginewright, was recalled, and gave the following dimensions of the engine and beam:—The engine was of 300-horse power. The diameter of the cylinder was 86¼in., with a 10-ft. stroke inside, 9ft. 3in. outside, and seven strokes per minute. The beam was cast by Messrs. Losh, Wilson, and Bell, of the Walker Ironworks. Its weight was 42 tons. The weight which it had to lift, including the "spears" and the column of water, was 43 tons 18 cwt., and it was calculated to carry at least three times that weight, if not more. The length of the beam was 34ft. 6in., and the vertical section in the centre where it broke was 8ft. 2in. It was formed of two separate sides joined together by bolts and studs. The diameter of the piston rod was 9¼in., and its weight 4,816 lb. The weight of the piston was the same, and the weight of the cross-head, which was of malleable iron, and was fractured by the accident, 1,904 lb. The cap of the cross-head, which was also fractured, was 4¾in. thick on the top side, and 3½ on the under side. The main dry spears or pumping rods were 14in. square, and the bottom spears 10in. square. They were of Memel pine. The pumps in the staple worked from the cylinder, and were not disturbed by the accident. The load of the engine was balanced by a counter beam and by a metal catch-pin. The bottom and middle pumps were 24in. diameter in the barrel, and the staple pumps 20in. The steam was condensed on both sides of the cylinder. Mr. Short reiterated his opinion that the spears broke before the beam. The face of the fracture was quite bright, and there were no indications of a previous crack.

Mr. T. Hoskings, C.E., chief engineer to Messrs. Hawks, Crawshay, and Sons, was next called. He said that he had minutely examined the whole of the beam, and was of opinion that the metal was of very fair quality and would be calculated to carry a weight considerably greater—at least four times as great—than that which it was carrying at the time of the accident. A sudden check, operating with other causes, would be very likely to cause it to break. He did not believe that the slipping down of the beam from the hydraulics when it was raised three inches out of the brasses would have fractured it, and certainly if there had been a crack then it would have gone on to complete fracture long before the accident, which he understood was several weeks after. The face of the fracture was quite bright, but if there had been a crack before it would have been rusted by the atmosphere. The sides of the beam were what were called opens and castings, which would not be so strong as box castings. The cavities in the beam revealed by the fracture had occurred from the contraction of the fluid metal during the process of cooling. Such cavities would always occur in cooling where there was a large section to cast, unless the metal abstracted by the contraction were supplied by a process of feeding. That might prevent such cavities occurring to a certain extent, but not altogether. The centre gudgeons or axles of the beam had been wedged and keyed into a hexagon-hole in the beam. This must have required very great force, so much so that their heads showed strong marks of the "swages" used to drive them. The effect of this would be to throw an enormous strain on the cohesion of the metal surrounding the gudgeon-hole, and probably it would be one of the causes assisting to break the beam. In addition to that the angular shape of the gudgeon-hole was unfavourable to its strength; a circular hole would have been the best. Two of the angles of the gudgeon-hole, those at the top and bottom, coincided with the line of fracture. The modern practice in fitting these gudgeons on axles was to bore a circular hole in the beam, turn the gudgeon to fit, and then simply secure it by one key. That mode threw the least possible tension on the metal.

On being asked his opinion of the cause of the fracture, Mr. Hoskings said there must have been two or three causes in operation. In the first place he thought the gudgeon had been unduly keyed — driven home with unnecessary force. There had also been a want of due distribution of metal; there was too much metal in the centre bore, and the vertically curved ribs along it, instead of adding to its strength, would impoverish the metal in the line of the fracture. If the gudgeon worked hot—which he had been told was the case—a slight expansion would thus be produced, and, with the tight keying, this would be another operating cause of the fracture, especially at the time when it took place, there being a severe frost.

Mr. Hoskings did not think that the pumps had got wedged, but the bottom spear had given way, judging from the fracture he had seen, from the weight which was on it. The wood did not appear to be of the best quality. The engine would thus be relieved from the outside weight, and the beam would strike violently on the spring beam inside, producing a severe shock, which, taken in combination with the causes he had before referred to, sufficiently accounted for the accident. A very slight and comparatively inexpensive engineering arrangement would be quite enough to prevent beams from falling under similar circumstances. Either a strong scaffolding might be built underneath, or it might be secured by trusses and iron bridles; but, in one way or another, it would be the easiest thing in the world to secure a beam working in such a dangerous position so that it could not fall down the shaft, if it should unhappily break in a similar manner.

Mr. Thomas Clark, ironfounder, of Newcastle, said the quality of the metal was very good. That was shown by the fracture, for any cast-iron which possessed strength showed an irregularity in the fracture; and, in looking at the beam, he had observed a great many fragments still hanging to it, not broken entirely away. This showed great tenacity. The appearance, too, of the section of the fracture was very favourable as to its casting, and its colour also indicated good iron.

The explanation given by Mr. J. H. Murray, Chester-le-street, ironfounder, of the cause of the fracture, differed slightly from Mr. Hoskings' account. The beam had certainly not been broken by its usual work, but by concussion. When the engine lost her load in the pit the piston would strike violently on the bottom of the cylinder, and then the beam would be broken. The fracture of the cross-beam, he thought, proved this. The proportions of the beam were very good, though it would have been improved by the addition of more metal in the centre.

Mr. Blackwell remarked that he could not agree with the witness that the piston had struck the cylinder. The spring beam had received a very severe blow, as he should be able to show.

The next witness called was Mr. H. Warence, of the Walker Ironworks (where the beam was cast), who produced an entry from the books of the firm showing the composition of the casting was one-third Blenarven No. 3, cold blast, and two-thirds No. 1 O.M.O. Scotch.

NEW BLACKFRIARS BRIDGE.

On Thursday, the 31st ult., a special meeting of the members of the Common Council was convened at Guildhall, the Right. Hon. the Lord Mayor in the chair, to consider the report of the Bridge-house Estates Committee, made on the 12th of December, on the reference to them to obtain designs and estimates for the construction of a new bridge at Blackfriars, and recommending for adoption a design of Mr. Thomas Page for an iron bridge of three arches, at the estimated cost of £245,000. For some time past this question has attracted considerable interest and given rise to much contention among the members of the corporation. With the Common Council rests the approval or rejection of the report of the committee recommending Mr. Page's design, and their decision is anticipated with some curiosity and anxiety. Substantially the issue raised is whether there shall be a bridge of three arches or of five across the Thames at Blackfriars in the place of the present ricketty structure.

Mr. H. Wellington Vallance, Chairman of the Bridge-house Estates Committee, producing their report, said the subject was so important as to need no apology for convening a special court for its careful consideration. Reverting briefly to the circumstances out of which his motion, agreed to by the court on the 4th of March last, had arisen, for the removal of the present Blackfriars Bridge and the construction of another on its site, he stated that the London, Dover, and Chatham Railway Company had obtained statutory powers to make their railway and extensions, and to cross the river Thames by means of a bridge in close proximity to that of Blackfriars, namely, at no greater distance than 105ft. from it. Whether that legislation were wise or not it was too late late to say. The bridge for carrying the railway across the river was required by statute to be erected according to a plan and elevation to be approved by the Admiralty, the Court of Common Council, and the conservators of the river Thames. The court would see that such sanction was requisite in the interests of the general public and of the ancient and no less valuable public rights and privileges of the Corporation of London. Mr. Joseph Cubitt, representing the railway company before the committee as their civil engineer, produced a drawing of the proposed bridge of nine arches, to be built by the company, and having no less than eight piers in the river. He (Mr. Vallance), as chairman of the committee, started back at such a proposal, and unhesitatingly denounced it as so objectionable that it could not be expected to receive the sanction of the Court of Common Council. It became obvious that it would be better to remove the existing but failing structure, and with it take away the pretence for the inappropriate design to be accepted. The necessity was, therefore, once more forced upon the committee of avoiding the waste of thousands and thousands of pounds in so-called repairs for the maintenance of a structure wholly inadequate to the public wants, either for the navigation under or the traffic over it. Mr. Vallance then related the proceedings of the committee, their selection of the most eminent men that could be found, to whom invitations were sent for plans and designs, merely indicating to them the terms of the reference, and leaving full scope, in all respects, for the exercise of individual skill and experience. Eventually, having the whole subject before them, with the designs and plans sent in, the committee carefully deliberated upon it for many months, and decided, at last, on recommending the design of Mr. Page for adoption. Mr. Vallance explained that a subsequent reduction of Mr. Page's estimate took place prior to his knowledge of Mr. Cubitt's estimate. The estimates, variable as the designs themselves, varied from £84,000 to £410,000—the former being Mr. Brunlees', the latter Sir John Rennie's. The estimate, however, could only be taken as honestly and reasonably approximate and no more. The Chamberlain, who had investigated the question of finance, had reported to the committee that a sum could be raised on the surplus rents of the Bridge-house Estates more than sufficient to meet the estimated outlay of £245,000 for the erection of the new bridge, without infringing on the City's cash, or having recourse to indirect taxation, or even to the all-powerful Metropolitan Board of Works. He (Mr. Vallance) then invited the assent of the court to the report, having regard chiefly to the *desideratu* to be attained, namely, facilities for the traffic over and the navigation under the proposed bridge, elegance of structure, durability, economy of cost, and the minimum of time required for construction. He also urged the desirability of a bridge with iron arches, rather than one of stone; of its having not more than three arches; and the propriety of adopting Mr. Page's design. His (Mr. Vallance's) preference of an iron over a stone bridge was mainly dependent upon the facts that iron was less expensive, that a bridge of iron could be constructed in a fourth of the time of a stone one, and that the haunches of the arches, not being so large, would offer less impediment to navigation. As to durability, he would only direct their close inspection of the granite on the present bridges to see its integral decomposition. The court were now as able as they would ever be to determine the question of a stone bridge or an iron one. The engineers had proved their opinions were as four to one on the subject, there being only four designs for a stone against sixteen designs for iron bridges. Looking at the reports they had received from engineers of such acknowledged eminence, it seemed puerile, if not an insult, to propose that they should have recourse to further professional aid to solve the question whether the proposed bridge should be of three arches or of five. For himself, on that question he had, after great consideration, made up his mind, and he was content calmly to found his acquiescence in this proposition upon the evidence given by Sir John Rennie, Mr. Fowler, Mr. Hawkshaw, Mr. P. W. Barlow, and Mr. Page, all of whom had sent in designs for three-arch bridges. He concluded by moving the adoption of the report, and that it be referred back to the committee to modify the design, if deemed expedient on further information, such modification afterwards to be sanctioned by the court; in the meanwhile to take the requisite steps for obtaining such Parliamentary powers as may be necessary.

Deputy Fry, a member of the committee, rose to move an amendment. It was with some regret that he felt it his duty to oppose the adoption of the report. On a matter so important he asked every member of the court to hold his judgment in suspense until the debate was concluded, adding that many of the members of the committee who had signed the report had done so with great uncertainty and anxiety. He complained that on the day on which the committee came to a decision there was no notice on their paper of business that they were about to select finally a plan involving an expenditure of about £500,000. That was the only meeting from which he (Deputy Fry) was absent, and he was then attending another meeting of the corporation; but had he been aware that the committee were then to come to an irrevocable conclusion he should have foregone every other consideration to be present. It was under these circumstances that they decided on adopting Mr. Page's design. The wrong done was that no less than twenty plans by men of the first engineering skill of the day were submitted to non-professional and unpractical men, including himself, who on a great engineering question knew nothing whatever. He tried hard to induce the committee to take the professional advice of Mr. Bunning, the City architect, a gentleman of high repute, on the engineering questions involved in the different plans, but without success. Another point was worthy of notice. The original estimate of the cost of Mr. Page's bridge was £285,000; the estimated cost of that of Mr. Cubitt was £245,000. The various estimates were afterwards bruited about, and just before the committee came to a decision a letter was sent by Mr. Page to the chairman—not to them—to the effect that he had made a grievous mistake in his calculation, and that he would do the work for £245,000, the precise amount of Mr. Cubitt's estimate. He (Deputy Fry) was not there to say how that occurred, but to him it appeared passing strange. On Mr. Page's original design a great deal of artistic embellishment, calculated merely to attract the eye, had been lavished, but he afterwards sent in an estimate for a bridge devoid of ornamentation. Coming to the question of a bridge of three arches or of five, it was remarkable that, of the whole twenty designs sent in, all by distinguished engineers, there were but two for a bridge of three arches. All the other competitors sent in designs for a bridge of three arches, and also of five, Mr. Page himself being among the number. Deputy Fry, turning to the question of water-way, contended that in a three arched bridge the spring of the arches came so low that in very high tides, for a considerable way on each side of the piers, though there was water, there would be in fact no waterway, and vessels would only be able to pass under the very centre of the arch. Mr. Page himself in his estimate made the admission, speaking of the eight bridges across the Thames, that "the least waterway is that of Southwark Bridge, but the great spans of the arches probably more than counterbalance the difference." He (Deputy Fry) submitted that this question ought to turn upon ascertained facts, and not upon mere probabilities. With regard to the important question of material Mr. Page in the estimate of his three-arched bridge said, "The structure of the arches would be in cast iron from the piers to within 40ft. of the crown, the centre-piece forming the key of the arch 80ft. in length, being of wrought iron; so that the thinnest part of the bridge, which is in immediate contiguity with the roadway, and consequently subject to any shocks from the traffic, would be of the most safe material." Did not that mean that there was some material which might be less safe? When Mr. Page committed himself to such a doctrine he (Deputy Fry) thought the court would do well to pause before sanctioning his design. What did Mr. Barlow, an eminent engineer, say with respect to the use of cast iron? "It is now admitted that cast iron is not trustworthy when any responsible duty has to be performed, and its use is entirely abandoned in all girders, and nearly, or quite so, in arches. The great objections to it are that, being cast metal, whatever care is used it is liable to strains arising in the material itself from unequal contraction in cooling, which sometimes fractures the material without its having any weight to sustain; and, secondly, it is less rigid than manufactured iron, and liable to more vibration." On the subject of gradients, that of Mr. Page's proposed bridge on the Surrey side of it was such that the roadway, he had been told, would have to be raised nearly as far as the first-floor windows of some of the houses in the Blackfriars-road. For these reasons he (Deputy Fry) submitted that the court was not yet in a position to commit itself to any definite plan in a matter involving so enormous an outlay as £300,000, and that before giving their sanction to any design for a bridge they ought to be convinced that it was one which would most answer the public requirements, and for generations to come reflect credit on the city of London. He moved as an amendment—"That the report be referred back to the committee, with instructions further to examine the whole of the plans and estimates with professional assistance, to confer with the various engineers who have furnished the designs, to reconsider the whole subject, and report thereon to the court."

Mr. Kearns complained that the committee, of which he was a member, had been completely surprised into the adoption of Mr. Page's design. On the 19th of July the committee had all the plans before them from which to make a selection. At their meeting on the 26th a member, without the slightest previous notice, proposed the adoption of Mr. Page's design. Shocked at the abruptness of the proposition, he (Mr. Kearns) urged the committee, but without success, to pause before adopting any particular plan, while they had before them the designs of so many eminent engineers. What was done? The committee on that day, by a majority, approved the design of Mr. Page, and immediately afterwards the rest of the designs were hermetically sealed, and the members were never again permitted to see them. As to the corrected estimate which Mr. Page was allowed to send in, it would only have been ordinarily just for the committee, before adopting that estimate, to ask the rest of the engineers if they had any corrected estimates to give. Seeing that this was a purely engineering question, he (Mr. Kearns) moved, in the first instance, the appointment of a sub-committee, who, with the

assistance of the City architect, should go carefully into the plans and report to the general committee. Overruled in that by a majority of 14 to 6, he afterwards appealed to the committee not to urge on recklessly before the Common Council a plan so objectionable as that of Mr. Page, as he conceived, but without avail. On the 7th of November, however, mainly at his instance, the committee agreed to delay their report recommending Mr. Page's plan to the Common Council. A chance then arose at last of doing right in the matter; but on the 14th November, when the committee were to have had a meeting, their chairman (Mr. Vallance) did not call them together—why, he (Mr. Kearns) could not imagine. On the 29th of November, when they next met, on the strength of petitions to them signed by a number of watermen, the committee determined upon making their report to the council. Now he found that the same electioneering agency had been practised on the members of the Common Council as on the committee. Mr. Kearns related some amusing instances of how watermen had been induced, or, as he said, seduced in signing petitions in favour of a three-arched bridge when they really thought they were signing for one of five arches; and he cited, amidst some laughter, the written recantation in support of five arches of Mr. Sawyer, superintendent of the Iron Steamboat Company. He (Mr. Kearns) submitted that the proposed bridge should be considered beforehand strictly with reference to the contemplated embankment of both sides of the Thames, and that it would be a perpetual subject of regret and of censure if a structure were erected to which the embankment could not be adapted. Adverting to the question of gradients, he pointed out that the proposed bridge, while professedly 5ft. lower in the centre than the existing one, and 4ft. 6in. lower in the side arches, would be 3ft. 6in higher than it on the Surrey side. They were asked to adopt a centre arch of 280ft. span and the lesser arches each of 220ft., the result of which would be unnecessarily to heighten the roadway, which was exceedingly objectionable, and without increasing the facilities for navigation. With a centre arch of a span so great as 280ft. they must of necessity have piers large enough to sustain so ponderous a burden, and these would detract so much the more from the tidal way. In London-bridge—unsurpassed for durability and elegance—they had all that was required, both with respect to waterway and roadway, and yet its centre arch was not more than 152ft. What possible reason could there be for raising a needless engineering difficulty? Mr. Kearns then pointed out in some detail what he conceived to be the inconveniences and dangers in the river navigation of Southwark, a three-arched bridge, in the immediate vicinity of which he had carried on his business for years. He particularly adverted to the tidal wave caused by steamers, and unbroken by piers, as in the other bridges, spreading to the shore on each side, and disturbing the craft delivering merchandise at the wharves, and to the danger to life by the peculiar rapidity of the current there at times. What was wanted in a bridge was utility and not grandeur. If they must have an arch of 280ft. they could not have the higher spring which would afford facilities for navigation.

The debate, at the suggestion of the Lord Mayor, was at this point adjourned for a fortnight.

RAILWAYS AND PASSENGERS.—The *Leeds Intelligencer* has been writing a series of articles under this heading, and in one lately published, says:—In the first of these articles we drew attention to the peculiarity of the railway wheel as differing from all others, and to the unsatisfactory working of a rigid wheel upon an uneven rail. The wear and tear which results to rail, wheel, and axle is something enormous, and the discomfort of the motion most people can declare for themselves. It is, therefore, strange that when a remedy is offered for such a serious evil, it should be obstinately rejected. We allude to a wheel invented by a sound engineer (and most vigorous writer), Mr. Bridges Adams, having springs, or rather a circular spring, between the tire and the body of the wheel, which breaks the force of the blows whether vertical or lateral. In other words the tire has a sufficient amount of "play" for it to yield to the inequalities of both the *surface* of the rail, and the *side* of the rail. The results are that the face of the tire, and the face of the rail, which by mutual concussion now so rapidly wear out, are both saved; the flange of the wheel is no longer stripped off by the lateral projections of the rail; and as the wheels no longer jump, but roll, the train runs easily along with comparatively little vibration. It is a fact that by this invention an inferior and low priced iron works perfectly well, and lasts beyond comparison longer than the hardest and most expensive metal on the old method. Its practical value is freely admitted, yet because juries exact such enormous compensation for injuries, if there be any departure from the established system, the companies really dare not introduce it. This, at any rate, is their excuse—how far prejudice and vested interests are concerned, we had better not inquire too closely. As regards safety no objection has been offered. Even if the tire should break, it could not fly off—a common cause of accident—but of this there is little danger even in frost, as the tire is put on cold, with the fibres of the metal in a state of rest, and uninjured, whereas the ordinary tire is strained on hot, with the fibres in a state of tension, and therefore of weakness. It has been in actual service, not for a few months merely, but for six years, on several lines, and applied to engines as well as carriages, and has stood the severest tests that could be applied to it. In fact the principle is scientifically correct, and therefore *must* answer. We may add that the original cost is less than the regulation wheel, while the wearing power is from 100 to 400 per cent. greater, to say nothing of the saving to the rail, which is in similar proportion. Its economy is a consideration for shareholders, its comfort is a consideration for the public, and on any theory of forces the two combined should be powerful enough to overcome the *vis inertiæ* of directors and engineers. To return to the *Lancet*. Numerous cases are cited in proof of the statements previously made that predisposition to disease is greatly exaggerated by railway travelling. Most persons are familiar with the noise and singing in the ears, and sometimes inability to sleep, which follow after a long journey. These symptoms are generally slight, and yield to ordinary rest, but they are indications of brain disturbance, more or less trivial, as the case may be. When the journeys are frequent they often assume a violent form; thus, in one instance reported, they were accompanied by numbness of the limbs and great depression of mind, and a paralytic seizure seemed probable. The gentleman was living at Brighton, but came to London daily on business, and was advised to give up travelling, and live in town for a while. One by one the symptoms gave way, and finally disappeared, when he was persuaded to join his family at Brighton, travelling as before. The work was rapidly undone, and he was again compelled to live in town; however, with no other treatment than simple restraint from travelling, he was shortly as well as ever. Various reasons induced him once more to try a residence at Brighton, but as brain affection showed itself almost immediately, he finally renounced the plan, and took up his permanent residence in London, with the result as before of fully restored health. Much shorter journeys have been found to produce the same consequences on men of weak constitution—half an hour's ride in a first-class carriage for example, if undertaken daily, will shelve men who otherwise can undertake their six or eight hours of business duties without inconvenience. It will be at once said that it is the actual travelling, and not the *mode* of travelling that is to blame. But it is distinctly proved that coach travelling does not produce the same effects. Dr. Anthony refers to an epileptic patient who travelled on the Continent some years ago, and so long as he kept to his chariot did not suffer from his malady more than usual, but a short journey by rail was certain to be followed by epileptic seizure—sometimes the attack would come on before he left the carriage. To mark the fact more strongly, these fits were always much the most severe, and made sad havoc of the patient. Any other mode of conveyance was harmless, so that the railway was entirely abandoned, though often at serious inconvenience.

RAILWAY MATTERS.

THE Midland dividend is to be at the rate of 7 per cent. per annum.

THE Lancashire and Yorkshire dividend is to be at the rate of 5 per cent. per annum.

THE Portuguese Government have arranged with the Union Bank to place £4,500,000 of bonds in London, the money being intended for expenditure on railways.

A WORKMAN was run over and killed, on Saturday, in the Midland Railway tunnel, about midway between Belper and Duffield. Another workman had his arm fearfully shattered.

A MEETING of the Shrewsbury and Hereford proprietors has been held, and resolutions passed to oppose the lease of that line to the London and North Western, unless all the new shares lately authorised are called up in full.

THE works on the extension of the Halsted and Colne Valley line from Castle Hedingham to Haverhill are being actively pushed forward, and in the course of the present week from 100 to 200 additional men have been set to work. It is expected that the line will be opened from Castle Hedingham to Yeldham early in the summer, and to Haverhill before the close of the year.

THE Great Northern dividend is expected to be, viz., at the rate of £7 15s. per cent. per annum on the original stock of the company, giving for the half-year £3 17s. 6d. per cent. to the original stock; £3 per cent. to the B stock; and £4 15s. per cent. to the A stock. These rates will make the dividend for the whole year 1861 as follows, viz., £5 15s. per cent. on the original stock; £6 per cent. on the B stock; and £5 10s. per cent. on the A stock.

A PROSPECTUS has been issued of the Bristol Port Railway and Pier Company, with a capital of £125,000 in shares of £10. The object is to obviate the delay and inconvenience of the present water transit from the mouth of the Avon to the city and docks of Bristol. The line, which will be 5½ miles through an attractive district for building purposes, has been strongly recommended by leading engineers as an essential work for the prosperity of the port.

A PROSPECTUS has been issued of a new Italian line, to be called the Turin and Savona Railway, with a capital of £2,408,000, including £368,000 for a branch to Aqui. Of this sum £480,000 will be a subvention or free gift from the Government and communes, £800,000 in shares, and the remainder in obligations, of which £368,000, the sum required for the Aqui branch, is to enjoy a Government guarantee. The distance from Turin to the port of Savona is 90 miles, and the branch to Aqui will be 30 miles, making a total length of 120 miles.

AT the Brighton meeting the chairman, in reply to the various observations, stated that millions of passengers had been carried to and from the Crystal Palace without accident. The gradients on the Crystal Palace line were 1 in 65, and they never allowed more than 13 carriages to a train drawn by their most powerful engines; they sometimes carried more than 40,000 passengers in a day, and it would not do to overload any train to the Crystal Palace, as that might stop the traffic. There were 37 trains daily from the Victoria station, and by waiting a short time for the next train first-class passengers could obtain first-class accommodation.

THE Bristol and Exeter dividend is expected to be at the rate of 5 per cent. The report of the directors of the Stockton and Darlington Railway states that the receipts for the half-year ending the 31st of December, including £558 from the preceding half-year, amount to £215,342. The expenditure, including interest, amounts to £116,502, leaving a balance, after payment of the preferential and guaranteed dividends, of £49,000, out of which the directors recommend a dividend at the rate of 8½ per cent. per annum (making the dividend 8¾ per cent. for the year 1861), leaving a balance of £1,346. The arrangements entered into with the North-Eastern Company have been cordially carried out during the past year. The Eden Valley line from Kirby Stephen to Penrith will probably be opened for traffic next month. The capital account shows that £3,144,470 had been expended to the 31st of December last, leaving a balance in hand of £145,910.

THE North-Eastern directors state in their report that the traffic receipts for the past half-year show a decrease of £17,219, and the expenses an increase of £8,237, as compared with the corresponding half of the preceding year, showing a falling off in the net receipts of £25,456. The balances available for dividend on the revenue accounts of the several sections were as follows, namely, on the Berwick section, £188,611, and on the Thirsk and Malton account, in the same section, £1,634; on the York section, £72,611; and on the Leeds section, £19,896. The directors recommend that the following dividends be declared, viz., on the Berwick ordinary stock at the rate of 5 per cent. per annum, leaving £6,895, and on the Thirsk and Malton stock at the rate of 4 per cent. per annum, leaving £634; on the York ordinary stock at the rate of 4½ per cent. per annum, leaving £383; on the Leeds ordinary stock at the rate of 2¾ per cent. per annum, leaving £730 to be carried forward to next account.

THE Severn Valley Railway, extending from the West Midland, at Hartlebury, to Shrewsbury, a distance of about forty miles, was, on Friday, opened throughout for public traffic, amid the usual rejoicings. The first train started from Worcester, with the officials of the line, at eleven o'clock, and proceeded along the new line past Hartlebury, to Stourport, Bewdley, Arley, Highley, Hemton, Bridgnorth, Coalport, Ironbridge, and Berrington, arriving at Shrewsbury at two o'clock, and on returning to Bridgnorth, a public dinner was provided, at which the Mayor presided. The line is constructed on the narrow gauge, and is a single line throughout, though the bridges and viaducts are built for a double line. Mr. J. Fowler is the engineer, and Messrs. Brassey and Field are the contractors. The gradients are generally good, but there are some sharp curves on the line, occasioned by its following the course of the Severn, for a considerable distance. It enters the valley of the Severn at Bewdley, and crosses the river by an iron bridge of one arch 200ft. span. The line continues on the west side of the river, and, until it runs into the Shrewsbury and Hereford Railway, about a mile from Shrewsbury. The line is worked by the West Midland Company.

The traffic receipts of railways in the kingdom amounted for the week ending the 25th of January, on 10,059 miles to £458,782, and for the corresponding week of last year, on 9,846 miles, to £476,917, showing an increase of 213 miles and a decrease of £18,185. The gross receipts on the following fourteen railways amounted in the aggregate, on 6,406 miles, to £344,242, and for the corresponding week of 1861, on 6,274 miles, to £363,399, showing an increase of 132 miles and a decrease of £19,157. The decrease on the Caledonian Railway amounted to £701; on the Great Northern to £1,824; on the Great Western and West Midland to £432; on the Great Southern and Western to £150; on the Lancashire and Yorkshire to £4,537; on the London and North-Western to £6,629; on the London and South-Western to £147; on the Manchester, Sheffield, and Lincolnshire to £1,125; on the Midland to £2,610; on the North-Eastern to £1,983; and on the South-Eastern to £1,020: total, £21,158. But from this must be deducted £755, the increase on the Eastern Counties; £1,208 on the London, Brighton, and South Coast; and £38 on the North British; together, £2,001; leaving the decrease, as above, £19,157. The goods and mineral traffic on those lines amounted to £194,533, and for the corresponding week of 1861 to £212,682, showing a decrease of £18,149. The receipts for passengers, parcels, &c., amounted to £149,709, against £150,717, showing a decrease of £1,008. The traffic receipts on sixty-six other lines amounted, on 3,653 miles, to £114,490, and for the corresponding week of last year, on 3,572 miles, to £113,518, showing an increase of eighty-one miles and £972. These figures show a considerable falling off in the traffic of the past week as compared with the corresponding period of 1861. The chief falling off has been in the goods traffic, showing that it has been caused by the depression of trade in the manufacturing districts. The traffic receipts of the past week exhibit a decrease of £1,887, as compared with those of the preceding week ending the 18th of January.

RAILWAY BILLS.

THE following railway bills have been disposed of since our last by the examining barristers of the Houses of Lords and Commons:—

LONDON AND NORTH-WESTERN.—To enable the company to construct the following additional railways, viz., a line from Beeston to the Farnley Ironworks, in the West Riding of Yorkshire; a line to connect the Chelford and Knutsford line with the Cheshire Midland: a line to connect the Stour Valley with the Birmingham Canal Navigation; an embankment along the north-west side of the old harbour of Holyhead, together with a deviation in the South Leicestershire Railway, and other deviations; to raise an additional capital of £253,000, and to borrow £83,000.

LANCASHIRE AND YORKSHIRE.—To construct railways from Askern Junction to the Rawcliffe station of the Wakefield, Pontefract, and Goole Railway, and from near Goole to the Hull and Selby at Cave Sands, to raise £248,000, and borrow £82,000.

MID-KENT AND ADDISCOMBE.—For a railway from Beckenham to Croydon, and to raise £45,000.

EASTERN COUNTIES.—For two new lines in Middlesex, the first commencing by a junction with the Northern and Eastern at Tottenham, and terminating by a junction with the North London at Hackney; the second commencing at Edmonton and terminating at Tottenham. To raise on shares £160,000, and to borrow £53,000; also to subscribe to the North London extension £300,000, and £100,000 on loan.

METROPOLITAN.—To acquire lands and houses in the parishes of St. Sepulchre and St. Botolph, Aldersgate, near the northern side of Long-lane, between Charterhouse-street and Goswell-street, near the western side of Coppice-row, and to raise £300,000 by the creation of preference shares.

RICKMANSWORTH, AMERSHAM, AND CHESHAM.—For a line between these places, with a capital of £91,000 and loan of £31,000, and for arrangements with the London and North-Western.

EASTERN COUNTIES.—To vest in the company the powers of the Epping Railway Company, to abandon the railway from Epping to Great Dunmow, to make a railway to Crouch-street, Colchester, to raise £140,000 by shares, and borrow £46,600.

NEWPORT AND RYDE.—To construct a railway from Newport to Ryde, in the Isle of Wight, and to raise £100,000.

CANNOCK CHASE EXTENSION.—To make a railway to connect the Cannock Chase Railway with the South Staffordshire Railway, and to raise £40,000.

MIDLAND.—To make three new railways: the first from Duffield to a junction with Manchester and Midland Railways: the second from Great Bowden, in Leicestershire, to near Market Harborough; and the third from the Bristol and Birmingham to a junction with the Birmingham Extension; to raise a further capital of £120,000 in new shares, and to borrow £40,000.

NORTH-EASTERN.—For new lines between Blaydon and Conside, with branches; to raise £165,000, and borrow £55,000.

BISHOP'S WALTHAM, BOTLEY, AND BURSLEDON.—For a railway between these points, in connexion with the London and South-Western, at a cost of £60,000.

GARSTON AND LIVERPOOL.—To authorise the abandonment of a portion of the line.

LONDON, CHATHAM, AND DOVER AND ST. MARY CRAY.—To lease the line from Bromley to St. Mary Cray to the London, Chatham, and Dover Railway Company, and to issue new shares not exceeding the aggregate capital of the Cray Company.

NORTH-EASTERN.—To construct the Team Valley and other branch railways in Durham, to raise £400,000, and to borrow £133,000. The company's second bill is for leasing the Hull and Holderness Railway.

BISHOP'S WALTHAM, BOTTLEY, AND BURSLEDON (WEST SHROPSHIRE MINERAL).—For making railways, at a cost of £180,000, and to borrow £60,000 on loan.

THE other bills passed were those of the London Railway Depot and Storehouses (for the relinquishment of the street and railway they were authorised to make by their Act of 1860, in favour of the Corporation of London, who undertake to do it); Llanidloes and Newton, Mid-Wales, and Manchester and Milford (a joint station at Llanidloes, and to raise £32,000); Edinburgh, Perth, and Dundee, and Fife and Kinross (amalgamation); Newry and Armagh (deviations); Uxbridge and Rickmansworth (deviations); West Midland and Severn Valley (to alter terms of lease); Somerset Central and Dorset Central (amalgamation); Severn and Wye (to enlarge harbour at Lydney); London, Tilbury, and Southend; Llanelly; Deeside; Great Western and Andover and Redbridge (for leasing the latter to the former); Edinburgh and Glasgow (for a railway to Dunfermline by Queensferry and subsidiary branches, and an increased capital of £250,000); Burton-on-Trent (for a railway between the breweries of Messrs. Bass and the Midland Railway); Keighley and Worth Valley (to raise £48,000); Ulster and Banbridge, Lisburn and Belfast (for leasing the latter to the former); North-Eastern and Newcastle-on-Tyne (amalgamation); Eastern Counties and East Anglian, Eastern Union, Norfolk, and Newmarket (amalgamation); North-Eastern (branches to Hull and Doncaster); to Market Weighton and Beverley; Great Southern and Western and Limerick and Castleconnell, and Hereford (for lease to the London and North Western); the Shrewsbury and Welchpool (to widen and improve their main line and to raise £80,000); the Newtown and Machynleth (to make agreements with the Great Western Company); the Furness (to enable them to make a branch line to Hawcoat Quarry, to vest in them the Ulverstone line, to enable them to purchase and hold steam-vessels, to raise £142,000, and borrow £40,000); Furness and Coniston (amalgamation); Oswestry and Newtown, Llanidloes and Newtown, and Shrewsbury, and Welchpool Amalgamation, &c., with London and North-Western; the Parsonstown and Portumna (for an extension to Portumna across the Shannon, and to raise £22,000); the Enniskillen and Bundorn (for an extension to the Midland Great Western at Sligo, and to raise £150,000 and borrow £50,000); the Hereford, Hay, and Brecon (for deviations); the Dare Valley (for a line from Aberdare and branches, at an estimated cost of £40,000); the West Midland (for additional works); the Faringdon.

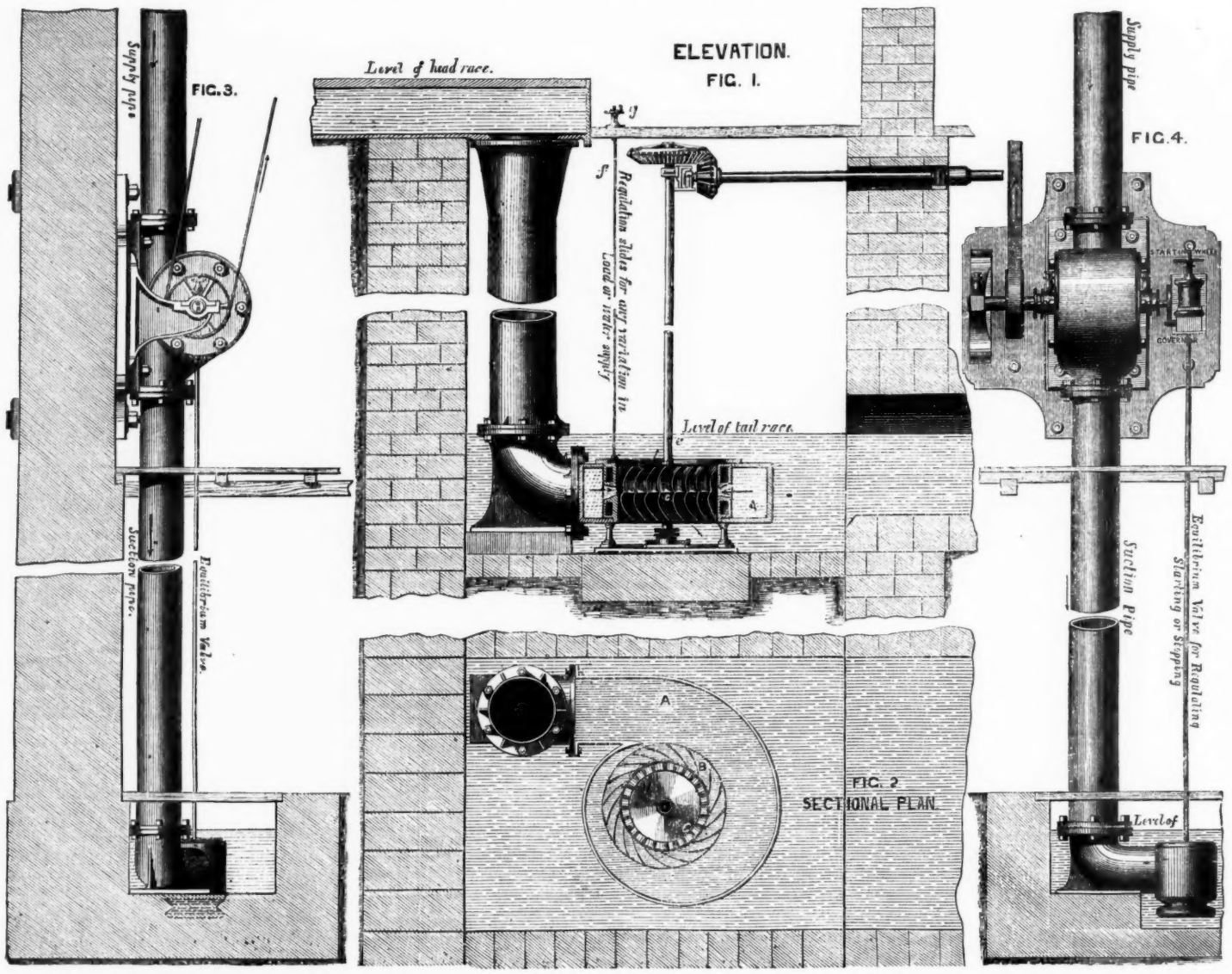
THE railway bills withdrawn were the Marton and Harbury; the Fermoy; Cork, Middleton, and Fermoy Junction; Cowes and Newport extensions, and West Galway; Carlow, Tullow, and Newtownbarry; the Southampton and Netley; the Edinburgh, Dunfermline, and Perth Junction; the Mid-Wales, for a branch line to the Manchester and Milford Railway.

IN the case of the Stafford and Uttoxeter, for a line between those places, and to raise £170,000, the standing orders were declared not complied with.

IT is stated that one of the leading ironmasters in Staffordshire is erecting a furnace in which exhaustion is to be applied at the top instead of blast at the bottom. It is not easy to see what is to be gained, while it is evident that much power will be required.

MAJOR WALTER'S WORLD'S BAROMETER AND WEATHER INDICATOR.—While the Admiralty, very properly as the branch of a paternal Government, are rendering unerringly efficient a course of cautionary storm signals for our coasts, Major Walter, the scientific and intelligent meteorologist of Liverpool, is introducing into the homes of the wealthy and middle classes the means of watching the weather, and anticipating its varied changes. Although the indicatory table of Major Walter's instrument, placed side by side with the sensitive mercurial tubes, have cost years of patient thought and research, a youth may, with the greatest facility, arrive at the premonitory facts. Indeed few things which appeared during the last century have done more to familiarise the science of meteorology, and the new era which the Government has so well inaugurated has received one of its most valuable auxiliary contributions from the hands of Major Walter. The effect of the weather during the last 20 years upon the corn returns here practicalised is fraught with suggestive advantages

SCHIELE'S TURBINE WATER WHEEL.



The illustrations show two modifications of Schiele's patent turbine water-wheel, manufactured by the North Moor Foundry Company, Oldham.

Fig. 1 is an elevation of a turbine with a vertical shaft, with the casing around the wheel shown in section. Fig 2 is a plan of the same, corresponding to Fig. 1, showing the casing around the wheel in horizontal section.

Fig. 3 is an elevation of a turbine with horizontal shaft, and Fig. 4 is an elevation of the same at right angles to Fig. 3. This turbine is shown fixed against a wall at some distance above the level of the tail-race, that part of the water-column below the turbine acting by suction as hereafter explained. The water being conveyed to and from it in pipes, it may be fixed in any position, as most convenient, either to a wall as shown, or on the ground level, or to the beams of a roof. The pipes can, of course, be placed obliquely at any angle to suit the locality.

The action of the wheel, as shown in Figs. 1 and 2, is as follows:—The water is conducted to the turbine either in an open canal, or, as is more generally the case, in a range of piping passing to the horizontal spiral water-chamber A surrounding the wheel, from which it is guided, by properly constructed guide vanes B, against the bucket or vanes C of the wheel, so that it enters the same in the middle, without any shock, and gives off its power by a steady pressure, while it is passing along the curved vanes or buckets, one half passing upwards and the other half downwards to the tail-race. In thus entering in the middle of the buckets, and acting towards both sides, the water exerts no pressure whatever on the footstep. In the "Jonval" turbine, which is acknowledged to be one of the best construction of turbines, the whole column of water presses on the footstep, and thereby causes much inconvenience in keeping the footstep in order, particularly at high falls. In Schiele's turbines the vanes of the wheel are similar in shape to the vanes of the "Jonval" turbine, and the action of the water along the buckets on each half of the wheel is exactly like its action in the "Jonval" turbine. But, by introducing the water on the middle of the wheel, all difficulties arising from the column of water acting from above the wheel are avoided, as the pressure of one-half the quantity of water flowing through the buckets upwards balances the pressure of the water flowing downwards, so that no pressure is exerted by the water on the footstep. Again, where the weight of the turbine shaft is considerable, part of its weight can be balanced by letting a larger quantity of water act on the upper half of the wheel than on the lower, and this can be so adjusted that no pressure at all will be exerted on the footstep. The footstep is made adjustable, and is constructed to Schiele's patent "Anti-friction Curve," which is unsurpassed for little wear and friction in footstep bearings.

The construction of these turbines is very simple, in fact quite as much so as that of a common water-wheel, and they are consequently not at all liable to get out of order. The wheel can sink freely in the cylinder of the water-chamber that surrounds it, if the footstep should wear, without any danger of touching, and it can be taken out and the footstep got at without removing any other parts or breaking any joints. Another important advantage which this turbine possesses over others is the perfect adjustment of which it allows either by hand or by governor. The illustrations show a method of adjustment or regulation by hand; this consists of brass slides *e* moved by rods *f*, and handwheels *g*, by means of which any number of water-ports or guide-grooves can be closed successively in proportion as the quantity of water at command or as the amount of load on the turbine, decreases. These slides when shut form a true surface with the casing or cylinder surrounding the wheel, and they consequently do not impair the efficiency of the turbine when not working at its full power, as practical trials on a considerable scale have proved.

The quantity of water allowed to flow into any turbine should never be regulated by means of a sluice or throttle valve. As the water acts by its momentum, its duty depends on the velocity with which it flows through the water-ports B on to the wheel. For if at a certain fall the water was partly shut off by a throttle valve in the pipes, so that only half the quantity for which the turbine was made, was admitted, the velocity with which the water would pass through the water-ports would also be reduced to one half the original velocity, and, as the effect of the water is in proportion to the square of the velocity and to the quantity, the effect obtained would therefore only be one-eighth of the full power, though half the quantity of water is passing through the wheel. But when, as in Schiele's turbine, the flow of the water is regulated by shutting off the ports in succession, the quantity of water passing is reduced without reducing its speed, so that half the quantity will give half the original power, and so on in proportion.

This mode of regulation is of the greatest importance, where the water supply or the load is valuable, for, as we explained in our article on turbines in the The Engineer of 9th August last, it is a grave fault of all other turbines that, when the gate or sluice is partially closed, under circumstances which render it desirable to expend the least amount of water, and therefore to attain the greatest economy, the efficiency is least. It is only when the gate is wide open that the best results are obtained. This advantage, combined with its great simplicity of construction, make Schiele's turbine the best and most practical machine of its class hitherto brought out.

In the arrangement of turbine with horizontal shaft, shown in Figs. 3 and 4, the water, as it leaves the wheel, on both sides, is collected in a chamber, enclosing the whole from which it is taken by the pipe, to the tail-race. In all other respects the action of this turbine is the same as that of the one already described with vertical shaft. The tail-race being below the turbine, there is suction in the chamber which receives the water from the wheel, and this has exactly the same effect as pressure, so that the turbine can be placed, without any injury to its effect, at any height of the fall, not exceeding, however, 33ft. above the tail-race, as the suction can never be more than that of a column of water equal to the pressure of the atmosphere. This arrangement of turbine is particularly well adapted for high falls and moderate quantities of water. They need scarcely any foundation, and can be placed in the exact position where the power is wanted. All the working parts can be easily taken out without breaking any joints or removing the outer casing.

The best proof of the advantages of the turbine over the common water-wheel is in the fact that, in those countries where water-power is most valuable, on account of the scarcity or dearness of fuel rendering steam-power too expensive as a motion, the turbine has almost entirely superseded the ordinary water-wheel. The best description of ordinary wheels are the "overshot," and to utilise the power of water-fall these wheels must necessarily be of a diameter nearly equal to the height of the fall; this gives a very ponderous machine, requiring very expensive foundations and other similar preparations, and as they run at a very slow speed they must be connected with a great deal of expensive auxiliary gearing to produce the rapid motion invariably required in any kind of manufactory; the consequence is that a great amount of the power in the water is uselessly expended or absorbed by the friction occasioned by this additional gearing.

On the other hand, the turbine is comparatively very small, and requires scarcely any foundation or other similar preparations, while its speed is so much higher that its power can be transmitted direct, thereby dispensing with expensive intermediate gearing, and giving, at the same time, an increase of effective power. A turbine can also frequently be applied where it would be too inconvenient to have an ordinary wheel. Another important feature of the turbine is that its motion is much more constant and uniform than that of a common wheel, in consequence of the equal diffusion of the water over the whole of its circumference at the same instant. The turbine will also work under backwater of any depth, and will only suffer so much diminution of power as is just proportional to the loss of fall, but a common wheel, to the great annoyance and loss of the manufacturer, has to come to a stand when the water in the tail-race rises. Again, with overshot wheels there is always a loss of fall, through its being necessary to place them a certain distance above the tail-race or bottom of fall to allow of a free escape of the water, and in many cases where the tail-race is very liable to backwater this distance, or loss of fall, is still further increased, or otherwise the wheel would be almost continually working in backwater. Part of the water also leaves the wheel before it comes to the lowest point, but in a turbine all the water is properly applied and every inch of the fall is equally available.

The Exhibition Building.—Messrs. Kelk and Lucas, it is understood, will have the Exhibition building practically completed so as to admit of the reception of goods by the 13th inst. The appearance of the building does not improve as it approaches completion. The *Art Journal* for February condemns it severely, although hardly more, perhaps, than it deserves. As a shed or receptacle for goods to be exhibited, the building is passable, but as a work of art the less said of its general features and details the better.

The Achilles.—Although the construction of the iron ship Achilles, 50, 6,079 tons, 1,250-horse power, building at Chatham, has been seriously retarded owing to the difficulty experienced by the Admiralty in procuring iron of the quality required, considerable progress has been made in the work, and already about one-half of her massive ribs, answering to the timbers in an ordinary vessel, have been forged and successfully fixed in their place without accident. The difficulty experienced by the Admiralty in obtaining adequate supplies of iron is still felt in as great force as ever, and instead of the Achilles being completed within two years from the time in which she was commenced, as was originally expected, at least treble that period will elapse before she will even be afloat, if she continues to progress only at her present rate. There are not more than about 100 workmen engaged on her, including those in the factory department, and yet it was estimated that at least 1,000 hands would be constantly required to complete her in the prescribed period of two years. The chief difficulty appears to be in obtaining adequate supplies of plate iron, the establishment being overstocked with angle iron. Negotiations are, however, now pending with several eminent firms, and it is believed that in a very short time sufficient supplies of first-class iron will be sent into the dockyard. During yesterday and Saturday a number of the massive armour-plates were landed at the dockyard, although these will not be required to be used for several months to come. Each plate weighs slightly over four tons, is about 15ft. in length by about 3ft. in width, and of an uniform thickness of 4½in. The whole are manufactured of rolled iron, at the Parkgate Ironworks, Yorkshire, where powerful machinery has been erected for the purpose.

TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

ERRATA in THE ENGINEER *of the 31st January*, 1862, *pp.* 70, 71.—*In various parts of a paper "On the Use of Mechanical Hypotheses" for "neutral attraction" read "mutual attraction."*

"C. D. A." and "V. P." *next week.*

A. S.—*We do not think the works have yet been let.*

G. N. (Pennfields.)—*See column of "Miscellanea" on another page.*

J. H. (Liverpool.)—*Mr. Bourne's is the best work on marine engines and boilers.*

W. A. O'D.—*We regret that we are unable to refer you to any makers of such motors.*

S. B.—*Crowded out this week. The letter will need to be somewhat curtailed if you wish it to appear next week.*

E. A. L.—*We know nothing to the contrary. The statement, moreover, is made by the authorities of the city of Brisbane.*

A LEARNER.—*Your crooked steam pipes would tend to become straightened, just as does the bent tube of a Bourdon steam gauge.*

OLD SAW.—*Jute is a sort of hemp grown in Bengal, and is the material of which gunny bags are made. Manilla is the fibre of the wild plantain from the Phillipine Islands, and is the substance from which white ropes are made.*

SUBSCRIBER (Glasgow).—*The manufacturer of a patented machine would, if making it in the country where it was patented, be liable to the patentee for royalties, no matter what might be the destination or purpose of the machine.*

J. MC C. (Belfast.)—*Sir William Armstrong has invented nothing that we are aware of in connection with ordnance. As a maker of guns he has made some good work, but the most he can claim as an inventor is a combination of several inventions by others.*

J. J. K.—*We clearly see the object which you seek to obtain. We fear, however, that the extra cost, the extra wear on the stuffing-boxes, the extra care required to keep up the joints, and the objectionable guide-bar would neutralise all the advantage of the plan.*

W. R.—*We should be disappointed if you did not burst your gun at the first round, and even if you did not we are at loss to see where would be the gain, the resistance of the tompion and of the air beyond it being likely to neutralise any advantage in initial velocity obtained by starting the ball in a vacuum.*

J. L. — *The terms "high pressure condensing" and "low pressure condensing engine" explain themselves. There are condensing engines working at pressures of 100 lb. and upwards, and such pressures cannot be called "low." All sea a surface condenser has, in addition to the advantage of affording a vacuum, the additional advantage of giving a supply of distilled water for the boilers.*

J. W. (Bradford.)—*If you read* THE ENGINEER *regularly you will have seen the same question answered several times within the last two months. Apply, by letter, to the Secretary of the Admiralty, Whitehall, stating your age, and giving your certificate of previous service and of good moral character. If accepted, you will be notified to report at Woolwich for examination in arithmetic, book-keeping by single entry, the general plan of the marine engine, and in its ordinary working.*

SANDERS.—*The high-pressure cylinder may bear a very variable proportion to that in which low pressure steam is worked. A proportion of one-fourth may do in the case of condensing engines, working 30 lb. steam, while with 100 lb. steam a proportion of one-eighth is sometimes adopted. The proper point for cutting off depends upon a great number of circumstances, as upon the pressure of steam, the size of the engine, the power to be exerted, and whether steam jackets or superheated steam is used. The proper point for exhaustion is when the piston is near the end of its stroke, the nearer the better with very slow moving engines, while quick running, short stroke engines may require to have the exhaust port opened when the piston has made only about three-fourths of its stroke.*

THE WIND.

(To the Editor of The Engineer.)

SIR,—Can you kindly tell me the relative lengths of time during which the wind blows in the year from the north, south, east, west, north-east, south-east, north-west, and south-west?

I want the information to guide me in deciding which part of a yard would be preferable for building a chimney upon, so that the smoke may be as little nuisance as possible to neighbouring houses. S. S.

LATERAL STRENGTH OF PILLARS.

(To the Editor of The Engineer.)

SIR,—Can you give me a rule for obtaining the lateral strength of hollow cast iron pillars; for example, what weight will it take to break a hollow cast iron frame pillar of the following dimensions:—12½in. diameter at the middle, and the metal 1¼in. thick, the pillar projecting out of the ground 5ft. 6in. Also what you consider the safe weight such a pillar should bear, when made from No 3 Glengarnock iron, and cast on its side.

Manchester, February 4th, 1862. A SUBSCRIBER.

CUTTING JOINTS.

(To the Editor of The Engineer.)

SIR,—Seeing in your impression of January 10th that mention is made of certain improvements in cutting joints made by J. Lee and B. D. Tapiin, of Lincoln, which is done by circular cutters fixed on a mandril, and revolving in a lathe, I am constrained to send you the enclosed sketch of the self-same apparatus, which I invented some years ago, and which I have used in her Majesty's Arsenal at this place for the last two years. I apply it either in a lathe, or (as I prefer) in one of Sharp and Stewart's travelling drill and slotting machines. WILLIAM H. MARTIN.

Ferrol, January 24th, 1862.

FURNACES

(To the Editor of The Engineer.)

SIR,—Your correspondent who wishes to know how to prevent the arch of his furnace from getting loose, should secure well the easing plates and backing walls. Furnaces exposed to extensive heat expand considerably, and contract when getting cold, and the bricks become loose and give way. In forming his arch he should give the wall at the spring the proper inclination, and use bricks of the right form and of equable surface. The fire clay should also be fine and thin, to allow them to bear well on each other. If the clay is used thick it often melts away, leaving the bricks bare, which causes the arch to give way. In heating furnaces the curve of the arches should never exceed 1 in 12. After the furnace has been subject to great heat it should be allowed to cool gradually by keeping the doors and grate closed. The key bricks of an arch should not be driven in till the furnace is well braced up by the binders. If he attend to these simple facts he will not fail to secure his arches. I have constructed arches of 15ft. over boiler-plate furnaces which seldom or ever gave way till two-thirds of the bricks were burnt away. E. B. MONRO.

Wildon Works, Abergavenny, February 4th, 1862.

MEETINGS NEXT WEEK.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, February 11th, at 8 p.m., continued discussion upon Mr. Samuda's paper "On Iron-plated Ships, &c."

SOCIETY OF ARTS.—Wednesday, at 8 p.m., "On the Economic Applications of Sea-weed." by Edward C. C. Stanford, F.C.S.

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THE ENGINEER.

FRIDAY, FEBRUARY 7, 1862.

THE IRON-PLATED SHIP QUESTION.

THE paper on iron-plated ships, read last week at the Institution of Civil Engineers, by Mr. Joseph D'A. Samuda, demands very serious notice. The avowed object of the author is to revolutionise the practice of the Admiralty as regards the designing of our ships of war. He openly calls upon them to abandon the system of having their iron-plated ships designed by their own staff of naval architects, on the ground that it would be a far better thing "to trust to the engineering skill of the country" in this matter. The only function which he would leave in the hands of the Admiralty is that of "exercising a veto within such limits as experience fitted them to form a judgment upon"—the extent of their fitness being defined, as we presume is to be understood, by private persons. The term "engineering skill" is employed, of course, with such latitude that it is supposed to include "shipbuilding skill," since it is as a shipbuilder, and as a shipbuilder only, we believe, that Mr. Samuda has attained eminence, and it is as such also that he here propounds the views which we are about to discuss.

Mr. Samuda is too acute and able a man to fail to see that the demand which he here makes upon the Board of Admiralty presupposes two things, viz., that the staff of naval architects at Whitehall are unequal to their duties; and that he (Mr. Samuda) and others (or perhaps he without others) could perform those duties very much better. In fact, in another part of his paper, he distinctly states that the vessels which he has designed are much superior to those which the Admiralty are building. After erecting such pretensions as are here raised, Mr. Samuda will not be surprised to find that, in our anxiety for improvement, we shall examine with eager curiosity the proposals which he makes.

We are a little startled, we must confess, to find that among the earliest of the author's statements, we encounter a list of four conditions—which he pronounces "indispensable"—to the production of the best description of iron-cased ships, but not one of which—or, certainly not more than one—seems to us, by any means, indispensable. These four conditions are stated as follows:—"First, these vessels must be of such dimensions and power, and be built on such lines, that they should always command a superiority in speed over the best timber-built frigates afloat; secondly, they must be protected with armour over their entire length" (from below the water to the top of the battery being understood, we presume); "Thirdly, the armour must be so applied as to be capable of rapid replacement or repair; and, fourthly, the armour should enter into the construction of the ship, and thus give strength to the whole fabric, as well as protect it from the enemy's fire."

Now, that each of these qualities is *desirable*, viewed separately, we do not for a moment doubt; but that any one has a right to pronounce them indispensable—even in the "best description" of vessel, "best," that is, for its purpose—we strictly deny. Take the first two, for example, and suppose that we require the best iron-plated ship, of 2,000 tons burden say, that can be built. Now, if the first quality be demanded, the second cannot be supplied; you cannot make a very fast steamer of 2,000 tons sustain an armour over her entire length.* On the other hand, if you plate a 200-ton steamer from end to end, you cannot propel her at the speed of our fastest frigates. Of course, if a "best" ship must always be a colossal ship, then you can fulfil the two conditions; but not otherwise. As to the capability of having the armour replaced or repaired readily, that must not be insisted upon, supposing that it should be found that, by disregarding that quality, we can avoid the necessity for repair. If, for example, it should be proved that the resisting powers of the armour are very greatly increased by welding the whole mass into one, then we shall certainly not refuse to so weld it, merely because repairs would be rendered difficult. As to the last quality—the structural combination of the hull and the armour—that is a mechanical arrangement which we have often advocated, always providing that no great sacrifice has to be made in other respects. The whole question of iron-plated ship construction is one of mechanical concession and compromise, so to speak, and the phrase "indispensable conditions" is one which should play a very subordinate part in discussions upon it. Mr. Samuda, however, makes them the tests by which he tries the Admiralty's ships, and for want of conformity with which he, in very round terms, condemns them all.

The notion that it is very desirable to render the armour easy of removal seems to have greatly influenced Mr. Samuda's proposals concerning the way in which he would build the sides of his ship. He has devised a plan by which "the skin would be so distinct from the armour that, in time of peace, the armour could be removed, and the vessel be used as a transport, if desired;" although, if we understand the plan right, its removal would involve the unriveting or unbolting of every edge of every armour plate—an operation that few engineers, or shipbuilders either, would be likely to recommend, we presume. But on this point we may be in some error, as the official abstract of Mr. Samuda's paper (which supplies the only information concerning it that we are allowed to use by the rules of the Institution) is very confused as regards the armour. In one place it describes how the armour is to be fastened, and then a few lines further on states that by "this arrangement a perfect ship, without armour, is first made." We see considerable objections to the author's plans for building the side and plating it; but as we have much more important matters to deal with, we must pass these minor points by.

The chief thing which Mr. Samuda does by way of demonstrating the superiority of private skill to that of the Admiralty constructors is what many amateur designers of war ships have done before him: he gives the elements of what he conceives to be better vessels than any hitherto produced; and it is to the consideration of this vital part of his paper that we now come. He describes two classes of ships, both plated from stem to stern; the larger for sea service, and the smaller for coast defence. The first is a ship 382ft. long, 55ft. beam, and 31½ deep to the main deck. She will be of 5,600 tons burden, and be propelled by engines of 1,200-horse power. Her ports are to be 9ft. above the water, and she is to be "a 32-gun frigate" according to one statement by the author; but this must be a misprint, because in another place he distinctly asserts that the largest of the Admiralty ships "will not be able to carry a heavier armament," and it is well known that their armament is to be 50 of the heaviest guns—probably 100-pounder Armstrongs. As the whole pith of the author's argument lies in the assumed equality of his own with the Admiralty ships, we must of necessity consider her to be a 50-gun frigate. The most surprising fact concerning this ship is, however, that she is to steam at 15 *knots an hour*. Now, with these elements before us, we are compelled to pronounce at once against the author, and declare that this ship has *impossible* qualities attributed to her. We assert that he cannot perform what he proposes, and that if the Admiralty ordered him to build such a ship to-morrow he would break down in the undertaking. And we can demonstrate what we say. The first thing we require to know is, what will be about the weight, or displacement, of the proposed ship. This will consist of three portions—the weight of hull, weight of armour, and weight of equipment. It happens that we can give an approximate weight of hull on Mr. Samuda's own authority, for the design which he sent into the Admiralty some time ago was for a ship of just about the dimensions of the present one; and on that basis we may mention 4,500 tons as about the weight of hull in the present case. The armour will be at least 1,500 or 1,600 tons; and the equipment (which must be about that of the Admiralty ship), say 3,000 tons—which is certainly within the mark. Here, then, we have a total displacement of at least 9,000 tons to deal with, although the measurement tonnage (which is really no sort of measure of the ship's weight) will be no more than 5,600 tons. That the 9,000 tons are too little rather than too much may be inferred from the fact that the Warrior's weight is 8,852 tons, and while of the same length and depth as Mr. Samuda's ship, has much less armour and a much smaller armament.

We are now in a position, then, to see exactly what Mr. Samuda's proposals amount to: they are literally these—to build a ship some hundreds of tons larger than the Warrior, and, in order to drive her through the water half-a-knot faster than that ship, to put engines of 50-horse power *less* into her! There is no escape from this conclusion. It is true that Mr. Samuda's ship is to be 3 ft. narrower than the Warrior, but that helps him nothing; it only increases his difficulty in obtaining lines adapted for speed with the extra displacement which he has to provide. His length is the same as the Warrior's, his draft of water about the same, and his breadth so much less; how, then, is he to obtain these hundreds of tons of increased displacement? Clearly, only by filling out his midship section below, or by giving fuller lines forward, or by keeping her fuller abaft; or (which is most probable) by filling her out in all these three ways at once. And yet with engines of 1,200-horse power as against the Warrior's 1,250-horse power, he is to increase the speed by nearly a knot—to get 15 knots where the Warrior gets 14¼!

But this is not all. It is not the *displacement* only which defeats the author's plan; considerations of *stability* also present an ugly appearance. It is not possible to speak so exactly on this part of the subject, because the materials for so exact a judgment as we have pronounced in the other case are not before us. But we see very good reason for believing that Mr. Samuda's ship would have only about *one-half* the stability of the Warrior! As compared with the latter vessel, his centre of gravity is raised, and his metacentre is depressed—both causes acting injuriously, of course, upon the stability; and these changes are so great, we fear, as to render the ship unfit to stand up under sail at all. It is but just to the Admiralty designers to add, that on all these vital points of naval architecture—displacement, stability, and speed—concerning every one of which Mr. Samuda seems to have gone so far wrong—we say in respect of all these features, the Admiralty designers achieved a perfect success in the Warrior. And yet they must be set aside, in order to allow private skill to display itself, forsooth!

But there is one more paragraph, containing one more proposal, in Mr. Samuda's paper, which is more marvellous than anything that has gone before. He says:—"For coast defences vessels might be built, protected from stem to stern, having a length of 200 feet, beam of 48½ feet, depth of 25 feet, burthen of 2,200 tons, and engines of 350-horse power, piereed for thirty-two 68-pounder guns, but carrying only sixteen, with a draft of water of 16 feet, when the guns, ammunition, and coal were on board, and capable of attaining a speed of 11 knots an hour." Here we have unquestionably another impossible ship. The weight of this ship, with armour from end to end upon her, cannot well be less than 3,500 tons. But a mere box of her dimensions below the water, viz., 200 feet long, 48½ broad, and 16 feet deep, would displace only 4,440 tons, which exceeds what must be the actual displacement of the ship only by about 900 tons. Consequently, the lines of this ship must necessarily be extremely full and unfavourable to speed. An ordinary ship designed to steam at 11 knots seldom displaces very much more than *one-half* the volume which a rectangular box of like dimensions would displace, whereas this vessel, as we see, displaces 35-44ths of that volume. In fact, she would necessarily approximate to the form of a fashionable sailing collier. And yet, with a draft of water of only 16 feet, and, therefore, with a screw of only, say, 14 feet, driven by engines of only 350-horse power, this astonishing craft is to perform her 11 knots an hour comfortably! If this were a really practical project, and not a chimera, we should indeed think with the author, that "the time had arrived when the Admiralty should see the propriety and advantage to the public service" of handing over the construction of their ships to the private magicians. If our readers will turn, however, to that very matter-of-fact, but not less valuable, table to which we invited their attention a month or two ago, entitled "Results of Trials made in Her Majesty's Screw Ships and Vessels," they will find abundant demonstration of the futility of predicting such a speed for such a ship. Even Mr. Samuda does not hope, we presume, to greatly surpass all the results attained in so great a variety of ships engined by so great a variety of engine-makers; but he will certainly find nothing in those results to sanction his high expectations concerning this coast's defence vessel. We will cite only one example by way of comparison. The

* Always supposing, of course, that the usual *thickness* of armour is to be everywhere preserved.

Imperieuse is admitted to be a very well-designed ship, and she has engines of an excellent character, by Penn and Son, of 360-horse power. She is a little larger by measurement than Mr. Samuda's ship, but is really of about 500 tons less displacement. Yet with engines even more powerful than Mr. Samuda's, and with a 16-feet screw, her speed at the measured mile was slightly over 10 knots only.

We have only a word or two more to add. We have spoken plainly of Mr. Samuda's opinions and figures, because by assuming the position which he takes, he challenges the plainest speaking. But we have, nevertheless, spoken without asperity, because we are quite sure that Mr. Samuda's feelings and intentions are very estimable. It is an error on his part to suppose that mercantile shipbuilders are the best people to design war ships, and to advocate the transfer of the Admiralty trust to them; but we are sure that it is nothing worse than error, and therefore we respect him while we differ from him. What the mercantile builders can do, and ought to do, is this: They ought to watch carefully the ships which the Government designers produce; to note such faults as those gentlemen really commit; and then temperately and convincingly give the public the benefit of their discoveries in this respect. But, more than this, we are firmly persuaded, they cannot hope to accomplish, and they only sacrifice their legitimate influence when they grasp at one that is illegitimate. *Experience* is indispensable to the successful designing of war ships, and of that experience private builders are necessarily deficient at present. By and by, perhaps the work may gradually pass into their hands, and then their time will come.

[Since the foregoing portion of this article was sent to press, a letter has been received from a member of the Institution of Naval Architects, in which Mr. Samuda's paper is discussed to much the same effect as in our own remarks, and, curiously enough, with an illustration derived from the very vessel referred to by ourselves—the Imperieuse—this coincidence arising, probably, from the circumstance that she comes nearer than other ships to the proportions and horse power of Mr. Samuda's design. While the writer's conclusions coincide, however, with our own, his treatment of the subject differs sufficiently from ours to add greatly to the interest of the discussion. We, therefore, gladly give his letter insertion.]

NEW BLACKFRIARS BRIDGE.

The Court of Common Council appears to have become a Court of Arches, judging from the discussion going on with reference to the construction and number of arches to be admitted in the proposed New Blackfriars Bridge. The Bridge House Estates Committee had adopted Mr. Page's design for a bridge of three iron arches, the central arch to have a clear span of 280ft. and the side arches 220ft. each. On Thursday week the report of the committee came up, for acceptance or rejection, before a special Court of the Common Council, and after the case had been partly argued on both sides, the discussion was adjourned until Thursday next. Mr. Page, it is true, had submitted plans also for a bridge of five arches, and five was also the number of arches more generally proposed by the numerous other competitors, among whom were the best men in our profession. At the same time Sir John Rennie, Mr. Hawkshaw, Mr. Fowler, and Mr. P. W. Barlow, had, as well as Mr. Page, sent in designs for three-arch bridges. Of the twenty designs sent in, sixteen were for iron arches, and whatever may be the issue of the pending discussion, we do not apprehend that it will be the adoption of stone arches, which would cost much more than spans of iron, besides taking very much more time for their erection, and which would require also to be thicker in the haunches and to have much more proportionate rise than iron arches. As for the absolute safety of cast-iron arches, properly proportioned and constructed, there can hardly be two opinions at this time, and notwithstanding that Mr. Deputy Fry has made a decided stand against the use of iron, we do not think that the world will turn backwards, nor that even the Common Council will ignore all the engineering experience of the last half century, on account of Mr. Deputy Fry. Mr. Page, it is to be remembered, has provided wrought-iron crowns to his arches, using cast iron in the haunches, and although there would be no risk in either case, it is nevertheless preferable, in the case of very flat arches, to adopt Mr. Page's modification. Mr. Barlow has given Mr. Deputy Fry a text whereon to pin his outcry against iron, especially cast iron, but Mr. Barlow's remarks must apply to the use of cast iron in *tension*, as in the bottom chords of girders or the top flange of the Hartley engine beam. In compression, which is practically the only strain to which the material of an arch is subjected, cast iron is indisputably the best material to be had, and although Mr. Barlow has been quoted as saying that cast iron has been nearly or quite abandoned for *arches*, no statement could be more incorrect. As compared with cast iron, wrought iron is not a suitable material for arches, except the rise be very little, the resistance of wrought iron to compression being hardly more than one-third that of cast iron. A wrought iron arch bridge, it is true, has been erected over the Thames, but it has been severely and justly criticised, and, speaking for ourselves, we could wish it were the last of its kind ever to be constructed. If the ugliness of a girder bridge could be tolerated at Blackfriars, wrought iron would be the proper material, but as good taste requires arches the choice lies between stone and cast iron only. Here, as we have already said, cast iron is likely to carry the day.

So the question is narrowed down to that of the number of arches, iron being the only material with which arches of upwards of 200ft. span are practicable. In London bridge, Mr. Councilman Kearns said in the discussion at Guildhall, "they had all that was required, both with respect to waterway and roadway, and yet its centre arch "was not more than 152ft." Now the 152ft. span in this case is less a matter of choice than of necessity. London bridge is a stone structure, built at great cost, and in stone, with but a moderate rise, a span of even 200ft. would have been hardly practicable. Nobody can pretend that even the piers of London bridge are desirable obstructions in the river,—they are necessary evils at the best. We have said "nobody," but we may have gone too far, and should perhaps have excepted Mr. Kearns, who has found a new purpose for bridge piers, a purpose to be best fulfilled by making them as numerous as possible. Mr. Councilman Kearns' observations upon this point are somewhat obscurely reported in the *Times* as follows:—

> Mr. Kearns then pointed out in some detail what he conceived to be the inconveniences and dangers in the river navigation of Southwark, a three-arched bridge, in the immediate vicinity of which he had carried on his business for years. He particularly adverted to the tidal wave caused by steamers, and unbroken by piers, as in the other bridges, spreading to the shore on each side, and disturbing the craft delivering merchandise at the wharves, and to the danger to life by the peculiar rapidity of the current there at times.

If anything is to be made out of this horrible jargon of words, which is to be attributed, we suppose, to some ungrammatical reporter of the *Times* and not to Mr. Kearns, it appears to be that the "tidal wave" (!) of steamers meaning, we presume, the "wake" should be broken by the greatest possible number of bridge piers! In other words, piers should be put in, in addition to those required to support the superstructure, for the mere purpose of breaking up the wake of steamers! Excellent suggestion, Mr. Kearns! And as the piers of an occasional bridge can hardly suffice for such a purpose, let the river, between bridges, be studded with piers to break up the "tidal wave." Surely public bodies will now know where to go for valuable opinions upon hydrographical and engineering questions. They will go to Mr. John Kearns, Councilman! "What possible reason could there be," asked Mr. Kearns, "for raising a needless engineering "difficulty?" We echo the question, and apart from breaking up the "tidal wave," we ask, why raise the difficulty of putting in four piers instead of two? In the majority of bridges, the abutments and piers involve the larger share of the whole cost, and a five-arch must almost of necessity be more costly than a three-arch bridge.

The whole of the present question of arches is one of waterway and headway. A given headway being decided upon, the total rise of large arches will, no doubt, be greater than that of small spans, as will also be the thickness of the crowns in the former case. So, too, with three wide spans, the *average* headway under all the arches would not be quite as great, for any *maximum* amount of headway, as it would be with a greater number of narrower arches. On the other hand, three arches would present but half the number of piers in the river as a bridge of five arches, and the total waterway would be greater, in the former case, than in the latter. For all purposes of navigation, even when bearing in mind Mr. Kearns' oracular *dictum* as to the "tidal wave," the three-arch bridge would be conspicuously preferable to that with five spans. In such a discussion, with Messrs. Kearns and Fry to deal with, it would be of but little use to say anything of grandeur, but, nevertheless, there are those who, knowing that a three-arch bridge would be equally safe and permanent as a five-arch bridge, and much less costly of construction, and admitting of much more rapid execution, would, in consequence of its grandeur and simplicity, prefer the former. The decision at which the Bridge House Committee have arrived is, indeed, so sensible that we hardly think they will be called upon to reconsider that decision.

IRON STEAMSHIPS.

In many iron ships the launching weight of the hull is from one-fourth to one-third the displacement of the vessel when loaded ready for a voyage. Taking even as large a ship as the Great Eastern, about 10,000 tons of iron were worked up in the construction of the hull, and its launching weight was not, we believe, less than two-fifths of the ordinary displacement of the vessel when on her average draught. The weight of a ship is, of course, dead weight, paying nothing to the owners, and it would be easy to calculate the cost per ton of driving the hull of an iron steamer over a long voyage, or over the 30,000 or 40,000 miles which are reckoned a fair year's service. It would be found that the mere propulsion of this dead weight costs enormously, and that, indeed, the heavy subsidies granted to ocean steam companies hardly sufficed to cover it. Viewed in this light, at least, the best disposition of iron in the hull of a steamship becomes a matter of great importance. Not but that the question of safety, as involved in the good or bad disposition of the material of a ship, is of still greater importance.

When, however, we come to the consideration of the structure of a ship, we must confess that it defies all our rules applicable to questions of resistance to strain. In the case of a bridge or a girder we can safely trust to close calculations of the strain and resistance at any given point. The conditions are so certain, and the range of contingencies therefore so narrow, that, with ordinary care, we can hardly go wrong. Not so with the ship. It cannot be foretold, with anything like mathematical precision, what trials may be in store for a newly launched vessel, nor can we exactly calculate the best disposition of parts to resist the ordinary strains to which all ships are exposed. A ship is one moment mounted on a single wave, and suspended, in the next, between the crests of two waves. It is now lying far over to one side, and in the next few seconds it is thrown heavily over in the opposite direction. Mr. Richard Roberts, Mr. Bourne, and, more recently, Mr. Fairbairn, have urged the importance of providing more strength in the upper plating of ships, so that long hulls might approach to the conditions of well-proportioned girders. But the strain which requires to be provided against by additional strength at the gunwale is only one among a number of strains requiring additional strength everywhere. The consideration of the form of a ship, too, is not, *per se*, allied to that of strength, except that the form which enables the vessel to pass with the least resistance through the water is that naturally requiring the most strengthening, and it is that, furthermore, which presents the greatest number of difficulties in the way of strengthening. Indeed, the whole question of the stiffening of steamships is one of experience alone.

At a time not far back when in the strife for speed, there appeared to be great danger of overpowering steam vessels, the question of strengthening iron hulls was of conspicuous importance. In many cases such great speeds were contemplated that it was really a question whether the ship would withstand the thrust and pull of its own engines. A Yankee in Buffalo, in the State of New York, actually planned and took out a British patent for a steamer three-quarters of a mile long, and to run—whew! one hundred miles an hour! A public meeting was called, and an ex-president of the United States presided thereat, to consider this grand scheme, but we have heard nothing of it since. If nothing so startling has been broached at home, we have, at least, been constantly familiarising ourselves with the questions of how to make the fastest and strongest steamships with the least dead weight in the hull. The first iron craft had no frames, but were huge pans or tanks rivetted together, and having any amount of flexibility under the action of a sea. It was not long, however, before the present system of keels, keelsons, and angle iron frames was adopted, and nearly thirty years ago Mr. Charles Wye Williams applied iron bulkheads for stiffening the sides of some of the long boats built for navigating the Shannon. The great value of bulkheads as protections in case of collision or stranding might not have been at first perceived; at any rate, we have it from Mr. Williams himself that this was not the primary object of their introduction. As experience accumulated, Lloyd's found it necessary to exact additional means of strengthening and stiffening. Even certain ships which are reckoned, at least among shipbuilders, as of first-class construction, do not answer Lloyd's requirements. There is the West Indian mail steamer Tyne, which went ashore on the Dorset coast, and, after laying there for several months, exposed to the winter gales, was got off with very little injury. The Tyne is of 1,850 tons, old measure. Her frames, it is true, are only 15in. apart amidships, and 18in. thence fore and aft, whereas the well-known "Table G" merely requires 18in. spaces all the way. But these frames are only 5in. by 3in. by $\frac{7}{16}$in., whereas the table calls for 5$\frac{1}{4}$in. by 3$\frac{1}{2}$in. by $\frac{5}{8}$in. for even a gross tonnage of 1,500. The Tyne's frames are not doubled, although they have reversed angle irons as required. The bulkheads were specified $\frac{7}{16}$in. thick at the bottom, and $\frac{3}{8}$in. at top, whereas the rule requires $\frac{1}{2}$in. bulkheads for even a 1,500 ton ship. The garboard strake of plates is $\frac{7}{16}$in. thick, whereas a 12 years' ship of 1,500 tons only should have 1in. The rest of the plating is correspondingly below Lloyd's requirements, and the rivets, which, by the table, should be 1in., are but $\frac{7}{8}$in. in diameter. Lloyd's impose no restriction as to the quality of the iron in ships, furthermore than that it shall be of "good malleable quality," which may mean anything or nothing at all. The Tyne, if made as we believe she was, of good iron, is no doubt stronger than a ship of 25 per cent. larger scantling would be if made of "boat plates" and "merchantable angle iron." If the quality of iron especially was more taken into account, its proper disposition being at the same time studied, ship owners would doubtless find that, for a given strength, the saving in dead weight would amount to nearly one-eighth of the present total displacement, an amount representing a greater saving in fuel than that really effected by many improvements in engines and boilers, of which so much has been heard.

At present, in addition to the ordinary construction of iron steamships, there are examples of Mr. Scott Russell's longitudinal system of framing, in which the inside of the hull is traversed by a great number of keelsons; there is the plan pursued by Messrs. W. Simons and Co., on the Clyde, of running the deck-beams diagonally across, a deck-beam starting from one frame, on one side, extending to another much further forward, or aft, on the opposite side of the ship, the beams of each deck running in a direction opposite to that of the beams on the decks next above or below it; then there is Mr. Langley's plan of traversing the hold with a great number of bulkheads, so as to form a corresponding number of water-tight compartments, of course in the way of stowage with many kinds of freight. The Great Eastern's double skin and longitudinal bulkheads represent another system, not likely, we think, to be extensively copied, on account of the great amount of iron and work required. There is, we think, a disposition to improve upon the present practice of steamship construction, and it may be that, ere many years, we shall have abandoned the present mode of framing and plating. Whatever improvement may be made in this respect will conduce to increased safety, or with the present strength, to a considerably reduced displacement and expenditure of power.

LIMES AND MORTARS.

Adhesion, cohesive strength, and resistance to crushing are the chief requisites with ordinary mortar, and to these is to be added insolubility in the case of mortar put in under water. There is very great diversity in the extent to which different mortars possess these requisites. Some mortars have less cohesion than the poorest bricks; others are stronger than the stones which they unite. To a great extent these diversities are due to the original qualities of the limes and other substances employed in making the mortars. Much depends also upon the skill and care with which the essential ingredients of mortar are compounded together. In the simple operation of slaking alone, Mr. Robertson has mentioned that lias mortar may be made with an adhesion of 30 lb. per square inch, or of 10 lb. only, almost at pleasure, by a very slight alteration in the method and time of slaking. The time of grinding, and, conspicuously, the proportion of sand, also affects the strength of mortar in a marked degree.

Limestone may be regarded as the ore of calcium, which is a white metal, like silver, and of about the weight of iron. Calcium, which is seldom seen by human eyes, burns brilliantly in the air, becoming quicklime; the latter, or, in other words, ordinary caustic lime, being the oxide of calcium. This oxide, or quicklime, has a considerable affinity for carbonic acid, so much so that not even quicklime is ever found pure in nature. Associated with carbonic acid, lime exists as carbonate of lime, as in marble,

chalk, oyster shells, and in what are generally known as "limestones." Every 100 parts, by weight, of pure carbonate of lime contain 56 of lime and 44 of carbonic acid; and thus to obtain a ton of pure lime would require the calcination of nearly 36 cwt. of pure carbonate of lime, deprived of moisture, or in its anhydrous condition. Heated or calcined, however, marble, chalk, "limestone," and oyster-shells give up their carbonic acid, but unless the quicklime be used soon after burning it begins to re-absorb its combining equivalent of carbonic acid from the atmosphere. Once decarbonised, however, and mixed with a certain proportion of water, the quicklime becomes a hydrate, and, if no clay be present in the lime, the act of hydration, or, in familiar phrase, "slaking," will be attended with immediate swelling, heating, and steaming. When hydrated or slaked, 75·67 parts of lime are united with 24·33 parts (in both cases by weight) of water, quicklime requiring, therefore, about one-third of its own weight of water in slaking. These precise proportions are those assigned by Dr. R. D. Thomson. In slaking, as is well known, the little cohesion which the quicklime originally possessed is completely destroyed, a pulverulent mass, or powder, being the result. Mixed or "gauged" with more water, and to the consistency of a rather stiff paste, this hydrate "sets" in a practically solid mass. The water of mixture merely displaces the air, allowing the particles of lime to come closely together, where they cohere by their own natural cohesion, without any particular chemical action. In setting, neither lime nor lime mortar lose much of the water in which they have been mixed. Mr. Robertson has found that, in lias mortar originally containing 17 lb. of water per cubic foot, 16 lb. of water were retained in the mortar after it had taken a firm set, and when it was to all appearance dry. In the case of slaking, the water of hydration, as it may be called, is really solidified, chemically, in the lime. In the case of gauging, the water is only retained by capillary attraction. The making and setting of mortar is very simple as long as it is kept out of the reach of water. Thus exposed, however, lime, whether mixed or no with sand, is rapidly soluble.

In hydraulic lime the constituents are such that, shortly after gauging, an insoluble silicate of lime is formed throughout the mortar, which, therefore, is in no danger of being dissolved out of the masonry, at least after "setting" (which, in hydraulic mortars, is very rapid) is once complete. Hydraulic limestones contain, in addition to carbonate of lime, a greater or less quantity of clay, or, at least, of silica and alumina, the constituents of clay. Cements, which differ in degree only from hydraulic lime, contain a still larger quantity of clay, so much indeed that the calcined cement stones do not slake visibly, although the lime in them really does take up water the same as ordinary lime. In other words, the lime of cement stones is converted in the ordinary manner into a hydrate, the water requisite for this effect being solidified in the lime instead of being retained in it by capillary absorption merely. Lyme Regis lias limestone was found to contain nearly 17½ per cent of silica and alumina before burning, and 29·1 per cent after that process had been completed. "Pozzuolana," trass, and other substances employed to render rich limes hydraulic consist chiefly of silicate of alumina, with a little lime and iron. The so-called "Portland cement" is made by mixing chalk (carbonate of lime) with "mud," or the diluvial clay of some of our river bottoms, grinding the mixture well together, and then drying and calcining it. Burnt bricks answer well, also, for imparting to rich limes the property of setting under water. In short, almost any partly calcined material of an argillaceous nature will, by supplying silicate of alumina to the lime with which it is mixed, enable it to set under water. This fact was the substance of the late M. Vicat's discovery, made nearly half a century ago. Before that time manganese had been supposed to play an important part in the setting of lime under water. Most hydraulic limes contain more or less manganese, but in the particular case of a lime of notable hydraulic energy, from Chamouni, it was at length shown that there was not a particle of manganese in combination. Iron, too, has been commonly regarded as having great virtue in hydraulic lime, but we have quoted, in a former article, certain experiments made by Mr. Robertson and others which, we should suppose, would completely remove this opinion. The utility of magnesia in hydraulic or any kind of lime is also exceedingly doubtful, and it is well known that the magnesian limestones, or dolomites, yield the poorest limes.

The theory of hydraulic lime is simple and satisfactory, and applies well to observed facts, when only lime, silica and alumina are regarded as combined together. Silicate of lime is insoluble, and with the substances in question the rapid formation of silicate of lime in hydraulic mortar may be accounted for as follows. When clay (which is silicate of alumina) is calcined the affinity between the silica and alumina is weakened. Presented in this condition to lime, and with the presence of a certain proportion of water, the silicate forsakes the alumina for the lime, for which it has a stronger affinity, and the new combination is silicate of lime, with an excess of lime. Thus the alumina serves the purpose of a carrier of silicic acid to the lime, although there is reason to believe the alumina retains some of its silica, so that the final result is a double silicate of lime and alumina. In Ransome's stone-preserving process, as many of our readers are aware, silicate of lime is deposited in the pores of the stone by first applying a solution of silicate of soda (or soluble glass) and afterwards another of muriate of lime. A double decomposition is the result, the silicic acid of the soluble glass uniting with the lime, forming an indestructible silicate, while the chlorine leaves the lime for the soda, forming chloride of sodium, or common salt, perfectly deliquescent and soon washed away.

It has been found that hydraulic mortar made by mixing rich limes with pounded bricks does not withstand seawater. It answers perfectly in fresh water, and may endure even for three or four years in the sea, but after a longer or shorter period of exposure, in the latter case, the mortar crumbles to powder. Several serious failures of this kind have happened, and in France, where they had been particularly numerous, M. Vicat carefully studied the subject and arrived at some very reasonable conclusions. Finding hydrochloride of magnesia in the sea-water, he subjected the hydrates and imperfect carbonates of lime to the action of a solution of the salt in question. Perfectly carbonated lime was found to be unaffected, but the hydrates were changed to a soluble hydrochloride. In this state magnesia was taken into the mortar, and from certain peculiarities in the crystallisation of carbonate of magnesia the early disintegration of the mortar was believed to be inevitable.

THE SOUTH OF IRELAND DIRECT TELEGRAPH COMPANY.

THE saving of even an hour on the average passage of the Transatlantic steamers would be of very great value to the commercial world, if it were only for the earlier reception of news. If the speed of the steamers cannot be increased, we have the resource of intercepting them, and telegraphing their news from our remotest headlands, and thus we may obtain what would require a vast aggregate expenditure in driving the mail steamers to secure. A company has been for some time formed to connect London by the shortest route, by sea and land, with the entrance to the "Cove of Cork," the halting-place of the Transatlantic, Australian, and Mediterranean mail vessels. The South of Ireland Direct Telegraph Company have secured the exclusive privilege of landing cables at Roche's Point, at the entrance of Cork Harbour, and they have contracted with Messrs. Silver and Co., the eminent telegraph engineers and patentees of the india-rubber insulator (so favourably reported upon by the late Government Telegraph Commission), for a submarine cable for the sea portion of the line. This cable the contractors have guaranteed for a term of years, so that the shareholders are, in this case, exempt from those risks which would appear to be almost inseparable from submarine undertakings generally. Should the Galway line of steamers ever achieve any remarkable expedition it would be easy to extend the cable to the Isles of Arran, and, in any case, the South of Ireland Direct will probably be the complement of an Atlantic line, whenever laid, and, as such, "tap its traffic." There are at present four Transatlantic steamers touching weekly at Cork, and with the news by these and other vessels the new line is likely to enter upon a good business from the first day of its opening.

SPECTRUM ANALYSIS.—At a recent session of the French Academy of Sciences M. H. Ste. Claire Deville presented a note from M. Debray stating that the latter had been successful in obtaining a spectrum by means of the Drummond light suited to the detection of metals in coloured flames, in accordance with the remarkable discoveries of Kirchoff and Bunsen.

ROAD ACROSS HYDE PARK.—A road has been proposed from the Bayswater-road, near the Victoria-gate, cutting through the ground along the boundary of Kensington-gardens, and extending to the bridge over the Serpentine. Here it is proposed to pierce the piers, and to put in an iron trough roadway, the bottom five feet below the surface of the water, with strong iron walls at the sides. Beyond the bridge, the road would be extended in cutting under Rotten-row to Kensington Gore. Messrs. Ordish and Le Feuvre have surveyed the ground, but we cannot say that the plan will be carried out.

A TABLE of the exports from the United Kingdom to France in 1860 and 1861 is given in the *Gazette*. The total, exclusive of corn, was £5,244,703 in 1860, and £7,944,724 in 1861. The exports of iron and steel increased from £370,000 in 1860 to £791,000 in 1861; linen and linen yarn from £131,000 to £295,000; machinery from £171,000 to £361,000; wool from £573,000 to £782,000; woollens and woollen yarns from £527,000 to £1,272,000; cottons and cotton yarns from £298,000 to £749,000; coal from £564,000 to £618,000; hardwares and cutlery from £118,000 to £201,000; silk manufactures from £103,000 to £437,000. In several cases the reduced duties only came into operation last October.

THAMES EMBANKMENT, SOUTH SIDE.—At a meeting this week of the Commissioners for examining into the plans for embanking the south side of the Thames, the first plan submitted and explained was that of Mr. J. Carter, civil engineer. He proposed an embankment wall on a solid base from Lambeth new bridge down to Deptford, 100ft. wide, upon arches all along, and over these a "railway," consisting of a double line of rails, uniting with the various railways on the southern side of the water, with tramways for the interchange of traffic. Underneath the embankment, which would be on a level with all the bridges, he would have a continuous line of arches 50ft. wide, for the storage of coals and merchandise. The estimated cost of the entire structure, about five miles between Lambeth and Deptford, would be £75,000 per mile. Mr. F. W. Sheilds, C.E., proposed a fixed line of river boundary corresponding with the abutments of the bridges, with a general line of wharf frontage. Above Westminster-bridge he proposed an embankment in a straight line to new Lambeth-bridge, and extending considerably in shore, so as to leave a large portion of reclaimed ground between the river boundary and existing wharves, on which shops and villa residences might be built. From new Lambeth-bridge the embankment would be continued by an easy curve to the abutment of Vauxhall-bridge. Along the river side of this embankment a road 80ft. wide would be carried, so as to give a spacious and direct thoroughfare between the bridges of Westminster and Vauxhall.

HOW TO SELECT MUSHROOMS.—In consequence of the death of five officers, caused by eating poisonous fungi, the French Army Board have had the following instructions published:—Fungi afford man an agreeable and nourishing food, and, therefore, in some provinces of France, they are consumed to a great extent. The soldiers seek them, but unfortunately they often confound the poisonous with edible ones, and thus expose themselves to the gravest accidents. It is important, therefore, that they should be taught, as far as science is able, to distinguish the wholesome from the injurious species, and at the same time be made acquainted with the proper means to combat the poison. It is with this view that the Board of Health have drawn out the present instruction. Edible fungi grow usually in elevated and airy places in waste ground; whilst the dangerous species are found in woods, and in dark, damp places. The edible species have a compact, brittle flesh; while those with a soft and watery flesh should always be rejected. Wholesome fungi have an agreeable odour, although this character is also found in some injurious species. A powerful and disagreeable odour is the certain indication of noxious qualities. We ought at once to reject fungi which secrete a milky juice, and those which present an acrid, astringent, bitter acid or salt taste. We should suspect fungi which have a bright tint, red, green, or blue, of which the gills are coloured brown or blue. The flesh of the edible species is in general white; nevertheless, a beautiful red fungus, the *orange agarie*, is considered as the finest and most delicate species. Wholesome fungi do not change colour by contact with the air after being cut; those of which the flesh then acquires a brown, green, or blue tint, are poisonous. We ought to regard as dangerous those which insects will not touch. It is proper to abstain from fungi, whatever may be their apparent qualities, when they exhibit any signs of change; when even they have been collected more than twenty-four hours, the poisonous properties being capable of development when the fungus dries up.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

MR. SAMUDA ON IRON-CASED SHIPS.

SIR,—I should be glad, with your permission, to consider some of the points involved in the statements which were made last week by Mr. Samuda, in Great George-street, in the matter of iron-plated ships, and of which you published a summary in your number of the 31st ult.

He complains that the construction of the Warrior is complicated and costly, and recommends that the framework of the hull of such ships should be built as in an ordinary first-class steamer of the same size. One would have expected the charge against the Admiralty designers would have been that, while the extraordinary dimensions of the ship, and the great and unusual strain which would be brought upon the upper portions of the frame, called for a special mode of construction, the old modes had been adhered to with the usual tenacity.

The fact, however, was, that the great increase of longitudinal strength afforded by the system employed by Mr. Scott Russell in the Great Eastern rendered it desirable to apply it as far as possible in the new design, the ordinary transverse framing being combined with it for the purpose of obtaining proper support for the armour.

The economy of the mode adopted may, however, be best seen by comparing in several ships the weight of material expended in the hull for each ton of builders' tonnage.

I shall be able to do this from some notes which I have preserved on the various designs which were prepared for the Admiralty, by the most eminent English shipbuilders, when the Warrior was designed.

The weight of material, exclusive of armour plates, for each ton of builders' tonnage stands as follows:—

	Tons.
Mr. Scott Russell	·48
Messrs. Westwood and Baillie	·53
Mr. Mare	·57
Mr. Laird	·73
The Warrior	·77
Mr. Samuda	·82
Thames Shipbuilding Company	·86

From which it appears that, in Mr. Samuda's opinion, there should have been in the Warrior an additional hundredweight of material for each unit of tonnage.

But Mr. Samuda submits two designs of his own: the larger one he calls a 32-gun frigate. This I presume to be a mistake, as we are afterwards informed that she will be able to carry as heavy an armament as the Admiralty ships of 6,700 tons now building. These ships, as must be very well known to Mr. Samuda, are to carry fifty 100-pounder guns. He says they will cost £400,000 each, or £8,000 per gun. His will cost £340,000, which, for thirty-two guns, would be more than £10,000 per gun; and the argument of economy urged by him is turned against him. I will, therefore, assume that his second statement is correct, and that the proposed ship is to carry fifty guns. His ship will thus cost £60,000 less than the Admiralty ship.

Observe, now, how this is effected. It is not by simplifying the construction, or by the adoption of a different mode of protection, but simply by making the ship narrower.

Ships are paid for at so much per ton. Tonnage increases as the square of the breadth. Let us, therefore, argues Mr. Samuda, retain the length of the Warrior, and cut down the breadth 3ft. But Mr. Samuda has forgotten that, although the tonnage increases as the square of the breadth, the stability of the ship increases as its cube.

Let us see, as far as we are able from the information afforded us, how the matter of stability stands; and we will allow, for the sake of the argument, although it is not true, that Mr. Samuda's 5-in. plates, upon a skin 1in. thick, will offer as much resistance and penetration by shot as the Admiralty 4½in. of iron, upon 18in. of teak and a ½in. skin.

If half the inch skin is taken with the hull, we shall then have to consider as armour 5½in. of iron. This will weigh 1,600 tons. Add to this Mr. Samuda's own weight of hull, viz., 4,600 tons. Then, allowing for smaller engines and lighter masts, the weights to go on board will be, say 60 tons less than those which will go on board the Admiralty ships, or about 3,150 tons, including 254 tons for guns, 900 tons for engines, 938 tons of coals, and provisions and stores for 700 men. Adding these together, we get a total weight of 9,350 tons.

This is 700 tons heavier than the Warrior. How she is to be made, with less engine power, to go faster than the Warrior does not appear.

This additional weight can only be carried in a ship three feet narrower than the Warrior, by increasing the draft of water, and filling the section. The centre of buoyancy will, by this means, be lowered, with regard to the water line, about six inches. The height of metacentre above this point will be reduced by narrowing the ship from 13ft. 6in. to 11ft. 1in. The centre of gravity of the hull will be raised by the additional plating 9in. The combination of these changes reduces the distance between the centre of gravity and the metacentre, which, with the weight of the ship, is a measure of the stability, from 5ft. 3in. to 2ft.

I have no hesitation whatever in saying that such a ship would never dare to hoist her canvass in a breeze of wind, and would be utterly useless as a ship of war.

Mr. Samuda does not furnish sufficient information with regard to his smaller design to enable me to prove what I suspect to be the fact—that the dimensions proposed by him are too small to give, with the greatest imaginable fulness of form, the displacement he requires. This much, however, is certain, that if the ports are as high out of the water as those of the Admiralty coast defence vessels, viz., 7ft. 6in.—he will require 800 tons of his proposed plating.

If we were called upon to hazard a guess at the speed of such a vessel, let us see how we might go to work.

There is a vessel of war called the Imperieuse, whose mean draft of water is 20½ft., and the dimensions of which are something like those proposed by Mr. Samuda. Her speed does not reach, when she is loaded, ten knots. We must, however, so alter the form of this ship as to enable her to carry some three or four hundred tons additional weight. This must, of course, be done by causing her to make a larger hole in the water. But, to bring her to Mr. Samuda's dimensions, we must, at the same time, shorten her 12ft., narrow her 18in., and reduce her draught of water 4½ft.

Having, if possible, constructed the "tub," or washing tray, which will perform these conditions, reduce the power of the engines from 360 to 350 horses, and the diameter of the screw from 16ft. to 14ft. What shall we then say for the speed? Is there one of your readers who will endorse Mr. Samuda's statement that, after the metamorphosis, we should have a knot more speed?

Mr. Samuda concludes his paper by expressing the opinion that, in the construction of mail-clad vessels, the Admiralty had better abandon their present course of originating designs themselves, and "trust to the engineering skill of this country." That they should avail themselves of the skill of private shipbuilders and engineers is, I think, their duty, and they appear to think so too; but that they should trust it, Mr. Samuda has failed to show.

NATHANIEL BARNADY,
Mem. Inst. of Naval Architects.

London, 5th February, 1862.

RESISTANCE OF SHIPS.

SIR,—As you have reprinted a paper lately read by Mr. Mansel to the Scottish Shipbuilders' Association, in which he expresses dissent from a principle stated by me, that the whole of the appreciable resistance of well-formed ships can be accounted for by friction, I write in order to make an explanation which may, perhaps, lessen

his objections—viz., that the method of computation which I have followed includes not only the resistance to the motion of the ship directly produced by friction, but also the resistance indirectly produced through the opposition of the friction to the sliding of the water round the ship, and the consequent heaping up of the water against the bow higher than against the stern, so as to produce a preponderance of pressure against the bow. I do not attempt to compute those two parts of the resistance separately, which would be a waste of labour, but I use a method that gives the resultant of both at one operation. I believe that the point which I have now stated constitutes one of the chief differences between my researches and those of Mr. Bourne and other writers who have previously regarded friction as the most important cause of resistance to ships. W. J. Macquorn Rankine.

Glasgow, 3rd February, 1862.

STEAM BOILERS.

Sir,—Among the many causes which lead to the destruction of boilers, there is, perhaps, none which plays a more important part than the use of improper feed-water. I have seen a boiler with internal flues, when a certain kind of feed-water has been employed, rendered unfit for further service at the end of fourteen days, the crowns of the furnaces having become red-hot, and given way under the pressure of the steam. The same boiler had its defective plates renewed, and since then has been working at another place with another kind of feed-water, and has given entire satisfaction. In order to test it well it was fired for nearly ten weeks without any blowing off or cleaning whatever, during which period it never showed the slightest sign of the crowns of the furnaces being hot. When it was first reported to me that the plates over the fires were red-hot, I supposed the stoker had let the water down too low; but, on looking at the gauge, I found the water in the glass at the right level, which was likewise proved by opening the two cocks placed for this purpose beside the gauge-glass on the front of the boiler. On trying to melt a piece of tin by holding it in contact with the underside of the plates (screened, at the same time, from the heat of the fire on the grate by the intervention of a shovel), it was found to melt away quite easily. On the boiler being blown off, and afterwards opened, it was found to contain a considerable quantity of a fine whitish powder, which being removed, the tops of the furnaces were found thinly coated over with a grayish white substance, something like rough porcelain, hard to be removed, and about the thickness of an old sixpence. The water used for feeding the boiler was analysed, and found to contain per litre 0·2720 grammes of solid matter, of which 0·2226 grammes consisted of carbonate of lime; the remainder was composed of organic substances, clay, iron, &c. The water proved to be almost entirely free from sulphuric acid salts. It proved to be a hard water, containing, per gallon, 15·4 grains of hardness. On trying to mix some of the powder taken from the boiler with water, we became aware of the presence of a fatty matter in intimate combination with it, which caused the powder to float on the surface of a glass of water, without in the slightest degree mixing with it. On trying to plunge a finger through the powder into the water beneath it was found almost impossible to wet the finger, the powder surrounding it like the finger of a glove, and effectually preventing contact with the water. Filling a small bottle with water, and adding some of this powder, it was tried to cause them to mix by violent shaking, continued for upwards of an hour, but without success, the powder remaining nearly as separate as in the beginning. On mixing a small quantity with spirits of wine it was found possible to cause a nearer approach to a mixture by shaking, though still far from perfect. Throwing cold water over the damaged plates, which were thinly coated, as above stated, the water ran off without appearing to wet them. In other words, it was found that the deposit formed by the water in the boiler, owing to being mixed with a fatty substance (not found in the water examined), was impenetrable to the water, and that, consequently, the intervening coating between the tops of the furnaces and the water in the boiler prevented the iron plates from being properly cooled, and allowed them to accumulate an increase of temperature until they were too weak to hold up under the pressure of the steam, and the arch gave way, and came down to a dangerous extent over the fire. Providentially no rupture ensued, or the results might have been disastrous. Of course, when the crowns of the furnaces are thus heated a very considerable expansion takes place along the tops of the flues endways, and the ends, not being able to accommodate such an increase of length (which they were never intended to do), it is a common occurrence to crack the flanged plate or angle iron ring forming the mouthpiece. I must not omit to state that the engine in connection with this boiler was new, not overworked, and working the steam expansively, and condensing. The coal burnt per square foot of grate was about 12 lb. per hour.

The next case which came under my notice was that of a 20-horse boiler with one flue, 2ft. 6in. diameter, containing the grate. This boiler had been started seven years ago in connection with a non-condensing engine, and had never had any repairs done to it before June last, when I was told that the top of the flue had become very flat, and the seams over the fire were leaking badly. I caused a Low Moor plate of $\frac{7}{16}$ thick to be prepared, and replaced the old one by it, when, to my surprise, about a fortnight later, I heard from the mill that the boiler was in as bad a state as before. I sent an experienced stoker to see if he could discover anything in the manner of firing, which might throw a light on the subject, but he soon returned, telling me it was dangerous to continue firing that boiler, as the plates over the fire were red-hot. During a conversation with the owner of the mill, I desired him to tell me truly whether the water supply was still taken from the same spot where it had been originally, and he then acknowledged that his engine had been recently converted into a condensing engine, by the addition of an air pump and condenser, and that he now took the feed-water from the hot well, adding, however, that it was the very same water as before, with the exception of having first served as injection water. The water having been analysed, and found to be nearly the same as in the former case, I ordered the suction pipe from the feed-pump to be removed from the hot well, and fitted to the same place as before the alteration of the engine; and, to our extreme satisfaction, all the evils from which they had been suffering for the last two months ceased at once. From that time to this the boiler has continued to go on well, and to give no trouble. It is very remarkable that, since the boiler has been fed with the same water as before (the only difference being that it has not served as injection water), the white powder has entirely disappeared, and the deposit in the boiler is mostly found at the bottom as a kind of earthy matter, the top of the flue keeping pretty clean. There appears no doubt that, with this kind of water, the grease which passes with the steam from the cylinder into the condenser combines with the lime, and causes a coating to be deposited over the fues, which is, in a manner of speaking, water-proof, thus hindering the efficient coating of the metal beneath. With other kinds of water (which are of a softer description) this grease does not hinder the solid matter they contain from mixing with the water; and, although there may be a scale of considerable thickness over the fires, it allows the water to penetrate it, and thus the plates are kept cool. In the instance given above of a boiler having worked ten weeks it was found on being opened to be in a very dirty state, and portions of the furnace crowns were covered by a strong scale nearly half-inch thick; but this scale was of such a nature as to allow the water to pass through it and cool the plates.

I am afraid to trespass longer upon your space; I will only remark that since these cases happened I have had frequent occasion to examine the deposits found in boilers, and have generally found that the nature of the feed-water employed has exercised the greatest influence on their durability, and that always when the deposit was difficult of solution in water the destruction of the boiler has been most rapid. In several cases now this has been checked and put a stop to by feeding the boiler with water which has not passed through the condenser. The water is, however, first heated to a considerable degree, by passing through an apparatus made for that purpose, before it enters the boiler. It would be very interesting to know whether the scale formed by sea-water would be less injurious to boilers if the water were pumped direct into the boiler (after passing through a proper feed-heater), without having first served as injection. The adoption of surface condensation renders this of less importance than formerly, but there are still a vast number of sea-going steamers without this system, which would make an amelioration extremely desirable if possible. M. M. J.

Zurich, 30th January, 1862.

WATER TUBE BOILER.

Sir,—If "Tyro" will send me his address I will be very happy to send him a sketch of the horizontal water tube boiler he referred to, if he will tell me what horse power he requires. I will send him the dimensions with the sketch, or, if you wish, I will send you the sketch for insertion. V. P.

February 4th.

FALLING BODIES AS AFFECTED BY THE EARTH'S ROTATION.

Sir,—In answer to M——n's question I beg to give him the results of an experiment made at Freyberg, in a mine pit, by Mr. Reich. The height of the fall was 185 yards, the latitude of the point was 51 deg.; a deviation of 0.0276 m. (1.08 in.) towards the east was found at the bottom of the pit. T. E. Elwell, Jun.

No. 9, Avenue Trudaine, Paris, 22nd January, 1862.

Sir,—M——n inquires respecting the adherence of a falling body to the line of gravitation. The body would fall to the centre of the globe in a true line, described from that centre to the point from which it fell, for this reason: the impulse which the object possessed in the direction of the earth's rotation would decrease inversely as the times of falling, while the velocity of motion in the line of gravity would accelerate directly in proportion to the times.

Wolverton Station, January, 1862. Harry D.

PATENT TRIBUNALS.

HILLS v. EVANS.

Sir,—Those who have paid attention to the proceedings in this case before the Lord Chancellor will, I think, have arrived at the conclusion that the case suffered nothing by being tried before a single competent judge; but I go beyond this, and maintain that patent cases generally would be better tried in this manner.

The Lord Chancellor appears to me to be fully alive to the importance of settling the meaning of the specification according to patent law before going into any question of infringement. He appears to act on a clear apprehension of the function of a judge in trying a patent case, viz., to determine, in the first instance, what is the legal right under the patent as expressed in the specification. This surely must be the preliminary point to be settled. I cannot see the sense of considering the question of infringement until the extent of patent right has been authoritatively defined. How can it be said whether there is an infringement or not until it is known what constitutes an infringement? You must know the limits of a man's property before you can tell whether you are trespassing on it or not. And yet it has not been the practice to settle the point answering to this in an action for the infringement of a patent before considering the question of infringement. The jury have been frequently directed to find a verdict on the point of infringement, while the point of extent of legal right has been reserved.

Now, Sir, my object at present is merely to draw attention to the fact that, in the case referred to, the course pursued by the Lord Chancellor in concentrating his attention on the interpretation of the specification in the first instance had the effect of deterring the opponents of the patent from trying the question of infringement; and my conviction is that this would ordinarily be the result, because the denial of infringement usually rests upon some point of construction of the specification. While any material point on the specification remains open, the question of infringement cannot be concluded. Besides, the right construction of the specification has an important bearing on the relevancy of particular points of argument and evidence, and, therefore, on the duration and costs of the proceedings.

It is exceedingly gratifying to my mind to find a Lord Chancellor taking the lead in conducting the trial of a patent case according to the natural order of thought relating to the subject, instead of allowing the preliminary points of inquiry to be postponed to the consideration of secondary points, as has been the practice in too many instances. And I trust that this trial may produce a permanent effect in the ultimate establishment of a more natural mode of conducting inquiries relating to patents, in the place of the extremely artificial mode which has been suffered by degrees to gain too firm a footing in our courts of law.

William Spence, A.I.C.E.

50, Chancery-lane, W.C., January 30, 1862.

FALLING BODIES AS EFFECTED BY ROTATION OF EARTH.

Sir,—In The Engineer, of the 17th inst., your correspondent "M. N." asks what would be the effect of the earth's rotation on a falling body dropped from the summit of a high tower, supposing it to be unaffected by atmospheric resistance or attraction of contiguous bodies?

When it commenced falling it would have, in common with all objects in connection with the earth, a motion of rotation round the earth's centre, but, as it would describe a circle round this centre of greater radius than the circle described by the earth's surface, it would necessarily move through a greater space in a given time. This motion it would retain throughout its fall by virtue of its inertia, and would consequently fall slightly in advance of the point (in the direction of the earth's rotation) over which it was let loose. J. H. C.

Wolverhampton, February 4th, 1862.

PATENT LAW REFORM.

(From Newton's London Journal of Arts.)

Among the more prominent subjects awaiting legislation in the coming session of Parliament, the daily journal which claims to be the leader of public opinion and the discerner of the signs of the times enumerates the Law of Patents, which it denounces as "one of the most mischievous and anomalous laws of the day, which perpetuates monopoly in the very bosom of free trade, and stifles invention in a country the existence of which depends on success in the race between increased means of production and the increase of population." We agree with the *Times* so far, that the subject of patent law reform is ripe for parliamentry action, and seize the present opportunity to consider what are the defects of the existing system for rewarding inventors, and in what manner those defects may be remedied. It is not our purpose, in the remarks we have to offer, to enter upon the question of patents or no patents, for that subject has, we believe, been sufficiently discussed to convince every reasonable person of the untenable nature of the objection raised to such privileges. We shall, therefore, assume what is generally accepted as the truth, viz., that the granting of patents for new inventions does encourage the exercise of the inventive faculty, and that it induces the free expenditure of capital, both in testing the practical value of new ideas and in establishing new branches of manufacture, as well as tending to remodel and simplify old and tedious processes.

It will be convenient to base our remarks upon the report read at the Manchester meeting of the British Association, consisting of a series of resolutions passed by the Patent Law Committee, which sat in London in the summer of last year, and was composed of members of the Law Amendment Society and of the Social Science Association, who were peculiarly well qualified to offer an opinion on the subject brought before them. From the discussion which followed the reading of this report at Manchester, in which some of the leading men of the committee took part, it was easy to gather that, if there was not a perfect unanimity of opinion on all points, there was a general agreement that the administration of the law was defective, both in respect of the indiscriminate granting of patents to all applicants and in the trial of cases of infringement in the equity and common law courts. These are perfectly distinct matters, involving, in very different proportions, the application of scientific and legal knowledge; but, as will be seen hereafter, they are proposed to be dealt with by one and the same special tribunal. Whether this be the correct course or not can only be determined by a careful consideration of the nature of the duties involved in the inquiry preparatory to the granting of exclusive privileges arising out of applications for enforcing the rights thereby created.

The first resolution of the Patent Law Committee is—"That all applications for grants of letters patent should be subjected to a preliminary investigation before a special tribunal;" and following upon this resolution, and, indeed, forming part thereof, is the following:—"That such tribunal shall have power to decide on the granting of patents, but it shall be open to inventors to renew their applications, notwithstanding previous refusal." What the nature of the preliminary investigation is intended to be does not transpire; but it is further proposed that the sittings of the tribunal should be public. On this point we must take exception to the finding of the committee; and we are sure that, had the exact nature of the duties of the tribunal been clearly defined before the resolutions were drawn up, there must have been an unanimous decision for private investigation. It is difficult to say, in these reforming days, to what extent the inquiry of the tribunal might reasonably be expected to extend. But let it be assumed that, besides the existing formal examination, all applications should be subjected to an inquiry directed to the questions of novelty, as in the United States; to utility, as in Prussia; and to whether they contain proper subject-matter for a patent; and what benefit would come from a public inquiry. An inventor, when applying for provisional protection, has, in general, his invention but crudely formed, and takes that course, in order to enable him confidently to proceed with experiments. He is not, therefore, in a position to prove the utility of his invention, for that is the very point on which he is in doubt.* Then, again, with respect to novelty, are not investigations of this nature essentially the duty of a recluse? and if so, how can novelty be tested in an open court? To be properly conducted it would require a large staff of qualified examiners, whose Herculean labours would be most distasteful to the majority of inventors; yet we consider it is a duty that should not altogether be ignored. And, further, if an applicant fails to satisfy the tribunal that his invention is the proper subject for a patent, because of its being a trivial matter or an obvious adaptation, what good can accrue to the public from the inventor's failure being blazed abroad? Moreover, where is the public to be found who will listen to the court's proceedings? Such discussions must necessarily lack all public interest from their being but one party to the suit, except in the rare cases where an opposition is lodged to the grant of a patent. A tribunal charged with the preliminary investigation of applications for patents is dealing with matters of a strictly private character, and which do not admit of publicity, except to the manifest disadvantage of the suitors. We ought to be on our guard against the cant of the present day, which denounces private inquiry as inquisitorial, and shelters a prurient curiosity under colour of a love for the pure administration of justice.

The committee has wisely abstained from setting forth in its resolutions the precise character that the preliminary investigation should assume. This is a question on which great differences of opinion may naturally be expected; those most intimate with the working of the patent law inclining to a very limited inquiry. All that is requisite at present is, to take care that in any future legislation sufficient power shall be given to the authorities appointed to the duty to enable them to act in a manner that may be deemed beneficial to the public, and to patentees generally. We believe that there is a large number of patents granted which, on public grounds, ought to be refused; not by reason of the inventions being old—for the novelty of the idea may be unquestionable—nor because of their inutility (for where the ideas embodied are useless, such patents are perfectly harmless), but because they do not come up to the requirement of the statute of James, in respect of being a new manufacture. Of this class are the substitution of one material for another, when no mental labour or experimental research is required to effect such substitution; or the importing, under similar circumstances, of a process from one branch of manufacture to a kindred branch. If the rule to refuse the applications for patents based upon such inventions were established, and firmly adhered to, there would be an end of what are now termed advertising patents, which give nothing to the public that would not, in the common course of trade, and with little or no delay, find its way into the market. To this extent, and no further, do we agree with the *Times* and the other opponents of patent law in the expediency of withholding protection to inventors. Indeed, so thoroughly is the granting of patents for new discoveries interwoven in the national mind with the principle of justice and equity that we believe all attempts to abolish this system of rewards to be as futile as were the labours of the *Times* to abolish the new Poor Law

A far more important subject than the preliminary investigation of applications for grants of letters patent was that of the trial of patent causes, which obtained the special consideration of the committee. It was manifest to them, as it must be to all who are familiar with the proceedings in patent suits at either law or equity, that a more unsatisfactory system could not well be devised. On this point fresh proofs accumulate during every term, and the opinions of presiding judges condemnatory of the existing system are being constantly drawn forth. To meet the want of suitors the committee recommend the construction of a special tribunal, which shall take upon itself the general administration of the patent law. This tribunal, it is proposed, should be formed "by a permanent and salaried judge, assisted, when necessary, by the advice of scientific assessors;" and, further, "that the scientific assessors for the trial of patent causes should be five in number (to be chosen from a panel of thirty, to be nominated by the commissioners of patents), for the adjudication of facts, when deemed necessary by the judge, or demanded by either of the parties." When engaged on preliminary examinations "the assessors (if the judge requires their assistance) should be two in number, named by the commissioners of patents from the existing panel. In this tribunal we have a combination of two elements, the legal and the scientific, brought to bear upon questions which require for their elucidation both legal acumen and scientific knowledge; the latter to master the facts, and the former to apply them. How different this is to the present practice of trial by jury a short comparison of the action of two courts will render apparent.

The question to be decided by the verdict of a jury, so far from being laid before them in an impartial manner, is at first dressed up so as to bias their minds in favour of the plaintiff, and the evidence is made to take the same tone; even the judge knows nothing about the case for the defence (except the little he may gather from the cross-examination of the plaintiff's witnesses), until, the plaintiff's case being closed, the defendant's is opened. This usually commences by bringing before the judge a string of technical objections, either to the effect that the construction put on the patent by the plaintiff—so as to bring the defendant's acts within the scope of the claims—is untenable, or that the instrument is invalid for such and such reasons. Supposing these not to be sufficient, in the opinion of the judge, to stop the trial, the jury are treated with another jaundiced view of the case, and they are then called upon by the judge to give their verdict on the careful consideration of facts of which they have no adequate conception. That juries, in general, avoid making very egregious blunders, is mainly owing to their taking their cue from the tone of the summing up; but this is, by no means, a safe course; for the want of scientific knowledge to enable them to master the case is also common to the learned judge—although it is, to a great extent,

* This was well put in a paper read by Mr. Spence, at the meeting of the British Association at Manchester, in answer to a proposition contained in Mr. Grove's very able article on Patent Law Reform, published in the *Jurist*.

compensated for by his higher mental training. By the present system, therefore, Justice has to find her way through the trammels of prejudice and ignorance in order to assert her authority; and the investigation has to be arrested in mid career, in order to settle, *pro tempore*, points of law which, if they have any bearing on the case, ought to precede the scientific investigation.

Now, mark the operation of the proposed special tribunal. The presiding judge, if not appointed for his special fitness for the office, must soon become qualified through the continued exercise of his peculiar functions; he will possess, therefore, not only the high legal qualification so essential for suspending the judgment until all the facts are before him, and of balancing them in his mind to test their weight and value, but also the power of rightly estimating the value of the arguments of the contending parties. Not being trammelled by any rules of procedure, he will first take into consideration the points arising out of the construction of the specification, and, if he finds the objections tenable, arrest the case at that early stage. Should, however, it be allowed to proceed, he will weed the evidence of all the matter that is usually brought in to make weight with the jury; and, by taking his facts, where there is a conflict of evidence, from the impartial finding of scientific assessors, he will give to the case, for the first, the benefit of a combination of law and science, which elements, from having hitherto been kept asunder, have rendered investigations of this class so unsatisfactory and protracted. It will also be manifest that, by reason of all cases of infringement of patents being submitted to one special tribunal, the judge, instead of considering such questions as exceptional, will no longer feel the inconvenience of being more or less a novice in their treatment, but will approach them with that confidence which only constant practice can ensure. Thus, in the matter of precedents, he will be equal or superior to the counsel addressing the court, and in judging of the bearings of facts in science upon the questions at issue he will be little, if at all, inferior to the scientific witnesses employed by the litigants. How thorough a change would be thereby effected in the manner of getting up cases for trial all who have been engaged in such duties will understand at a glance. Points on which the case should rightly turn, but which could not be put, from the utter inability of the jury to understand them, will no longer be kept back; admissions which, if now made, would certainly ruin the case, will then no longer be withheld; and the tricky evidence which is sometimes relied upon to defeat justice will cease to be employed. The expenses of a suit will necessarily be greatly reduced, and questions in dispute will not unfrequently be brought for decision in a friendly spirit, and before the parties have had time to quarrel on their disagreement; while those who have determined to suffer spoliation, rather than resort to the existing means of obtaining justice, will have such an opportunity thrown open to them as can only be compared to that presented to tradesmen for the recovery of small debts by the establishment of the county courts throughout the country. Although the decisions of this special tribunal would in most cases be final, yet the committee propose that "the right of appeal should be to a Court of the Exchequer Chamber, with a final appeal to the House of Lords." This is manifestly a prudent course, for to bar the right of appeal would be an encouragement to reckless judgments; but, so long as the proceedings of the court is open to question, the public have the security of obtaining at least carefully considered decisions.

We have said that the resolutions of the Patent Law Committee provide for the examination of applications for patents, and the investigation of cases of alleged infringements, by the same tribunal—that is to say, the officer whose approval is required before the granting of a patent, and who, in his administrative character, must be guided by expediency rather than rigid rules, will have the opportunity, as presiding judge, of reconsidering his decision, taking now into account only the law of the case. It is not impossible to find in the same person sound administrative and judicial abilities; but when the thing required to be judged of is created by the judge's own administrative powers there would appear to be an anomaly that does not admit of being reconciled. We are, therefore, of opinion that this part of the programme for legislative action requires amendment. Moreover, we think it essential that, if the leading functionary invested with the powers of deciding upon the granting of patents is to be assisted by two scientific assessors, it is important that their duties should be permanent; for, so long as they retain their working powers, just in proportion to the length of their experience will be their usefulness.

There is one other matter embraced in the resolutions so foreign to the points we have had under discussion that it might well have passed at the present time unnoticed, but that it has an important bearing upon the obstruction cases cited and dwelt upon by the decriers of patents. It was, in fact, to meet the suppositious case of a dog-in-the-manger patentee not using his invention himself or suffering others to apply it, that the following resolution was framed, viz., "That the committee approve of the principle of compelling patentees to grant licenses on terms to be fixed by arbitration; or, in case the parties shall not agree to such arbitration, then by the proposed tribunal, or by an arbitrator or arbitrators appointed by the said tribunal." This is a provision that would by no means gain the universal consent of patentees; but it is so reasonable a proposition, that the public good must not be thwarted by the mere whim of an individual, that we are sure, it cannot, on consideration, but be acquiesced in. We hold, that the mere enactment of a provision of this kind would destroy the necessity for its enforcement. And, indeed, we expect more from it than this; for it will wean patentees from the desire of locking up their inventions for fourteen years. In this respect English patentees have much to learn, and they cannot do better than study the policy of American patentees, whose profits, we have had occasion to show, are often enormous, being derived chiefly from the granting of licenses to all who may desire to apply their inventions.

To acquire a license at a moderate cost is a right for which every manufacturer may reasonably contend; for it never was intended by the law that patent rights should bar the door to improvement. It is not our intention to contend that they do, for a refusal to grant a license has not unfrequently forced a manufacturer to invent something better than that which he was content to acquire by purchase; but it is quite within the range of possibility that a patentee may so stand in his own light as to perplex the calculations of manufacturers requiring the use of his process, and thus hamper their proceedings. In that case they have a right to complain; and it is to prevent the possibility of this imaginary obstruction that we advocate compulsory licenses. It is already provided in every patent that her Majesty's Government shall have the use of the invention on the payment of a reasonable remuneration for the same, and patentees are glad enough when that clause of the grant is acted on. The compulsory license will, therefore, only be an extended application of the same principle, and that for the benefit of the patentee. All objections, therefore, to this proposition of the committee we hold to be untenable.

In concluding our remarks upon the salient defects in the working of the patent law we should urge upon inventors the expediency of a united effort to bring the matter before Parliament without delay; for a better opportunity could not well arise than the coming session, when all the world will be called to admire the wonders of practical science, and the national importance of new discoveries will be in all men's minds. Ample funds to meet the proposed changes are already in hand, and there is nothing to oppose the movement: what can be done by individual effort shall not be wanting on our part, but it is only a class movement that can overcome the inertia of the Government.

STEAM BOILERS UNDER POLICE SUPERVISION.—In New York and its populous suburb, Brooklyn, steam boilers are subject to testing by the police, who are possibly better than no inspectors at all. Last year 2,566 steam boilers were tested by the hydraulic pump in New York, and 567 in Brooklyn. No less than 654 were found to be defective, and were repaired and remedied by order of the board. A number of explosions were undoubtedly prevented by this inspection.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

2341. WILLIAM THOMAS TONGUE and JOHN GREER, Liverpool, "An improved portable self-acting water-engine for extinguishing fires and other purposes."

2342. JOHN HAYS WILSON, Liverpool, "Improvements in pumps chiefly applicable to ships' lift pumps."—*Petitions recorded 19th September*, 1861.

2415. GEORGE SMITH, Liverpool, "Improvements applicable to gas meters."—*Petition recorded 27th September*, 1861.

2520. GEORGE DAVIES, Serle-street, Lincoln's-inn, London, "Improvements in machinery for manufacturing shoes for horses and other animals."—A communication from Thomas R. Taylor, Cleveland, Ohio, U.S.—*Petition recorded 9th October*, 1861.

2626. JOSEPH SCOTT PHILLIPS, College-crescent, Finchley-road, London, "A new method and apparatus for the propulsion of vessels through the water."—*Petition recorded 21st October*, 1861.

2677. THOMAS RICHARDSON, Newcastle-upon-Tyne, and ROBERT IRVINE, Hurlet, Renfrewshire, "Improvements in treating bones and gelatine."—*Petition recorded 25th October*, 1861.

2769. WILLIAM CLARK, Chancery-lane, London, "Improvements in water meters."—A communication from Messrs. Frank G. Johnson, Brooklyn, King's County, William T. B. Milliken, Morriasania, Westchester County, and Edmund Jones, New York, U.S.—*Petition recorded 4th November*, 1861.

2835. WILLIAM HENRY BALMAIN and JOHN KEAN, St. Helen's, Lancashire, "Improvements in the manufacture of flowers of sulphur and roll and other forms of sulphur."—*Petition recorded 13th November*, 1861.

2974. DAVID KER, West of England Soapworks, Plymouth, Devonshire, "An improvement in the manufacture of soap."—*Petition recorded 26th November*, 1861.

3156. JOHN AITKEN, Lasswade, near Edinburgh, "Improvements in supplying water to water wheels."

3158. CHARLES BAUMANN, Altdorf, Weingarten, Wurtemberg, "Improvements in buttons."—*Petitions recorded 16th December*, 1861.

3185. ALPHONSE TREUILLE and FRANCOIS XAVIER TRAXLER, Boulevart St. Martin, Paris, "Improvements in the manufacture of paper and card paper or cardboard, with the object of preventing forgery and alterations in cheques and other documents, and which improvements are also applicable to the manufacture of playing cards and railway and other tickets."—A communication from Joseph Prosper Oller, Rue de la Banque, Paris.—*Petition recorded 19th December*, 1861.

3196. WILLIAM CLARK, Chancery-lane, London, "Improvements in apparatus for the manufacture of matches."—A communication from Messrs. Francis Lavallee and Son, Boulevart St. Martin, Paris.

3199. EUGENE ETIENNE PEREAU, Moorgate-street, London, "An improved composition for cleaning and revivifying woollen cloths and other fabrics, and the colours thereof."—A communication from Alfred Thomas, Paris.—*Petitions recorded 20th December*, 1861.

3210. WILLIAM CHARLES MILES, Railway-place, Shoreditch, London, "Improvements in lamp glasses for lamps burning paraffine and other light mineral oils."—*Petition recorded 21st December*, 1861.

3216. CHARLOTTE SMITH, Bedford, "Improvements in stays."

3218. CHARLOTTE SMITH, Bedford, "Improvements in stays."—*Petitions recorded 24th December*, 1861.

3228. THOMAS SIMMONS and THOMAS TIMMINS, Birmingham, "Certain improvements in urns or vessels for holding and supplying hot water, tea, coffee, or other liquids separately or conjointly, as also in the stands for the same."—*Petition recorded 26th December*, 1861.

3240. WILLIAM TURNER and JOHN WILLIAM GIBSON, Hammersmith, Dublin, "Improvements in rolling bridges."—*Petition recorded 27th December*, 1861.

3253. JOHN BELLAMY PAYNE, Chard, Somersetshire, "Improved machinery for the manufacture of laid and other twine, lines, ropes, bands, and other cordage, whether made of hemp, flax, or other fibrous substances, or of wire."—*Petition recorded 30th December*, 1861.

8. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in shears or scissors, chiefly applicable to be employed in the manufacture of laces."—A communication from Pierre Joseph Heminot and André Carpentier, Caudry, France.

11. BENJAMIN RHODES, Old Ford, Bow, "Improvements in forming or making straight and bent pipes and bends for pipes, and also vessels of various shapes, and in coating and protecting objects and articles of various forms, and in the apparatus to be employed therein."

12. EDWARD BANFIELD, Ilfracombe, Devonshire, "Improvements in lubricating and maintaining in working order axle journals and brasses applicable also to other journals and bearings."

15. JAMES HOWARD and EDWARD TENNEY BOUSFIELD, Bedford, "Improved apparatus applicable to steam cultivation."—*Petitions recorded 1st January*, 1862.

19. ATHANASE MATHURIN PIERRE AIRIAU, Rue St. Dominique, St. Germain, Paris, "A new musical instrument."

22. GEORGE JEFFRIES, Golden Ball-street, Norwich, "Improvements in breech-loading fire-arms."—*Petitions recorded 2nd January*, 1862.

25. GILBERT STRACEY, Rackheath Hall, near Norwich, Norfolk, "Improvements in the manufacture of artificial fuel."

27. WILLIAM EDWARD GEDGE, Wellington-street, Strand, London, "Improvements in apparatus for dressing, cleaning, or sifting grain."—A communication from Louis Appolinaire Haton, Passage des Petites Ecuries, Paris.—*Petitions recorded 3rd January*, 1862.

44. FREDERICK SHAW, Sheffield, Yorkshire, "Improvements in apparatus for stopping railway trains."—*Petition recorded 7th January*, 1862.

61. JOHN BAUNT, Rue Petreile, Paris, "Improvements in gas meters."

63. DAVID WILSON, Colombo, Ceylon, "Improvements in machinery for pulping and preparing coffee."

65. DAVID WILSON, Colombo, Ceylon, "Improvements in hydraulic presses."

67. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in apparatus for carburetting and burning gas."—A communication from Léon Farrance and Henri Gloesener, Paris

69. HARRY BARBER, Belgrave, Leicestershire, "Improvements in safety lamps."—*Petitions recorded 9th January*, 1862.

70. ALPHONSE RENE LE MIRE DE NORMANDY, Odin-road, King's-road, Clapham Park, Surrey, "An improved method of fixing tubes in tube plates."

71. JOHN CARTER, Tipton, Staffordshire, "A new or improved draining plough."

73. MONTAGUE WIGZELL, Strand, Topsham, Devonshire, "An improved double acting ventilator for railway carriages and other carriages and compartments."

75. JAMES OATES, Mirfield, Yorkshire, "Improvements in washing machines."

76. HENRY DARVILL, New Windsor, Berkshire, "An improved method of hardening chalk for building purposes."

77. WILLIAM HENRY PREECE, Southampton, "Improved apparatus for signalling upon railways."

79. JOHN KENYON, Ivy Cottage, Lower Heath, Hampstead, and ARCHIBALD HORN, Great James-street, London, "Improvements in railway signalling by electricity, and in the arrangement of apparatus for that purpose."—*Petitions recorded 10th January*, 1862.

83. JOSEPH WHITE, Trinity-street, Southwark, Surrey, "Improvements in lubricating, or oil cans, or oil feeders, and in the mechanical arrangements for regulating the flow of oil therefrom."

84. LAUCHLAN MACKVIDY, Greenock, Renfrewshire, "Improvements in apparatuses for reburning animal charcoal."

85. THOMAS SCOTT, Nelson-square, Surrey, "Improvements in steam engines."—*Petitions recorded 11th January*, 1862.

88. JOHN MARTIN ROWAN, Glasgow, Lanarkshire, N.B., "Improvements in the manufacture of iron and steel."

89. THOMAS GILBERT, CHARLES GILBERT, and THOMAS HADDON, Birmingham, "An improvement or improvements in the manufacture of swivels for guns, and in machinery to be employed in the said manufacture."

91. THOMAS SOAR and MARCUS SOAR, and JONATHAN BELSHAW, Radford, Nottinghamshire, "An improved knocker to be attached to doors, shutters, or other parts of premises to which the same may be applicable, also for the reception of letters and other documents."

95. HENRY SCHOTTLANDER, Paris, "Improvements in albums for containing photographic and other pictures."

97. JOSEPH BETTELEY, Liverpool, "Improvement's in shipbuilding."

98. THOMAS WRIGHT GARDNER TREERY Westbourne terrace Villas, Paddington, "An improved method of, and apparatus for, producing rifled cannon and fire-arms."

99. JAMES GARTH MARSHALL, Leeds, Yorkshire, "Improvements in the preparation of flax, hemp, and other fibres previous to being spun."—*Petitions recorded 13th January*, 1862.

101. JOHN CARTER, Danvers-street, Paulson-square, Chelsea, London, "An improved shaft tug or bearer used in harness."

104. JAMES JACK, Liverpool, "An improved method of preparing cores for moulding or shaping metals."

105. MATTHEW CHADWICK, Radcliffe, Lancashire, "Improvements in machinery for folding or plaiting cloth and for measuring the same."

109. CHRISTOPHER HILL, Ferryside, Kidwelly, Carmarthen, "Improvements in the manufacture of lubricating compounds."

111. JAMES GARTH MARSHALL, Leeds, Yorkshire, "Improvements in the machinery and processes for producing fibre from woven and other textile fabrics."—*Petitions recorded 14th January*, 1862.

120. THOMAS MATANLE, Wilmot-square, Bethnal Green-road, London, "An improved runner fastening for umbrellas, parasols, sunshades, and other similar articles."—*Petition recorded 16th January*, 1862.

130. JOHN TOW, Poland-street, Oxford-street, London, "Improvements in the construction of stoves or fire-places."

132. THOMAS NEWTON, Manchester, "Improvements in sights for rifles."

138. WILLIAM LOUIS WINANS, Baltimore, Maryland, U.S., "Improvements in the manner of mounting and apparatus for manœuvring cannon or ordnance on ships or vessels of war and floating batteries."—*Petitions recorded 18th January*, 1862.

140. WALTER SANDELL MAPPIN, Birmingham, "A new or improved lock."

142. THOMAS HOLT, Edward-street, Blackfriars-road, Surrey, "Improvements in folding iron chairs and chair bedsteads."

144. WILLIAM BOALER, Manchester, "Certain improvements in the method of sizing paper yarns and woven fabrics, and in machinery or apparatus connected therewith."—A communication from John Adams Rhodes, Providence, Rhode Island, U.S.

146. JOSEPH BIRD, Bildworth, Nottinghamshire, "An improved crank axle applicable to cranks of any description whatsoever wherein the wear is mainly on one side thereof."—*Petitions recorded 20th January*, 1862.

154. JOHN BATE, Crescent, Birmingham, "Improvements in machines for corking or stopping the mouths of bottles, jars, or any vessel requiring to be stopped up air-tight."

156. GEORGE TOMLINSON BOUSFIELD, Loughborough Park, Brixton, Surrey, "Improvements in machinery for making nails and spikes."—A communication from Carl Gustaf Gustafsgon, Hellstorp, near Yonköping, Sweden.

160. WILLIAM BURGESS, Newgate-street, London, "Improvements in reaping and mowing machines."—*Petitions recorded 21st January*, 1862.

164. ISAAC ROBERTS, Liverpool, "Improvements in combined hydraulic motive power engines and meters."

168. THOMAS LITTLE and JOHN LITTLE, Alston, Cumberland, "Improvements in apparatus for cooling coffee berries."—*Petitions recorded 22nd January*, 1862.

Inventions Protected for Six Months by the Deposit of a Complete Specification.

196. JOHN HENRY JOHNSON, Lincoln's-inn, London, "Improvements in the prevention or removal of incrustation in, or from, steam generators, and in the apparatus employed therein."—A communication from Stanislas Michel Lecacheux and Bernard Sartre, Marseilles, France.—*Deposited and recorded 25th January*, 1862.

218. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improvements in engines actuated by heated air, or by combinations of air and steam."—A communication from Jacques Belou, Rue St. Georges, Paris.—*Deposited and recorded 28th January*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

280. JOSEPH GRIMOND, Manchester.—Dated 1st February, 1859.

276. JAMES ROBERTSON, Glasgow, Lanarkshire, N.B.—Dated 31st January, 1859.

422. JOHN THOMAS JONES, Glasgow, Lanarkshire, N.B. — Dated 15th February, 1859.

301. SAMUEL TEARNE, Birmingham.—Dated 2nd February, 1859.

304. JOHN HIRST, jun., and JAMES HOLLINGWORTH, Dobcross, Saddleworth, Yorkshire.—Dated 2nd February, 1859.

295. WILLIAM EDWARD NEWTON, Chancery-lane, London.—A communication.—Dated 1st February, 1859.

312. SAMUEL DODSON DAVISON, Leith, Midlothian, N.B.—Dated 3rd February, 1859.

377. ALEXANDER CLARK, Gate-street, Lincoln's-inn-fields, London.—Dated 8th February, 1859.

398. SAMUEL HAZARD HUNTLY, Upper Baker-street, London.—Dated 12th February, 1859.

309. WILLIAM CLAYTON and JACOB GOODFELLOW, Blackburn, Lancashire.—Dated 3rd February, 1859.

326. PATRICK ADIE, Strand, London.—Dated 4th February, 1859.

Patents on which the Stamp Duty of £100 has been paid.

250. GEORGE RITCHIE, Monmouth-place, New-cross, New Kent-road.—Dated 2nd February, 1855.

320. AUGUSTE EDOUARD LORADOUX BELLFORD, Essex-street, Strand, London. A communication.—Dated 10th February, 1855.

244. THOMAS OGDEN DIXON, Steeton, near Keighley, Yorkshire.—Dated 1st February, 1855.

Notices to Proceed.

2264. WILLIAM STEVENS, Godolphin-road, Hammersmith, Middlesex, "Improvements in mechanism or apparatus for ploughing and cultivating the land by steam and other power."—*Petition recorded 12th September*, 1861.

2341. WILLIAM THOMAS TONGUE and JOHN GREER, Liverpool, "An improved portable self-acting water-engine for extinguishing fires and other purposes."

2342. JOHN HAYS WILLON, Liverpool, "Improvements in pumps chiefly applicable to ships' lift pumps."—*Petitions recorded 19th September*, 1861.

2373. HENRY BRINSMEAD, Ipswich, Suffolk, "Improvements in apparatus for raising and stacking straw and other agricultural produce."—*Petition recorded 23rd September*, 1861.

2383. CHARLES WATT, Graham-street, and JOHN WATT, Lorrimer-street, Walworth, Surrey, and THOMAS SMAITH HAVISIDE, Cornhill, London, "An improved mode or method of bleaching palm oil."—*Petition recorded 24th September*, 1861.

2391. HENRY PURNELL, Glasgow, Lanarkshire, N.B., "Improvements in the constructing and arranging warming apparatus."

2396. THOMAS RICHARDSON, Newcastle-upon-Tyne, "Improvements in the manufacture of muriate of iron for the purification of coal gas."—*Petitions recorded 25th September*, 1861.

2400. THOMAS BENTLEY, Margate, Kent, "Improvements in apparatus for beating eggs and for mixing or agitating other fluids, compounds, or matters."

2401. HENRY NUNN, Chelsea, Middlesex, "Improvements in mangles."

2405. SAMUEL SINCLAIR ROBSON, Sunderland, Durham, "Improvements in machinery or apparatus for raising or lowering heavy bodies."

2407. JOSEPH TESSIER, Rue St. Nicolas d'Antin, Paris, "Improved means of treating barley, corn, and other cereals for brewing and other purposes."

2410. VICTOR SOSTHENE LETE, Paris, "Improvements in aerated or sparkling white wines."—*Petitions recorded 26th September*, 1861.

2415. GEORGE SMITH, Liverpool, "Improvements applicable to gas meters."—*Petition recorded 27th September*, 1861.

2424. SAMUEL WILTON RIX, Beccles, Suffolk, "New and improved methods of attaching or fixing woodwork, ironwork, fittings, or furniture to walls or buildings."—A communication from John Ackrill, Charles Maplestone, and Frederic Kawcran, Melbourne, Bourke, Victoria.

2425. JOHN REEVES, New York, U.S., "Improvements in electro-magnetic engines for obtaining and applying motive power."

2433. THOMAS POTTS, Old Kent-road, Surrey, "An improvement in clasps for books, portfolios, desks, and other similar articles."

2429. MEINRAD THEILER, Einsiedeln, Switzerland, "Improvements in telegraphs."—*Petitions recorded 27th September*, 1861.

2434. BENJAMIN GEORGE GEORGE, Hatton-garden, London, "Improvements in the mountings of tablets, show bills, prints, photographs, and drawings, and of producing embossed ornamentation, applicable to various purposes."

2435. JOSEPH LUSH, St. George's-square, Portsea, Hampshire, "Improvements in mashing attemperators."—*Petitions recorded 30th September*, 1861.

2442. WILLIAM EDSALL, MATTHEWS, Sea View, St Helen's, Isle of Wight, "An improved apparatus for conveying a line or other medium of communication from a ship or vessel for the purpose of obtaining relief or assistance in case of shipwreck, or for any other purpose to which the invention may apply."

2443. WILLIAM HENRY PAYN, Dover, Kent, "Improvements in apparatus for preventing the loss of, and facilitating the recovery of ships' moorings, and submerged property in general."—A communication from Elton Templemore, Madras.—*Petitions recorded 1st October*, 1861.

2458. RICHARD ARCHIBALD BROOMAN, Fleet street, London, "Improvements in the manufacture of figure-coloured fabrics, and in machinery employed therein."—A communication from Edme Germain Bossuat, Paris.

2459. WALKDEN THOMPSON and THOMAS STATHER, Kingston-upon-Hull, "Improvements in hydraulic presses."—*Petitions recorded 2nd October*, 1861

2472. JOSEPH WOOD, Birmingham, "Improvements in the manufacture of metal pens and holders in tools employed therein, and in cards for carrying the same."—*Petition recorded 3rd October*, 1861.

2485. SAMUEL ICELY, Kent Cottage, Byron-street, Bromley, Middlesex, "An improved manufacture o gongs."—*Petitions recorded 4th October*, 1861.

2496. THOMAS HUGHES, Birmingham, "An improved high pressure tap for regulating and controlling the flow of steam water or other fluids."—*Petition recorded 5th October*, 1861.

2503. HENRY WILLIS, Albany-street, Regent's Park, London, "Improvements in the construction of organs."—*Petition recorded 8th October*, 1861.

2520. GEORGE DAVIES, Serle street, Lincoln's-inn, London. "Improvements in machinery for manufacturing shoes for horses and other animals."—A communication from Thomas Randolph Taylor, Cleveland, Ohio, U.S.—*Petition recorded 9th October*, 1861.

2538. WILLIAM CLARK, Chancery-lane, London, "Improvements in apparatus for bending iron rails or bars."—A communication from Henri Nicholas Rogé, Boulevart St. Martin, Paris.—*Petition recorded 10th October*, 1861.

2578. WILLIAM CLARK, Chancery-lane, London, "Improvements in the

means or apparatus for closing and securing mail bags and other packages."—A communication from Jead Rémy Boubilla.—*Petition recorded 16th October*, 1861.

2589. Thomas Edward Merritt, Rochester, Kent, "Improvements in apparatus for obtaining motive power."—*Petition recorded 17th October*, 1861.

2649. Joseph Felix Victor Deliry, Soissons, France, "An improved mechanical kneading trough."—*Petition recorded 23rd October*, 1861.

2740. Elizabeth Anne Maling, Whitehead's-grove, Chelsea, London, "Improvements in glass cases for the cultivation of plants and flowers."—*Petition recorded 1st November*, 1861.

2761. George Evans, Gloucester-terrace, Portman-square, London, "Improvements in treating peat to render it useful as fuel, and for illuminating and metallurgical purposes."—*Petition recorded 2nd November*, 1861.

2795. John Richardson Wigham, Capel-street, Dublin, "Improvements in apparatus for the manufacture of gas, parts of which are also applicable for cooking purposes."—*Petition recorded 7th November*, 1861.

2974. David Kee, West of England Soapworks, Plymouth, Devonshire, "An improvement in the manufacture of soap."—*Petition recorded 20th November*, 1861.

3035. William Edward Gedge, Wellington-street, Strand, London, "Improvements in the manufacture of nose bags and similar articles, and in apparatus connected with such manufacture."—A communication from Felix Loignon and Victor Casse, Passage des Petites Ecuries, Paris.—*Petition recorded 4th December*, 1861.

3104. Marc Antoine Francois Mennons, Rue de l'Echiquier, Paris, "Improvements in jack machinery for moving heavy bodies."—A communication from Felix Winand, Goffontaine-Fraipont, Belgium. — *Petition recorded 11th December*, 1861.

3112. Marc Antoine Francois Mennons, Furnival's-inn, London, "An improved means of defecating and purifying cane and other saccharine juices."—A communication from Louis Marie Amand Achille de Courson de la Villeneuve, Caen, (Calvados), France. — *Petition recorded 12th December*, 1861.

3177. Jean Marie Hospice Auguste Taurines, Paris, "Improved modes of constructing balances, weigh-bridges, and other weighing machines." *Petition recorded 18th December*, 1861.

3202. George Tomlinson, Loughborough Park, Brixton, Surrey, "Improvements in machinery for attaching the soles of boots and shoes to the upper leathers."—A communication from Simon Smith Bucklin, Brookline, Massachusetts, U.S.—*Petition recorded 20th December*, 1861.

15. James Howard and Edward Tenney Bousfield, Bedford, "Improved apparatus applicable to steam cultivation."—*Petition recorded 1st January*, 1862.

62. Thomas Aldridge Weston, Birmingham, "A new or improved multiplying gearing for transmitting and multiplying power, which said gearing may be applied to cranes, windlasses, capstans, and presses, and to other purposes where it is required to transmit and multiply power."—*Petition recorded 4th January*, 1862.

88. John Martin Rowan, Glasgow, Lanarkshire, N.B., "Improvements in the manufacture of iron and steel."—*Petition recorded 13th January*, 1862.

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 1st February, 1862.

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*** Specifications will be forwarded by Mr. Bennett Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5*s.* must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for The Engineer, *at the office of her Majesty's Commissioners of Patents.*

Class 1.—PRIME MOVERS.

(Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.)

1727. E. R. Handcock, *Norfolk-street, Strand*, "*Motive power.*"—*Dated 6th July*, 1861.

This invention cannot be described without reference to the drawings.

1744. T. T. Chellingworth, *Buckingham-street, Adelphi, and* J. Thurlow *Belvedere-road, Lambeth*, "*Traction engines.*"—*Dated 10th July*, 1861.

For the purposes of this invention, in constructing framing for a traction engine, sheets or plates of iron are employed of considerable depth as compared with their thickness, and, excepting at the fire end, such framing consists of four parallel lines of plates, producing three spaces between them. In the central space the boiler is received, and in the side spaces are the driving wheels, each having inner and outer bearings, both the bearings being fitted with springs. In the side spaces, also, the steam cylinders are fixed in an inclined position, additional inclined side framing being affixed to receive them, and such inclined frames are affixed at their back and upper ends to the rising horns which rise above the descending horns, which receive the boxes or bearings of the axle of the hinder wheels. The plates of which the framing is composed are partly connected by riveting and partly by screw bolts and nuts, together with dove-tail connections, where it is desired that the parts of the framing should be readily separated to facilitate repairs or otherwise. Between the side framings which bound the central space above mentioned the boiler is placed, and it is suspended by suitable trunnions or axes, which it is preferred should be applied near the fire box end of the boiler, and they are arranged to be supported by, and to turn in, suitable bearings fixed to the two inner lines of parallel plates of the frame, which are strengthened at those points by additional thickness of plates. The outer parallel plates are connected to the inner ones, near where the axes of the boilers come, by transverse plates, the two ends of which are bent in opposite directions, and the parts bent are fixed to the inner parallel plates by rivets, and to the outer parallel plates partly by rivets and partly by screw bolts and nuts. The fore carriage of the traction engine is supported on two wheels, the locking apparatus of which is facilitated in its working by means of three or more wheels on radial axes, such wheels being placed between the upper disc or plate and the lower disc or plate of the locking apparatus. The steering of the fore carriage is accomplished in the following manner:—A segment of a toothed wheel is fixed to the lower framing of the fore carriage, into the teeth of which a worm gears, and such worm receives motion in the following manner:—on the axis of the worm is affixed a bevel toothed wheel, the teeth of which gear into the teeth of a similar wheel on an upright axis, which receives motion from a steering wheel on a horizontal axis, on which is fixed a bevel toothed wheel which gears into and drives a bevel toothed pinion on the upright shafts above mentioned.

1750. J. Farrow, *Ashton-under-Lyne*, "*Apparatus and fittings connected with steam engines and boilers.*"—*Dated 11th July*, 1861.

This invention consists, Firstly, in improved modes of operating upon the throttle valve for the purpose of efficiently regulating the speed of the engine, and also for working the slide or tappet valves of the expansion apparatus for regulating the working expansively; Secondly, in an improved mode of lubricating steam engine cylinders; and, Thirdly, in an improved water gauge for steam boilers. The invention cannot be described without reference to the drawings.

1757. W. B. Adams, *Holly Mount, Hampstead*, "*Locomotive engines and trains.*"—*Dated 12th July*, 1861.

In these improvements in engines and also in carriages the patentee arranges the leading wheels or trailing wheels, or both, in such a mode that each pair of wheels with their axles may be made to traverse latterly and in a forward direction, forming a radial curve, so that on curved lines of railway the axle may always point to the centre of the curve, and on straight lines the axle may be at a right angle with the line of rail. To obtain this movement he forms the horn plates or axle guards which hold the axle boxes in a curved line, struck from a centre at or about the middle of the next axle, and he forms the axle boxes to a shape corresponding to the curve, so that, when on a curved line of rail, the pressure of the flanges of the wheels against the rails will cause lateral and forward—*i.e.*, curvilinear—movement to take place; and, to keep the wheels in their true position for a straight line of rails, he forms the top of the axle boxes in a curve or hollow, or inclined planes, with the lowest part at the centre, so that the spring bearing, whether a cross spring or a side spring, will rest in the centre of the box by the force of gravity, till the pressure of the wheel flanges in curved lines of rail alters its position; or, instead of the curve on the top of the box, the spring may be placed below, suspended from the box by swinging shackles, in which case gravity will act in a similar manner to keep the wheels central in a straight line. The radius of the curve which the wheels are to describe may be regulated according to the length of the engine or carriage, or the curvature of the line of rails. The patentee has in his former patents described modes of working out the principle of radiating wheels and axles, on which the now described method is an improvement. Another part of these improvements relates to the structure of the cylinders and their position. In engines where the cylinders are placed centrally in the smoke box it is necessary to use cranked axles to the driving wheels, and with outside cylinders it is necessary to project them laterally, considerably beyond the wheels, to clear the connecting rods and other moving parts. In both these arrangements the connecting rod is attached to the cross head of the piston rod which moves in slides, and the driving wheels must be at a considerable distance from the cylinder front, in order to obtain a connecting rod of sufficient length to work efficiently. In the improved method he attaches to the cross head a lateral sliding bar, working in a groove in the fixed slide bars, and through a recess the whole length of the cylinder. On this slide bar is fixed a stud pin at or about the plane of the piston, to which the connecting rod is attached; and thus a long connecting rod is obtained, without placing the cylinders at a good distance from the driving wheels. Moreover, the projection of the cylinder from the said frame is considerably diminished, and it is fixed more firmly, and the slide bars may be attached to the cylinder head on one side or on both sides, receiving the cross head with its attached bar on the water side, and the end of the cross head on the inner side, or with small cylinders the outer side bars may be sufficient; or the slide bars may be placed near the middle of the cylinder ends, as usual, and the side bar attached to the projecting end of the cross head, or any other arrangement which will keep the piston rod firm may be used with the slide outside the cylinder. And for the purpose of heating the boilers of locomotive engines, whether used on rails or in vessels on water, he applies oil or other liquids from a level above the fire box, dropping it down gradually on incandescent or heated surfaces, which, by the aid of sufficient air made to enter the fire box at convenient openings, is flashed into flame at the point of contact. The reservoir for the oil or other liquid may be placed above the fire box in a cistern of sufficient size, or the liquid may be pumped up from below, or flow from a level, and the liquid used may be animal or vegetable oil, what is called rosin oil being preferable; or paraffin or mineral or earth oil may be used. By this arrangement a very small force will suffice to keep the boiler in readiness to get up steam rapidly, or to diminish the steam production rapidly, at the pleasure of the engineer, without "banking up" a large amount of coal, and with considerably less labour and annoyance to the stoker, as he can increase his fire without being exposed to heat in excess.

1763. J. Beamish, *Liverpool, and* N. Beamish, *Egremont*, "*Lubricating those parts of steam engines acted upon by the steam.*"—*Dated 13th July*, 1861.

In this improved system of lubricating the inventors force or inject the lubricating material in small quantities amongst the steam, by preference into the steam pipe near the valve, or into the valve box, and allow it to be carried forward to lubricate the various parts of the engine impinged on by the steam, more especially the valve and cylinder.—*Not proceeded with.*

Class 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

1663. W. Leopard, *Horstpierpoint*, "*Railway brake apparatus.*"—*Dated 29th June*, 1861.

This invention relates to railway brakes for stopping and retarding carriages, in which the momentum of the train is caused to take effect on the brakes. The inventor effects this by means of toothed or friction surfaces, formed or fixed on the axles of the carriages; these toothed or friction surfaces are caused to operate on longitudinal bars placed above and below the axles, which slide at each end in suitable bearings fixed to the framework, such bars having rack teeth or friction surfaces corresponding with the axles, so that, when pressed on the axles, they are propelled lengthwise, one in the opposite direction to the other.—*Not proceeded with.*

1683. S. Adams, *West Bromwich*, "*Omnibuses for street railways.*"—*Dated 2nd July*, 1861.

These improvements consist in a contrivance for locking and disengaging the pole of omnibuses for street railways, which greatly increases the safety and speed by facilitating the running on and off the metals, as occasion may require. This is accomplished by a double or two ended lever, which is acted upon by the drivers' feet, so that, when the vehicle is off the rails or metals, the pole is fixed and the lock in action, and when on the rails the pole is loose and the lock fixed. The fixing of the pole to the lock is by a pin or bar of iron or steel, having a fork at the lower end; the other end is a bolt; the fork end fits on and partly clips the pole when down, and thus fixes it to the lock; the forked pin is moved up and down by being connected indirectly to the foot lever; when the forked bolt is up the bolt end slides into a socket fixed to the landing. Next, the inventor has a brake apparatus, which can be worked by either driver, or conductor, or both. It consists of levers, two to each hind wheel, one on each side; the levers are acted upon by rods and chains, and the long ends of each pair of levers are connected together by chains which have the form of a rhombus or diamond; two opposite corners are connected to two of the levers, and the other corners are connected to the rods, and so on to the rotating brake handles; the blocks or rubbers are prevented, when not in use, pressing the wheel by a coiled spring.—*Not proceeded with.*

1685. R. Richardson, *Great George-street, Westminster*, "*Railway chair.*"—*Dated 3rd July*, 1861.

This invention consists in an improved railway chair, by which the upper lips of iron half chairs are, by elongation, made to wedge through or into each other on opposite sides of the rails, and in opposite directions, so as to firmly secure the rails in the chairs without the aid of the wooden keys commonly used for that purpose. The invention applies equally to single and double-headed rails, and also to the construction and application of half chairs, in such a mode as to retain the wooden or iron keys in their places on each side of the rail, and thus obviate the necessity of the half chairs wedging, as before mentioned, and by simply placing them in contact with the ends of the wooden or iron wedges or keys before referred to, to prevent the keys or wedges from becoming loose and falling out.—*Not proceeded with.*

1715. J. Dean, *Derby*, "*Apparatus for propelling vessels.*"—*Dated 6th July*, 1861.

In carrying out this invention the patentee mounts several cylindrical frames on axles or shafts, each frame having several floats, say four, six, or any other convenient number. The revolving frames—of which there may be three or any greater number—are mounted upon a main frame of square, polygonal, or circular form, having a central axis or shaft supported in main bearings, and as an equivalent for the ordinary shuttle-shaft. This shaft in a single propeller may be supported at each end within the vessel, or where employed as side wheels or propellers, and overhanging the side of the ship, the inner bearing may be taken by a block on the deck or side of the ship, or in an opening cut for that purpose, whilst the outer or overhanging end is carried by the "spring beams." Each of the revolving frames has fixed upon its axis a toothed pinion or its equivalent; these take into and receive motion from, and by means of, a circular rack or internal toothed wheel affixed to the ship's side, or within the propeller box or casing, and, upon motion being communicated to the main revolving frame or carriage in which they are mounted, they are made to revolve, and each of the floats or float boards in turn is made to dip, to perform its work, and withdraw. The floats enter the water behind the line of the main shaft, instead of, as in the ordinary paddle-wheel, before the line of the main or paddle shaft. This propeller is more particularly intended for river and other shallow water navigation.

1747. P. Adie, *Strand, London*, "*Apparatus in connection with railway carriage buffers.*"—*Dated 11th July*, 1861.

These improvements relate to the application of checks to railway carriage buffers whereby the recoil is prevented from taking place in cases of collision, and strengthening the springs so as to lessen the effects of such collision. For this purpose bolts or catches are attached to the buffer boxes or carriage, which drop by their own weight, or are pushed home by springs into one or more grooves or notches in the buffer rods when they are driven home, and so fix the buffers there until they are released, which release is effected either by rods or levers, or by a simple tap on the end of the bolts or catches. The improvements further relate to the introduction of very strong plates or springs, supported all round or at both ends, which the buffers or rods strike against in cases of collision. The inventor also applies the friction of a screw or saddle on the buffer rod to release it gradually.—*Not proceeded with.*

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

1764. J. Pickering, *Clitheroe*, H. Pickering, *Burnley, and* N. Pickering, *Wingates, Westhoughton*, "*Self-acting mules for spinning cotton, &c.*"—*Dated 13th July*, 1861.

This invention relates to that class of mules generally called Sharp and Roberts', and consists of certain improvements for regulating the speed of the spindles, so as to maintain the threads in a proper tension when winding on. The chain or band, which operates upon the bevel wheel connected with the screw of the quadrant, is put in motion by causing a lever to come in contact with clicks or catches on the pulley connected with the aforesaid chain or band. The pulley turns loose upon its shaft, and when not in contact with the clicks no action or effect takes place; but when the lever is in contact with the clicks, the chain or band is moved, and acts upon the bevel wheels and screw. The lever is put in motion by a chain, one end of which is connected to the under faller bracket, and the other linked to a small shaft on the other faller bracket To the shaft is fixed a ratchet wheel, which is moved one or more teeth by a catch when the faller descends to a certain point, which movement of the ratchet wheel turns the small shaft, and tightens the chain to the exact length required, and prevents the necessity for the operative to adjust the nut or screw of the quadrant.—*Not proceeded with.*

1766. F. Tolhausen, *Paris*, "*Looms for weaving ribbons, &c.*"—*A communication.—Dated 13th July*, 1861.

The object of these improvements is to afford the means for using in a practical manner a greater number of shuttles than heretofore, and thus weave fabrics of greater variety and richness of colours; and also to obtain the shuttle motion by a single "marionnette" or shuttle driver, instead of using one marionet for each shuttle, which is a source of much trouble in fancy weaving. Thus, by substituting one single marionet, or rather a marionet carrier, an indefinite number of shuttles may be used, instead of eight, which hitherto was considered to be the highest number practically applicable.

1769. E. Briggs *and* S. Fearnley, *Castleton-mills, near Rochdale*, "*Piled fabrics.*"—*Dated 15th July*, 1861.

This invention cannot be described without reference to the drawings.

Class 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

1767. T. Smith *and* G. Taylor, *Ipswich*, "*Horse rakes and cultivators.*"—*Dated 13th July*, 1861.

When using horse rakes, as heretofore, constructed upon furrowed land, and raking along the furrows, considerable difficulty has been experienced to get the middle or furrow teeth to reach the bottom of the furrows, owing to the teeth or tines having their centres or bosses all fixed on a continuous or straight axis rod. To avoid this inconvenience, according to this invention, in constructing horse rakes, in addition to the tines being all independent of each other, the central tines are arranged in such manner that they may be set suitably to descend lower down than the other tines, in order that such central tines may, when desired, work in a furrow when the rake is being moved along the same, whilst at other times, when the rake is on level land, the central and other tines, as heretofore, may be caused to work at the same level. For this purpose the tines may be mounted on a cranked axis, the crank occupying so much of the central portion of the length of the axis as is required for the central tines, which are desired to descend lower than the other tines; or the tines may be mounted on separate axes, or otherwise, so as to admit of the central tines being lowered to a greater extent than the other tines, when it is desired that they should work in a furrow or hollow.

Class 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

1839. W. Hood, *Reading*, "*Beams and girders.*"—*Dated 22nd July*, 1861.

For the purposes of this invention hollow iron beams or girders are constructed in such manner that they may be rendered suitable for conveying water into and distributing it in the buildings where such beams or girders are used. Girders so constructed and employed will also, by reason of their having water supplied to them, be prevented getting red-hot in case of fire, which would render them weak, and unequal to resist the weights thereon. The hollow beams or girders are made of iron and suitable angle iron, as common heretofore, and they are also closed at their ends or other parts, as well as at their sides, and are suitably formed to admit of their being connected to supply pipes leading to water mains or other sources of supply; they are also made with suitable perforations for distributing the water supplied to them into the rooms or parts of buildings where such beams or girders are situated, by which means such beams or girders will not only be the means of conveying water to extinguish a fire in the locality where they are situated, but will, at the same time, be prevented from becoming highly heated by reason of the passage of water through them, and will thus be caused to retain the requisite strength for upholding the weights thereon.

1841. J. Beattie, *South Lambeth*, "*Improvements in arrangements in buildings and ships with a view to the extinguishment of accidental fire therein, and also the ventilation thereof.*"—*Dated 22nd July*, 1861.

This invention is carried into effect in the following manner:—The patentee places in or between, or connects with, the brickwork or other material of which the main building is composed one or more main pipe or pipes of suitable metal, and of sufficient strength and bore, from the basement or ground floor to the roof or other part or parts of such building; and he has branch pipes of suitable metal, bore, and strength from such main pipe or pipes into each floor, and, if required, into each room, and he carries such branch pipes round the ceiling or other part or parts of such rooms, and other parts of the building; and he has perforations in such branch pipes, and mouths or roses, made ornamentally or otherwise. He has also suitable joints and cocks, or other apparatus, so that, when a fire has taken place in any one or more of such room or rooms, the water can be forced by steam or other power from below through the main pipe and branch or branches into such room or rooms as required for the extinguishment of the fire therein. He also, in some cases, constructs flues in different parts of the building for the passage of water for cooling the walls and pipes with requisite inlets and outlets. He also, at other times, forces or partially exhausts air, by means of a fan or other suitable apparatus, worked by steam or other power, through the main and branch pipes, for the purpose of ventilating the rooms of such buildings. He also applies a like arrangement of such main pipes from the decks or other convenient parts of ships with similar branch pipes into the various cabins, saloons, between decks, holds, and other parts thereof, for the extinguishment of fire, and also for purposes of ventilation.

1842. C. Batty, *Marylebone-road, London*, "*Preventing the extension of fire in buildings.*"—*Dated 23rd July*, 1861.

This invention consists in so arranging the ceilings that they may be separated from the floor immediately above by a space through which a current of air passes with a great velocity when the ceiling becomes hot by a fire beneath, and thus, by keeping the inside or top surface of the ceiling cool, or comparatively so, preventing the floor above becoming heated.—*Not proceeded with.*

Class 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defences, Gun Carriages, &c.

1758. J. Adams, *King William-street*, "*Improvements in revolving fire-arms, and in cartridges for the same.*"—*Dated 12th July*, 1861.

This invention relates principally to that class of revolving fire-arms wherein a cylinder or series of revolving chambers containing separate charges is employed, each chamber being brought in succession opposite to a fixed barrel to be discharged. The first part of these improvements consists in forming the barrel and the frame or opening in which the chambers rotate from one piece of metal; but, in place of forming the frame and barrel as heretofore in one piece, suitable for being attached to the stock of the fire-arm, the patentee forms it in two parts. The part of the frame which carries the rotating chambers is firmly connected to that part of the frame which carries the lock and hammer, and which is attached to the stock of the fire-arm, by which arrangement the construction of the parts is greatly simplified. The second part of the improvements consists in constructing and arranging the cylinders or series of revolving chambers in combination with a revolving breech piece or base plate, so that such chambers may be suitable for receiving and exploding the charges contained in cases or cartridges, somewhat similar to the cases or cartridges denominated "Lefaucheux Cartridges;" and part of this invention consists in so constructing revolving fire-arms of this description that a set of rotating chambers, suitable for being charged at the muzzle with cartridges or with ordinary ammunition, may be substituted for the set of chambers which are only suitable for being loaded with cartridges at the breech end. Apparatus is also arranged for forcing out the empty cases when exploded, and forcing in the charge when the cylinder is loaded at the muzzle. Heretofore, when the "Lefaucheux Cartridge" has been employed for charging the chambers of revolving fire-arms, a fixed breech piece or base plate has been employed to close the back ends of the chambers, to receive the lateral concussion when the discharge takes place, and revolving fire-arms so constructed were only suitable for being charged with such cartridges; now, according to this invention, the series of revolving chambers, and the breech-piece or base plate, are arranged so as to rotate together on the same pin or central axis, which is capable of being readily withdrawn when it is desired to detach or exchange the rotating cylinders. The improvements in cartridges for revolving fire-arms, such as before described, consist in forming them with a percussion cap and an exploding pin placed in the base or back end of the cartridge, in place of introducing the pin through the side of the cartridge as heretofore.

Class 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

1751. J. R. Cotter, *Cork*, "*Improvements in the pianoforte.*"—*Dated 11th July*, 1861.

The principal novel feature of this invention consists in eliciting or

producing the tone from the central point or part of the strings throughout the whole range of the instrument, instead of eliciting the same from a point nearer to one end of the string than to the centre, as hitherto practised. By this means the vibrations of the string commence in the centre (instead of commencing near to one end), and hence the vibrations are more perfect, and the tone, consequently, more powerful and pure. In putting this invention into practice the patentee finds that for the lower or bass notes any of the ordinary arrangements of pianoforte mechanism, and the ordinary percussion hammer, will answer the purpose, producing the full tone at once by percussion at the central part of the string; but that in the middle and upper parts of the scale or keyboard, when the string is struck at or near the centre, the vibrations are so rapid that it is impossible to get the hammer out of the way before the return vibration of the string, and, consequently, the vibrations would be immediately checked, and the tone greatly deteriorated. The second part of the invention is designed to remedy this defect, and consists in attaching to the ordinary mechanism of the pianoforte (at the middle and upper part of the scale) "claws" or fingers, instead of percussion hammers, such "claws" being so arranged and constructed as to strike past the string and retire (again past the string) without touching the same, instead of striking against the string and then falling back as the ordinary percussion hammer does.

1761. J. P. DE RETTE, *Bruxelles*, "*Improvements in the manufacture of wind musical instruments in brass or other metal to which pistons are applicable.*"—*Dated 13th July*, 1861.

This invention cannot be described without reference to the drawings.

CLASS 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

1722. W. PASK, *Sydney, Gloucester*, "*Procuring a colouring matter from the refuse of ironstone, called colour spert.*"—*Dated 6th July*, 1861.

In carrying this invention into effect the patentee takes a quantity of the mineral or refuse of ironstone, and puts it into a cast iron mill with iron or stone runners or rollers, fluted and plain, worked by horse, or steam, or water power, in which mill he crushes and pulverises such mineral, and brings the whole into a fine powder. He then puts this powder into a tub or tank containing water, and washes it by stirring it about, either by the hand or by a process called tossing or tozing, when the colouring, at a particular stage of the washing, is suspended in solution, and the heavier or gritty substances sink. He then instantly pours off the water containing such colouring matter into another vessel, and allows this to stand for the space of six hours, or such time as may be necessary, and it appears that the colouring matter or sediment has all sunk to the bottom; at this time he pours off the water from the colouring matter, which by this time has been precipitated to the bottom of the last-mentioned vessel, and collects it together. He then puts the sediment, which is in fact the colouring matter obtained, as before stated, into a stove constructed of fire-clay or brick, and therein dries it, when the colouring matter is perfected and rendered fit for use.

1726. A. NOELE, *Bristol*, "*obtaining products from alkali waste and gas lime refuse.*"—*Dated 6th July*, 1861.

For the purposes of this invention alkali waste is allowed to stand in a heap or in vats for a few days, after which water is poured upon it, and it is permitted to remain on it for a short time; the liquor is then run off. This liquor, or the liquor which drains from alkali waste heaps, is mixed or brought in contact with sulphurous acid, either in a gaseous state, or in solution. By these means sulphur is precipitated in a marketable form; the clean super-natant liquor also contains hyposulphite of lime. This solution of hyposulphite of lime may either be boiled down to obtain solid hyposulphite of lime, or may be decomposed with carbonate of soda to obtain hyposulphite of soda, or may be decomposed with hydrochloric acid to obtain sulphur and sulphurous acid. In like manner the refuse from lime purifiers of gas works is treated to obtain like products.

1732. T. COELEY, *Meerholz, Germany*, "*An improved process for the manufacture of fluo-silicates and silicates of lead and baryta, and for the application of the same to various purposes in the arts and manufactures.*"—*Dated 8th July*, 1861.

The patentee claims the manufacture and use of fluo-silicates of lead and baryta by the method, process, and means set forth, and the application of the same, either separately or together, to the manufacture of glass and porcelain, either as a glaze or as a pigment, and either applied and used as direct or real fluo-silicates, or by the admixture of any salt of lead or baryta with any fluoric or silicious or fluo-silicious material, so as to obtain the same results as if a fluo-silicate had been actually employed.

1754. T. COELEY, *Meerholz, Germany*, "*An improved process for the treatment of silicates of metallic and non-metallic bases, and other silicious compounds, as slags, scoriæ, and such like, in order to recover the said bases, and also in the production of a fluo-silicic and silicic acids.*"—*Dated 9th July*, 1861.

The patentee claims, First, the application of fluorine for desilicising metallic and non-metallic bases, as described. Secondly, the manufacture and production of fluo-silicic acid and silica by the same process simultaneously, and in combination with the process for desilicising mineral products, as described.

1748 J. KIDD, *Strand, London*, "*Manufacture, application, and combustion of gases.*"—*Dated 11th July*, 1861.

This invention is carried into effect in the following manner:—From the centre of the interior of a gas holder dipping into a tank or well in the usual way, the inventor suspends a piece of zinc, iron, or other proper material. The tank is partly filled with acid or other proper liquid. As the gas is generated by the action of the acid or liquor on the suspended zinc, iron, or other material, it rises through the acid or liquor, and forces the holder upwards. Proper means are used for permitting the escape of gas for use. If the gas is generated quicker than it escapes out of the holder, its pressure forces the holder to rise higher out of the tank, thus lifting the suspended zinc, iron, or other material, out of the acid or liquor, and thereby stopping the generation of the gas till sufficient gas has escaped to allow the holder to fall, and the suspended zinc, iron, or other material, to again come in contact with the acid or liquor. The gas thus generated is carburetted, when requisite, by bringing it, by proper means, into contact near the point of combustion with the vapour of naphtha or benzole.—*Not proceeded with.*

1772. T. COELEY, *Meerholz, Germany*, "*Improvements in the manufacture of metallic and earthy silicates, or silicious compounds of the same, from the metallic and earthy bases, or their salts and soluble alkaline silicates, the formation of alkaline acetates or caustic alkalies and application of the same.*"—*Dated 15th July*, 1861.

This invention consists in a method of forming silicates of lead, zinc, copper, baryta, or any other base solicifiable, by treatment with soluble alkaline silicates.

1773. T. COELEY, *Meerholz, Germany*, "*An improved process for preserving and incrusting timber, wood, and other vegetable matters, and for rendering them unaflammable.*"—*Dated 15th July*, 1861.

According to this invention a strong solution of potash, baryta, lime, strontia, or any of their salts, or of the salts of any metallic or other base capable of forming an insoluble compound with hydro-fluo-silicic acid, is forced into the timber, wood, or other vegetable matter, to be acted upon by hydraulic or other means, and this process is repeated until the wood or other vegetable substance is sufficiently charged or impregnated with the solution to enable it to withstand the influence of flame. After the impregnation has been thoroughly effected with any of the given solutions, hydro-fluo-silicic acid is forced into the wood or other vegetable substance by analogous means with a view to render the solutions insoluble.

CLASS 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

1785. J. MAPPLE, *Kentish Town, London*, "*Telegraphic apparatus.*"—*Dated 16th July*, 1861.

This invention consists of an endless chain rotated by a train of wheels, and in its rotation it is made to rub against an inking roller supplied with common printing ink, and the strip of paper is pressed against the inked surface of chain by the attractive force of an electro-magnet, which magnet is common to all the Morse telegraphs.—*Not proceeded with.*

1809. W. O'S. BROOKE, *India*, "*Apparatus for suspending and insulating electric telegraph wires.*"—*Dated 17th July*, 1861.

For the purposes of this invention, in order that electric telegraph wires may be insulated where they are supported, the apparatus is formed in the following manner:—An inverted cup or hollow vessel—by preference of cast iron, and of a rectangular form—is used, the upper end of which is closed, and has formed on it a recess suitable for receiving and having a wire fixed therein by solder or by clamps of hardened india-rubber, prepared wood, or other material. The edges of the sides at their lower ends are turned up into a trough or gutter-like form; on the interior of this inverted cup or hollow vessel is fixed another hollow inverted cup or vessel, composed of the hard compound produced by combining india-rubber and sulphur, and submitting the same to high temperatures. This inner cup or hollow vessel is of like section to the outer cup or vessel above mentioned, but of less dimensions, so as to leave a space in all directions between the inner and outer cups or hollow vessels, and such space is filled up with melted sulphur. This apparatus is placed on an upright pin or support, by preference of wrought iron, though other material may be used, and such pin or projection is of like section to the interior of the inner inverted cup or vessel, but of different dimensions, so as to leave a space in all directions between the pin or support and the interior of the cup or vessel which is filled with melted sulphur. The pin or support is carried by a bracket or post, or other suitable means.

1806. C. WEST, *Derby-street, Parliament-street, Westminster*, "*Insulating and covering wire.*"—*Dated 18th July*, 1861.

In carrying this invention into effect the inventor uses only the very best South American rubber, not masticated, but in its native state. The inventor states the difficulty he has hitherto had to contend with in using the native rubber has been from not being able to consolidate it after it has been placed on the wire. This arises from the rubber in its native state containing a large per centage of moisture, which prevents its cohesion even with the use of solvents. He has, however, overcome this difficulty by a very simple and efficacious method. He drives off the moisture in the india-rubber previous to its being placed upon the wire; this he readily accomplishes by subjecting the strips or ribbons of pure india-rubber, after they are cut from the bottle, to a process of desiccation or evaporation. The result is that the india-rubber so treated will, when on the wire, with the aid of solvents, unite with the second coating of rubber, and this again with the third, and so on. The rubber in contact with the wire does not become soft.—*Not proceeded with.*

CLASS 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

1614. H. COULTER, *Philadelphia*, "*Door springs.*"—*A communication.*—*Dated 27th June*, 1861.

This invention relates to an improved arrangement of mechanism constituting a door spring, possessing the properties of more uniform resistance, and also of keeping a door either partially or entirely open or closed, as desired. To effect this the inventor employs a casting of metal, having a long slot or opening formed through the face thereof, in which is fitted a bent lever or arm connected thereto by a pin, which is the fulcrum thereof; the back of this lever is formed of a cam shape at one end, and the opposite end of the said lever is cranked or bent downwards, such bent part being intended to fit in a long slot or mortice made in the top edge of a door. The casting containing the aforesaid lever or arm is fitted into the top part of the framework (to which the door is hinged), and flush therewith on the face, so that, when the door is closed, the aforesaid bent lever is concealed in the slot in the casting and mortice in the top edge of the door. To the back of the aforesaid casting is affixed a long flat wedge-shaped steel spring, the thinner part of which presses upon the edge of the before mentioned cam of the aforesaid bent lever, and thus presses this shorter arm of the lever outwards, and the other arm, which is considerably larger, inwards, and thus the door may be kept closed; but upon opening the door, say half way, for example, the highest point of the cam having been brought at right angles to the flat spring against which the cam presses, as before mentioned, the door will be kept open, and can only be allowed to close by pushing or pulling the door inwards. By thus constructing a door spring, and connecting the same to a door, the leverage of the door on the spring increases as the resistance offered by the spring increases, and decreases in the same ratio, by which a spring of nearly uniform resistance is obtained. The inventor proposes, if desirable, to form the cam of such shape as to keep the door open at several different angles, instead of only at one angle.—*Not proceeded with.*

1649. J. GIBSON, *Todmorden*, "*Sewing machines.*"—*Dated 28th June*, 1861.

This invention consists in applying to sewing machines a vessel containing water or other liquid, either alone or combined with size or bees' wax in a fluid state, through which the sewing thread is conveyed in its passage from the bobbin to the needle, the object being to render the work firmer and more durable, and to prevent the breaking of the sewing thread; the needles will also last much longer than when dry thread is used.—*Not proceeded with.*

1651. A. FORD, *Mortlake, Surrey*, "*Waterproof felt.*"—*Dated 28th June*, 1861.

In performing this invention the inventor takes a certain quantity of india rubber and gutta percha, and mixes the same with naphtha or turpentine, in a machine usually employed for that purpose, until he has reduced them to a very soft plastic state. He then adds to the mat's hair, or wool of animals, hempen or cotton fibre, in such proportions as shall result in the production of a light pulpy dough. He then passes the dough through metled rollers for the purpose of getting it into sheet, and giving it a felt-like surface. When he wishes to make the dough unusually light he adds to it cork, or some light vegetable fibre. The novelty of the invention consists, first, in mixing hair or wool, hempen or cotton fibre, with india rubber and gutta percha in such a way as to produce a light pulpy dough, capable of being rolled out with the aid of water into sheets or a felt-like appearance. Secondly, in the application of such felt-like material to the manufacture of hats and caps in particular, and to other useful purposes. The dough being rendered very soft before the admixture of the hair, wool, or other fibres, the latter are preserved unbroken in the felt produced.—*Not proceeded with.*

1659. J. B HAWKINS, *Limehouse*, "*Cocks for drawing off liquids and vapours, and for regulating the flow or passage thereof.*"—*Dated 28th June*, 1861.

This invention consists in so constructing such said cocks as to prevent fixing or setting of the plugs thereof in their seats.—*Not proceeded with.*

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

THE IRON OF SOUTH STAFFORDSHIRE: *Continued Inactivity: French Inquiries again in the Market*—THE GOVERNMENT COMPLAINTS RESPECTING THE ACHILLES RIDICULED — COAL TRADE—PROPOSED GOVERNMENT EDUCATION OF BOYS IN IRONWORKS—BIRMINGHAM AND WOLVERHAMPON GENERAL TRADES: *Continued Depression: Slight Stir in the French Trade*—REDUCTION IN THE PRICE OF COPPER—EXHIBITING SAMPLE RAILWAY STORES—BIRMINGHAM AND WOLVERHAMPTON CHAMBERS OF COMMERCE: *The Canadian Tariff: French Trade: Zollverein Tariff: the American War: Mr. Bright on Chambers of Commerce* — BANKING COMPANIES — THE COLLIERY ACCIDENTS AT SHIELDS AND DUDLEY.

THE iron trade of South Staffordshire remains pretty much in the same condition that it has occupied now for some few months past. Taking the district round about, two-thirds time is being worked. Those firms who are doing more are very few and an exception, and cannot be quoted as fairly indicating the state of the trade. Such firms enjoy a connection, and are making efforts to extend that connection that together make their position an exception. The complaints of the very depressed state of trade were almost universal yesterday in Birmingham, and in Wolverhampton on the day before. The complaints were accompanied with expressions of surprise that, with so little doing, men kept out of the insolvency court. For iron of the best makes the prices fixed by the association are being obtained in nearly all the transactions; but first-class makers are willing to take rates a shade lower when the inquiries relate to "good orders." Prices, however, much below the orthodox standard are being accepted by some makers, who are not so particular as to the quality of the article that they send away; and this underselling is more observable in general merchant iron than in any other descriptions. Plates and sheets continue to realise good prices. The inquiries on account of France have again appeared. It is plain that no one would accept them as they stood before, on account of their indefinite conditions. These are now slightly, but not much more explicit. The complaint that Government cannot get plates enough for the Achilles is ridiculed as absurd, for, as we have again and again shown, good plates in plenty can be produced at every well established works in the kingdom, if Government will only pay a fair price for them.

Coal is inactive, and prices are tending downwards.

A suggestion for placing the boys employed in ironworks upon a similar level with those working in collieries and mines has emanated from a number of intelligent working men. They comprise an association for the education of the operatives of the Chillington Company's ironworks, Wolverhampton. Through their president, this association have put themselves in communication with her Majesty's Inspector of Schools in the South Staffordshire district, suggesting the lads employed at the various mills and forges in the different iron producing districts of the kingdom should be compelled to attend school a certain number of hours per week, not exceeding ten. They say that as most works "even in brisk times" stand on Monday for repairs, there would not be any difficulty in the way, provided Government would subsidise national schoolmasters, or allow them to have extra pupil teachers. The benefit which would result from the carrying out of the suggestion by the training a superior class of workmen would be immense in every part of the country where iron is manufactured.

Respecting the Birmingham and Wolverhampton general trades we may say that, in the great majority of instances, there are not more orders in hand now than there were to recommence with after the Christmas holidays. Some of the experienced men in trade have expressed an opinion that business has not been as quiet as it now is for more than twenty years, neither are the prospects by any means encouraging of an early improvement. The factors' travellers ought to be sending home well-filled order-sheets for goods suitable for the spring trade; instead of this the shopkeepers are buying on the most limited scale, and manufacturers in many branches are unable to find work for their men for more than three days per week. A slight stir is, however, taking place in the French trade on account of the Marseilles stores.

Copper has been reduced £5 per ton. On Tuesday evening, after 'Change hours, a telegram was received in Birmingham formally notifying the reduction. Earlier in the day that metal was offered at £6 and £7 below the trade prices without finding buyers. The reduction is equal to one halfpenny per pound on the manufactured article. Tough cake and tile is now £102 10s., and best selected £105 10s. per ton. Brass wire and tubing has been reduced one farthing, and copper wire one halfpenny per pound.

The directors of the London and North-Western Railway have opened a room at their offices in Birmingham for the purpose of exhibiting samples of the various articles used by them, and for which they will be glad to receive tenders.

The Birmingham Chamber of Commerce gave a public dinner on Tuesday evening last, at Edgbaston, and it was numerously and influentially attended. The Chairman of the Manchester Chamber of Commerce could not attend, but sent a letter in which he impressed upon the parties assembled what he called "the very unaccountable proceedings of some of our colonial fellow-subjects, and the apparent absence of control at the Colonial Office in Downing-street. Continuing," he wrote, "the Customs' duties upon our manufacturers, which some of them have imposed, are so numerous that they not only hold our commerce in check, but have a growing tendency to protection. Referring to our Canadian tariff since 1849, it has been gradually increased from 10 per cent. to 20 and 25 per cent., and the entire range of duty varies from 10 to 100 per cent." To prove that the declared value of the five leading articles of British manufactures, viz., cotton, iron, leather, silk, and woollen were not only scanty, but were declining, he appended to his letter a table from which we gathered that the value of the iron, tin, cutlery and hardware exported to Canada in 1860, and upon which the duty was 20 per cent., was of the value of £469,322, whilst in 1856 it was £640,853. He said that our manufacturers were saddled with high duties to pay the cost of the large expense at which the Canadians are governed by the mother country. Mr. Bright, M.P., was one of the speakers at the meeting. He spoke of the importance of chambers of commerce, and on the influence which they could exercise on the Government of the day, by acting within their legitimate sphere, and with the full weight of their combined action. He said he had foreseen the present rupture between the Northern and the Southern States of America, and the consequent suspension of the cotton supply, and observed that, if the labours of the committee he obtained some years ago to inquire into the capabilities of India had been carried to their legitimate result, they would now have had an ample supply from that country. He declared that a world of nonsense had been talked on American affairs, that the blockade of the Southern ports was more effective than any blockade of the same extent of coast had ever before been, and that if England were to interfere it would simply lead to a war, which would increase instead of diminish the existing difficulties as to the supply of cotton, and raise the price to five times its present value. They had better subsidise the suffering artizans of Lancashire until better times came, than break a lawful blockade. He said that chambers of commerce should watch the expenditure of the country. In the past twenty years the amount that had been expended by Government amounted to not less than £300,000,000 over the amount in the preceding twenty years—a sum which was equal to all the dividends on all the railways in the United Kingdom. Such an absorption of money must tend greatly to cripple the commerce of the country and create a fierce competition.

The Wolverhampton Chamber have held their annual meeting since our last. Respecting the French Treaty, the council reported —"Its results have equalled all that could have been expected." The Council urge the desirability of a reduction in the rates of postage to France, which are 4d. under ½oz. and 8d. under ½oz. In reference to the Zollverein duties, the report states that the duties imposed by the Zollverein, or Customs Union of North Germany, are fixed every ten years, and the new code will come into operation at the beginning of the year 1863. At present the duties levied on the manufactures of this district are so heavy as almost to prohibit a trade. Thus on small bars of iron the duty is £7 10s. a ton; on sheets and plates, £9; on nails, coffee mills, chains, &c., £18; on articles of fine iron and steel ware, £30; and on papier maché goods and other fine hardware, £150 per ton.

The Wolverhampton and Staffordshire Banking Company closed its doors for a time in 1857-58 in consequence of the failures of iron and coal masters to whom they had advanced money. The accounts then closed amount even now to £110,486. Upon one of the estates a loss had been sustained in the past year of £1,890, for which composition bills had been received. These bills (Messrs. Giles's) were duly honoured as they became due, until the lime works on which their realisation depended fell in, and were irretrievably ruined by the breaking in of the canal. A dividend at the rate of 5 per cent. per annum was, however, declared. The Bilston District Bank, who have just had a loss by the failure of Messrs. Pitt and Fletcher, declared a dividend at the rate of 10 per cent. per annum, and a bonus of 2½ per cent. on the half-year. The Stourbridge and Kidderminster Bank has declared a dividend of 7s. 6d. per share on the half-year.

On Saturday an attempt was made to open the shafts of the coal pit at Blackheath, near Dudley, which fired on the 25th ult. by, it is supposed, the explosion of a boiler under ground, and on which occasion three men were killed; but so great was the rush of "deadly vapours and noxious gas" that it was considered dangerous to proceed with the operation; and the pit was accordingly again closed.—On Monday a miner was summoned before the Dudley magistrates for leaving his lighted candle in a portion of one of Earl Dudley's pits whilst he went to another part of the workings to solicit a more experienced workman to examine them with his lamp for sulphur. The negligence of the defendant occasioned serious injuries to the superior workman referred to, for when he got to the spot to which he was summoned, the sulphur exploded at the defendant's candle. The workings were in an ironstone mine, and although defendant exposed himself to a punishment of three months' imprisonment, yet, as he had never before worked in other than a limestone pit, he was cautioned and discharged.

"The Ten Yard Seam" is the title of an article in the number of *Once a Week* for Feb. 1. The working of that wonderous seam of coal in the Dudley district is partly described and the long wall system of working strongly advocated.

Mr. Kenyon Blackwell, a gentleman of much mining experience, and brother to Mr. S. H. Blackwell, of Dudley, has been appointed by Government to act with Mr. Dunn, the Government Inspector of the Newcastle district, and report fully to the Home Department on the state of the New Hartley Colliery, and the causes of the late distressing accident. Towards the fund for the bereaved a subscription was opened on Monday, on Birmingham 'Change, and amongst the workmen who have contributed are those of Messrs. Elkington and Co., who have sent £21; Messrs. Chubb and Sons' (Wolverhampton) men, £3 3s.; and the operatives of the Wolverhampton Gas Works, £6. The men of the Chillington Company's Ironworks and Collieries, in sending their £20, desired that £5 should be given to the five heroes who, at so great a risk, descended the shaft to attempt to liberate their fellow-workmen, "with the sentiment of respect entertained for them by some of their working brethren in Staffordshire."

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

From our own Correspondent.)

Lincolnshire: *The Isle of Axholme*—Liverpool: *Approaches to the Landing Stages: New Street Arrangements Proposed: Mersey Docks and Harbour Board: Life-boat on a New Principle: Street Railways in Birkenhead*—State of Trade: *Sheffield: Leeds: Derbyshire: Bankruptcy of Messrs. Calvert and Co.*—Railway Traffic: *England and France*—Northern Matters: *North-Eastern Railway: Tunnelling Machine Conducted by Messrs. Hawks, Crawshay, and Sons: Launch of a Screw Steamer*—Scotland: *Launch of a Steamer for the Russian Trade: Depression of Trade*—A Long Rail: *Manchester Geological Society: The Hartley Colliery Accident.*

As stated some since in The Engineer, a new railway bridge of some importance is in course of construction over the Trent at Keadby. The first cylinder for the arches has just been sunk, and the works will now be rapidly carried to a completion. A large number of men are now engaged upon the extensive line from the Trent to the proposed junction with the South Yorkshire; and, taking into consideration the progressive development of the iron-stone resources of the neighbourhood, drainage works at Hatfield Chase, and the straightening and widening of the Great Northern Railway, near Doncaster, it is expected that there will be no lack of employment during the year in the district known as the Isle of Axholme.

In accordance with instructions agreed to some time since, the engineer of the Mersey Docks and Harbour Board has prepared plans for improving the access to the landing stages. The plans embrace as their leading feature a junction of the two landing stages on the Liverpool side, and a removal of both so far to the south as to occupy the whole of the pier from the north end of the George's Dock Basin to the Manchester Basin, doing away with the George's Basin as a basin, and substituting for it a capacious ship canal, with suitable access to George's Dock on the south and Prince's Dock on the north, with sufficiently commodious swing bridges to carry the ferry traffic at all times without interruption, by having the bridges so readily within reach of each other that one or more of them would be at all times available. Mr. Boult, one of the members of the Board, has also propounded a plan on the subject. He proposes considerably to shorten the Prince's Dock by cutting off a portion at the south end, which he means to devote to the construction of a tidal basin with access to the Prince's and George's Docks, both of which he suggests should be considerably enlarged, the former towards the east nearly two-thirds of the way to Old Hall-street: the latter he proposes to extend eastward as far as the Goree warehouses, and as far west as about the rails of the Pierhead Baths. He also contemplates a direct north and south thoroughfare parallel to the proposed new quay at Prince's Dock, and bending slightly round towards the east by a curve from the south-west corner of Chapel-street, immediately east of St. Nicholas's Church to the north-east corner of Canning-place, at the north side of the Custom House. The space which he would gain between the Prince's and St. George's Docks he would devote to building purposes, keeping open three distinct lines of access by means of swing bridges across the ship canal, one a continuation of Chapel-street, and another of Water-street, while the third is to be midway between them. In addition to these lines of communication, he also proposes another running directly east from the foot of James's-street. By his contemplated alteration on the two docks named, Mr. Boult not only does not sacrifice either water or quay space; but, on the contrary, he shows that he should gain 6 acres, 3,645 yards of water-space, and 429 yards in additional length of quay space; besides obtaining space for two large graving docks, and 24,395 yards of area for warehouses.

The last weekly meeting of the Mersey Docks and Harbour Board was a long and important one. On the recommendation of the Works Committee it was agreed to increase the salary of Mr. John Ellacott, principal assistant to the engineer, from £350 to £450 per annum, and that of Mr. John Millar, principal foreman of works, from £450 to £500 per annum. It was explained that Mr. Ellacott had been twenty-one years and Mr. Millar thirty-seven years in the service of the board. In reply to Mr. Kendall Mr. Brocklebank stated that the mooring chains for the Woodside Stage were not taken by tender because it was believed that Messrs. Parkes' chains were the best manufactured. In reply to questions by Mr. Laird it was further stated that the chains would be tested up to 118 tons at a public testing machine. A report was read from the engineer on the "Best Mode of Providing Additional Graving Dock Accommodation on the Liverpool Side." It was urged in this that graving docks were a *sine qua non* for the perfection of the north dock scheme. For the proposed new works, therefore, at the north, the report recommended an expenditure of £605,206; for making such alterations at the Toxteth Dock as would admit of its being temporarily used for repairing purposes, and also as a floating dock when not required as a graving dock, and other arrangements there, an expenditure of £12,000. At the Herculaneum Estate it was said the river approaches were of a most favourable character, and great accommodation could be afforded. It was proposed that there should be two docks there 670ft. long each, with 50ft. entrances, and two 780ft. long, with an 80ft. and a 60ft. entrance respectively. The average cost of the graving docks now erecting at Birkenhead, it was stated, was £87 a foot lineal, whilst those now proposed would not exceed £36. It was agreed that the plans should be lithographed, the report printed, and a copy of each be sent to the members of the board, the discussion being adjourned for a fortnight. Mr. Laird intimated that he cordially approved of the construction of graving docks at the south end, but he disapproved entirely of the proposed extension at the north. On the motion of Mr. Rees it was ordered that a return should be furnished showing the cost of constructing the other graving docks in operation, and the revenue derived from them, so that it might be seen whether they were self-supporting or otherwise.

A model of a lifeboat on a new principle has been exhibited at the Underwriters' Rooms, Liverpool. The boat is constructed without a bottom, a rope net being introduced to prevent persons from falling through, and there are two heavy iron keels, which act as ballast and keep her steady in the water. The body of the boat is filled with air-tight barrels, and the fenders, gunwale, seats, mats, &c., are hollow, so that, if necessary, they may be thrown into the sea and turned to account as life-preservers. It is said that under any circumstances the boat, which is the invention of Mr. J. M. Holbrook, will maintain an upright position.

The Birkenhead Street Railway Company has become involved in an odd dilemma. When permission was granted to lay the line down it was intimated by the Birkenhead commissioners that they would not grant any monopoly. It is now further contended that the Street Railway Company can have no exclusive right to any portion of the public high-road, and, as a Mr. Evans says he has suffered considerably by the diminution of the passenger traffic by his omnibuses since the rails were laid down, he thinks himself quite justified in placing cars upon the line. In accordance with this view, he surprised the public by bringing two splendid cars, one called "Old England," and the other "Look-out," and placing them upon the line. On Friday there was at times considerable commotion at different points along the street railway, arising, it seemed, from a determination, on the part of the company, to "bloc- up" Mr. Evans' new cars. In several places the company's cars were brought up in front and at the rear of those belonging to Mr. Evans, so that the latter could not proceed. The company managed to get over the difficulty by transferring their passengers from one car to the other. Fortunately the drivers of the respective cars kept their temper, so that no disturbance took place to require the interference of the police. It is said that Mr. Evans is fully determined to continue running on the line, and that he will shortly increase the number of his cars. It is utterly impossible that such an intrusion can, however, be maintained, for it would be an intolerable injustice that other persons should be permitted to wear up rails laid down by one set of people without paying some compensation, at any rate in respect to the additional wear and tear.

Rather more activity is noted in the steel trade at Sheffield. The demand for steel from machine-makers and other consumers in various parts of the country is moderately active and the orders for crinoline steel, both for home use and exportation, are still considerable. Several firms in the edge-tool business are doing a little more, but business generally is not much better. The continental and local markets continue dull, but in other departments of Sheffield industry fair orders have been received on metropolitan account. With regard to the iron, machine, and machine-tool trades of Leeds, the directors of the local Chamber of Commerce observe in their monthly report just issued—"The makers of the better classes of iron are busy and are likely to continue so for some time; and the makers of lower sorts are pretty well employed. The machine makers are many of them working short time, and no great improvement can be expected in this branch until there is a greater revival of trade. The machine-tool makers still work full time, but generally without orders for any long time forward. The locomotive manufacturers remain as before, and many of these have contracts which will employ them for some time to come. The iron smelting trade is on the increase in this town. In Derbyshire there is a steadily sustained demand for iron for home consumption, and some good orders are in the market; but in consequence of the American troubles external operations are being conducted on a restricted scale. Messrs. G. J. Calvert and Co., of the Railway Foundry, York, are insolvent. Their liabilities are £52,105, and their assets £16,620. A deed of assignment has been prepared under schedule D of the new Bankruptcy Act for the purpose of vesting all the available property of the firm in the hands of trustees; and Mr. James Whetham, of Leeds, iron-founder, and Mr. Roden, of the Shelton Bar ironworks, have been appointed trustees. If the assets can be realised cheaply and expeditiously, a dividend of 5s. to 6s. in the pound is anticipated. The house has been in existence for some years, and the failure is attributed to a want of sufficient capital and some extensive losses by contracts. The first important work undertaken by the firm was the building of a railway station at Bahia, and subsequently other large operations were entered into, among which were the Amsterdam Crystal Palace, a bridge across the Thames for the West London Railway, and contracts for the supply of chains to the North Eastern and Shrewsbury and Hereford Extension Railways. They also undertook the erection of the Lendal Bridge at York, which was the scene of a terrible accident, and proved most disastrous to the firm.

It will be seen from the annexed figures that the aggregate traffic receipts on the railways of the United Kingdom reflect most faithfully the prevalent depression of trade, instead of showing the increase which has been uniformly observed for many years past—an increase which is necessitated by the growth of mileage and the consequent additional capital expended. The mileage now at work shows an increase of 2 per cent as compared with the corresponding period of 1861; but the decrease last week in the receipts was 4 per cent, making a relative deficiency of 6 per cent as compared with 1861. When it is remembered that almost all this decrease falls upon the ordinary or unguaranteed stocks, which only stand in the ratio of one-third to the whole amount invested, the gravity of the situation will be readily apparent, and nothing but prudent economy and abstinence from anything like reckless speculation on the part of boards of directors can avert the evils which seem to be impending. It may be said that this is too gloomy a view to take of matters, and that everything will be set right by the Exhibition traffic. We hope this may turn out to be the case, but at present we are not very sanguine upon the subject, for it will take some time for trade to regain its ordinary course, even if the American hostilities close to-morrow. But we have almost forgotten the "annexed figures," in referring to which we set out:—

	Weekly Receipts.	
	1862.	1861.
Week ending Jan. 4	£463,265	£454,248
" " 11	458,730	452,240
" " 18	460,619	459,338
" " 25	458,732	476,917

While we are upon railway traffics we may, perhaps, be pardoned for adducing the annexed statistics to show how extraordinary well the six great systems of France are working, thanks to jobbery and competition being kept at a minimum. The receipts of these six great undertakings were as follows in 1859, 1860, and 1861:—

	1861.	1860.	1859.
Eastern	£2,783 300	£2,548,945	£2,374,197
Orleans	3,033,902	2,843,348	2,731,081
Paris, Lyons, and Medi.	5,744,458	4,824,670	4,737,086
Western	2,200,611	2,036,000	1,972 869
Northern	2,565,348	2,425,590	2,281,290
Southern	1,201,910	970,651	816,241

Of course these great results were not attained without the expenditure of additional resources on capital account—the Eastern having 1,064 miles at work last year as compared with 1,018 miles in 1859; the Orleans, 1,222 miles last year as compared with 1,097 miles in 1859; the Paris, Lyons, and Mediterranean, 1,247 miles last year as compared with 1,158 miles in 1859; the Western, 757 miles last year as compared with 740 miles in 1859; the Northern, 664 miles last year as compared with 594 miles in 1859; and the Southern 559 miles last year as compared with 516 miles in 1859: but still the dividend result puts the English companies to the blush, the lowest (paid by the Western) being 8 per cent. per annum, while the Orleans divides no less than 20 per cent. per annum!

We turn to the north. The report to be submitted to the proprietors of the North-Eastern Railway at the half-yearly meeting to-day (Friday) states that bills have been introduced into Parliament to enable the company to construct branches up the valley of the Derwent, from Bladon to Conside, and between the Great Northern line near Doncaster and the Hull and Selby line near Howden. No competing line in the Derwent Valley being promoted this year, the directors trust that this company's bill will pass without serious opposition. Besides the line between Hull and Doncaster proposed by this company, three other lines are projected through the same district, two of which are promoted by existing companies. Mr. Harrison, the company's engineer in chief, reports that the rolling stock and permanent way have, during the half-year, been maintained in a satisfactory state; and that the different branches under construction are also proceeding satisfactorily. The Nidd Valley line will shortly be ready for opening; the Middlesborough and Guisborough in about two months; the Lanchester in the course of the spring; and the Harrogate, it is hoped, prior to the commencement of the Harrogate season. An elaborate machine has been manufactured by Messrs. Hawks, Crawshay, and Sons of Gateshead, which is intended to be employed in cutting the great railway tunnel through the Alps at Mont Cenis. The engine for propelling the cutting machine resembles a locomotive and is mounted on very low wheels; it has no funnel on the top, probably on account of the limited height of the tunnel, but the steam will be emitted at one end. The cutting machine, to which the engine will be attached, resembles a large wheel, and a double row of knives or teeth of the finest steel are arranged on what may be termed the spokes. The knives of the machine are placed against the rock intended to be cut, and the wheel revolves and is pressed forward at the same time against the rock cutting a large circular hole. A series of iron rakes are also attached to the machine for removing the fragments of the rock cut out by the knives.

On Saturday afternoon Messrs. J. Wigham, Richardson, and Co., of Low Walker, launched an iron screw-steamer intended for a new line between the Tyne docks and St. Petersburg. The dimensions of the steamer are—length, 190ft; breadth of beam, 27ft.; depth, moulded, 16ft. 6in.: she is rigged as a three-masted schooner, and is fitted with water-ballast. Her engines, of 70-horse power nominal, will be supplied by Messrs. J. Thompson and Co., of Spring Garden Engine Works. Messrs. J. B. Richardson and Co., of the Shotley Bridge Ironworks, have just signed a large contract for plates to be supplied for Government purposes.

Scottish advices report the launch of an iron screw-steamer intended for the Leith and St. Petersburg trade from the yard of Messrs. S. and H. Morton, Leith. The steamer, which has been named the Leith, is 250ft. in length by 30ft. in width, with a depth of hold of 25ft., and her burthen is 1,300 tons register. The celebrated "Dumferline splint" seam of coal has just been discovered in a new pit lately sunk on the estate of Lassodie. The coal is of unusually fine quality. It is stated that, in consequence of the the present depression in the iron trade, a fourth of the furnaces in Coatsbridge district are to be blown out. At one or two of the small works the men are still on full time, but, as regards the others, two or three days per week is the general average. Of the four furnaces at the Dalby Ironworks only two are in blast.

A rail was rolled last week at the Crewe Railworks 44ft. long, exclusive of bad ends, yielding 84 lb. to the yard. The Crewe Railworks are under the superintendence of Mr. A. Stott.

At the last meeting of the Manchester Geological Society Mr. Joseph Goodwin read a paper on the ventilation of mines, and referred to the New Hartley Pit catastrophe, with a view to consider how far it was safe to trust to a bratticed shaft for ventilating coal mines. The system of working a colliery with only one shaft presented an unfavourable aspect from whatever point of view it might be regarded; but probably the system was more at fault as far as it affected ventilation, and the risk to which it exposed employers and employed. At the New Hartley Pit, employing 200 to 300 men, 200ft. from the surface, there was only a 12ft. shaft divided by bratticing; and leaving only half that space for the cages to pass up and down, which in itself would impede the progress of the air. On each descent of the cage the progress of the air would be temporarily stopped, and if an explosion took place under such a system what hope was there of safety for the men or the employer's property? If, as at Hamilton Colliery, a furnace was used and the brattice should take fire, there would be again no hope for the safety of the men; or, if an unlooked-for occurrence took place, as at the New Hartley Pit, what human power could render assistance to the unfortunate victims?

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

	£ s. d.	Dis. p. ct.
IRON, English Bar and Bolt:—		
in London ..... per ton	5 15 0	2
in Wales ..... "	5 0 0	"
in Liverpool ..... "	5 10 0	"
Staffordshire Bars .. "	7 0 0	1½
Sheet, Single "	8 10 0	"
Ditto, Double "	10 0 0	"
Hoop ..... "	8 0 0	"
Rod, round "	7 0 0	"
Nail Rod, sq. & flat "	7 5 0	"
SHIPPING IRON:—		
Staffordsh. Bars "	7 0 0	2
Sheet, Single "	8 15 0	"
Double "	10 5 0	"
Hoop "	8 0 0	"
Rod, Round "	7 0 0	"
Nail Rod, Square "	7 5 0	"
IRON, Rails, in Wales, cash "	5 7 6	nett
" 6 months "	5 10 0	"
Old, to cut up "	0 0 0	"
Railway Chairs, in Wales "	4 0 0	"
" in Clyde "	3 15 0	"
Pig No. 1, in Clyde .... "	2 9 0	"
3-5ths No. 1 & 2-5ths } "	2 9 0	"
No. 3. ..... }		
No. 1, in Wales..... "	5 8 9	"
No. 1, in Tyne and Tees "	2 12 0	"
Ditto, Forge ..... "	2 9 0	"
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom. "	3 10 0	"
Welsh Forge Pig (all Mine), at the Port .. "	3 5 0	"
Acadian Pig, Charcoal.. "	7 10 0	"
Scotch Pig, No. 1, in London ..... "	3 0 0	"

	£ s. d.	Dis. p. ct.
IRON, Swedish, Indian assortments..... per ton	11 15 0	2
Russian C.C.N.D to arrive "	16 0 0	"
STEEL, Swedish Keg, bars. "	16 0 0	½
Ditto, rolled..... "	15 0 0	½
Faggot..... "	17 0 0	"
SPELTER, on the spot .. "	18 0 0	Nett
To arrive ..... "	18 7 6	"
Hard, remelted ..... "	17 0 0	"
ZINC, in sheets ..... "	24 0 0	"
COPPER, Tile, 14 to 28 lb. "	102 0 0	2
Tough Cake..... "	102 10 0	2
Sheathing and Bolts ..per lb.	0 0 11½	"
Sheet..... "	0 0 11½	"
Bottoms..... "	0 1 0	"
Old ..... "	0 0 9½	"
Yellow Metal ..... "	0 0 9½	"
Barrs..... "	100 0 0	"
Russian..... do. .. "	101 0 0	"
LEAD, British Pig ..... "	20 10 0	"
Spanish ..... "	19 10 0	"
W. B. .. .. "	21 0 0	"
Sheet..... "	21 10 0	"
TIN, English Block, nom. "	120 0 0	"
Bar "	121 0 0	"
Refined "	122 0 0	"
Foreign Banca ..... "	124 0 0	"
Straits ..... "	119 0 0	"
TIN PLATES, Charcoal, IC..... per box	1 8 0	"
Ditto IX ..... "	1 14 0	"
Coke, IC ..... "	1 2 6	"
Ditto IX ..... "	1 8 6	"
Do. at Newport, 1c. per box less	—	"
Do. at L'pool, 6d. "	—	"
CANADA, Plates..... per tn	12 0 0 2	
QUICKSILVER ..... per bt	7 0 0 3	

Rails.—The market this week has been firm, and there has been a good inquiry.

Scotch Pig Iron.—The market has been quiet this week and prices have slightly given way. The nearest quotations are 49s. cash, and 49s. 9d. three months open for Warrants, Mixed Nos. f.o.b. Glasgow.

Spelter may be purchased a trifle lower than last week, viz., £18 5s. per ton on the spot. The stock on the 1st inst. was 5,423 tons, showing a decrease of 617 tons when compared with that on the 1st January.

Copper.—On the 3rd inst. the smelter announced a reduction of £5 per ton on cake and tile, and halfpenny per pound on manufactured.

Lead in good request.

Tin.—English in fair demand, but Foreign dull of sale at our quotations, viz, £123 to £124 for Banca, and £119 for fine Straits.

Feb. 5th, 1862. Moate and Co., 65, Old Broad-street, London

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Teak.....	15 10	17 0	15 0	16 0
Quebec, red pine ..	3 10	4 10	3 5	4 0
yellow pine..	3 0	4 0	3 0	3 15
St. John, N.B., yel.	3 0	3 10	3 0	3 10
Quebec, oak, white	3 0	3 10	3 0	3 10
birch	3 10	4 0	4 0	0 0
Memel..	0 0	0 0	0 0	0 0
elm	3 10	4 15	3 10	4 15
Dantzic, oak	3 10	6 0	3 10	6 0
fir.....	2 15	3 10	3 0	4 0
Memel, fir	3 10	4 0	3 10	4 0
Riga	3 5	3 10	3 10	3 15
Swedish	2 10	2 15	2 15	3 0
Masts, Queb. red pine	5 0	6 0	5 0	6 0
yl. pine	5 0	6 0	5 0	6 0
rd pine	0 0	0 0	0 0	0 0
Lathwood, Dants, 1m	6 0	8 10	6 0	7 0
St. Petersb.	8 0	8 10	9 0	9 10
Deals, per C., 12 ft. by 3 by 9 in.				
Quebec, wht. spruce	13 0	18 0	15 0	19 0
St. John, wht. spruce	13 0	16 0	15 0	17 10

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Yel. pine, per reduced C.				
Canada. 1st quality	17 0	18 10	17 10	19 0
2nd do ..	12 0	12 10	12 0	13 0
Archangel, yellow.	13 0	14 0	14 0	15 0
St. Petersbg, yel...	12 0	13 10	13 10	13 10
Finland.....	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	15 0
Gothenburg, yel...	10 0	11 10	10 0	12 10
white	9 10	10 0	9 10	11 0
Gefle, yellow	10 0	11 0	11 0	12 10
Soderhamn	10 0	10 10	11 0	12 10
Christiania, per C				
12 ft by 3 by 3	22 0	25 0	22 0	24 0
in. ..... yellow }				
Deck plank, Dnts per 40 ft. 3 in.	0 4	1 4	0 14	1 4
Staves, per standard M				
Quebec, pipe	60 0	70 0	80 0	85 0
puncheon	16 0	18 0	16 0	18 0
Baltic, crown pipe ...	160 0	170 0	170 0	180 0

SCOTCH PIG IRON REPORT.

		s.	d.	
No. 1	Gartsherrie	55	0	f.o.b Glasgow.
" 1	G.M.B.	48	9	" do.
" 3	Do.	47	9	" do.
M. Nos.	Do.	48	3	" do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths " 3 .. G.M.B.	Cash prompt	49	1	per ton.
	1 mo. open	49	6	do.
	2 mos. "	49	9	do.
	3 " "	50	0	do.

MANUFACTURED IRON.

	£	s.	d.
Bars, Govan	7	0	0
" Common	6	17	6
Drumpellar, Common	6	17	6
Do. Best	7	17	6
Plates and Sheets	9	0	0 to £10.
Rails	7	5	0
Pipes	5	0	0
Chairs	4	0	0

Glasgow, 5th February, 1862.

For the past week there has been considerable activity in our market, and prices steadily advanced to 49s. 9d. cash, and 50s. 6d. three months open. The chief cause of the rise has been the expectation that several furnaces would be soon put out of blast until prices advanced. No resolution has yet been come to amongst the makers.

Exports last week were 9,917 tons, against 7,748 tons in the corresponding week of last year.

Shaw, Thomson, and Moore, Metal Brokers.

The steam-boat contract between the Brighton Railway Company and Mr. Maples expires in less than seventeen months, and the Company are about applying for powers to purchase and run steamers of their own.

SOCIETY OF ARTS.

January 29th, 1862.

JOHN HAWKSHAW, F.R.S., in the Chair.

ON SOME RECENTLY-EXECUTED DEEP WELLS AND BORINGS.

By GEORGE R. BURNELL, C.E., F.G.S., F.S.A.

(Concluded from page 86.)

THE horizontal distance of the Passy well from the one at Grenelle is about 3,830 yards; and it will be observed from the section on the wall, that the water-bearing stratum is nearly 100ft. nearer the mean level of the sea at Grenelle, than it is at Passy, whilst the surface of the ground is about 35ft. higher at the latter locality than it is at the former one.

Unquestionably the effect produced upon the respective sources of supply, by the alteration in the heights of the columns of water, proves that the wells of Passy and of Grenelle are fed from the same stratum; and there can be no reason, therefore, to suppose that, when the Passy spring shall have cleared its water passages, there should be any difference in the qualities of the waters at the two places. M. Peligot has carefully analysed the Grenelle waters, and he found that they contained 0·000142 of saline matters, composed principally of the carbonates of lime, potash, and magnesia, associated with a compound of sulphur, and of soda of variable proportions and conditions, and with the carbonate of the protoxide of iron and silica. The salts of the sulphate of lime, or of the more permanently insoluble description, are absent, and it would appear that the gases diffused through the water are of considerable volume, the carbonic acid gas being one of the most so. There is a sensible evolution of sulphuretted hydrogen from both the wells of Passy and of Grenelle, and it is worthy of remark that the same gas is given off from the water in Mr. Gatehouse's well at Chichester, though in the latter instance the smell is sufficiently strong to render the water positively repulsive. At the present day the water at Passy is still foul, on account of the matters it brings up in suspension; but, as in the case of the Grenelle well, this inconvenience will no doubt soon disappear. The temperature at which it reaches the surface is identical in the two wells, and is about 82 deg. Fah.

It may be worth while to call attention to the mechanical means adopted by M. Kind in sinking a boring of the large diameter of 2ft. 4in. to the enormous depth of nearly 2,000ft. from the surface. The work was commenced by a shaft, as usually is the case, and, after it had been sunk to a depth of about 50ft., the boring commenced, and was continued, with as nearly as possible the same diameter, to the bottom. M. Kind employed for this purpose what may be called rods with releasing joints, very closely resembling the joints introduced by Œuyenhausen, which allowed the cutting portion of the tool to be raised a certain height, and then to be released automatically; this arrangement was adopted in order to avoid the lashing of the sides of the bore by the long rods, and to regulate the force of the blow. The cutting tool used by M. Kind also differed from the tools generally employed, for it consisted of a single or a double trepan, according to the nature of the ground, instead of the ordinary chisels and augers. A patent was taken out for these tools by M. Kind, No. 13,478, of the year 1854, the printed specification of which contains a series of engravings of the various modifications proposed for the various kinds of rocks; in the *Annuaire Scientifique* for 1861 illustrations will also be found of the ordinary trepans and of the slide joints. M. Kind is able, by these combinations, to strike as many as twenty blows in a minute with the greatest regularity at a depth of 2,000ft. The patent of 1854 specifies also certain methods of lining the sides of the borings; but it must be confessed that they do not seem to me to possess any great merit, and indeed M. Kind had more difficulties to encounter at Passy from the collapsing of his tubes than from any other cause. It is a common error of well borers to undervalue the effort exerted by clays swelling when charged with water; and the great delays encountered in sinking the Passy well were precisely caused by the false economy introduced in the execution of the tube linings. The time actually employed in sinking the Passy well was nearly the same as that employed at Grenelle; in the former instance it was 6 years 275 days, in the latter it was 7 years 90 days. The cost of the Grenelle well, as above stated, was £14,000; that of the well at Passy was £40,000, but it must be observed that the quantity of water, delivered at the same height in the two cases, is ten times greater at Passy than it is at Grenelle; the rates of delivery are, in fact, nearly in the direct ratios of the diameters.

I have not been able to learn whether the artesian wells of Elbœuf and of Rouen have been affected by the completion of the new well at Passy, and at present I am inclined to believe that they may escape this action, on account of their proximity to the entering ground of the lower green sands on the western margin of the cretaceous basin. At Tours, however, so many wells have lately been sunk (in an early edition of M. Degoussée's excellent *Guide du Sondeur*, that gentleman mentions that he himself had executed no less than sixteen of them) that the subterranean supply is becoming exhausted, and, as in the case of the wells supplied by the basement beds of the London clay, the lower green sand wells are gradually losing their artesian character. In two wells also, at Evres and Ferrières, the subcretaceous formations yielded no water; and in the latter the bore was even carried to a depth of 30ft. in the great oolitic, or jura limestone series, without obtaining a supply. I call especial attention to this fact, because it illustrates again the uncertainty at all times overshadowing the execution of the first deep wells in a particular district, and that the stratum which yields water in one locality is likely to be unable to do so in another. The enterprising gentlemen who are engaged at the Hastings well should bear this fact in mind, and though I believe that after they shall have traversed the lower members of the Wealden series they are more than likely to find the upper or Portland oolite, which is of sufficient water-bearing power to ensure them a good supply of water, they must also be prepared for disappointment. The Hastings well is already 553ft. deep, still in the Hastings beds, and, as these have never yet been traversed, it is impossible to say whether they will be found to be 7ft. or 1,700ft. thick. Most probably the former guess will be found to be the more correct, because the town of Hastings is situated at a low horizon in the series of Weald beds; but all operations of this description at Hastings must for the present be conducted in doubt as to the ultimate result, however strong may be the hopes of success.

I dwell a little on this point because the Board of Guardians of Brighton are engaged upon a similar experiment, at a place called the Warren Farm, near that town. It is not my place to criticise the mode of execution adopted in carrying on this work, but I cannot refrain from saying that there are many things about it which seem to me to be in opposition to the opinions now entertained by scientific engineers, and I gravely suspect that, even if water from the subcretaceous formations should be obtained at this well, it cannot, by any possible chance, rise near the surface, which, at the Warren Farm, is not less than 410ft. above the mean tide level. It is inexplicable to me, also, that this well should be continued by means of a shaft, at the great depth already reached, instead of by means of boring; and I regret bitterly to see an experiment, which has been carried on hitherto with so much spirit, compromised by what I consider the mistaken course latterly adopted. At Brighton, nevertheless, the only chance of securing a supply in the parts of the chalk basin lying beyond the influence of the faults or "cross throws" which have, for instance, enabled the Water Works Company to obtain, as is said, 1,000,000 gallons per day, is to penetrate the chalk to the lower green sand. Notwithstanding the cost of the previous experimental borings in the surrounding countries, I am convinced that the cheapest manner of effecting this object would have been to have bored rather than to have sunk a shaft, and even now the guardians would do wisely to adopt this course, especially as theirs is really the first experimental shaft or boring on the east bank of the Arun. It is, however, a sad peculiarity of the municipal bodies of England that they are always disposed to listen to those whom it is the fashion to call "practical," in contradistinction to "scientific" men, as though the mere fact of working "by rule of thumb" gave men truer insights into the laws of nature than long study and careful observation. At Brighton this seems emphatically to have been the case, and in a report addressed to, and received by, the Board of Guardians, the opinions of three practical well-borers are quoted as to the probable cost of continuing the well at Warren Farm, but no opinion seems to have been asked from such men as Mr. Hawksley, Mr. Mylne, or Mr. Homersham, who have brought great experience and deep study to bear on the hydrographical conditions of this district on other occasions. It is one of the fashionable theories of the day that a scientific education incapacitates a man for the exercise of a profession, and that the most able men in any branch of art or science are those who have not been brought up to pursue it. Under these circumstances it may not be surprising, however unfortunate it may be, to find empiricism preferred to science, or that the Brighton guardians should avoid taking the opinions of really eminent engineers.

In stating, in the previous part of this paper, that I should return to the question of the abnormal beds met with at Highgate, I had especially before my mind's eye the cases of the well sunk under my own orders at Warnham Court, near Horsham; and at Red Hill, by my friend Mr. Docwra. In the former case, the boring, after it had been carried through the sandstones, clays, and shales of the upper Wealden deposits, passed at a depth of 142ft. from the surface into a bed of red clay and sandstone intermixed. At first I believed, from the external characters of the materials, that they were of the same nature as the beds found at the bottom of the Kentish Town well, and I was supported in this opinion by several distinguished geologists to whom I showed the samples. As the Kentish Town beds were, at the time I refer to (about five years since), universally considered to be members of the new red sandstone series, of course I regarded the Warnham bed as one of the same range. But Mr. Docwra, at Red Hill, after he had traversed the sands and loams of the subcretaceous series to a depth of 438ft., passed into a bed composed of red clays and particles of red sandstone, which were identical with the Warnham beds, and with some members of the Wealden series. It seems, therefore, to me to be very probable that the Kentish Town beds may be members of the Wealden series, but the solution of this question has simply a geological interest, for alike the Weald clays and the new red sandstone clays are without water; and, under these circumstances, the wisest course to be adopted was to stop the further progress of the works in all such cases as Warnham and Red Hill, unless they were carried on distinctly as philosophical experiments.

The well at Rugby, though it has proved to be, no doubt, a source of annoyance and disappointment, may eventually turn out to be of importance to the commercial interests of the locality. It was commenced with the hope of finding in the new red sandstone series under the lias, some water-bearing strata which might be able to furnish a supply to compensate for the deficiency under which the town of Rugby was suffering, after it had been put to the expense of carrying out the absurd crotchet of the so-called "gathering grounds" system. A boring has here been carried down to a great depth in the new red sandstones of the triassic group, which, at Liverpool and Birkenhead for instance, frequently supply large quantities of water. At Rugby, however, the boring at present has only yielded a brackish water, and I suspect that now all hopes of securing the result desired by the Local Board of Health by this well must be abandoned, unless the Board determine upon tubing the bore-hole throughout its length, and upon continuing to sink to a much greater depth. It is possible that, within a moderate distance from the bottom of the present well, stronger brine springs than those now brought to the surface may be found, which it would be possible to evaporate economically for the purpose of salt making; but a very careful comparison between the strata of this locality and of those near Derby or Droitwich, would be required before any decided opinions could be formed as to the probability of finding soft water within a reasonable distance from the surface at Rugby.

The well at Great Yarmouth, executed by Sir E. Lacon and Co., is of interest, on account of its showing the great depth attained by the tertiary strata on the east of England; but, unfortunately for the spirited proprietors, the results, so far as water supply is concerned, have been "negative." The depth of the tertiaries here was found to be 527ft., and the first 170ft. of this thickness were composed of recent estuarine and blown sand, deposits of very recent formation.

At Norwich, Messrs. Colman are steadily pursuing an experimental boring, which has already passed through the chalk to a depth of 1,158ft., the upper green sand to a depth of 8ft., and the gault to a depth of 30ft.; the works have been suspended in this formation on account of some accident to the machinery, but when this shall have been repaired they will no doubt be resumed. It may be necessary to descend 150ft. lower before reaching the water-bearing stratum, but the comparative success of Mr. Lankester Webb's well, at Stowmarket, affords good reason to hope that Messrs. Colman's perseverance will ultimately be rewarded. I do not anticipate, however, that the water will overflow the surface, because the lower green sand is traversed by one of the affluents of the Ouse, near Downham Market, at a comparatively low level.

In a paper which I had the honour of reading in this room last year, I alluded to the very successful borings made by the Kent Waterworks Company in the Ravensbourne Valley, and this evening I am enabled to lay before you a section, showing the strata they traversed. One reason for my doing so is, because I have heard that some parties propose, as I said in the opening paragraph of this paper, to sink artesian wells near London for the supply of the metropolis; and I think it desirable to state, for their guidance, that, unless they meet with the peculiar conditions of the faults of the Ravensbourne Valley, they are not likely to obtain a large supply of water from the chalk on the north side of the Thames, whilst there is no chance whatever of their finding water below the chalk. There are, no doubt, copious and beautiful springs given off from the head valley of the Lea and the Colne, both of which rise in, and are fed by, the chalk; but those springs may, in almost all cases, be shown to be connected with some geological disturbance of the strata, and the only locality near London where there seems to me to be any chance of obtaining a large quantity of water from the chalk would be on the left bank (or the west) of the river Lea, somewhat to the north-east of Stratford, because there is about that district a line of disturbance in the chalk parallel to the great fault which brings to the surface the springs lately tapped near New Cross, and those of Grays, in Essex.

Finally, it must be evident to any one who reads attentively the records of the success and of the failure of the attempts above-mentioned, that the execution of artesian wells is an operation which should only be entrusted to skilful and well-tried men acquainted with the theory and practice of their art. No such work should be commenced without a careful preliminary survey of the geological and hydrographical conditions of the country extending over a very wide range. This is seldom done, because public bodies, in England at least, do not seem to object to pay for engineers' blunders and miscalculations, but they do object to pay for their study, and it is at once assumed that because artesian wells have succeeded in one case they must succeed in all. But even when the greatest amount of skill and science have been brought to bear on the preliminary investigations for the establishment of an artesian well, it is impossible to predict with any certainty what the result of sinking a shaft or a boring may be in a stratum hitherto untried. Moreover, every artesian source of supply is limited in amount, and even in the case of the Paris basin it would be desirable to watch the effects of the increased draught upon the lower green sand during a dry summer, especially before commencing, as has been proposed, the execution of a large number of wells like those of Passy and Grenelle.

I may here add that in the number of *La Presse Scientifique* for the 16th January of this year I find a notice of a well lately sunk at Columbus, Ohio, U.S., which is not less than 2,575ft. deep. The thermometer (on the system invented by Mr. Walferdin) registered a temperature of 88 deg.; this would seem to show that the law of the increase of temperature is rather slower in Ohio than it is near Paris. No particulars are, however, given of this important boring.

SOCIETY OF ARTS.

February 5th, 1862.

Dr. A. W. MILLER, F.R.S., in the Chair.

ON IMPROVEMENTS AND PROGRESS IN DYEING AND CALICO PRINTING SINCE 1851.

By Mr. F. CRACE CALVERT, F.R.S.

I CANNOT presume to give, in a paper like the present, an account of all the improvements and inventions which must have occurred in such extensive trades as those of dyeing and calico printing during a space of ten years, and especially during a decade of extraordinary progress like that which has just passed. The utmost, therefore, that I can do is, to lay before you an outline of the principal discoveries which have come to my knowledge during the period under consideration.

I wish, however, to state that the processes of which I shall speak to-night are those generally known to calico-printers; for it will be easily understood that many printers may use methods peculiarly their own, and that it would be a breach of confidence were I to publish any such processes that may have been communicated to me.

I shall divide the subject into two heads. First, treating of new dyeing materials obtained from well known dyestuffs, and then of dyestuffs altogether new, together with their application to dyeing. Secondly, I shall consider the subject of calico printing.

Madder.—This valuable dyestuff, which is chiefly imported from France, Turkey, Italy, and Holland, is obtained from the *Rubia Tinctorum*. Our chemical knowledge of the composition of this root, so important to dyers and calico printers, was, up to 1851, in a most unsatisfactory state. Thus, whilst we find that MM. Decaisne, Jean Gerber, Edmund Dollfus, &c., asserted only one colouring principle, to which they gave the names of *alizarine*, *colorine*, or *azale*, others, such as MM. Persoz, Runge, &c., admitted two colouring principles, *alizarine* and *purpurine*, and Kuhlmann added to these two a third, called *xanthine*. But Dr. Edward Schunck, F.R.S., published, in 1851, his most valuable and extensive researches on the chemical composition of madder, which not only threw much light on the colour-giving principle of the rubia root, but also, as I will presently show, led to valuable commercial applications. He ascertained that, although the roots contained a certain quantity of colouring matter called alizarine, yet that the ultimate source of this only colour-giving principle was a substance to which he gave the name of *rubian*. He further found that one equivalent of this substance under the influence of a ferment called *erythrozym*, or of acids, or alkalies, would, by losing fourteen equivalents of water, be converted into four equivalents of alizarine, as the following equation shows:—

$$\underset{\text{Rubian.}}{C_{56}H_{34}O_{30}} = 4\,\underset{\text{Alizarine.}}{(C_{14}H_2O_4)} + 14\,\underset{\text{Water.}}{HO}$$

This result satisfactorily explained the change of madder into garancine by the action of sulphuric acid on that root, from the fact that rubian was susceptible of conversion, under the same influences, not only into alizarine, but also into two valueless substances, called rubiretine and verantine. This led Dr. Schunck, in conjunction with Mr. Simon Pincoff, in 1852, to the production of a most important dyeing material, called by them *commercial alizarine*. But to enable you to understand in what this product differs from garancine, and also its mode of preparation, it is necessary that I should state that the verantine and rubiretine are not colour-giving principles, and that they interfere with the beauty and brightness of the fine shades of purple given by alizarine, which, according to Dr. Schunck, is the only colour-giving principle contained in madder.*

Garancine, which, even before 1851, was extensively used for producing red, purple, and chocolate upon calico, was obtained, as you are aware, either by mixing together at an ordinary temperature equal weights of madder and sulphuric acid, then adding water, when the garancine was produced, requiring only to be thoroughly washed so as to remove the acid — or by mixing the roots with one-third their weight of sulphuric acid previously diluted with water, and carrying the whole to the boil for one or two hours, washing the residue repeatedly, and using, in the last operation, some alkaline carbonate. Although garancine thus prepared gave colours similar to madder, yet they were wanting in solidity. This effect, especially as regards purples, was overcome by Messrs. Pincoff and Schunck by taking principally garancine prepared as above, but thoroughly depriving it of acid, and submitting it to the action of high pressure steam, when the substance called verantine is decomposed or modified so as not to interfere with the purple dyeing power of alizarine. The advantages possessed by this product, which is now so extensively employed in calico printing, that several millions of pieces have been dyed with it, are, as stated by Messrs. Pincoff and Schunck, as follows:—It produces good lilacs economically and without soaping; great promptitude and regularity in the production; facility of producing combination of lilacs with catechu, lilac and chocolate, and lilac and orange, which results cannot be obtained so satisfactorily with madder or garancine; production of lilac shades graduated *ad libitum*. Lastly, economy of mordaunts. I shall again refer to this in speaking of calico printing.

Whilst on this class of madder products, I may refer to an improvement effected by Mr. John Lightfoot, in the manufacture of garanceux (which was discovered in 1843 by Mr. Schwartz), or spent madder, which has been treated with sulphuric acid, as above described, for the preparation of garancine. The method now generally followed is to collect the spent madder in bags as it runs from the dyebecks, and then throwing it on to a heap, to be ultimately converted into garanceux, by acting upon it as above described, with sulphuric acid. Mr. Lightfoot, however, recommends large vats to be provided, allowing to run into them the hot spent madder liquors of the dyebecks, together with vitriol, leaving the whole to stand for twenty-four hours, running off the clear liquor and washing the solid garanceaux thus produced, until all impurities and acid are removed. The advantages claimed are, first, saving of fuel, by economising the heat of the waste liquors, and secondly, the production of one-fourth more colouring matter. Of late years the French calico printers have applied, for light styles of madder-pinks, extracts of madder, or garancine, which have generally been obtained by treating madders or garancines with alcohol or wood-spirit, and adding to them acetate of alumina and acetic acid; a similar process has recently been patented by Mr. F. A. Gutty. Another most interesting process has recently been published by Mr. Emile Kopp, for the production of alizarine from garancine. It consists in submitting dry garancine in a double cylinder to the action of superheated and saturated steam, when the alizarine is carried off by the steam, and the whole condensed in a refrigerator.

Flower of Madder.—This product, which is now extensively used by continental printers, and which was introduced to the trade by MM. Julian and Roquer towards the beginning of 1852, is prepared by allowing madder to ferment, and then washing it thoroughly, which removes from it not only all soluble matters, such as sugar, mucilaginous substances, acids, &c., which interfere with the fixation of the alizarine on the various mordaunts, but also (in accordance with Dr. Schunck's researches on the influence of the ferment erythrozym on rubian) increases the quantity of colour-giving principle or alizarine. It is found, by experience, that 100 parts of flower of madder are equal to about 200 parts of ordinary ground roots, and that the shades are finer, the pinks and reds also having greater solidity. Mr. E. Mucklow has recently patented a process similar to the above which consists in alternately macerating and pressing madder roots so as to expel from them various materials which, as above stated, interfere with the dyeing of the fabrics.

Mr. Emile Kropp has published a very interesting paper on the subject of madder, in which he proves that if the madders of Alsace are treated with a weak solution of sulphurous acid, and to this solution, which has a fine golden colour, he adds 3 or 4 per cent. of hydrochloric acid, and heats the whole to a temperature of 150 deg.,

* Dr. Schunck also obtained as products of decomposition of rubian, rubianine and sugar. Those who are interested in these chemical researches will find them fully detailed in the Transactions of the Royal Society.

a red colouring matter is precipitated, which he states to be pure *purpurine*. If, after the separation of this precipitate, the liquor is again carried to the boil, a new colouring matter is formed, which he calls *green alizarine*, and finds to be composed of pure alizarine and a dark green resin, which he considers is produced by the decomposition of chlorogenine.

As a *resumé* of my observations on madder, I may state that the only two madder products which have received extensive application since 1851 are commercial alizarine and flower of madder.

Indigo.—I have the pleasure again to draw your attention to a series of researches by Dr. Edward Schunck, and to enable you to appreciate the value of his discoveries in connection with this important dyestuff, it is necessary that I should first state that chemists held two different opinions as to the condition in which the colouring matter existed in the indigo plants. Thus Chevreul, Girardin, &c., considered that the indigo contained in the plant was in the form of white, or de-oxygenated blue indigo; whilst Giobert and others believed that it did not pre-exist in the vegetable, but was formed during the process of fermentation, which is usually employed for the extraction of the colour from the *Isatis tinctoria* and *Indigofera anil*. Serious doubts having arisen in the mind of Dr. Schunck, whether either of these theories correctly explained the state in which indigo existed in the indigo plant, he undertook a long series of researches, by which he was enabled to show, with a positive certainty, that the *Isatis tinctoria* contains a substance easily soluble in hot and cold water, alcohol, and ether, and which, by the action of strong mineral acid, yields indigo blue. Further, that the formation of the colouring matter from it can be effected without the intervention of oxygen or of alkalies, and that the latter, indeed, if allowed to act upon it before the application of acid, entirely prevents the formation of the colouring matter, viz., indigo blue. To ascertain whether the substance which he calls *indican* pre-existed in the plant Dr. Schunck operated as follows:—He digested in ether some perfectly dry leaves of the *Isatis tinctoria*, removed the ethereal solution, and having exposed it to spontaneous evaporation, it left a green syrupy residue, from which water extracted *indican*, for by the action of boiling sulphuric acid it yielded an abundance of indigo blue. To obtain the *indican* in a high state of purity he found it necessary to treat the leaves with alcohol and ether, and to submit the extract to various chemical operations, to get rid of all impurities, so as to obtain indican as a yellow transparent glutinous substance, of a slightly bitter and nauseous taste. This substance presents the remarkable property (similar to that of rubian in madder) of being susceptible under the influence of a ferment in the plant, or of acids, of yielding indigo blue and sugar, as seen by the following chemical formula:—

$$\left.\begin{array}{l}\text{1 eq Indican } C_{52}\,H_{31}\,NO_{31}\\ \text{4 eqs Water } \quad H_4\,O_4\end{array}\right\} = \left\{\begin{array}{l}C_{16}\,H_5\,NO_2 \text{ 1 eq Indigo blue}\\ C_{36}\,H_{30}\quad O_{36} \text{ 3 eqs Sugar}\end{array}\right.$$

$$C_{52}\,H_{35}\,NO_{38} \qquad C_{52}\,H_{35}\,NO_{38}$$

To obtain this interesting decomposition with acids it is simply necessary to heat the indican with strong sulphuric or hydrochloric acid, when the indigo blue precipitates while the sugar remains in solution. But indican is so liable to undergo modifications that, if the action of the acids be continued, besides the indigo blue an indigo purple is formed, called by Dr. Schunck *indirubine*. To fully appreciate the value of these researches it is necessary that I should lay before you an outline of the manufacture of indigo, as some of you may not be acquainted with it. Commercial indigo is obtained from plants belonging to the leguminous tribe, known under the general name of *indigofera*, that these plants are mowed and placed in large vats with water, and allowed to ferment for eight or ten hours, when the supernatant liquor first becomes green and then blue. It is then run off into other vats and well agitated, so as to bring it throughly under the action of the atmospheric oxygen, when the white soluble indigo becomes throughly oxydised into blue insoluble indigo. A little lime water is now added and the whole left to settle, the deposit collected on a cloth, drained, pressed, divided into square lumps, and dried in the sun, when it constitutes commercial indigo. Dr. Schunck's researches show, as above stated, that, under the influence of a ferment, the *indican* is converted into sugar and white indigo; and they also explain that if the manufacturer is not extremely careful he may experience great loss in the amount of indigo obtained, for Dr. Schunck has observed that *indican*, when dissolved in water, is liable to undergo rapid modifications, and that instead of yielding by the acids indigo blue and *indirubine*, it gives *indiretine indilhumine*, &c. You will, doubtless, be struck with the great similarity which exists between the colour-giving principles of the madder and indigo plants, and with the light thrown upon this class of tinctorial matters by the laborious researches of Dr. Schunck. I cannot leave this interesting substance without stating that, although one or two attempts have been made to introduce new preparations of indigo, they have not, to my knowledge, yet received the sanction of the trade. Such are the preparations of the sulpho-indigotic acid of Mr. Haeffly, the sulpho-purpurate of soda of Mr. Bolley, and the indigo of Mr. Johnson.

Orchil.—It is hardly necessary for me to state that this dye-stuff has been used for producing violets, mauves, reds, and other colours, for many years, and that the colouring matter was obtained by allowing lichens to remain in contact at natural temperature for several weeks with putrid urine and a little lime, and that of late years ammonia has been substituted for urine, with the addition of a little carbonate of soda, nitrate of soda, or alum. You are also doubtless aware that Robiquet was the first to obtain a colourless principle called *orcine*, and to show that under the influence of oxygen and ammonia it became transformed into water and a red colour called *orcéine*, and that Dr. Schunck proved that a substance extracted by him under the name of *lecanoric acid*, from lichens, would, under the influence of heat and a solution of baryta, decompose itself into water, carbonic acid, and orcine. Without overlooking the interesting researches of Heeren and Sir Robert Kane on this subject, I must especially mention the labours and valuable researches of Dr. Stenhouse, which not only added greatly to our knowledge of the various chemical principles existing in lichens from which the orchil colouring matters are obtained, but also led him to discover a commercial method of extracting from the lichens the various organic substances capable of giving orchil colours when placed in favourable conditions. He also showed that the very small percentage of colouring matters in proportion to the bulk of weed might be cheaply and commercially extracted in the locality where the lichens grow, thus saving the enormous expense of carrying a large bulk of useless matter from Africa and elsewhere to this country. If this valuable hint of Dr. Stenhouse's has not yet been acted upon as regards the saving of transport, his process for extracting the colour-giving principle has of late years been extensively adopted by manufacturers of orchil, enabling them to obtain cheaper and better colours from lichens. But still none of these advantages led manufacturers to the great desideratum of giving fastness to the beautiful purple shades obtained from orchils until 1856, when Mr. Marnas, of the firm of Guinon, Marnas, and Bonnet, of Lyons, found that by treating lichens, as suggested by Dr. Stenhouse, with milk of lime, filtering the lime liquor off and precipitating the colour-giving principle from it with hydrochloric acid, gathering these on a filter, and, after having properly washed them, dissolving them in caustic ammonia, and keeping this ammoniacal liquor at a temperature of 153 deg. to 160 deg., for twenty to twenty-five days, when under the influence of that temperature, the colour-giving principles of the lichens fix ammonia and oxygen and are transformed into a new series of products, which Mr. Marnas separates from the coloured liquor by adding chloride of calcium, which causes a fine purple lake to be deposited, which, after being well washed and dried, is sold under the name of French purple. It is easy to understand that the chloride of calcium can be replaced by salts of alumina, tin, &c. What characterises this orchil colour from those previously known is, that it dyes animal fibres with greater facility than the common orchil, that it gives directly mauve colours, which can be modified by adding to them a little carmine of indigo, roscine, &c.; but the essential difference of these purples and mauves from ordinary orchil colours is—that while the latter are destroyed by acids and light, those of Mr. Marnas, on the contrary, withstand their action, thus accounting for the public favour given to Messrs. Guinon, Marnas, and Co.'s orchil colours. To dye silk or wool with French purple it is simply necessary to mix the lake with its weight of oxalic acid, boil with water, and then filter, the oxalate of lime remaining on the filter while the colour passes in the filtrate. This liquor is then added to a slightly ammoniacal liquid contained in the dye-beck; all that is now necessary is to dip in the beck, silk, wool, cotton, mordaunted with albumen, or cotton prepared for Turkey red, when any of these materials will become dyed with magnificent fast shades of purple or mauve. It is a curious coincidence that, after many years of anxious search, two purples from widely different sources should have been first discovered in the same year (1856) in different countries—I allude to Mr. Perkin's purple from coal tar, to which I shall refer further on.

Catechu, or Terra Japonica, which is extracted from the wood of the acacia catechu, and which we import in large quantities from the East Indies, is daily becoming of increased importance, owing to the great variety of colours that can be obtained with it. It contains two very distinct substances, a tannin (studied by Dr. Stenhouse) which gives a green precipitate with salts of peroxide of iron, and also a substance called *catechine*, which, under the influence of alkalies and oxygen, is rapidly transformed into two acids called japonic and rubinic acid. As in catechu, the tannin gives various shades of drab, the catechine giving, with proper metallic salts, salmon, red, and wood colours. Some calico printers have of late, under my advice, washed with cold water pulverised catechu, which dissolves freely the tannin, leaving the catechine insoluble in cold water, which, however, being soluble in hot water, becomes susceptible of application.

Aloes.—Owing to the interesting researches of Drs. Schunck and Stenhouse upon the resin obtained from the *aloe socotorina*, and imported from the East and West Indies, as well as Africa, the various colouring matters obtained by them have of late been employed by the French dyers for producing pinks, violets, maroons, and other shades.

Lac Dye.—Messrs. Haworth and Brooke, of Manchester, have introduced into commerce a lac dye superior to that imported from India, which, as you are aware, is prepared from stick lac. Their improvement consists in treating stick lac with weak ammonia, and adding to this solution chloride of tin, when a fine red insoluble matter is formed which precipitates. This is collected, and is ready for use.

Chlorophyll.—For many years attempts were made to fix upon fabrics the green colouring matter of leaves, but unsuccessfully, until, in 1854, MM. Hartmann and Cordillott, of Mulhouse, succeeded, by the following simple process, in obtaining on silk, wool, and cotton, fine green brilliant and solid colours. After having boiled a quantity of grass, so as to remove everything soluble in boiling water, it was heated with a hot caustic lye of specific gravity 1·03, this alkaline solution being then neutralised with hydrochloric acid, a fine green precipitate was thrown down. This precipitate was then dissolved in a solution of caustic lye, to which had been previously added some phosphate of soda and oxide of tin. This mixture, properly thickened with gum, was printed and fixed by steaming. No doubt, by a slight modification in the *modus operandi*, this colour might be applied to dyeing.*

Chinese Green, called *Lo-kao.*—In 1851 and 1852 public attention was drawn by several English gentlemen to samples of a green colouring matter imported from China; and in 1853 Messrs. Guinon, of Lyons, imported such quantities of the material as to enable them to dye silks for the requirements of the trade. The silks so dyed by them, under the names of *Vert-Venus*, *Vert-Azof* and *Vert-Lumière*, were especially admired, from the beautiful green shades they assumed in artificial light; and, although the price of the dye fell from £21 per pound in 1853, to £4 in 1860, these beautiful shades of green (especially under artificial light) have almost disappeared from the market, owing to the two following reasons, first, their want of stability; and, secondly, because Messrs. Guinon, Marnas, and Bonnet have found the following means of producing, at less cost, shades of green which also maintain this character under the influence of artificial light, *i.e.*, by first dyeing their silks in Prussian-blue, and then dyeing them in an acidulated bath of carboazotic, or picric acid. It is an interesting fact to observe that, while the greens produced with indigo and picric acid appear blue in artificial light, those produced as above with Prussian-blue and picric acid appear green under the same conditions. I cannot leave this interesting subject without making two further remarks—first, lo-kao is the only substance with which I am acquainted capable, with proper reagents, of producing the seven colours of the spectrum; secondly, that, thanks to the advanced state of chemical and botanical science, we have succeeded in producing in Europe the identical substance imported only a few years ago, as a great novelty, from China, and for which, but for those sciences, we should still probably have remained tributary to that empire. Thus Mr. Charvin, of Lyons, has been able to obtain lo-koa from a weed indigenous to Europe, viz., *Rhamnus catharticus*, for which he has received, from the Chamber of Commerce of Lyons a gold medal worth 6,000f.†

Murexide, or *Roman Purple.*—The colour to which I am now about to draw your attention furnishes another example of the assistance which the progress of chemical science has rendered to the art of calico printing. In 1776 the illustrious Swedish chemist, Scheele, discovered, in human urine, uric acid. In 1817 Brugnatelli found that nitric acid transformed uric acid into a substance, which he called erythric acid, but which was subsequently called, by Wöhler and Liebig, alloxan. In 1818 Dr. Prout found that the latter substance gave, when in contact with ammonia, a beautiful purple red colour, which he called purpurate of ammonia—the product known by the name of murexide since the researches of Liebig and Wöhler, published about 1837. These discoveries remained dormant in the field of pure science until the year 1851, when Dr. Saac observed that when alloxan came in contact with the hand it tinged it red. This led him to infer that alloxan might be employed to dye woollens red, and further experiments convinced him that if woollen cloth were prepared with a salt of tin, passed through a solution of alloxan, and then submitted to a gentle heat, a most beautiful and delicate pink colour resulted. In 1856 MM. Depouilly, Lauth, Meister, Petersen, and Albert Schlumberger, applied it as a dyeing material to silk and wool, and succeeded in obtaining red and purple colours by mixing the murexide with corrosive sublimate, acetate of soda, and acetic acid. For printing, a mixture of murexide with nitrate of lead or acetate of zinc, properly thickened, is applied on cotton fabrics, which are then allowed to dry for a day or two, when the colour is fixed by passing them through a mixture of corrosive sublimate, acetate of soda, and acetic acid. The Roman purple style of printing has been carried out extensively by Messrs. Edmund Potter and Co.; Boyd, Sons, and Hamel; and James Black and Co. No doubt you will wonder whence such quantities of uric acid, or murexide, could be drawn to supply a demand like that which has arisen. This result has been achieved by the following process of extracting uric acid from Peruvian guano. Guano is treated repeatedly with hydrochloric acid, until all soluble matters are removed by heat and washing. The insoluble mass, which consists chiefly of sand and uric acid, is carefully treated with nitric acid of specific gravity of 1·40. When the action of the acid is completed the mass is treated with warm water, and thrown on a filter. The filtrate, which has a yellowish colour, and contains alloxan, &c., is evaporated carefully to such a degree that when left to cool it becomes a brownish red or violet solid, called by the inventor *carmin de pourpre*, which is the substance chiefly used for printing, as above described. It is to the enterprising commercial spirit of Mr. Robert Rumney, chemical manufacturer, of Manchester, that is due the extensive production and application of murexide in this country.

* Any one who wishes for further information on the green colouring matter from plants will find a most interesting paper by M. Fremy, published in the *Comptes Rendus* of the French Academy for 1860, vol. 50, in which that chemist shows that chlorophyll is composed of two colouring matters called phyllo xanthine and phylloxcyanine.

† For full details on this subject see Report presented to the Chamber of Commerce, at Lyons, by the Rev. M, Hélot, M. Persoz, &c.

Doubtless you are aware that alum and cream of tartar are used largely as mordaunts in the dyeing of silk, wool, and cotton, and that the latter substance has much risen in price, owing to the failure of the wine crops of late years; therefore, any process for economising the use of cream of tartar is a matter of importance. I am happy to state that Mr. Kuhlmann has, within the last few weeks, published in the Mémoirs of the French Academy a paper in which he furnishes a means of attaining that end. Having first confirmed a most important observation of Mr. Chevreul's, viz., that when cream of tartar is used as a mordaunt it is decomposed into tartaric acid, which adheres to the libre, and into a neutral tartrate which remains in solution and is lost, and that if, on the contrary, instead of using the cream of tartar as a mordaunt, it is first decomposed into tartrate of baryta, and that this salt be used as a mordaunt, in connection with a little hydrochloric acid, the two equivalents of the tartaric acid of the cream of tartar become available, and consequently a saving of one-half the quantity of cream of tartar formerly used is effected.

In the hope that it may prove interesting to the members of this society I will now give some details respecting a few new processes for dyeing silk, before proceeding to treat of coal-tar colours.

Catechu Black.—The silks are first passed into a solution of salts of peroxide of iron, then into a hot soap solution containing an excess of soap, from whence they are passed into a slightly acid bath of prussiate of potash. The silks which have thus been dyed Prussian blue are dipped in a solution of persalt of iron having a specific gravity of 1·15, the object of which is to give an iron mordaunt to the silk. They are then thoroughly washed, and passed into a bath of catechu for organzine at 203 deg., and for tram at 172 deg., the silks being worked in this bath until it is cold, so as to saturate thoroughly the iron mordaunt with the colouring principle of catechu, and thus produce a black. They are then wrung on the peg and exposed to the atmosphere for twenty-four hours, after which they are passed into a soap solution at 150 deg., washed thoroughly, and the organzine is then dipped in a bath of weak acetic acid, and the tram in one of weak hydrochloric acid; finally, the silks are passed through an emulsion of oil, well worked on the peg, and allowed to dry. These last operations are intended to remove, by means of the fatty matters, the harshness which the silk would otherwise possess.

The following is a process for preparing dyed silks, so that when woven into fabrics these will be fit for taking the moire antique:—Two parts of pure olive oil are mixed with one of concentrated sulphuric acid, and agitated until sulphurous acid begins to be liberated. It is then well mixed with fifteen parts of lukewarm water, and the whole further diluted with boiling water. The silks are then passed into this bath, and then into a second similar bath, to which has been added a little free vitriol. After this they are successively dipped in a hot bath containing a little citric acid, then into the previous No. 2, to which is added a little sulphate of alumina, and a little black dye, to restore to the silk any colour it may have lost during the former operations. The silks, after having been dried in the air, are ready for weaving. The object of these processes is to introduce into the silk fatty acids, the property of which is to communicate to the silk a great degree of softness, and adapt it to receive, by intense pressure, the intended moire.

I will now describe a process for dyeing silks white. The silks, after having been boiled, are first passed into a slightly ammoniacal bath, and from thence into another of water, in which has been dissolved a little French purple, and, lastly, into another bath containing lukewarm water, to which is added, in successive portions, some carmine of indigo, and the silks are then dried. Many of you will doubtless remember that, in my papers read here in 1851, I explained that, when the three primitive colours of the spectrum are mixed in due proportions, they produce white if reflected, and black if absorbed. The French purple gives the red; the carmine of indigo blue; and the silk itself the required yellow.

Several improvements have also taken place in the production of maroons, greens, and Prussian blues, but time will not allow of my laying the details before you.

Colours derived from Coal Tar.—These colours are as interesting for their beauty and brilliancy as for the source from whence they are derived, and present a remarkable instance of the valuable services which abstract science so frequently renders to the material interests of society. How little did even chemists dream that a substance first perceived by Unverdorben in the year 1826, then named *aniline* by Fritsche, and discovered in coal tar about 1841 by Dr. A. W. Hofmann, would lead to the production of such magnificent colours as aniline purple, magenta, &c. There can be no doubt that it is to the interesting and learned researches of Dr. Hofmann on aniline that we owe the possession of these splendid colours, and, further, it was one of his pupils, Mr. W. A. Perkin, who produced for the first time, on a commercial scale, aniline, and then the splendid purple colour which it is susceptible of yielding. Before describing to you the process patented by Mr. Perkin in 1856 to produce his purple, allow me to lay before you an outline of the present plan followed for obtaining aniline. A carburetted hydrogen, which I mentioned to you in one of my previous papers, called "Benzine" ($C_{12}\,H_6$), and obtained by the careful distillation of purified coal naphtha at a temperature of about 186 deg., is treated with strong nitric acid, when a violent action ensues, which gives rise to nitrobenzine or $C_{12}\,H_5\,NO_4$. To convert this compound into aniline, 100 parts of nitrobenzine are mixed with an equal quantity of acetic acid, and 200 parts iron filings, heat is produced, and the following chemical action ensues:—

$$\underset{\text{nitrobenzine.}}{C_{12}\,H_5\,N\,O_4} + \underset{\text{water.}}{2\,H\,O} + \underset{\text{iron.}}{4\,Fe} = \underset{\text{oxide of iron.}}{2\,(Fe,O_3)} + \underset{\text{aniline.}}{C_{12}\,H_7\,N}$$

The whole is then introduced into a retort, and the raw product which passes from it is mixed with a little alkali or lime, and again distilled, when aniline is obtained. This important substance is, as you perceive, a colourless fluid, which boils at 359 deg., has a decided alkaline reaction, and a specific gravity of 1·028. The following is the process described by Mr. Perkin for preparing his purple. Solutions containing equivalent proportions of sulphate of aniline and bichromate of potash are mixed and allowed to stand till the reaction is complete. The resulting black precipitate is then thrown on to a filter and washed with water until free from sulphate of potash; it is then dried. This dried product is afterwards digested several times with coal tar naphtha until all resinous matter is separated, and the naphtha is no longer coloured brown. After this it is repeatedly boiled with alcohol to extract the colouring matter. This alcoholic solution, when distilled, leaves the colouring matter at the bottom of the retort as a beautiful bronze coloured substance, which may be considered as Mr. Perkin's commercial aniline purple. This colour, which can also be produced by oxidising aniline by other metallic salts, is slightly soluble in water, freely soluble in alcohol, and presents the remarkable property of not being effected by light, alkalies, or acids. To dye wool or silk with it it is simply necessary to add to a hot-water bath, slightly acidulated with tartaric acid, some of the alcoholic solution of aniline purple, and to work the silk in the said bath, wringing and washing it; the purple shade thus produced can be modified with roseine, Prussian blue, or sulphate of indigo. To dye cotton so as to resist the action of soap and light, the process is modified so as to form on the cotton fibre an insoluble compound of colouring matter with tannin and a metallic base. To effect this the cotton is passed for an hour or two into a bath containing a tanning substance, and then into a weak solution of stannate of soda, wrung out, passed into an acid liquor, rinsed in water, and then, like silk, dipped into an acidulated bath of purple aniline. Also cotton prepared with a basic salt of lead, or as for Turkey red, will take up aniline purple On the 12th January, 1861, another interesting process to obtain aniline purple was patented by Mr. Adam Girard.

(To be continued.)

The Eastern Counties Company are about proceeding with the construction of the line from Bury St. Edmunds to Sudbury.

THE MAIN DRAINAGE.

AT the last monthly meeting of the Metropolitan Board of Works Mr. Bazalgette, the Engineer to the Board, sent in the following report:—

"On the northern outfall sewer contract Mr. Furness has made good progress during the past month. The ironwork for the river Lee aqueduct is upon the ground, and the girders are fixed. The subways for the East London Waterworks and the suspension of the supply mains have been nearly completed without accident, and a cutting through the embankment of the Eastern Counties Railway, 24ft. deep, has been made without interruption to the traffic. The foundation of works for the new Stratford-road, and the concrete foundations along the line of sewer towards East Ham, are considerably advanced. The three lines of intercepting sewers are in course of formation between the Bow and Barking Railway and East Ham. Sixty of the arches, each of 18ft. span, which will carry the intercepting sewers across the marsh land, are completed. The materials supplied are abundant and of good quality. The value of the work done is about £185,000. Of the middle level sewer Messrs. Brassey and Co. have constructed about 21,400ft., varying in size from 3ft. in diameter to 9ft. 6in. by 12ft., at an expenditure of about £96,400. These works were for a time retarded by an accident to their cofferdam while constructing the sewer underneath the Regent's Canal, by which the water escaped into the sewer and emptied the basin of the canal; but it was again opened in two days, and no further mischief was done. Precautions have since been taken to prevent the possibility of the recurrence of such an accident in this difficult portion of the work. The completing works of the Ranelagh Storm Overflow are in a very confined space in the Uxbridge-road, and progress slowly. The value of the work is £26,900. The southern high level sewer progresses very slowly, and the works are subject to frequent stoppages, owing mainly to misunderstandings between the contractors and their work-people. About 7¼ miles of sewer are now constructed, valued at about £144,000. Mr. Webster continues to progress satisfactorily with the southern outfall sewer contract, which will to all appearance be completed early in the spring, and before the time named in the contract. He has now constructed about 6½ miles of sewer, at an expenditure of about £263,000. At the Deptford pumping station Messrs. Aird and Co. have brought up the foundations of both engine-houses to the ground level; they have constructed 484ft. of the double line of low level sewer near to and below Deptford creek, and have laid 3,648ft. of cast-iron pipe 3ft. 6in. in diameter, from the high-level sewer under Deptford creek to the pumping station, and driven piles for about 150ft. of the wharfing. The value of the work executed by them is about £57,000. Mr. Pearson has commenced his contract at Dulwich, and Mr. Downes has constructed 332ft. of the Southwark subway, 355ft. of sewer, and 70 vaults, at a cost of £3,600."

RAILWAY BILLS.

SINCE our last the examining barristers of the Houses of Lords and Commons have declared the compliance with standing orders in respect of the following bills:—

EDINBURGH AND GLASGOW AND CALEDONIAN AND DUMBARTONSHIRE JUNCTION (amalgamation).

MERIONETHSHIRE.—For new lines to Merionethshire.

LLYNVI VALLEY.—For power to raise an additional capital of £40,000 by shares, and to borrow £13,300 on loan.

MID-WALES.—For making a junction between the Mid-Wales and the Central Wales (Extension) Railways, and for altering the levels of the Mid-Wales line.

SOUTH YORKSHIRE.—To authorise the transfer of the undertaking to the Manchester, Sheffield, and Lincolnshire Company.

RAMSGATE, SANDWICH, DEAL, AND DOVER.—For a railway between these places.

GREAT WESTERN, HEREFORD, ROSS, AND GLOUCESTER, AND ELY VALLEY (amalgamation); DAVENTRY.

BANSTEAD AND EPSOM DOWNS.—For making a railway from the Sutton station of the Croydon and Epsom Railway to Banstead and Epsom Downs, and to raise for the purpose £85,000 in shares, and £28,300 upon loan.

KENT COAST.—To construct railways or tramways at Ramsgate, and to empower the Board of Trade, if they think fit, to transfer the harbour of Ramsgate to the Kent Coast Company, with power to raise £160,000 on shares, and borrow £53,000.

BRISTOL PORT.—For a railway from the port of Bristol to the old channel at the mouth of the river Avon, and a pier there, the estimated cost of the railway being £85,000, and of the pier £40,000, with power to borrow £41,000.

SPALDING AND BOURN.—For a railway between these places, and a capital of £130,000.

The other bills disposed of were the Caledonian (deviations); Londonderry and Coleraine (arrangements with creditors).

ISLE OF WIGHT.—For a railway from the eastern section to Newport, at an estimated cost of £100,000.

WATERFORD AND PASSAGE.—For a line from Waterford to the town of Passage, at a cost of £80,000.

BRISTOL AND SOUTH WALES UNION.—For a branch to the pier at the mouth of the river Avon, at an estimated cost of £50,000.

LONDON AND NORTH-WESTERN, AND CHESTER AND HOLYHEAD RAILWAY (for arrangements as to capital).

DRAYTON JUNCTION.—For a railway between the London and North-Western at Weim, in Shropshire, and Eccleshall, in Stafford, and to raise £200,000.

THE cases of the Kensington Station and South Junction and the Dulais Valley Mineral were adjourned.

THE standing orders were declared not to have been complied with by the Newcastle (County Down) Railway, for the construction of a line from Wateresk to Newcastle, and to raise, £26,000. Also, the Dagenham (Thames) Dock, to raise £80,000, the Bristol and Exeter; Chard and Taunton; Hatfield and St. Alban's; Cowbridge.

THE following bills were withdrawn:—Ledbury and Gloucester; Southampton and Isle of Wight Railway and Pier; North Metropolitan, for lines to connect the Eastern Counties, Great Northern, and Hampstead Junction Railways; Dublin Metropolitan; Mid-Wicklow; Great Northern; Balham and Putney Junction, and the Weymouth and Portland.

A TEST FOR ARSENIC.—Dr. Letheby recommends the following method of detecting the presence of arsenic in wreaths and dresses:—"Put a drop of strong liquid ammonia (liquor ammonie, the druggist calls it) upon the green leaf, or dress, or paper, and, if it turns blue, copper is present; and copper is rarely, if ever, present in these tissues and fabrics without arsenic being also present—the green compound being arsenite of copper. I have tested papers and dresses in this manner more than a hundred times, and have never failed to discover arsenic when the ammonia changes the green into blue. It is, therefore, indirectly a very reliable test; and if every lady would carry with her, when she is shopping, a small phial of liquid ammonia, instead of the usual scent bottle, the mere touch of the wet stopper on the suspicious green would betray the arsenical poison and settle the business immediately."

IMPROVEMENTS IN RIO JANEIRO.—A prospectus has been issued of the Rio de Janeiro City Improvements Company with a capital of £850,000, in shares of £25 each. The company have a concession from the Brazilian Government for draining the city of Rio de Janeiro on plans of Mr. Gotto, approved on behalf of the Brazilian Government by the late Sir W. Cubitt, Mr. Robert Stephenson, M.P., and Mr. Rendel, and which stipulates an annual payment to be made direct by the Imperial Government to the company of £6 5s. per house. An absolute contract for the work and its subsequent maintanance has been entered into by Messrs. Brassey and Co., on terms which, after providing for 7 per cent. interest during construction, will leave a permanent net divisible profit to the shareholders of 8½ per cent.

MISCELLANEA.

THE deepest mines in England are the Astley Deep Pits, near Dukinfield, which are 686¾ yards in perpendicular depth.

THE Lambeth bridge is expected to be opened in May. The cables, being made by Messrs. Newall, are to be ready by the middle of next month.

ON Friday last Mr. John Scott Russell was adjudicated a bankrupt on an *ex parte* hearing. To day (Friday) he is expected to show cause against the adjudication.

110 charges, consisting of a 10-in. round shot (136 lb.), wad, and 38 lb. of powder each, have been sent to Shoeburyness for testing the new Armstrong 300-pounder, not yet rifled.

THE *Times'* naval correspondent states that hydraulic presses are being erected in Chatham Dockyard to withstand a pressure of 2,000 tons per square inch! They must be wonderful presses indeed.

THE Eastern Counties Railway Company are having plans prepared for a number of new express engines, to weigh 30 tons each, and to have 16-in. cylinders, 24-in. stroke, and 7-ft. driving wheels.

IN January, 1861, the quantity of coal brought into London was 136,900 tons by rail, and 302,774 tons by sea. Last month only 126,270 tons were brought up by rail, and 233,020 tons by sea, the total decrease being upwards of 80,000 tons.

MR. TRAIN has been notified, by the Board of Works of St. Margaret's and St. John's, Westminster, to remove the Victoria-street tramway by the middle of next month, under the penalty of the £1,000 deposited when the line was put down.

MR. HANKEY's motion, in the House of Commons, for a select committee to inquire into the existing state of legislation, and of any existing arrangements for the protection of life and property against fires in the metropolis, has been agreed to.

THE Electric and International Telegraph Company have announced that they are about to lay a cable between Wales and the South Coast of Ireland. This cable will compete with the London and South of Ireland Direct Company's proposed line.

LETTERS received from Lisbon state that the Warrior, 40, iron frigate, laboured in a most extraordinary manner on her passage out from England, floating her decks and cabins with water, and, in nine cases out of ten, taking no notice whatever of her helm.

MESSRS. KELK and LUCAS formally delivered up the Exhibition building, "practically completed," to the Royal Commissioners on Wednesday, at noon, the time stipulated in the contract. It is doubtful if the shafting will be completed in the western annex in season to permit of running the machinery on the 1st of May.

EIGHT baths, furnished with every convenience, have been lately erected at the Great Cambridge-street (Hackney-road) station of the Imperial Gas Company, for the accommodation of the numerous body of men employed upon the works. Mr. Joseph Clark, the company's engineer, deserves much credit for this excellent provision for the health and comfort of the workmen.

THE London and North-Western Railway Company are rolling rails, at their Crewe workshops, from ingots of Bessemer steel, supplied by Messrs. Bessemer and Co., of Sheffield. Upwards of 200 tons have been already rolled. Mr. Ramsbottom is also adopting Bessemer steel axles extensively for engines and tenders, and it is probable that axles of the same material will soon find their way under the carriages and wagons.

THE following appointments of naval engineers have been made since our last:—David Hughes, first-class assistant-engineer, to the Indus, for the Clinker; and John Boswell, acting first-class assistant-engineer, to the Blenheim, for the Heron; J. H. Treliving, chief engineer, to the Virago, vice McInnes superseded, sick; Henry W. Elgar promoted to chief engineer, and discharged on half-pay; William Fedach, acting first-class assistant-engineer, transferred from the Asia to the Indus as supernumerary.

THE railway carriages recently built at the Eastern Counties' workshops are among the most commodious and comfortable in the kingdom. They are of somewhat unusual weight, the first-class, on four wooden wheels, 3ft. 6in. in diameter, and seating 18 passengers in three compartments, weighing, empty, 6 tons, 12 cwt., 1 qr. The bodies of these carriages are 21ft. long. The second-class carriages, having four compartments, and seating 32 passengers, weigh 6 tons, 7 cwt., 2 qrs. They also have four wheels, and the bodies are 21ft. long.

THE prospectus has appeared of the London Drawing Association for engineering, mechanical, architectural, and general drawing, designs, maps, plans, tracings, &c. The association, whose business is under the management of Mr. C. Frederic Young, C.E., has been formed to supply engineers and architects with accurate drawings, tracings, &c., from sketches or memoranda, so as to remove the necessity which exists in many cases for intrusting such work to lithographers and other inexperienced persons. The offices of the association are at 7, Duke-street, Adelphi.

THE Chanticleer, 17, screw, made her official trial of speed at load draught at the measured mile in Stokes Bay on Wednesday. The weather was favourable for the occasion, there being smooth water, with the wind off shore and light. The ship's draught of water was 14ft. forward, and 15ft. 2in. aft. Her propeller was a "Griffith's," with a pitch of 15ft., and a diameter of 12ft. The ship was tried first with full, and afterwards with two-thirds boiler power, the mean speed being respectively 10 knots and 9½ knots.

ON Saturday last a trial of the engines and machinery of the screw steam frigate Galatea, 26, took place outside Plymouth Sound. This ship (sister to the Ariadne), of 3,227 tons, is 280ft. long, and 49ft. broad. She was built at Woolwich. The Galatea is completely rigged, and has her guns on board; the draught forward is 20ft. 9in., and aft 21ft. 9in. She is fitted with a pair of trunk engines of 800-horse power by Messrs. Penn and Co., and made six runs at the measured mile with an average of a fraction over 13 knots; revolutions, 57½; vacuum, 26 to 28; pressure of steam, 21 lb.

THE Bessemer process of converting iron into steel has been adopted by Messrs. Petin, Gaudet, and Co., and other French ironmasters, and we understand that the *Société Cockerill* are negotiating for its introduction at Seraing. Some French ironmasters have lately brought their own iron, in the pig, to Sheffield, to be tested before engaging in the new manufacture, and so pure was it found that, in one case, the Bessemer converting process, which commonly occupies twenty or twenty-five minutes, was completely through in eight minutes. In another case twelve minutes sufficed for the conversion of the French pig iron into steel. The waste was very trifling in amount.

THE screw steamship Defiance, 89, was taken from Hamoaze on Wednesday morning, the 5th inst., to Plymouth Sound, for the purpose of testing her machinery. The force of the wind was at four, and there was a considerable ground swell. The Defiance is a vessel of 3,475 tons. Her draught is 18ft. 3in. forward, and 20ft. 4in. aft. Her engines (horizontal) are of 800-horse power; the diameter of the screw 19ft., and pitch 27ft. 6in. The measured mile was run six times with an average result of 11·930 knots. Steam was fairly maintained at full pressure, with a vacuum of 24½in.; average revolutions, 58·6. Two runs were afterwards made with half-boiler power, when the result was 8·960 knots; revolutions, 45.

THE Java, target-ship, has been towed from her position in Porchester Lake to a position alongside the dockyard at Portsmouth, where workmen are busily employed affixing armour-plates to her sides for future testing and experimental purposes from the guns of the gunboat Stork. The "sample" armour-plates are from the manufactories of the Thames Ironworks Company; Messrs. John Brown and Co., Atlas Works, Sheffield; and from Rigby and Co., Lancefield Works, Glasgow. The Thames Company's plates are "hammered," Messrs. Brown's are "rolled," and Messrs. Rigby's are a combination of both, the face of their plates being rolled on to hammered backs. A Mr. Wrigley sends a "cellular" plate, said to be adapted for either ships or forts; and Captain R. S. Hewlett, C.B., contributes a plate, or rather double plate, of ¾-in. iron, of simple construction, but which must furnish *data* of a most important character relative to the mode of hanging the armour in future on our war ships.

LAW INTELLIGENCE.

VICE-CHANCELLORS' COURTS, FEB. 10.

(*Before Vice-Chancellor* Sir J. STUART.)

HILLS *v.* THE LIVERPOOL UNITED GASLIGHT COMPANY.

MR. ROLT, Mr. Grove, and Mr. Marten moved for an injunction to restrain the defendants from manufacturing and purifying gas according to, or in imitation of, the invention comprised in the plaintiff's patent of the 28th of November, 1849, as modified by the disclaimer and memorandum of alterations, and also from using or selling gas manufactured and gas purified as aforesaid, and from renovated and reoxidised purifying materials according to, or in imitation of, the same invention; and from using such purifying materials for the purifying of gas, and generally from infringing the plaintiff's patent. The patents of the plaintiff have been the subject of much and continued litigation both in equity and at common law. The matter has recently been argued before the Lord Chancellor at great length in the case of Hills *v.* Evans, arising out of an alleged infringement of the plaintiff's patent by Mr. Frederick John Evans in the use of Evans's patent for purifying gas. The Lord Chancellor decided in favour of the plaintiff upon the question of the validity of his patent. The present bill was filed to restrain an alleged infringement by the Liverpool United Gaslight Company, and an injunction was moved for in the terms above stated. The evidence and arguments in support of, and in opposition to, the motion were almost entirely of a scientific nature, involving a review of the various chemical processes employed in the manufacture and purification of gas.

Sir H. Cairns and Mr. Druce, on behalf of the defendants, opposed the motion.

The Vice-Chancellor reserved his judgment until Friday.

THE HARTLEY NEW PIT DISASTER.

THE following is the verdict of the coroner's jury, rendered on the 6th inst., in the case of the Hartley New Pit calamity:—

"That John Gallagher, on the 22nd of January last, was found killed in the workings of New Hartley Colliery, having died therein from inhalation of gas, being shut up in the yard seam of the said colliery on the 16th of the said month, when the shaft was closed by the accidental breaking of the engine beam, which with other materials fell into the working shaft of the pit, and there being no exit therefrom all access to the deceased was cut off, and he perished from the cause above mentioned. The jury cannot close without expressing their strong opinion of the imperative necessity of all working collieries having at least a second shaft or outlet to afford the workmen the means of escape should any obstruction take place as occurred at New Hartley Pit, and that in future beams of colliery engines should be made of malleable instead of cast metal. They also take occasion to notice with admiration the heroic courage of the miners and others, who, at the risk of their own lives, for so many nights and days devoted their best skill and energies to rescue the unfortunate men who were lost; and that everything that human ingenuity could accomplish was done towards this humane object."

In the House of Commons Mr. Sheridan has intimated his intention of asking the Home Secretary whether he had received any information from the Inspector of Mines on the subject of the calamity at Hartley Mine, as to the necessity of two shafts in each working mine, whether he has given attention to the recommendation of the coroner's inquest on that point, and also on the use of malleable instead of cast iron for the beams of colliery engines; and, further, what steps the Home Department are prepared to take in the matter.

With regard to the shaft Mr. Coulson, master sinker, who was examined on the inquest, said that the cost of a staple from the high main to the yard seam would have been about £300 at the outside. It would, however, have taken fifteen weeks to complete it. Of the great number of winnings he had made he had sunk about twenty-four single-shafted pits out of the eighty-four he had completed. To a considerable extent it was the practice in this part of the country to sink one shaft at first, and subsequently to make another shaft at a considerable distance from that first sunk, the distance of the second shaft being regulated by the dip of the coal, or, to speak more generally, it is regulated by the circumstances brought to light by the exploration from the first shaft, without a knowledge of which a second shaft could not at all times be put down. The Hartley Pit shaft cost £3,600 sinking. Now, he calculated that two 8ft. 6in. pits in the same situation would cost £4,500 to finish them in a similar manner to the single shaft. Another 12ft. 3in. pit, including the same materials, but sunk under more favourable circumstances, would cost £2,600. The two 8ft. 6in. shafts, instead of the 12ft. 3in., would cost £3,100. But in the one case—Hartley—they had 600 gallons water in a minute; at the other place comparatively none. In sinking through a place making a quantity of water the tubbing would cost £4,800 more. To this might be added additional engine power and additional pumps and spears. He had based his calculations upon a shaft to be sunk 100 fathoms deep.

As for the accident being caused by the breaking of the pump spears, Mr. Horsley, who set up the engine, stated that they broke once in September, 1858. The key of the crosshead was damaged as it would likely be by the piston striking the end of the cylinder but the beam was not broken.

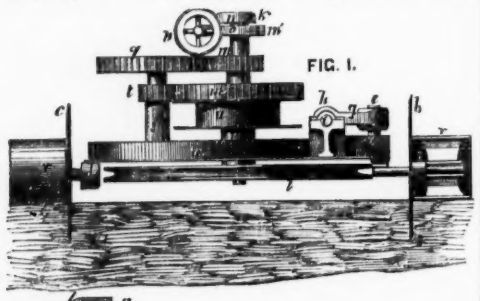
FOWLER'S STEAM PLOUGHS.

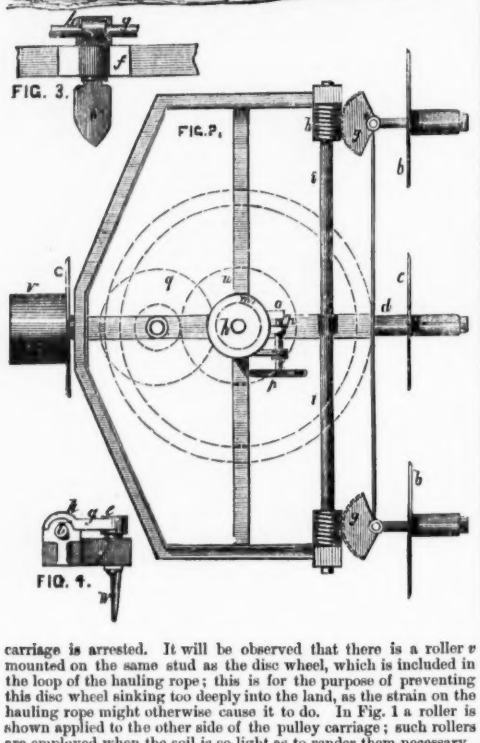
THIS invention, by John Fowler, jun., of 28, Cornhill, E.C., has for its object improvements in machinery for ploughing or tilling land by steam power.

In ploughing or tilling land by steam power it is common to mount the pulleys round which the hauling rope passes on carriages carried by disc wheels which cut into the land, and thus prevent the carriage being drawn sideways by the strain on the rope, but allow of its travelling endways with considerable facility. In some cases, also, in place of disc wheels, metal plates or shares, also cutting into the land, have been employed; the pulley carriages thus arranged can only with facility be made to travel forward in a straight line. According to this invention the disc wheels or coulters are so arranged that they may be set at an inclination to the carriage either to the one side or to the other, so as to cause the carriage to travel in any required direction. This power of steering the pulley carriage is very necessary when the headland along which it is required to travel is curved.

Fig. 1 is an elevation, and Fig. 2 a plan, of a pulley carriage constructed according to the invention. *a*, *a*, is a platform of wrought iron; it is carried by four disc wheels, two of them, viz., those marked *b*, *b*, are capable of locking or turning about vertical axes; the other wheels *c*, *c*, have not this power; these latter are mounted so as to rotate freely on studs fixed horizontally in the cast-iron bracket *d*, *d*, bolted to the platform *a*. The disc wheels *c*, *c*, also turn on studs, but these are formed at the lower ends of the vertical axes *e*, *e*, which are carried in bearings *f*, *f*, bolted to the platform *a*. On the upper end of the axes *e*, *e*, quadrants *g*, *g*, are fixed, and these have teeth formed on them, into which worms *h*, *h*, gear; these worms are mounted on an axis *i*, which is made square at each end to receive a crank handle; and it will be seen that by turning the crank handle so applied to the axis, the two wheels *b*, *b*, may be set to any desired inclination to the wheels *c*, *c*, but the wheels *b*, *b*, will incline in opposite directions, the worms *h*, *h*, being right and left handed, as shown; the pulley carriage then as it travels forward will move in a circle, and the planes in which the wheels *b*, *b*, for the time being lay will be tangential to this circle. In the centre of the platform *a*, a cast-iron standard *j* is fixed; this standard is hollow, and the axis *k* passes up through it. *l* is a pulley on the axis *k*; round this pulley the hauling rope passes. The wheelwork

above the platform is for the purpose of moving the carriage forward; it forms no part of the present invention. We may, however, shortly describe its action. *m* is a pinion, mounted loosely on the axis *k*; and m^1 is a cylinder cast in one piece with it; *n* is an arm fixed on the upper end of the axis *k*, and carrying the metal strap *o*, passing around the cylinder m^1; *p* is a tightening screw and hand wheel, by means of which the strap *o* may be made to nip the cylinder m^1; *q* and *r* are intermediate wheels, fixed to each other, and turning on a stud carried by the standard *s*; they gear with the spur wheel *t*, formed on the flange of the drum *u*, which turns on the standard *j*. A rope is wound on the drum *u*, and the end of the rope is made fast to an anchor or post ahead, when the screw *p* is screwed up tight, and the pulley *l* revolves in consequence of the hauling rope passing over it, the drum *u* will be driven and wind the carriage forward. By slacking the screw *p*, the motion of the





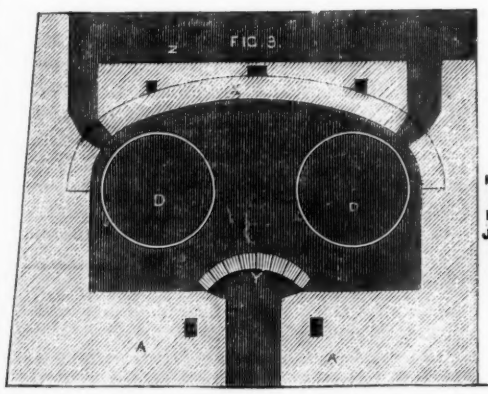
carriage is arrested. It will be observed that there is a roller *r* mounted on the same stud as the disc wheel, which is included in the loop of the hauling rope; this is for the purpose of preventing this disc wheel sinking too deeply into the land, as the strain on the hauling rope might otherwise cause it to do. In Fig. 1 a roller is shown applied to the other side of the pulley carriage; such rollers are employed when the soil is so light as to render them necessary.

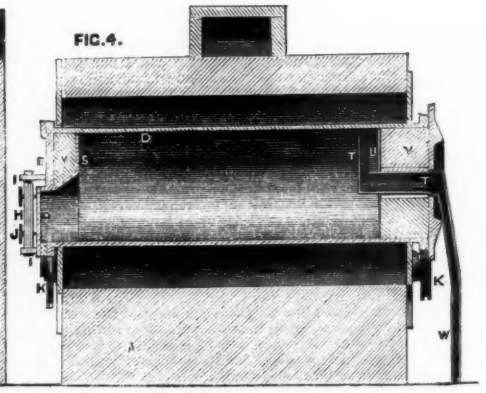
Although it is preferred to mount the pulley carriage on disc wheels it may be mounted on metal plates or shares, and the plates or shares are then arranged to lock round in the same manner as the disc wheels. Fig. 3 is a side view, and Fig. 4 a front view, of a plate or share so applied, with the parts connected therewith. As in Figs. 1 and 2, *a* is the platform; *f*, a bearing bolted thereto, and carrying the axis *e*, on the lower end of which is mounted the coulter *w*, and on the upper the toothed quadrant *g*, gearing with the worm *h* on the axis *i*.

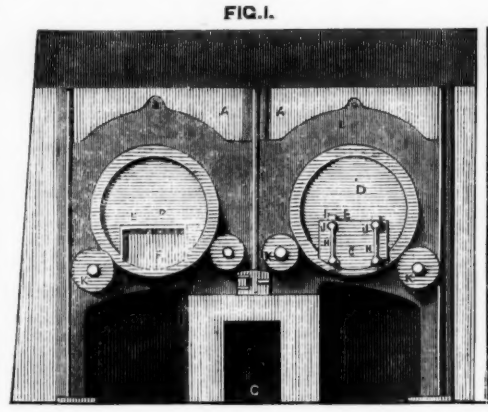
Bread from Germinating Wheat.—Professor Nickels has recently directed the attention of the Agricultural Society of Nancy, France, to a very simple process of treating germinating wheat, so as to make it fit for use in bread. The two principal ingredients of wheat are starch and gluten, both of which are insoluble in water, but become soluble after germination. Thus the starch becomes dextrine; the gluten loses that elasticity necessary to make good dough; and the bread made from it is heavy, indigestible, and injurious to the health. By the addition of salt, however, the gluten is restored to its natural state of insolubility, and is rendered fit for making good bread. Mr. Nickels ascertained that about 4 oz. of salt, mixed with 13 lb. of flour from germinated wheat, yield about 17 lb. of excellent bread. About 2 lb. of salt, worth 1½d., will be sufficient for 110 lb. of flour, producing about 143 lb. of bread.—*Builder*.

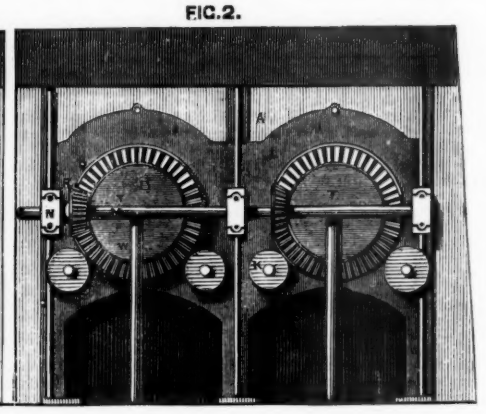
Well-Sinking and Boring in the Royal Horticultural Gardens, Kensington.—In the paper read and discussed at the Society of Arts on Wednesday evening, the 29th ult., "On some Recently-executed Deep Wells and Borings," much valuable information was given as to works at a distance, in France and parts of England; but nothing was said of some wells recently made, or attempted to be made, near home. It would have been interesting to have learned all the facts as to a well and boring now on hand at the head of the Serpentine, Hyde Park. A well has also been sunk and bored at Kensington, which is to supply water for the Royal Horticultural Gardens, and probably also for the Great Exhibition buildings of this year. We give the facts connected with this work as we have recently learned them. The contractors for the new well at Kensington are, as our readers know, Messrs. Easton, Amos, and Sons. Mr. Tilley, of Enfield, has performed the work of sinking and boring. The well is 5ft. clear in diameter, and has 9-in. brickwork in cement, from the surface to a depth of 200ft. vertical. The borehole is 201ft. deep from bottom of well. Water rises to within 130ft. of surface, or to some 70ft. deep in shaft. The pumps, lifting water at a rate of 100 gallons per minute, only reduce the head some 18in., and this speedily rises to its level when pumping ceases: 100 gallons per minute are equivalent to 144,000 gallons each day. The water, in quality, is pronounced "excellent;" it is, in fact, chalk spring-water. At 312ft. in depth the water from the green sand was not so abundant, but stood at 20ft. higher level than at present. The chalk, therefore, though containing more water, must have a lower general level than the water in the green sand. The contractors have fitted up some beautiful pumping machinery, both for the deep lift from the well and for garden fountains and cascades. The tall chimney is, however, an ugly structure. After Mr. Rawlinson's work on "Tall Chimneys" it seemed less likely that we should find the old, plain, tapering furnace shaft amidst the ornamental work of the Royal Horticultural Gardens.—*Builder*.

COWAN'S APPARATUS FOR RE-BURNING ANIMAL CHARCOAL.









This invention, by John Cowan, of Barnes, Surrey, has for its object improvements in apparatus for re-burning animal charcoal. An important object in re-burning animal charcoal consists in preserving it from the atmospheric air when it is to be removed from the cylinder or retort. For this purpose, instead of having to remove the whole end or cover (of the cylinder or retort), in order to withdraw the contents, as is usual, thereby allowing a full and continuous rush of air, the patentee forms in the front, or discharge end or cover an opening, which only occupies a limited or restricted portion thereof, and is closed, as required, by a door, lid, or plate, which, when the charcoal is to be discharged, is open, thereby only exposing a small portion of the interior, preserving the mass from being decomposed by the rush of air, and only allowing a small quantity of air, if any, to get access to the products to be discharged. The cylinder or retort is supported on wheels or rollers, on which it turns; it is preferred to have two such wheels or rollers at each end of the cylinder, and to form the front end or cylinder cover with a flange broader than the rim of its supporting wheels, to allow for expansion, and it is also preferred to cause the flange at the back end of the cylinder to turn in a groove in its supporting wheels, to keep that end in gear with the driving arrangements. The cylinder or retort is turned by forming or fixing teeth, or a cogged or toothed wheel, rim, or flange on the end, which is driven by a pinion or equivalent on a driving shaft, so that, by having a number of pinions or wheels at intervals on a main driving shaft lying horizontally along the back ends of a row of cylinders or retorts placed side by side, and having toothed wheels or flanges on such ends, any desired number of cylinders may be driven by the same shaft. The cylinders or retorts are mostly formed with double plates or covers at the ends, having a space between those of each end. This space is filled with fire-brick, or other non-conducting media, to prevent radiation of heat at that part.

Fig. 1 is a front end elevation of a furnace containing, for example, two cylinders or retorts; Fig. 2 is a back end elevation, and Fig. 3 a transverse vertical section; Fig. 4 is a longitudinal section taken through one of the cylinders or retorts.

A, A, is the brickwork of the furnace; B, the furnace door; C, the ash-pit. The fire-bars are not shown, but are constructed and supported as usual. D, D^1, are two retorts or cylinders. Retorts of the description shown, being generally of cylindrical form, are mostly called "cylinders." The cylinder D is shown as open, and the cylinder D^1 as closed.

Heretofore in the usual mode of constructing these cylinders or retorts the front end or cover, that is, the cover of the discharge end, is so arranged that it must be taken completely off when the cylinder is to be opened in order to discharge the contents: thus the whole end is thrown open from top to bottom and from side to side, so that the atmospheric air rushes forcibly and continuously over and into the mass of charcoal in the cylinder, and decomposes and injures the same, whereas, according to this invention, the front or discharge end plate or cover E is made as a fixture bolted or otherwise secured to the body of the cylinder or formed in a piece therewith, and at its lower part is made an opening F, which only occupies a portion of the end plate or cover, and does not even reach up to the centre thereof, nor extend laterally to the periphery of the plate. This opening is carefully closed while the operation of re-burning is proceeding, by a door G which is fastened by bolts H, which bolts pass at each end through staples or eyes I fixed to the cylinder end, and are secured by screws J. When the contents of the cylinder are to be discharged the door G is unfastened and removed, whereby only a small portion of the interior or transverse section of the cylinder is discovered or exposed. The fixed portions of the plate resist the entrance of the atmospheric air, which can only find admission (if at all) through the small opening F; the draft inward is reduced, and but little if any air rushes in. K, K^1, are wheels or rollers on which the cylinder is supported; there are two such wheels at each end of the cylinder. The wheels are keyed on short spindles, supported in the metal end plates L, L, bolted to the brickwork. One of the front wheels is in this particular arrangement made smaller than the other to clear the furnace door, but this is only done when the door is placed as shown. The cylinder ends or covers E, T, are flanged, the flanges forming the surfaces that roll on the wheels K, K^1; the flange of the front end or cover is broader than the edge of the wheels K, to allow for the expansion of the metal under the heat evolved. The peripheries of the two front wheels K, K, are smooth, but those of the back wheels K^1, K^1, are grooved, and the flange of the back end or cover T of the cylinder runs in such groove, whereby the driving arrangements are kept in proper gear. M is a horizontal driving shaft which extends the whole length of the back end of the furnace, and communicates motion to the whole of the cylinders therein. This shaft is supported in plummer blocks or bearings N, supported on standards O, bolted to the furnace ends L, L. Rotary motion is communicated to this shaft M by strap and pulley (not shown) driven by a steam engine or other ordinary means of communicating motion. The shaft M carries as many toothed pinions P as there are cylinders. On the back end or cover T of each cylinder is fixed a toothed wheel or rim Q, and each such wheel Q is in gear with a pinion P. By these means, on rotary motion being communicated to the shaft M, the said rotary motion will be transmitted to each cylinder. The pinions P are held on the shaft by forked clutches R, so that any one of the pinions may be made to run loose on the shaft M, and thus any one cylinder may be stopped without interrupting the motion of the others.

The cylinders used in re-burning animal charcoal are usually constructed with double end pieces, namely, an outer front end or cover E, and an inner or "false" front end S, also an outer back end or cover T, and an inner or "false" back end U. The space left between the pieces E and S and the space left between the pieces T and U have been hitherto left empty, thereby causing radiation and loss of heat at those parts. Now, according to this invention, these spaces are filled with fire-bricks, as shown at V, Fig. 4. W is the exit pipe for carrying away the vapours or volatile products of the distillation or re-burning; this pipe is constructed in the usual manner, except that it is bent, as shown, in order to clear the gearing P and Q.

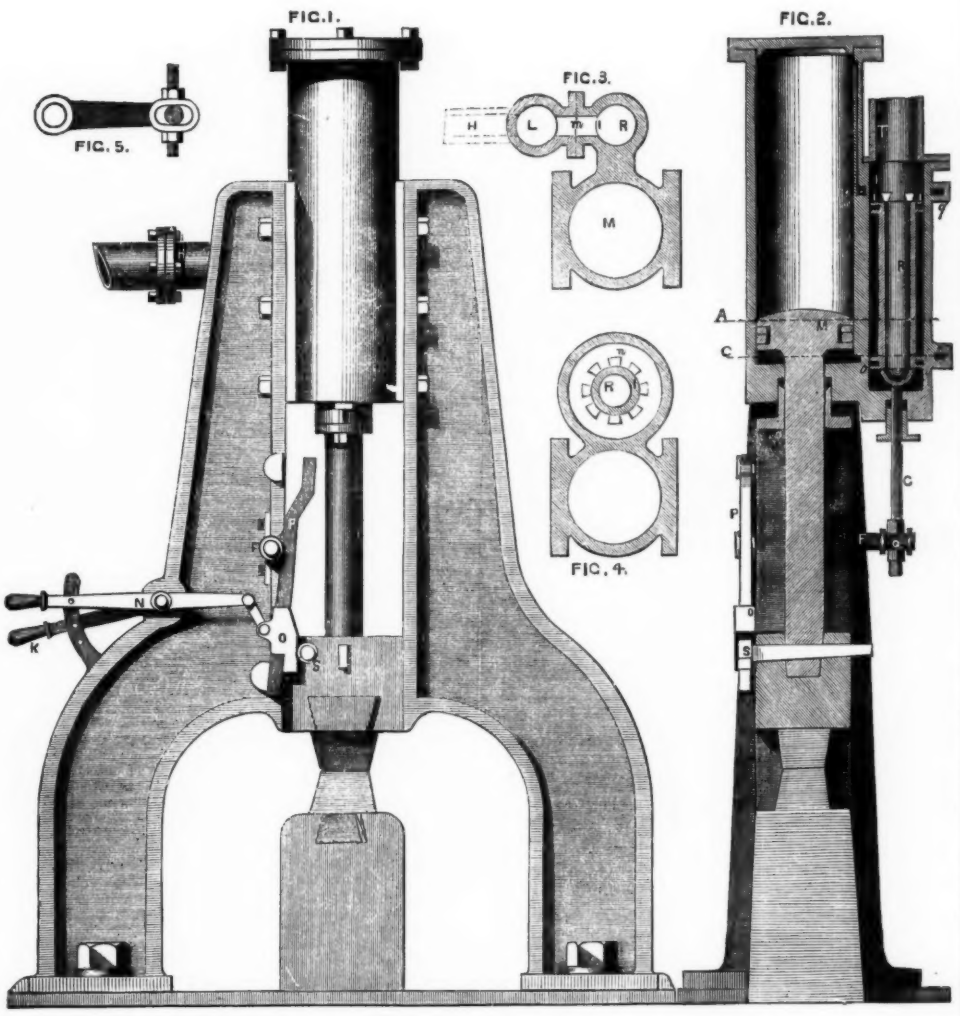
The furnace shown is so constructed, that instead of each cylinder having a separate furnace, as is usual, the arch X is of such span as to hold two moving or revolving cylinders, both being thus enclosed in and heated by one and the same furnace; or the span, instead of only subtending two such cylinders, may be of such radius or curvature as to hold more than two such cylinders. The furnace is so built, and its bridge Y so situated, that the hot air, flames, and gaseous products of combustion from the fuel on the fire-bars of the furnace surround and heat both or all the cylinders fitted in the furnace. The heat and flames pass away through flues Z to the chimney; or the furnace may be arranged with a series of arches X, each arch subtending one or more moving cylinders, a series of fires or sets of fire-bars being arranged in the furnace at a part thereof under the cylinders, and the chambers or portions of the furnace in which the cylinders are held communicate with one another, so that each fire may contribute its heat to more than one cylinder. The number of fire-places may be fewer than that of the cylinders, say, half as many, and instead of being placed immediately under them, may be arranged one between every two cylinders, for example, so that a comparatively small number of fires may heat a large number of cylinders.

"Melado."—"Melado," the name of a substance of recent importation, is a general term equally applicable to "cane juice," when boiled down without the molasses being drained off, or to a mixture of molasses, sugar, and sweepings, boiled into one substance. Upwards of two-thirds of its bulk is crystallisable matter.

Sewer Gases in Houses, drawn by the Heat of Fires.—No trap has been made to prevent heat from drawing up the gases from sewers, especially if very old and highly saturated with sewage matter. New houses are less likely to have foul-smelling drains than old ones—Osborne and Balmoral less than old Windsor. Twenty or thirty years have caused drains to be foul. What will they be in sixty years? In this "winter of our discontent" it becomes a question, "Who is safe?"—*Builder*.

Deodorising Sewers.—In a report from Dr. Letheby and Mr. Hayward it is stated that charcoal has a property of absorbing foul gases, and a practical specimen of its efficacy has been made over a space of about fifty-seven acres in the east of London. The report says:—"The total length of sewers in the district is 25,587ft; of which 2,081ft. are pipes, and the remainder are constructed of brick, varying from 3ft. high by 2ft. wide, to 5ft. high by 3ft. wide, internal dimensions. Upon this length of sewer there are 104 air-shafts, 265 gullies, 15 flushing shafts, 4 tanks, and 26 side entrances. . . . The deodorising power of the charcoal has been satisfactorily proved to be complete. Not only have there been no complaints from the public of stenches from the ventilating gratings, but we have ascertained by actual observation that the odour of the sewer gases is not perceptible when they have traversed the charcoal." The deodorising power of the charcoal endures for a great length of time, and the ventilators tried were in action from nine to twenty months. The report says that the power will last for years. As to cost it is remarked:—"The expenditure incurred in fitting up the 104 ventilating shafts was £918 18s. 5d., which is at the rate of about £8 16s. 8d. per ventilator. An experiment is necessarily more costly than an established system, and a much less sum may be taken as a fair average of the probable expense of extending the process over to the west of the city."

HOBSON'S STEAM HAMMERS.



This invention, by William Hobson, of Sheffield, relates to steam hammers. To the guide handle is attached a slotted or mortised tappet, which moves upon an elbow tappet connected with the rod which actuates the steam valve; the trip or hammer in moving strikes against the elbow tappet, and therefore influences the sliding tappet, rendering the combination self-acting. The valve is cylindrical, and acts vertically; it is formed with flanges, so as to admit of a concentric space for steam. When the valve is raised so that the top flange passes over the steam port or orifice in the top of the cylinder this port becomes the inlet, and depresses the piston and hammer; the length of the valve is so regulated that the lower steam port is then below the lower flange, and becomes an exhaust port, the steam passing off through the centre of the valve to the exhaust pipe at the top. When, on the contrary, the valve is depressed, the lower flange passes below the port in the bottom of the cylinder, which then becomes the inlet, the exhaust steam passing off by the top port to the outlet.

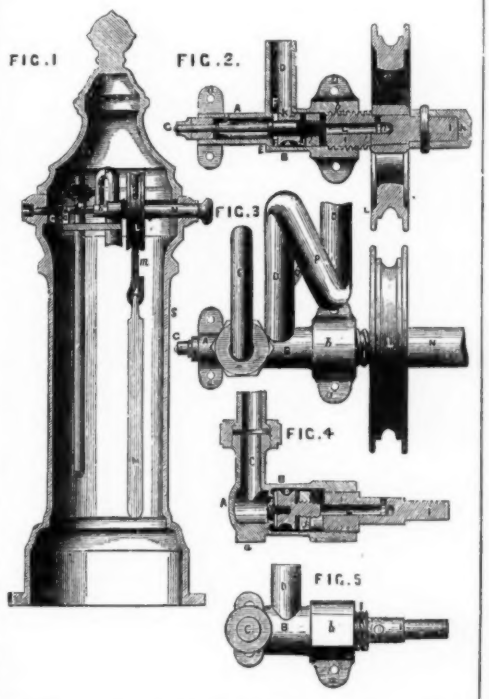
Fig. 1 represents an elevation of a steam hammer constructed with the improvements; Fig. 2 is a sectional elevation of the same; Fig. 3 is a horizontal section taken through the cylinder and valve on the line A, B, Fig. 2; Fig. 4 is a horizontal section taken through the lower ports on the line C, D, Fig. 2; and Fig. 5 is a view showing the connection of the shaft F (Figs. 1 and 2) with the rod G, which actuates the working valve.

The steam, when turned on from the boiler into the pipe H, is admitted or shut off from the steam chamber I by means of the hand lever K, which communicates by a rod with an ordinary stop or mushroom valve in L. When the steam is admitted into the concentric steam chamber I, around the valve at *m*, with the piston M depressed as shown, the hand lever N is raised, and the slotted tappet O lowered upon the elbow tappet P; this turns the shaft F and lever L, which moves the rod G and valve R, so as to admit the steam through the ports *n*, *n*, *n*, beneath the piston. The piston rod and hammer being thus raised, the friction roller S is brought into contact with the elbow tappet P, and turns the shaft F, so as to raise the rod G and valve R to such an extent that the pressure of steam is adapted to the position of the hammer. When the flange O is raised above the lower steam ports *n*, *n*, *n*, and the flange P above the top steam ports *q*, *q*, *q*, the steam passes from the chamber I to the top ports above the piston, and depresses the hammer, the waste steam passing through the centre of the valve R into the exhaust pipe T. The friction roller G, in falling, forces the slotted tappet to the lower part of the tappet P, and modulates the pressure of the steam. When the piston is again raised the waste steam passes above the valve R, to the exhaust pipe T.

GALE AND KENNEDY'S TAPS AND VALVES.

This invention, by J. M. Gale, of Glasgow, and Thomas Kennedy, of Kilmarnock, relates to the production of taps or valves, suitable for street wells.

Fig. 1 is a vertical section of a street well, showing a modification of the tap in elevation within it; Fig. 2 is a horizontal section, and Fig. 3 is a plan of the tap, detached and drawn to an enlarged scale. In this example the body of the tap consists of a cylindrical barrel A, B, one part, A, of which is of less diameter than the other, B, the inlet from the service pipe being by a branch C, entering laterally the smaller part A, whilst the outlet branch D, communicates laterally with the larger part B, of the barrel. At the enlargement of the barrel there is an internal step, forming a slightly projecting seat E, for the valve, which when closed prevents the passage of the water through from the inlet C to the outlet D. The valve is a washer F, of leather, gutta-percha, vulcanised rubber or similar material fixed on a spindle G. Or the valve and its seat may both be of metal, and either conical or flat, and when of metal the valve may be contrived so as to be capable of adjusting itself truly to its seat. One end of the spindle G projects through the small part A of the barrel, and has a cup leather H fixed upon it, which serves as a packing for that end of the barrel, whilst the internal pressure upon it balances the pressure upon the valve washer F. The other end of the spindle G enters a second spindle I, made tubular to receive it, which second spindle I, can turn upon it while moving it longitudinally, being connected by a pin and groove at *i*. The outer spindle I is screwed externally with, by preference, a quick-pitched screw of, say, four threads, and works in a correspondingly screwed part *b* of the barrel B. A washer J on the inner spindle G acts as a packing between the screw and the parts through which the water passes. The valve washer F is fixed on the spindle G, between a shoulder thereon and a tubular piece K, passed on between the two washers F and J, a nut *j*, screwed upon the spindle outside of the

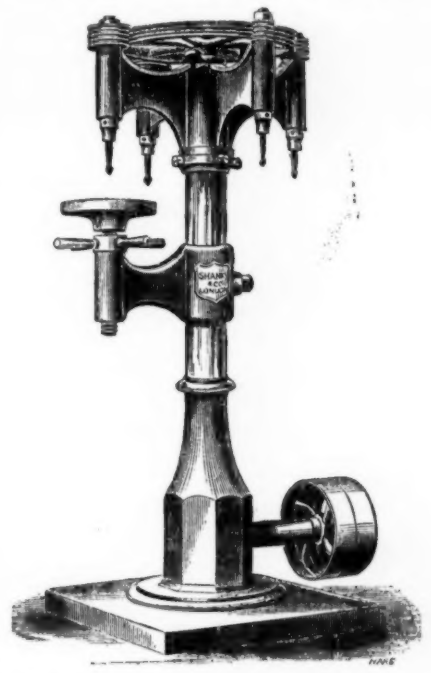


latter washer J, securing the whole. The second or outer spindle I projects externally beyond the screwed part where the barrel B, *b*, terminates, and has fixed upon it (a weighted lever or a quadrant or) a pulley L, with a cord *m* or a chain and weight M attached, while the extreme end of the spindle is shaped to receive the handle or key N, by means of which the tap is opened. The opening is effected by means of the handle N, by turning the outer spindle I, which through the action of the screw at *b*, draws the valve washer F from its seat, whilst on the handle N being released, the weight M by the reverse action closes the valve. The discharge pipe D is by preference formed with a coil of convolution P, which has the effect of throwing the water off in a solid stream, and a small branch tube Q, uniting the two lower parts of the coil, is added to insure the emptying thereof on closing the tap, and thereby prevent injury from frost.

An important feature of the tap is the constructing and putting together of the parts in such a way that the moving parts can be easily removed, and the whole be examined, cleaned, or repaired, without unfixing the tap body A, B, or any of the pipe connections. Thus the tap body A, B, is by means of lugs *a*, fixed in a horizontal position (in this example) upon brackets R, cast upon the inside of the well or fountain S, Fig. 1. On removing the handle or key N, the spindles I and G, with the valve details upon the latter, can be withdrawn completely from the tap body A, B, for examination or repairs without taking to pieces any other part.

SHANKS' DRILLING MACHINE.

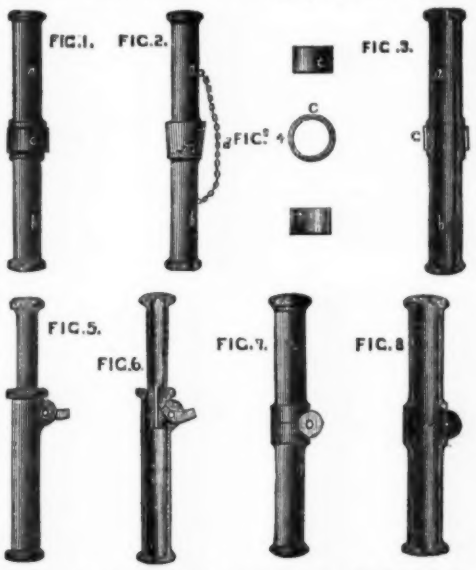
This invention, by Mr. A. Shanks, of No. 6, Robert-street, Adelphi, W.C., relates to drilling machines intended for drilling, successively, holes of various diameters. The driving power is applied through the pulleys near the sole-plate of the machine, the driving shaft being geared, by bevel wheels, to an upright shaft within, and concentric with, the upright column which forms the frame of the whole machine. On the upper end of this central shaft is keyed a large friction wheel, grooved, according to Mr. Robertson's patent. The head-stock carrying the required number of drills (in this case four) is made to turn, like a turnstile, around the upper part of the upright column, but with a slight amount of eccentricity, say an eighth of an inch, or thereabout, so that there is but one position in which the grooved



frictional pinion on any given drill spindle engages closely in gear with the large friction wheel which drives it. But one drill, therefore, can be in gear at once, and by a catch, with a projecting handle, the head stock can be securely held in any one of its pre-determined positions. The grooved pinions of the different drill spindles are of different diameters, so that each drill has a speed different from that of any of the others, and drills of various diameters, and suited to various kinds of work, may be fitted to the different drill-stocks, according to their speed. The table for supporting the work to be drilled slides up and down, at will, on the upright column, the table being adjustible by a large set-screw, which pinches the column, and there is also a vertical screw with handles, as shown, for feeding the work up to the drills. The frictional gearing gives great power, without noise, jar, or wear. Its "bite" is so strong that the strongest drill would be broken in the machine, if held fast at the point.

JOHNSTON'S PILLARS FOR COAL MINES.

This invention, by William Oliver Johnston, of Newcastle-on-Tyne, has for its object improvements in pillars for supporting the roof in coal and other mines. For this purpose pillars of wood are



usually employed, and most of these pillars are, when the minerals are worked out, abandoned in the workings, because the weight o the roof on the pillars prevents the removal of them.

According to this invention pillars of metal cast or formed in two parts are employed. When the pillar is required for use the two

parts of which it is formed are placed the one on the other, and are then secured, and the pillar is set up in its place as when wooden pillars are employed. When it is desired to remove the pillar (the weight of the roof being then upon it), the fastening between the two parts is removed, and the two parts of the pillar then either fall apart, or are readily separated, the joint being so formed as to allow of their doing so, notwithstanding the weight on the pillar. It is preferred to make the two parts of the pillar which rest the one on the other inclined or bevelled, so that when placed the one on the other the parts will just slide if not retained; and, in order to hold the parts in their places while the pillar is in use, a ring is employed, which slides over the joint, and then prevents the parts moving the one on the other.

Fig. 1 is an elevation of a pillar constructed according to the invention for supporting the roof in coal and other mines. The pillar is here shown as it appears when in use; it consists of three parts, the upper portion *a*, the lower *b*, and the ring *c*, which holds the parts *a* and *b* together. Fig. 2 is an elevation of the same pillar with the ring *c* removed; Fig. 3 is a longitudinal section of the pillar; and Fig. 4 shows the ring *c* separately. The joint between the parts *a* and *b* is, as shown, made at such an inclination that, when a weight is resting on the pillar, the parts *a* and *b* will just slide the one off the other, but their tendency to do so will not be sufficient, under any circumstances, to strain the ring *c*, or prevent it being readily knocked off when required. The portion of the parts *a* and *b* around the joint the ring *c* fits on is turned conical, so that the ring being of corresponding form may, when driven on, remain in its place until force is used to displace it. *d* is a chain to keep the parts *a*, *b*, and *c* together when out of use.

The pillars are used in the mine in the same manner as the wooden pillars now ordinarily employed, but they will not have to be abandoned, as is the case with wooden pillars whenever a heavy strain comes upon them; for with pillars constructed according to this invention, or knocking off the ring *c*, they will at once fall whatever may be the weight upon them.

Fig. 5 is an elevation, and Fig. 6, a longitudinal section of a pillar constructed on a similar principle, but somewhat modified in form. Here the upper part of the pillar is made smaller in diameter than the lower, into which it is able to descend. The upper part has notches at its lower end, into which a catch turning on an axis carried by the lower part of the pillar drops when the upper part of the pillar is raised to arrange the pillar for use; and to remove the pillar it is necessary only to strike down the tail of the catch, and the upper part of the pillar falls down within the lower.

Fig. 7 is an elevation, and Fig. 8 a longitudinal section of another form of pillar. In this arrangement the upper and lower parts of the pillar are jointed together at a point beyond the bearing surfaces of the upper and lower parts of the pillar; this pillar when in use will stand firmly whatever the weight upon it, but a moderate blow near the join will at any time overturn it.

LETTERS TO THE EDITOR.

(*We do not hold ourselves responsible for the opinions of our Correspondents.*)

ON THE PRACTICAL USE OF STEAM EXPANSIVELY IN MARINE ENGINES.

Sir,—So many contending opinions are at present held on the above subject, so much has been written for and against the principle, that you will, perhaps, permit me to offer a few practical remarks on the subject; the rather that, although we are deluged with mathematics, we have scarcely a line written on the actual mode of carrying out those important principles on which all further improvements must depend. Expansion resembles a kingdom having good laws badly administered, and, in consequence, the very laws themselves have been regarded with doubt and contumely. I will dwell as briefly as possible on the subject, only remarking that, in what follows, I refer solely to marine screw engines: undoubtedly much of it will apply to other forms of engine, but the reader must draw his own deductions himself.

It is necessary for a proper consideration of the matter that we should first see with what we have to deal, and then to consider the best manner of dealing with it.

Steam, then, is a subtle, elastic, invisible fluid, the existence of which depends on heat with which it unfortunately parts, with the utmost possible facility, to every surrounding body with which it may come in contact; not only this, but the mere fact of suffering it to expand in a cylinder so lowers its temperature that some of it is sure to be condensed; add to this that it has to be conveyed long distances in pipes, formed of more or less good conducting materials, and is then employed in engines, every portion of which is prepared to abstract heat with the utmost avidity, and we will cease to wonder that the theoretical so far exceeds the practical value of expansion.

As many readers of The Engineer may not even yet quite comprehend the theory of expansion, I will here venture to give a simple illustration, which may make the matter clearer.

If we suppose a cylinder 4ft. long and exactly 1 square foot in area, to be fitted with two pistons, one at a distance of 1ft. from the top, resting on a stop so that it can descend no further, and loaded with 15 lb. on the square inch in addition to the atmosphere, or 30 lb. on the square inch in all; the other piston at the bottom of the cylinder, and the space between them containing air at its normal pressure: if, now, we cause the lower piston to rise in the cylinder, it is obvious that the first effect produced will be the compression of the air between the two pistons, which will go on until the lower piston has moved through a space of 18in., when the contained air, being reduced to half the volume, will have doubled its pressure, and will, in consequence, force up the upper piston if the lower one continues to ascend. Suppose this motion goes on until the upper piston reaches the top of the cylinder, and can go no further, we will then find that we have 1·5 cubic feet of air of 30 lb. pressure between the pistons, and the whole useful effect produced by the motion of the lower piston will have been the compression of this 1·5ft. of air, and the elevation of the upper piston through 1ft. If we now discharge the condensed air into the atmosphere, it is quite obvious that we lose all the useful effect due to its compression; in other words, we waste all the power employed in condensing it. This is precisely what happens in any steam engine which works without expansion; and if we suppose a large engine, using some 1,000 cubic feet of steam per minute, and consider the immense mechanical effect required to condense it from a pressure of a few ounces to 30 lb. or 100 lb. on the square inch, we will be in a better condition to understand the enormous loss we suffer by not expanding properly.

To put this frightful waste of power in a still clearer light let us employ a very few figures. If we take a cylinder 20,000ft. long, and 1ft. in area, filled with steam of 1 lb. pressure on the square inch, and wish to raise it to 20 lb., it is only necessary to reduce its volume twenty times, which we may do by using a piston fitted to the cylinder to travel through 19,000ft.: but let us see the mechanical effort exerted by the piston in doing so. We may take the average resistance in round numbers at 10 lb. per square inch through the stroke, then 10 lb. × 144in., area of piston, equal 1,440, and $\frac{1{,}440 \times 19{,}000}{33{,}000} = 826$-horse power if the stroke be made in one minute; and yet this enormous force is actually wasted in any engine discharging 1,000 cubic feet of steam per minute into the atmosphere, or a condenser, at a pressure of 20 lb. on the square inch. There cannot be a more appropriate term than "waste steam" in such a case. One such illustration is, in my opinion, worth a whole volume of figures.

Were we to abstract a cubic foot of steam at 100 lb. pressure from a boiler, place it in a close vessel so protected that no loss would ensue from condensation, and, carrying it to some other place, there employ it in giving motion to a small steam engine, it is clear that, to gain the whole useful mechanical effect contained in that cubic foot of steam, we should usefully employ it all by making it pass through the cylinder of the little engine, and it would be a most absurd proceeding to open the vessel, and discharge the remainder of the steam, when half of it had been used in the engine; yet this is precisely what takes place in engines which are considered to be very expansively worked—namely, cut off at half stroke. To go a little further with my illustration, if we imagine the piston of our little engine to be loaded with a resistance of 50 lb. to the square inch, it is obvious that it would cease working as soon as the pressure in the vessel containing the steam had fallen to that limit, and the remaining half of our steam would be useless; but it is equally clear that, by increasing the size of our piston fiftyfold, we may reduce the resistance to 1 lb. per square inch, and then, instead of losing 50 per cent. of our power, we will lose but 1 per cent.

Having thus endeavoured to show the loss and disadvantage of not expanding, I will now turn to some of the chief objections brought against the use of this important principle—objections so powerful, in some cases, and with improper appliances, that, as shown by Mr. Isherwood, expansion is a mere loss of power and waste of steam, and many persons think these objections and difficulties so insuperable that they will still insist that we are going "farther and faring worse" when we pass the half stroke cut off; but before I can show how these difficulties may, in my opinion, be best overcome, we must see what they are.

The first and most serious is the condensation due to the expansion of the steam in the cylinder after the cut off valve is closed. I need not take up your valuable space by showing what every reader of The Engineer should be aware of, that a reduction of pressure is always accompanied by a reduction of temperature both in steam and fixed gases. A cylinder may contain steam of 350 deg. at the beginning of a stroke, which may fall to 250 deg. at the conclusion from this fact alone; and it is clear that merely clothing the cylinder, no matter how carefully, will not in any way prevent this ruinous reduction of temperature. The cylinder can never be maintained at a proper heat by any such negative means; we must apply heat to it positively, by some one of the methods pointed out below; in fact, unless we adopt some plan of the kind we may give up all hope of a satisfactory result.

The next objection is that in order to get power enough we must use a very large piston; and, in consequence, the whole engine must be constructed of enormous size and weight to enable it to sustain the violent strains and shocks due to the admission of steam of a very high pressure at the beginning of the stroke; in consequence, we see two, three, and four cylinders resorted to, in order that the high steam may act on a very small piston first, and, as it becomes weakened by expansion, may have a larger and larger piston to act on—a very good plan, were it not for the weight, complication (and consequent liability to get out of order), and expense due to such an arrangement, besides the enormous increase in surfaces with which the steam must come in contact, to each of which it is sure to impart more or less of the precious heat, which it should be our endeavour to impart to, not take from, it. The third objection—inequality of speed—is of so little importance in driving the screw propeller, and may be so easily reduced to a minimum by various expedients, that I may pass it over without comment.

Now it is not to be denied that these obstacles assume such an alarming aspect that they have with reason deterred engineers from attempting anything like the degree of expansion necessary to the utmost economy; and even when we resort to the most select mechanical expedients, we will still find ourselves very far from the theoretical limit, because, unfortunately, in the high pressure expansive engine, every fault of design, workmanship, or principle is magnified one hundredfold, and all the resources of talent and experience are necessary to secure a successful result; as an instance, the clearance space at each end of the cylinder, which is of so little importance in an ordinary engine as to be practically neglected, becomes an important element in all calculations when we expand to an extreme degree; thus a piston, having a stroke of 30in. and steam cut off at $\frac{1}{15}$, will only have moved 2in. from the end of the cylinder at the instant the cut off closes; yet there must be $\frac{1}{16}$in. of clearance between the piston and the cover of the cylinder filled by steam which is almost absolutely useless, inasmuch as it has imparted no motion to the piston; and yet this little $\frac{1}{16}$in. of space, unimportant as it seems, will consume one-fifth of all the steam supplied to the engine. True, it will give out a little power by maintaining the average pressure a little higher during the stroke, but even with this the waste is so great that it at once dictates the imperative necessity of making the stroke as long, and the diameter of the piston as small, as we possibly can. There is no doubt that the rapid reciprocation of the heavy masses of iron which constitute the working parts of a steam engine is a source of loss of power, and, still worse, frequently leads to disarrangement, or possibly a regular break down; but it is by no means certain that reducing the stroke to a minimum is anything like an effectual remedy, and it is quite possible that the whole power lost in an engine with the extravagantly short stroke now so much in fashion might equal, if not exceed, that lost by an engine with a moderately long one, such as I recommend, even when running at the same number of revolutions, because the short stroke must have a heavier piston, piston rod, &c. &c., than its rival; and as weight, multiplied by velocity, constitutes momentum, the loss in both cases may be more nearly equal than may appear at first sight. One fact is certain, that the consumption of oil and tallow by these short stroke direct acting engines is something fabulous, and clearly denotes the friction going on. The best excuse for a short stroke is that it gives us a long connecting rod, but that can be got just as well by many expedients not necessary to refer to here; and from what I have already said about the loss by clearance I think it will be unnecessary to dwell further on the unsuitability of large cylinder covers, seldom protected from radiation, for any engine in which we wish to obtain the maximum of economy.

It is useless to point out faults and imperfections if we do not also point out the best means of avoiding them in future practice, and I therefore once more venture to enunciate the principles which, through your kindness, I have often advocated in the pages of The Engineer, and which I am happy to say you have indorsed, partly if not wholly, in many able leading articles. These principles are, shortly, a high speed of piston, a comparatively long stroke, and a high pressure with an early cut off. It may seem at first sight that I could suggest no arrangement more likely to lead to an unfavourable result; but I trust that a little consideration will show that such a conclusion is erroneous, and that the reader will say, before I have done, that the arrangement I propose is founded on good sense, and avoids the faults of present practice, while it takes advantage of every good point that can be found in it. I will proceed to show the best means of arriving at a successful result.

In order to lessen the strain and shock caused by the sudden admission of high steam to the cylinders I reduce their diameter to the smallest possible dimensions commensurate with the production of the required power, and I compensate for this reduction in their size by an increase in their number. I would never recommend the employment of less than three, but where admissible four cylinders are far better, and will be found, in the long run, well worth a little extra weight and expense. The stroke should never, under any circumstances, be less than the diameter; where practicable, a proportion of two to one will be found advantageous. All screw engines should be geared, except in very exceptional cases, as where a very small screw with a very fine pitch is employed; but the gear should be used to take down the speed of the screw, instead of raising it—that is, the pinion should drive the wheel, not the wheel the pinion; amongst other advantages we secure the engines by this arrangement from much of the strain due to the action of the screw in a heavy sea. The cylinders should be placed horizontally side by side, each driving a separate crank 90 deg. in advance of the one before it on the shaft. Objection may be taken to the cost and difficulty of forging so many cranks on one shaft, the liability to fracture, &c. However, when we consider how much the diameter and weight of the engine shaft is reduced by the gear I propose, and the rapidity with which the difficulty of forging large masses of iron increases with their size, these objections must fall to the ground. Besides the engine shaft will be exposed to none of those strains which so often break it when coupled direct to the screw shaft. By multiplying the number of cranks, too, irregularity of speed is almost avoided; for it is obvious that, as far as shock is concerned, there will be no more sudden strain here than there would be in an engine with double or triple pistons, on which the steam would act successively on Woolf's principle; and instead of the steam having to pass from cylinder to cylinder, and losing on every side by waste, clearance in ports and passages, and condensation due to the enormous exposed surface of such a number of large cylinders, we should have it beginning and ending its work in tidy compact cylinders so well protected that the loss from condensation would be reduced to the lowest limit. Engineers are well aware that we can only get the same number of foot pounds out of a cubic foot of steam of any given pressure, whether it does its work in a second or an hour, and of course the longer it is in giving out this power the more the liability to condensation is increased. Thus we see the expediency of making the steam do its work at once, in the one stroke, instead of in two or three, as in multi-cylinder engines; and we may still have a long connecting rod by adopting the excellent arrangement proposed lately by you, of placing the cylinders at one side of the ship, and the engine shaft at the other, the screw shaft (which of course stops short at the spur wheel aft) being in the centre line of the ship.

The prevention of condensation demands the utmost degree of qualified attention on the part of the engineer; everything must be sacrificed to attain this important object, without which all our exertions to obtain a successful result will be fruitless: let us see some of the means at our disposal to attain the desired end. They are four in number: a steam jacket, filled with steam of a greater pressure and temperature than that used in the cylinder; superheating the steam employed in the engine; a jacket filled with hot air from the furnace; and a jacket supplied with superheated steam, to which may be added the negative precaution of clothing the cylinders, steam pipes, &c. As to the simple steam jacket, so much has been written for and against it that I will not enter into any discussion of its merits, but I am inclined to believe that its advantages, at least for such engines as I am speaking of, are more than doubtful. It is not very easy to cast a cylinder with a suitable jacket in the first place; secondly, it seldom or never heats the cylinder sufficiently; and lastly, it occasions a very considerable waste of steam itself, for not only is the thin film of steam contained in the jacket exposed to the cooling influence of the atmosphere outside (for jacketed cylinders are seldom clothed), but it is also exposed to the cooling influence of the steam expanding within the cylinder, and the consequence is that we can always obtain a very considerable supply of distilled water from a jacket; indeed, some patentees depend on it to make up the loss in engines fitted with surface condensers.

The best plan of all would undoubtedly be the third, but unfortunately it is almost impossible to carry it out practically, and in any case would lead to a serious amount of complication, any approach to which should be studiously avoided. The fourth plan is open to nearly the same objections as the first, and therefore we must turn to the second—superheating *per se*. Enough has been written on the subject to render it unnecessary for me to dwell on it, and it only remains to recommend that it be not carried to excess, as it only burns out the apparatus, and cuts the valves, &c. A temperature of 450 deg. is quite sufficient if steadily maintained. There is no danger of injuring the piston, as the cylinder is sure to be always lower than this by many degrees.

The cylinders should be very carefully clothed with at least two inches of hair felt, properly "lagged" with inch boards; the cylinder covers should be fitted with false lids in addition to the usual air spaces cast in them, with a clear two inches of space between them, to be filled with hair felt. These lids can be screwed on after the whole engine is put together. No objection should be made on the ground of their interference with the stuffing-box, guide-rods, &c.; if properly fitted they will interfere with nothing, and are absolutely indispensable to economy. Valve chests are usually left without clothing of any kind, as though steam cannot be condensed there as well as in the cylinder; they also must be carefully protected: it may seem a trifling matter, but it is on such trifles our success depends.

The speed of piston should be from 600ft. to 800ft. per minute, and all the rubbing surfaces should be made much larger in proportion than they are now; this need lead to no increase in the size and weight of cast iron plumber blocks, &c.; we have only to alter their shape, and make the brasses longer. The gain will soon be found in the diminished wear and tear of all the parts in motion.

I think an initial pressure of 100 lb. above a vacuum per square inch will be found very suitable. It is not excessive or dangerous, nor is it likely to cause any severe strain on the engine, especially if the ports are so shaped as to admit the steam gradually, according to many well-known plans; steam of this pressure, cut off at $\frac{1}{10}$ or $\frac{1}{15}$ of the stroke, will be found to give us all the economy we require, without any of the objections which attend an earlier cut-off. Steam, when very much expanded, seems to acquire an increased facility for being condensed, and in any case very low steam reduces the temperature of the cylinder so much that, however fast the piston travels, we cannot keep it hot enough without superheating to such an extent as is sure to injure the valves.

There is one point yet I wish to refer to, the means of cutting off: if we do this late in the stroke a lap on the valve gives us all that we require; but the case is very different when we cut off at $\frac{1}{15}$; it is very difficult to make a valve with such an enormous lap as would then be required, act properly, and if we resort to a second slide, worked by a separate excentric on the back of the first, we complicate the valve gear, which should be simplicity itself to the last degree. All things considered, I think the best plan is to have a separate valve box and slide at each end of the cylinder, according to the present practice with long stroke engines. It may be said that this is unnecessary with such a stroke as 30in. or 40in.; but when we see the great proportionate waste by clearance, ports, and passages in the expansive engine, we will understand the propriety of reducing this waste of steam to the lowest limit, by bringing the ports to the extreme ends of the cylinder; we may then either make each valve act separately, so as to cut off at the proper time without interfering with the waste, or, what is better, have a second slide in each valve box on Dr. Alban's principle slightly modified. If we adopt the latter plan I would not recommend a link motion; one excentric can be employed to drive the engine both forwards and backwards, by a simple modification of the old-fashioned "gab," and the valve gear will thus be rendered simple and inexpensive, and easily kept in order.

The best means of working the air and cold water pumps is not very easy to decide; many plans are adopted, but I think only two are worthy of consideration in this case; one is the employment of a separate engine for the purpose, the other a differential beam, to which the pump rods are attached, worked by a crank on the engine or propeller shaft. This plan is adopted in the Duke of Wellington and several other ships, and by it we can reduce the stroke and consequently the speed of the pump pistons in any degree we desire, If a separate engine is adopted, I am inclined to prefer a horizontal one, with the piston rod coming through both ends of the cylinder and coupled direct to the pistons of the two double acting pumps placed in the same line of course and with the same stroke. A small heavy flywheel may be driven by a slotted cross-head for the crank-pin between one of the pumps and the cylinder; it will be easy to make the same engine drive the feed and bilge pumps, by a suitable rocking shaft or otherwise. This engine should be supplied with steam from a separate boiler, using salt water at a very low pressure; this will make up for all waste in the surface condenser, and maintain an ample supply of fresh water to the boilers of the main engines.

I must apologise for the length of this letter, both to you and your readers, and I shall be very glad to see any argument your able correspondents may urge against my views, as I court such a free

discussion as may riddle the chaff from my wheat, such a discussion as your liberality and kindness gives free scope to in the pages of THE ENGINEER. V. P.

Feb. 1st, 1862.

TRACTION ENGINES.

SIR,—I beg to call your attention to the particulars of the trial of a traction engine, constructed on the original patent of Messrs. Longstaff and Pullan, and combining the more recent improvements of Mr. Pullan's subsequent patent. This engine was built by Messrs. Gardiner and Mackintosh, of Railway Foundry, New Cross. Its weight, with complement of water and fuel, is 13 tons, and it drew on this occasion three trucks, each weighing 2 tons 15 cwt., and carrying 13 tons of ashes and 8 tons of cast-iron, making a total weight of 42¼ tons. The engine started from New Cross, and arrived at Southend in 1h. 15min., the distance being four miles and a half. A stay of 45min. was made at Southend for the purpose of obtaining a supply of water and refreshments for the attendants.

One hundred and thirty-seven gallons, or only one-half of the contents of the tank, were evaporated on the journey down.

The return journey was accomplished in one hour, showing a result of a gross weight of 42 tons carried over 9 miles in 2 hours and 15 min. The route traversed comprised several heavy gradients, one of which, viz., Loampit-hill, is 1 in 16. The amount of water evaporated on each journey was about the same, and the total weight of coke burnt during the three hours was 3 cwt. and 23 lb. This engine is fitted with Pullan's patent superheating apparatus, the economical advantages of which, in the prevention of priming (that great source of waste of water and fuel in traction engines), was evident to all present.

As the details of this trial speak so plainly for themselves I shall make no comment thereon. I feel assured the importance of the subject will be a sufficient apology for thus trespassing on your space. JOSEPH HOPGOOD.

77, Addison-road, Kensington, Feb. 12th, 1862.

THE RENEWAL OF PROVISIONAL PROTECTIONS.

SIR,—I observe in last week's number of your journal that you state, in answer to an inquiry of a correspondent, "W. G.," that, as far as you are aware, the validity of the now so common practice of inventors abandoning a provisionally protected patent, and recommencing the same before the expiration of the term of protection accorded to the first patent, has never been decided by law.

Considering the importance of the point in question, you will perhaps permit me to correct this statement by drawing your attention to the following:—

A case was tried (Oxley *v.* Holden) before Byles, J., in the Court of Common Pleas, in May, 1860, where an action was brought for the recovery of royalties, payable on a license to use plaintiff's patent invention. One of the particulars of objections delivered by defendant was that the patent (dated 17th March, 1858) to which the agreement related was abandoned, and another and different patent (dated 10th April, 1858), to which the agreement did not relate, was taken out.

The verdict was, however, entered for the plaintiff, the judge reserving all the various points for the court.

Subsequently, therefore, a rule *nisi* was obtained to enter a verdict for the defendant, on the ground, amongst others, that the filing by the plaintiff of the specification (dated 17th March), and his allowing it to expire, amounted to a dedication of the invention to the public, and prevented the subsequent patent applied for on the 10th of April, for the same invention, with additions, being a valid one. Grove, Q.C., showed cause against the rule, and cited various sections of Patent Law Amendment Act, 1852, to prove that during the term of provisional protection there was no publication of the provisional specification; that, therefore, at the time of the second application on the 10th April, the invention was not publicly known; and that this second patent was consequently a valid one.

Erle, C. J., in delivering judgment, gave the following important decision on this point:—

"We are of opinion that a provisional specification abandoned does not become public by abandonment. Furthermore, although the first provisional specification may afford an objection either to receiving a second for the same invention, or to granting a patent for the invention after the first specification has been published, there is no principle of law, and no enactment making the patent void, if it is so granted; and, on the contrary, section 24 enacts that the patent, dated as of the day the provisional specification was delivered in, shall be of the same force and validity as if it had been sealed on that day.

"This patent is dated as of the 10th April. On that day the protection given under the specification of the 17th March existed, and the patent is valid by the operation of this section."

The rule was accordingly discharged.

Those interested will find the case above alluded to in the 8th vol., part vi., of "Common Bench Reports, New Series."

20, Southampton-buildings, Feb. 6, 1862. C. D. ABEL.

BOILER EXPLOSIONS.

SIR,—There have been numerous well-authenticated instances of violent explosions occurring in boilers nearly new, and of ample strength, at times after the engine has been stopped for a period (as at the dinner hour), the water-gauge showing abundance of water, and no steam escaping from the safety-valve, the pressure having been apparently low, with a dull fire. On starting the engine, after a few strokes, steam has been generated with such sudden violence as to rend the boiler into fragments, strong and weak parts giving way together, as if it had been blown to pieces with gunpowder. Attempts have been made to explain this by the supposed ignition of the mixed gases from decomposed water, or from a large portion of scale being dislodged by the disturbance from the heated surface of the plate, and so allowing the water to come into sudden contact with the hot iron: or, still more improbably, by the agency of electricity. There would not be much difficulty in proving that explosion from any of these causes must be impossible. It seems strange that so little notice has been taken of the fact that water itself becomes explosive when heated under certain conditions. It has long been known that water, at atmospheric pressure, deprived of air by long boiling, may be raised to a temperature much above the boiling point, in an open vessel, by the gradual and gentle application of heat. Water thus treated may be heated to 225 deg. The slightest disturbance, either by stirring or shaking, will cause a sudden ebullition violent enough to throw most of the contents out of the vessel. As the converse of this, water—also deprived of air—may be gradually reduced from 10 deg. to 15 deg. below the freezing point, without the formation of ice, crystals of this will instantly make their appearance on slightly jarring the vessel or disturbing the water, the temperature of which immediately becomes raised to 32 deg.

As water at atmospheric pressure can thus be raised 10 deg. or 15 deg. above the boiling point, without the formation of steam, it seems extremely probable that at higher pressures the water may be surcharged with heat in degrees corresponding with the increase of pressure, or, perhaps, even in a greater ratio. It would be easy to ascertain this by experiment, on a small scale, by means of a closed vessel furnished with a pressure gauge and thermometer, immersed in an oil-bath, and very gradually raising the temperature of the whole so as to avoid circulating currents in the water experimented upon. If it could be shown that water, gradually heated in this way, at high steam pressures, could be made to take up a large surplus of heat without ebullition beyond that properly due to the pressure, it may readily be imagined how the sudden liberation of the steam arising from this surplus heat, pervading the enormous body of water contained in a cylindrical or Cornish boiler, would be sufficient to rend the plates asunder with explosive violence. This condition probably seldom takes place to its fullest extent, but to an approximate effect I myself have oftentimes been an eye witness. After an engine has been stopped for an hour, with the fire banked up and a very small escape from the safety-valve, on starting the engine the steam has soon rushed violently therefrom, but after the engine has run a few minutes the pressure has lowered rapidly from insufficient fire.

Some years ago I tried some indiometer experiments, for the purpose of viewing the expansion of isolated steam, by increase of temperature. The short leg of a glass syphon tube, closed at top, was filled with water. Mercury was then poured in so as to fill the bend of the syphon and seal up the water. On immersing the syphon in a hot bath, so as to cause the water to boil, the whole evaporated, leaving the short leg filled with dry steam. On allowing this to condense the mercury rose in the short leg with the small drop of water from the condensed steam at the top. It was the varying expansion of the steam, from this drop of water, that I wished to observe, but on immersing the syphon in a mercurial bath, at temperatures from 212 deg. to 500 deg., I was much troubled with the sudden explosion of the spherule of water, which was so violent as to break several tubes, and always jerked them unpleasantly in the hand, blowing out the mercury. I found the simple remedy for this was to introduce a minute bubble of air with the water, which, with this precaution, invariably expanded quietly into steam. I have no doubt that the introduction of a small quantity of air into the water contained in any steam boiler would prevent the water from becoming surcharged with heat, while in a quiescent state. This condition is not likely to occur while the engine is running and the water in active ebullition, for it is impossible to increase the temperature beyond that due to the pressure with rapid circulating currents in the boiler.

In your last number your correspondent "M. M. J." describes the corrosive action of minute particles of copper, deposited from the water in the interior of a steam boiler. This effect has also come under my own observation, in a somewhat different form. In an establishment with which I was connected, many years ago, a number of tubular heaters were made with brass tubes for warming buildings, &c. After a short period the heaters were returned in a leaky state, and on breaking them up the whole of the interior water surfaces were regularly pitted all over, and in many places entirely riddled through like a colander. The heaters were renewed and iron tubes substituted, which completely remedied the evil. As, accounting for the rapid corrosion, it may be mentioned that, in ordinary hot water heaters, there is no scale deposited from the water, the same quantity being used over and over again for years together. Galvanic corrosion can thus take place on the bare surface of the plates without impediment. In locomotives furnished with brass tubes a scale is rapidly formed, which serves as a protective coating to the iron, but still in many places in a locomotive boiler a scale cannot be deposited from the rapid circulation of the water at the part or other local causes. And it is here that in many cases lately a dangerous degree of corrosion has been observed, eating the iron into pits and furrows. If the evil is general there is no reason to doubt that iron or steel tubes, with fire-boxes of the same material, would furnish the remedy. F. H. WENHAM.

1, Union-road, Clapham Rise, Feb. 10, 1862.

SIR,—I have read with much interest Mr. Dunn's remarks upon the Byer Moor boiler explosion, contained in your journal of the 24th January, 1862. Having had considerable experience with boilers, I beg to draw your readers' attention to experiments which I tried with two boilers quite similar in shape and construction to those of Byer Moor, and which you had the kindness to publish about the 11th January, 1862. Upon reference to that letter Mr. Dunn will see at once that I have had a similar case to deal with, only without explosion. I have three or four photographs of the fractured plate, which may be had on application. The facts are briefly these:—The boiler required to be repaired; in fact, never had been sound a week together over the fire. The contractor replaced (without my consent) the common grate bar by the Argand fire bar. The boiler worked four or five days, then began to bulge down over the fire, and then a crack was visible, and before No. 2 boiler was repaired No. 1 had become useless. The grate bars were lowered and the boiler again repaired; but it did not work so long as in the first instance. In three days the crack was 9in. long. The heat was over 2,000 deg. in certain places under the boiler; and, after making several experiments, my conclusions are that the plain cylindrical, hemispherical end boiler will not work safely with more than 1,800 deg. of heat, and should not upon any occasion be urged by excessive heat; for, if the fire be urged on to a great heat, the iron plate will conduct the heat or caloric through in volumes, so rapidly forming globules as to drive back the water from the plate. I have seen the float rise and fall 18in. to 20in. within a minute, and such behaviour is more likely when the boiler is a long one. The plate then gets hot, bulges down, and fracture and explosion is the result, carrying destruction on all sides. New plate or a clean boiler is more liable to this oscillation of water than an old furred one.

The fact is evident that there could not be this buckling and stretching of the plate with mere pressure of steam; it must be from being over-heated. It is likewise evident that, if water was in contact with the plate, the plate could not be heated so ast o weaken its tenacity. Therefore, I conclude that water is not in immediate contact; hence the stretching, and cracking, and explosion. I have had plates 60in. long stretch 2in. in that length by the heat and pressure when being at work in a boiler.

What is wanted, then, is to double or treble the heating surface over the fire—that being the vulnerable point—and also to obtain a free circulation of water over the heating surface. Let us just look at the old hay stack-like boiler of thirty years' wear, with 100ft. area over the fire, and compare it with the present cylindrical boiler, doing five times the work with only 30ft. area heating surface over the fire. The one lives as a boiler thirty years, and the other has a short reign of about four months, as that at Byer Moor. We have improved the construction of the steam engine there is no doubt, but what shall we say of boilers? Now, for strength and carrying pressure, of course the cylindrical is the best; but have we enough heating surface directly in contact with the fire?

What I propose is this:—A large fire-tube, with cross sectional water-tubes in the fire-place, so as to increase the heating surface, thereby absorbing the heat of the fire; the conical tube absorbing the greatest heat at the top or large end, will cause a free circulation of the water over the fire plates. The conical tubes will boil the water up over the fire-tube, even if the water should get low in the boiler. CHARLES TAPP.

Chesterfield, Feb. 6, 1862.

PATENT TRIBUNALS.—PRELIMINARY INVESTIGATIONS.

SIR,—I am glad to find you thought the article on "Patent Law Reform" in the last number of "Newton's London Journal" worthy of being transferred to your columns. The extensive experience of the writer of the article gives increased value to any expression of opinion proceeding from him. Still there are some points in the administration of patents on which, probably, there will always be some difference of opinion, even among persons of experience. The preliminary investigation of applications for patents is such a point.

Now Mr. Newton says, "This is a question on which great differences of opinion may naturally be expected;" but he adds, "Those most intimate with the working of the patent law inclining to a very limited inquiry."

I purpose, then, submitting my own opinion on this controverted point in a more positive form than I did in my paper read at the meeting of the British Association, my object on that occasion being merely to show what objections appeared to me to exist in the way of Mr. Grove's particular suggestion. It appeared to me that he proposed to deal judicially with matters that were not ripe for judgment, and therefore I submitted that an investigation based on such an erroneous principle must fail. It was enough for me to make out this point, which, of course, only amounted to a negative indication of my own opinion as to preliminary investigation.

My opinion may be briefly expressed thus:—I believe that the powers given to the law officers of the Crown for investigating all applications for patents are abundant in theory, but the practice is defective, and that all that is required is to bring the practice up to the theory; in other words, I think the preliminary investigation ought to be confined to the provisional specification as it is now, but I think the means provided for conducting the investigation quite inadequate to the purpose. I agree with Mr. Grove in advocating "the transference of the duties now performed by the law officers of the Crown to a new tribunal," because, to use his words again, "they are overworked, though highly competent men." Let us have "highly competent men" not "overworked," and then it would be seen how salutary a check could be put upon improper provisional specifications. When we consider that there are, on the average, about ten applications for patents daily, each purporting to contain an adequate statement of the nature of an invention, and that the duty of the law officers is to ascertain in each case that the rule of the Patent Commissioners has been complied with—"The provisional specification must state distinctly and intelligibly the whole nature of the invention, so that the law officer may be apprised of the improvement, and of the means by which it is to be carried into effect"—I think we come to see that there is in the aggregate a considerable quantity of work to be got through by two "overworked though highly competent men."

But it appears to me that, in order to administer patents properly, it is as important for the law officer to check irrelevant statements as to require sufficient statements in provisional specifications. In my judgment he ought to require every document to be amended that contained anything beyond the statement of the nature of the alleged invention. It is common for applicants for patents to insert general expressions relating to matters which are intended to be included (if convenient) in the final specification, but which are probably not invented at the period when the provisional specification is deposited. The matters here referred to are not merely matters of detail belonging to the invention the nature of which is stated (these might be inserted in the final document without being named in the provisional), but matters involving some nature of invention beyond that so stated.

In order to administer this check adequately, it might frequently become necessary to make the applicant, or his agent, attend upon the law officer to show cause why certain statements should not be struck out or amended.

Then, again, there is a matter of administration to which Sir John Romilly (now Master of the Rolls) used to attach great importance when deposits of particulars of invention (under the old law) came under his notice—that of allowing portions of the statement to be struck out on application. We have, unhappily for the present, lost this practice. The consequence of this is, that it is usual now for patentees to act as if they were at liberty to drop any matter stated in the provisional specification that it may be convenient to abandon, and to concern themselves only about ultimately specifying something within the provisional document. I believe Sir John Romilly's principle to be the right one, and I trust it may be restored, of which there is some probability, if I have been correctly informed that the present Solicitor General (no small authority) is favourable to the practice.

Looking, therefore, to all the work for the law officers that is involved in a thorough administration of provisional specifications, it does not appear to me reasonable to expect that "overworked men," however competent otherwise, can properly discharge the duties imposed upon them.

I will only add that I think a competent lawyer, provided he be a good logician, is fully equal to the task of preliminary investigation thus indicated, and the cases would be very rare in which it would be requisite for him to call in a scientific man to aid him, because he might properly reserve points of science until the complete description was put in. It appears to me, therefore, that the "Patent Law Committee" have given too much prominence to the scientific assessors in their notion of preliminary investigation.

I think every appearance of investigating in such a manner as to give the least colour to the idea that an application, when it has passed, is thereby declared to be valid in law, ought to be avoided. I think it is even better to let frivolous patents pass than to attempt to discriminate between applications for patents by the aid of a scientific board. WILLIAM SPENCE, A.I.C.E.

50, Chancery-lane, W.C., 12th Feb., 1862.

THE HARTLEY ENGINE BEAM.

SIR,—As the Hartley inquest closed yesterday, and by this time you will have seen the verdict, I merely wish to state to you that I entertain a different opinion from the engineering witnesses examined, and I think my opinion is borne out by certain evidence produced, and that those who supposed the spear had broken have no evidence to support their opinion. Should you desire my reasons for coming to a contrary opinion I shall be happy to forward them. I may remark here that the Friday morning after the accident I stated to Mr. M. Dunn, the Government Inspector, that I had no doubt that the beam had many a hundred times been working to its breaking strain, but a little extra friction, or such like, had brought the breaking point up, when the beam would give way just in the lift. I may also state that, in former years, I was a colliery engineerwright, when I had some years' experience with a similar engine as that at Hartley, viz., the Tyne main pumping engine.

Yesterday I explained my reasons partly to Mr. Short, at Hartley, and he considered my explanation the most likely.

I was glad to see my views confirmed in THE ENGINEER of last week. WM. KENDALL.

Locomotive Superintendent's Office,
Percy Main, Newcastle, February 7, 1862.

SIR,—The inquest held last week to inquire into the cause of the late terrible accident at Hartley Pit proves what I fully expected it would do, viz., that the sides of the beam were open sand castings.

THE ENGINEER of the 31st ult. also stated that "the metal does not appear to have been well distributed;" and the local papers stated also "that the beams were honeycombed in appearance," which is the usual result of open sand castings, as all iron founders can testify. Had the beam, when being cast, been covered with a top box, the metal would have been distributed in a proper way because of its confinement in the mould, and the runner or gate for the metal to pass into the mould being higher, obtaining thereby greater density of metal, the result would be a sounder casting, consequent on the greater specific gravity of the metal while in a fluid state, and it would not have been honeycombed, as the atmospheric air would have been totally excluded from the mould during the process of casting. Again, the boss or centres of the beam, where the greatest mass of metal was, on the mould being covered, could have been fed with fresh melted iron, in the usual way, to supply the loss by contraction in cooling. It was not possible to do this on account of the great heat of the casting. The usual result followed, viz., unsoundness in the boss, where the greatest strength was needed.

Engine beams constructed in this manner might be very materially strengthened if the plan of trussing (so useful to strengthen wood beams for cranes, &c.,) with wrought iron rods were adopted. A series of projections could be cast or fixed on the beam, having holes in to pass the rods through to keep such rods in position, the rods to have a nut on each end to screw up with, such rods to be placed parallel with the edge of the beam, one on each side, so that four rods would be required for one beam, and such could be placed in the space between the sides, quite out of the way. If a beam so constructed did break across the centres the truss rods would prevent it from falling down the pit. I would respectfully suggest to colliery proprietors and others the adoption of this plan where similar beams to the one at Hartley are used, thereby giving strength and a greater feeling of security to the miners who may have to work under them, which is a great desideratum at the present time. Further, such a plan could be adopted at considerably less cost than replace the cast iron beam with a wrought iron beam, the greater cost of which would prevent many from using them.

THE ENGINEER for the current week gives the brand and mixture

of iron used for the beam. No matter what mixture of iron or brand where such inequality of thickness exists, as in engine beams the process known as feeding must be used, or sound castings cannot be made. Gentlemen requiring such massive castings ought specially to specify that such must not, in any case, be cast upon sand, and that such be fed with fresh melted iron. To give an instance, Government, on a 13-in. mortar being cast, required such mould to be supplied constantly for four hours before allowing the metal to set in the mould.

I do not wish it to be inferred, from what I have stated, that the primary cause of the accident has been the unsoundness of the beam, but to the manner in which it appears the beam was cast. I wish to draw the most serious attention of all persons concerned in such matters.

Joseph Roberts, Ironfounder.

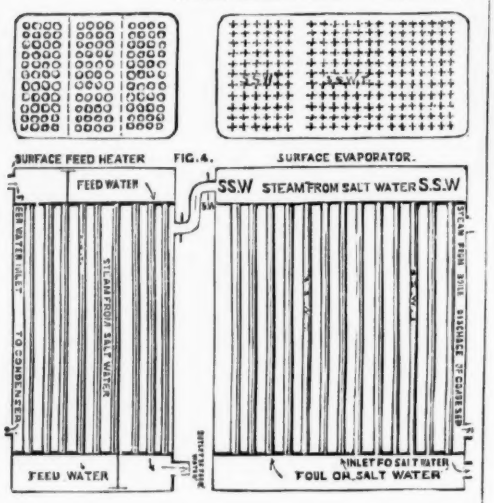
Staleybridge, Feb. 10th, 1862.

SPENCER'S STEAM ENGINES.

This invention, by Mr. John Frederick Spencer, of Newcastle-on-Tyne, relates to certain improvements connected with steam engines combined with surface condensers and working with surface condensation, instead of by the ordinary system of injection condensation, and whether such engines, machinery, and apparatus be employed on board of ships or on land.

The first part of the invention consists of a mode of supplying surface condensers with condensing water when it is convenient or preferred to work the air-pumps only (with or without the feed and bilge-pumps) by the main engines. In such cases the pump or pumps for supplying the condensing water required for condensing the steam in surface condensers are worked by a steam engine or engines worked distinct from the main engines; the steam to work such auxiliary engines may come direct from the main boiler, or from the auxiliary boiler or boilers, as preferred.

The second part of the invention consists in an arrangement of apparatus and mode of working the combined air and cold-water pump previously patented by Mr. Spencer (16th November, 1857); or the cold-water pumps only in connection with his arrangement of surface condensing engines (as patented 29th March, 1858, No. 661, and 17th January, 1860, No. 120).



It is usual in direct-acting inverted screw (or stationary) engines to work the air-pumps by levers placed across the line of the keel, and attached at one end by means of links to the piston-rod or its crosshead, and at the other end by links to the air-pump crosshead; the fulcrum or centre of vibration of the lever being placed at some convenient distance from either end, and a short shaft or axis carrying the lever is supported in bearings in some portion of the engine framing, or in standards provided for the purpose.

By this arrangement the work of the pump, and the load on its bucket, help to balance the descending weight of the steam piston and its connections, or the moving parts of the engine. Now, in the pumps which the patentee commonly uses for such descriptions of engines fitted with surface condensers, the work or load of the pump is in or during its downward stroke, or the reverse of the ordinary condition of working engines, as before described.

For the purpose of meeting this alteration in the conditions or requirements of such pumps and engines, the plunger of the combined pump is worked by means of a lever or levers, one end of which being attached to the piston-rod cross head, the other end is made the fulcrum or centre of vibration, and is attached to brackets connected with or attached to the framing of the pump or the engine; motion being communicated to the plunger at any convenient point between the two extreme ends. By this arrangement the load of the pump on its downward stroke helps to counterbalance the weight of the steam piston and the moving parts connected therewith.

The third part of the invention has reference to steam engines worked with surface condensers, the two previous parts of this invention having reference to certain arrangements for working the pumps of engines fitted with surface condensers.

For the purpose of pumping and feeding steam engine boilers to be fed or supplied with fresh water, and with a view also to enable them to be supplied with water of a higher temperature than when it has left the surface condenser in which it has been collected, Mr. Spencer applies a heater in connection with a vaporiser as hereafter described.

In cases where it is not convenient or desirable to employ the auxiliary boiler for making up the loss or waste of fresh water, the following arrangement is adopted. With the main boiler or boilers is connected a vaporiser or vessel, into which salt or foul water is admitted on one side of the metallic divisions or surfaces, while the hot contents (water and steam, or both), of the main boiler or boilers are brought by pipes, &c., in contact with the other surfaces, and made to circulate between them, and impart the heat thereto, and so ensure its transmission to the salt or foul water on the opposite side of such metallic surfaces, and by which vapour or steam is driven off, which vapour or steam in its passage therefrom through a surface heater, is made to part with its heat to the feed water, which in its course from the pump or pumps to the boiler or boilers, is likewise caused to pass through the said surface heater, and thus a large proportion of the heat drawn from the main boiler, for the purpose of vaporising the salt water, is returned to it through the increased temperature of the feed water supplied thereto. When the amount of feed water is insufficient to abstract all the useful heat from the steam or vapour driven off from the salt water contained in the vaporiser, the portion condensed, together with that which is uncondensed, may be passed into the main surface condenser, and thus be utilised.

Fig. 1 is a plan view of a pair of overhead cylinder engines suited for driving the screw propeller in mercantile steam ships. The central surface condenser forming part of the framing, and the means of supporting the two inner sides of the steam cylinders. The combined air and condensing water pump of each engine is shown in the position, and worked by means of levers having their fulcrums respectively carried by brackets projecting from the hot well and chamber casting connected with each combined pump.

Fig. 2 is an end elevation of the engines, condenser, and pumps shown in Fig. 1.

Fig. 3 is a sectional plan of the surface evaporator and the surface feed water heater constructed according to the third part of the invention, but the surface feed water heater, instead of being separate as shown in the plan, may form a portion of the condenser.

Fig. 4 is a vertical sectional view of Fig. 3, taken on the line C, D, of Fig. 3, and showing the mode of connecting the surface evaporator with the surface feed water heater, and of connecting them both with the other parts of the apparatus.

In these Figs. (3 and 4) there are employed, in addition to the written description upon some of the parts thereof, compound letters of reference for the more readily distinguishing their functions. Thus, those parts marked F, W, T, refer to the feed-water tubes; S, S, W, T, the course of the steam from the salt water tubes, which may be traced through the course of the arrows; I, F, feed water inlet or the inlet from hot well or feed pump; F, W, feed water chamber spaces, at top and bottom of heater; S, S, W, steam contained in salt water chamber; M, S, I, the main steam inlet near the top of the evaporator; O, S, S, outlet for steam from salt water evaporator; O, F, outlet for feed water after it has been heated; M, S, D, main steam discharge or opening from which the steam from the boiler, or the condensed water resulting therefrom, is permitted to escape; I, S, W, inlet for the salt water taken from the discharge of the condensing water from the main surface condenser; P, S, S, W, passage or pipe for the steam generated from the salt or other water admitted from the main condenser.

SPENCER'S STEAM ENGINES.

FIG. 2.

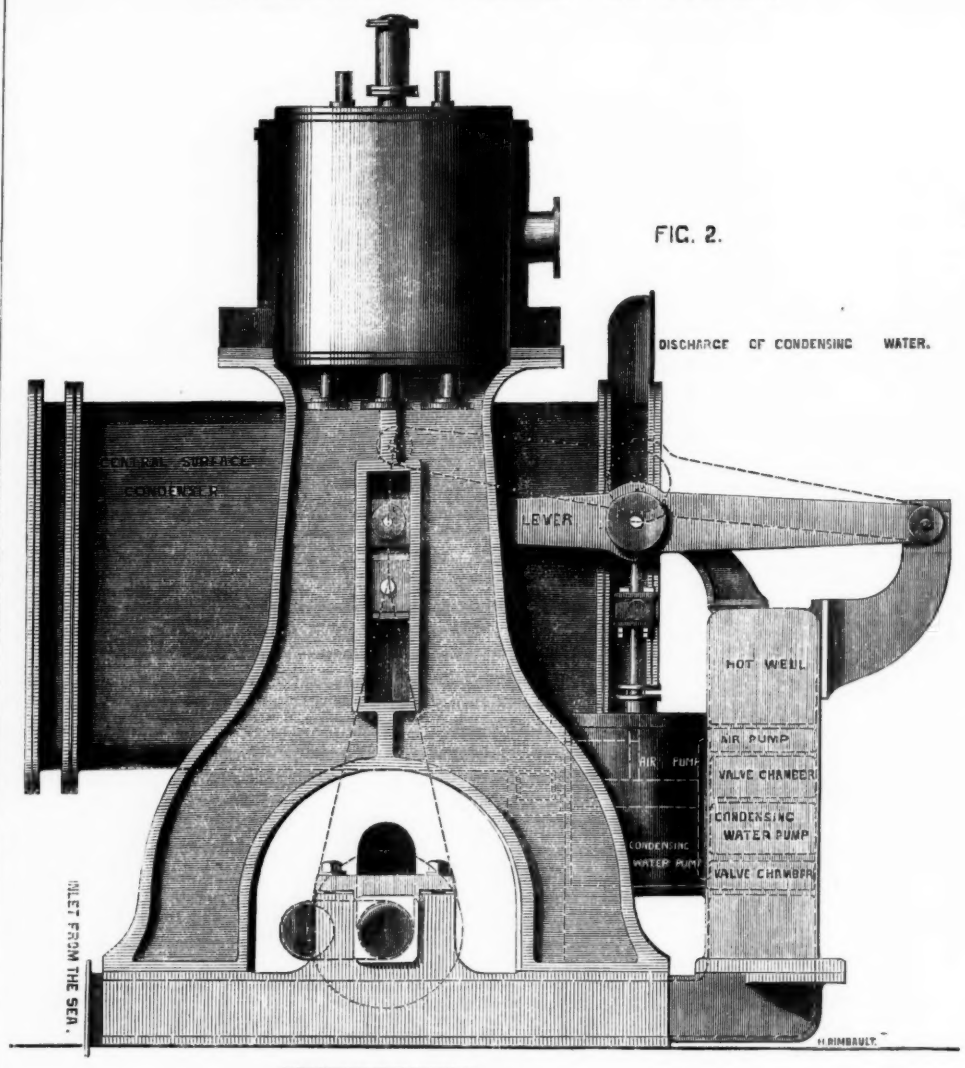
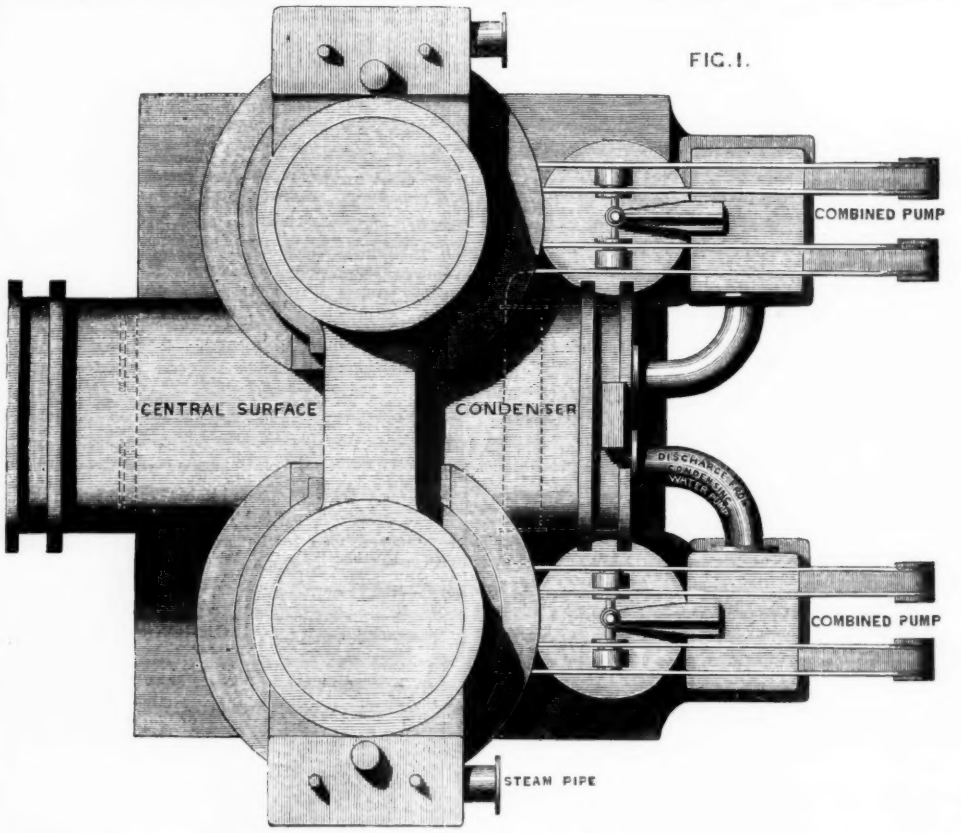


FIG. 1.



TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

N. O. P.—*We know of no society for assisting working men in taking out patents.*

W. T.—*Mr. Bourne's work on the screw propeller is, we think, the best. The price is, we believe, about 25s., or perhaps two guineas.*

A. T. (Newcastle).—*We have not had time since receiving your note to collect all the rules you require. You shall have them next week.*

S. H. (Durham).—*It is many weeks since the Commissioners of the Exhibition ceased to receive applications for space. All the space is already allotted.*

M. J. (Cardiff).—*Mr. McConnell, of Wolverton, some years ago patented, and, we believe, used steam cylinders and cylinder covers of wrought iron.*

P. Q.—*The Saltash bridge was described at some length in* THE ENGINEER *in October, 1858. Mr. Humber's new work gives very full particulars of its construction.*

ANTHROPOS.—"*Drysdale's Practical Railway Engineer,*" *published, we believe, by Mr. Weale, of 59 Holborn (price £2 10s.), is perhaps the best work for your purpose.*

J. S. (Wolverhampton)—*Mr. Whitworth's "Mechanical Papers," published by the Messrs. Longmans, describe his system of measurement. Mr. Whitworth, we presume, supplies the measures on application.*

M. I. M. E.—*Mr. Hay's compound is now advertised daily in the* Times, *but we do not recollect the address. Mr. Bertram's specification may give you the information you ask for about welding. We have not seen the process practised.*

T. G. P.—*If you have a good draught your boiler should have a grate 3ft. wide and 3ft. long, the bridge being 3ft. 6in. from the door. It would give off steam for an engine of 7 nominal horse-power, working up to 12 or 15 actual horse-power.*

A. S.—*We have no means of knowing which indicator is correct. They might have all been correct, at least we see no reason for supposing the contrary. It is difficult to take the exactly similar diagrams from the same engine, even with the same indicator.*

J. R.—*We do not exactly understand what you mean by a rule to "find the lap of the valve," especially when you add "for both high and low-pressure engines." If you will explain your wishes more fully we will endeavour to give you the required information.*

A. A. A.—*On page 115 of Clark's Railway Machinery, et seq., you will find recorded the lowest consumption of fuel in locomotives of which we are aware. If you read the context in the article referred to you will see that we do not speak of a consumption of but 1½ lb. per hourly horse power as having been actually attained.*

N. I.—*Mr. Weale of Holborn, publishes a work giving full particulars of the Niagara suspension bridge. The railway platform is overhead, the carriage way platform 24ft. below. These platforms, which are of wood, are connected at the sides by a trussing of diagonal timber struts and iron tension bolts. The floor of the bridge is steadied, moreover, by fifty-six "guys" or wires anchored below in the rocks forming the sides of the river.*

W. F.—*To give you the pressure exactly we should require to know the weight of your safety-valve lever, not weighed as a loose piece of iron in a scale-pan, but in the following manner:—Take off the ball weight, leaving the other end of the lever jointed to its stud, as when in use. Apply a pair of steelyards, or a spring balance, exactly at the centre of the pin through which the lever presses on the valve. Thus weighed, your lever would not probably weigh far from 60 lb., equal in itself to nearly 9 lb. steam per square inch on the valve, irrespective of the weight of the ball. Apart from this load the ball-weight itself will balance a pressure of 60⅞ lb. per square inch on the valve, the whole being probably about 70 lb. Weigh the lever as we have directed, and divide its weight in pounds by 7, adding the quotient to 60⅞ lb. for the exact pressure per square inch.*

DYNAM.—*Your first question raises a point upon which there has been much discussion. The friction of a slide valve does not, we believe, correspond to the whole area of the back of the valve, but to that of the ports covered, for it is a demonstrable fact that two smooth plates, without ports or openings of any kind, will move as easily upon each other under steam of a pressure of 50 lb. or 100 lb. per square inch, as in the open air or in a vacuum. Then, again, the unbalanced pressure being determined, the friction would vary from one-thirtieth to one-fifth, according to the lubrication and the state of the surfaces. To your second question, five square inches is the effective area on the up stroke, and five also on the down. The eccentric strap would not break at all when moved in one direction; in the other it might spring from the centre midway between the two lugs. But its strength is the same all the way round, provided it is of uniform strength and thickness, like a chain link.*

THE HARTLEY BEAM.

(*To the Editor of The Engineer.*)

SIR,—Will any of your correspondents be kind enough to give the calculations of the strength of the Hartley beam from the dimensions given in your number of the 31st ult., and also the proper formula for calculating engine beams generally, taking into account the feathers, flanges, holes, &c.; if they would do so by figures and mathematical reasoning they would, perhaps, set at rest many disputes among engineers, whose formulæ differ very widely. JOHN JAMIESON.

Newcastle-on-Tyne, Feb. 11th, 1862.

FRICTIONAL GEARING.

(*To the Editor of The Engineer.*)

SIR,—I observe, with regret, in your last number that Messrs. W. and C. Sellers, of Philadelphia, U.S., have recently patented certain modifications of frictional wheels for transmitting motion, to which I have prior claims, and which I have been applying these several years past. I beg to send herewith a copy of a specification of a patent obtained by me, dated January the 31st, 1855 (No 276), in which the forms of frictional wheels described by Messrs. Sellers are also described and claimed. Figs. 62 up to Figs. 92 illustrate various forms of these. In Figs. 65, 66, and 67 these wheels are arranged for transmitting and varying motion in the same way as you illustrate from the Messrs. Sellers' patent. JAMES ROBERTSON.

Frictional Gearing Works, Glasgow, 12th February, 1862.

PORTABLE ENGINES.

(*To the Editor of The Engineer.*)

SIR,—I noticed the specification of Messrs. Aveling and Rawlinson's patent in your impression of the 10th ult., claiming the arrangement of a steam cylinder or cylinders within the steam dome of a portable, traction, or roadway engine. I also noticed Mr. Pulien's letter of the 31st. ult., and your remarks at foot.

I beg to state that I made portable engines with steam cylinder, cast in steam dome, years ago. Messrs. Hedley and Manning, of Cambridge, also made engines of this description.

If Messrs. Aveling and Co. will favour me with a call I shall be happy to take them to see one of these engines at work. WILLIAM BUTLIN.

Northampton, Feb. 11th, 1862.

EMPLOYERS AND EMPLOYEES.

(*To the Editor of The Engineer.*)

SIR,—It must have occurred to the minds of many thoughtful men that the relationship between workmen and masters is not that most likely to promote the interests of both parties, especially the employers. We are told that co-operation is power and unity is strength, but I am sure we find very little of that power and strength in the systems of the majority of our present workshops.

If masters would consider their men as something more than machines, and give them that respect which is due to them as the moving power of their own superiority, and in cases of fault, instead of using harsh language and a commanding manner, would tell a man kindly the risks he is running of being discharged, and of the chances he is losing of promotion, certainly such usage would have a good effect. I believe there is no passion greater and none more genuine than that regard which a good servant has for his master. As to what a workshop ought to be there can be but one opinion; there should exist none of that cowardice which workmen often exhibit at the approach of their master, nor should the manner of masters tend to cause it, but, on the contrary, men should feel disposed, if the privilege be allowed them, to give expression to their feelings of welcome upon seeing the person and hearing the voice of their employer. Such a state of things would exist if masters would be a little more courteous—their men would certainly hold them in higher estimation. AN EMPLOYÉ.

ERRATA.—In Mr. Dixon's paper, given last week, the following corrections should be made:—Middle column, 4th line below the table of loads, for "minus the *force* of engine," &c., read "friction".624 lb. About 8 lines further down, for "What is the load for the same engine on one of 320-horse power," &c., read "or one of 320-horse power." About 17 lines from the bottom, for "therefore $\frac{2,480}{g\ 22{\cdot}4 \times F\ 9} = 78{\cdot}97$," read "$22{\cdot}4 + 9$."

About 6 lines from the bottom, for $\frac{5,883}{g.\ 378{\cdot}33 \times 9} = 127$ tons, should be $g\ 378{\cdot}33 + 9$.

MEETINGS NEXT WEEK.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, February 18th, at 8 p.m., continued discussion upon Mr. Samuda's paper "On Iron-plated Ships."

SOCIETY OF ARTS.—Wednesday, at 8 p.m., "On the Relative Merits of the Different Systems of Working Metallic Mines and Collieries," by H. C. Salmon, F.G.S., F.C.S.

Advertisements cannot be guaranteed insertion unless delivered before eight o'clock on Thursday evening in each week. The charge for four lines and under is half-a-crown; each line afterwards, sixpence. The line averages nine words; blocks are charged the same rate for the space they fill. All single advertisements from the country must be accompanied by stamps in payment.

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THE ENGINEER.

FRIDAY, FEBRUARY 14, 1862.

NEW BLACKFRIARS BRIDGE.

AT a special meeting of the Court of Common Council, held yesterday afternoon, it was decided to recommit the whole question of the rebuilding of Blackfriars bridge to the Bridge House Estates Committee, with power to call in professional assistance and to confer with the authors of the various plans already sent in. Considering the various contradictory representations which have been made to the Common Council this course was altogether a proper one. It would be interesting, however, to know whether the pressure brought to bear upon this, the parliamentary body of the Corporation of London, was prompted by sincere and honest motives. One councilman, at least, appears to have exhibited the greatest zeal for the railway company, who are already preparing to erect a bridge only 105ft. below the present structure at Blackfriars. The engineer to the railway company having designed a five-arch bridge for his own work, naturally wishes to avoid any alterations of his plans—alterations which would be compulsory in case a three-arch bridge were to be erected, by the City authorities, only thirty-five yards above him. Taking up the railway engineer's plan, the councilman in question has given out that it has been sanctioned by the Admiralty, and thus has induced a number of those most interested in the navigation of the river to express the hope that the new Blackfriars-bridge might be made to conform to it. This unworthy piece of deception was exposed yesterday by the reading, at Guildhall, of an official letter from the Admiralty, stating that they had not yet considered the matter of the bridges at all. Nor is it likely that the Admiralty will decide upon the construction of the new railway bridge, or permit anything to be done towards its construction, until the question of new Blackfriars-bridge has been definitively settled. The Bridge House Committee, in reconsidering their former decision, will have the ground entirely clear before them, and, unless they have new evidence of the unfitness of Mr. Page's design, will, we presume, again recommend its adoption. Another unpleasant feature in the case is the dishonest outcry that has been raised to the effect that, according to Mr. Page's design, the approaches on the south side were to be considerably raised. In the communication accompanying that design, Mr. Page stated to the Chairman of the Bridge House Committee that "the width and order of the pre-"sent approaches to the bridge render it unnecessary to "make any change in them; the bridge, therefore, "should be designed to avoid the expense of any alteration "in these important features." Mr. Page's bridge was so designed, as every member of the committee, including Mr. Kearns, well knows. His roadway starts at the present level of the northern and southern entrances to the present bridge, but, describing a flatter curve, is several feet lower at the centre of the bridge. With iron ribs, however, the thickness of the centre arch, at the crown, is so much less than that of the present stone arches, that the absolute headway under the arches would be nearly the same as at present, at any rate not less than that under other important bridges over the Thames. Mr. Page's design, furthermore, is the only one of the twenty sent in which provides for the embankment of the south side of the Thames, a matter which is one of very great importance in view of the prospect of that work being undertaken within a few years. If we compare Mr. Page's design with Mr. Joseph Cubitt's (for the others appear to be out of the question), we find in the former, one arch of 280ft. and two of 220ft. each, besides two small arches in the abutments, the main arches alone giving 720ft. of clear navigable water way, broken by two piers. Mr. Cubitt proposes one arch of 150ft. span, two of 145ft. each, and two of 135ft. each, without abutment arches. The whole navigable water way is 710ft., broken by four piers. Mr. Page provides, for 26ft. of headway under the centre arch, and 22ft. beneath the side arches. Mr. Cubitt's several spans are to have 25ft., 22ft., and 18ft. headway respectively above Trinity high water level. Mr. Page's original estimate, sent in on the 28th June last, was £285,000. Mr. Cubitt, it appears, was permitted to send in his estimate a week later than the other engineers, and after their figures had become known in Great George-street, and his estimate was £245,000. Mr. Page afterwards determined to send in the result of a careful measurement of the whole work, and named £245,000, at which his estimate now stands. As for superiority in respect of the navigation and in grandeur, the three arch-bridge manifestly has the advantage over any structure having twice the number of piers in the same width of channel. Many hundreds of coal merchants, wharfingers, steamboat captains, bargemen, &c., interested in the navigation of the Thames, have signed petitions earnestly requesting that the least possible number of piers might be adopted, and with the exception of Mr. Kearns, who appears to think that a stream cannot be obstructed with piers at too many points, in order to break up the "tidal wave" (!) occasioned by steamboats every sensible person must agree with them.

STEAM ENGINE IMPROVEMENT.

THERE are places in the world where the fuel for steam engines costs little or nothing. In most of the American steam saw mills the wet bark stripped from the logs, the "slabs" removed by the outside cuts, and the saw dust—all valueless, or nearly so, for any other purpose—are burnt under the boilers, and in these mills the quantity of this kind of fuel is generally such that economy in its use is no object. "Bagasse," or crushed cane, is similarly burnt under the boilers of the Cuban and other sugar mills; and, even then, the refuse accumulates rapidly and uselessly. The "slack" burnt under colliery boilers has little, if any value, and costs only the trouble of collection and hoisting from the workings. When, by an Act of Parliament, the London coal merchants were compelled to screen their coal and deliver it in sacks, they were at a loss to know what to do with the screenings. Nobody, it was thought, would take them as a gift. However, a value of 4s. a ton. was at length placed upon them; and, by and by, through careful firing, and, in some cases, with the aid of Jukes' endless revolving grate, "slack" was found to answer almost if not quite as well for steam boilers as the largest and finest screened coal. The majority of the metropolitan water companies, brewers, and others now burn it for steam purposes; and very fine coal, too, is now carbonised at nearly all our gasworks. The price of slack has gone up in consequence to 10s., 11s., and even 12s. a ton, at which figures, even, economy in its use is already desirable. Something has been said, lately, about burning the petroleum oil, now being collected in America, but, although this substance costs no more originally than would water raised by the same means (that is to say, by digging wells and pumping through short lifts), its freight over sea, and other charges, must render it somewhat expensive, even if steam boiler furnaces can be successfully adapted to its use. In the latter respect we do not, indeed, apprehend any substantial difficulty, and, providing the supply is so abundant as to cause extensive competition, so as to break up the monopoly which it is now sought to maintain in the coal oil trade, we may, perhaps, look for oil fires under our steam boilers at a day by no means distant.

Cheap fuel, however, is by no means favourable to mechanical improvement in the steam engine. The comparative economy of the Cornish engine has been due to the stimulus to improvement, arising from the dearness of fuel in the stanniferous duchy. The steamship companies have obtained heavy subsidies from Government, and reconciled themselves to enormous prices for coal on distant stations. At Panama coal is worth £4 a ton, although the banks of the Dagua river, emptying into the Bay of Choco, a few hundred miles distant, are represented as being filled with coal. In the East the Peninsular and Oriental Company pay 50s. a ton for coal delivered at Aden, and probably £3 is under the average cost of all the coal burned by all their steamers running beyond the Isthmus of Suez. Yet good coal, which the company, it is understood, however, will not use, is raised to the extent of 1,000,000 tons a year in New South Wales, a short distance north of Sydney, and at a cost of less than 20s. a ton. The Labuan coal, also, mined in the island of that name, near Borneo, is reported to be of excellent quality, and while it has been heretofore supplied in driblets to the steamers it is now about to be worked on an extensive scale, and at a price which will doubtless yield fortunes to its owners, who have but little competition to fear. In the meantime the British public are made to pay not only for the coal but for all other expenses connected with running some of the company's steamers, they having, as the chairman has informed the shareholders, taken care to obtain a subsidy which would insure that the Australian line, at least, should "pay," even without traffic. Without these subsidies, and with the present class of marine engines, distant steam navigation would be commercially impracticable. As it is, marine engine economy should be carried to the farthest practicable limit.

Steam engine economy depends upon the conditions, taken collectively, of first cost, cost for fuel, and cost of attendance and repairs. A Cornish engine may be economical in fuel and repairs, but a first-class Cornish pumping engine, capable of exerting 375 effective horse power in regular work, costs £14,000, the interest of which sum, at 5 per cent., is alone equal to the cost of 700 tons of coal at £1 per ton, representing 1¼ lb. per effective horse power per hour, for 10 hours daily, throughout a year of 313 working days. Our London water companies pay about 11s. a ton for "slack," so that, at this price, the interest alone would represent about 2¼ lb. coal per hourly horse power, throughout the year, working 10 hours daily. The coal burnt, taking a duty of 80 millions per cwt., is about 2·8 lb., so that, if we assume interest on first cost as being taken together with the actual cost of the fuel (to economise which fuel the great first cost was incurred), we should have, as the equivalent in coal, 5·3 lb. per horse power per hour. In the long run, therefore, and with coal or slack at 11s., it is doubtful if the Cornish engine is really more economical than other pumping engines of less expensive construction, even if they required one-third or one-half more fuel for a given power. A locomotive, exerting 375-horse power with an expenditure of 3 lb. or 3½ lb. fuel per hourly horse power, costs but £2,500, even including a tender worth £500, and the interest on this sum is but £125, while the average repairs of a locomotive, exposed as it is to severe use, are hardly £300 per annum, so that, were the same kind of fuel burnt in both, the locomotive engine would be considerably more economical than the Cornish engine as worked in London.

Theoretically, the most economical steam engines are those in which high pressure steam is used, expanded to a great extent and condensed by a surface condenser so as to return distilled water to the boilers. In order to work steam highly expansively, the cylinder must be protected—not so much from external radiation as from internal cooling—by steam jacketting, and, possibly, by superheating. Then, again, steam loses a great deal of its heat and force

in the very act of expansion. With a boiler in which the pressure of steam is 200 lb. and upwards per square inch, the hand may be held in the water escaping at the gauge cocks, notwithstanding that its heat, before leaving the boiler, was such that the flesh would drop from the bones if held for an instant in it. With dry steam, without the presence of water, the hand may be held in steam escaping at from 20 lb. to 50 lb. per square inch, the coolness of the escaping jet being wholly due to its rapid expansion on issuing into the air. It is a question whether any of our tables, giving the densities and temperatures of steam of different pressures, are exactly applicable to steam when separated from, or, rather, taken into a separate vessel from the water from which it has been generated. Steam from water at, say, 300 deg., must, while it is in the same vessel as, and in contact with the water from which it has been generated, have the same temperature as the water itself; steam may, however, while yet in contact with (but accumulated above) the water, be superheated to almost any extent. Mr. Elder, of Glasgow, and others have found that while the steam—in a boiler provided with a steam chamber around the uptake—had the same temperature as the water at the water level, it was 30 deg. or so hotter at a foot above the water level, growing gradually hotter until, in the upper part of the uptake, it was nearly or quite 150 deg. hotter than the water from which it had been generated. The superheat had been applied above the water, and as steam is a bad conductor of heat, this heat had not been communicated to the water below. The superincumbent steam could not have been colder than the water from which it had disengaged itself; at least, in that case, the heated water would have immediately communicated its heat upwards to the steam. Steam, however, when experimented upon out of communication with the water from which it has been raised, may not, as we have said, exhibit the same relations of pressure to temperature as given in the tables. If, however, we admit that it does, the abstraction of temperature and consequent condensation of the steam in the cylinder is undeniable. To prevent this condensation no amount of external lagging—whether of felt or of wood—will avail. Steam jackets will render substantial service, and so will superheating. It is becoming more and more the practice to expand steam from a high pressure to a low-pressure cylinder, and the right point for superheating appears to be during the passage of the steam from one cylinder to the other, a plan patented and adopted by Mr. F. H. Wenham some years since. By this plan not only is the tendency to overheating, or injurious superheating corrected, but less heat escaping at the uptake is required, and thus more of the furnace heat may be utilised—where it should be—in the boiler itself. In any form, however, superheating apparatus is somewhat expensive, both in cost and in maintenance. So, more especially, with surface condensers, which are being applied not only to marine engines, but to land engines, where the feed water is not good. The surface condenser, besides returning distilled water to the boiler, does not require so large an air pump, and thus a smaller opposing resistance in that quarter is encountered. With high expansion, too, less steam is required to be condensed, the necessary quantity being still further reduced by superheating, it being well known that superheated steam, of any given pressure, is condensed with less water than ordinary steam.

The whole question of high pressures, expansion, superheating, and surface condensation, is one of a more or less increased cost for original construction and in repair. Where the interest on this cost is not greater than the saving to be effected, or, in other words, where the value of fuel is such as to warrant the increased outlay at the start, those means of economising steam are being pretty carefully considered by our engine makers and manufacturers. High-pressure engines, nevertheless, are of considerable antiquity—as old as Trevithick at least. So high and low pressure engines date from Hornblower's time, and Woolf did much—more than fifty years ago—to extend their use. Superheating was practised and recommended in 1827, by Mr. Howard, of Rotherhithe; surface condensers, originally patented by Watt, were employed by David Napier forty years ago, and by Mr. Hall in 1834. Indeed, there is nothing new about the steam engine; yet, by means of better combinations and better workmanship, we are at last making a nearer approach to the ultimate economy of steam.

THE PATENT OFFICE LIBRARY.

The present condition of the library of the Patent Office, in Southampton-buildings, is deplorable. As a library, it was full three years or more ago. Every inch of shelving was occupied. A few visitors only could be comfortably accommodated at a time, each with a seat, a few inches of elbow room, and a support for the opened volume before him. Happily for their own comfort the visitors had not then become very numerous. But the books were accumulating all the time. They began encroaching upon the tables; they were piled upon the floor; they were made to occupy curious contrivances in carpentry in the narrow passages. The apartment itself, a sort of tunnel of some length but inconsiderable breadth, has finally been divided longitudinally by a consolidated wall of bound books, piled in ever so many vertical courses. Into the narrow gorge on either side the scanty light from the distant single window penetrates feebly. We have often shuddered at the thought of a stout searcher of specifications getting wedged there. How ever would he be got out? Already the books are being stacked in a formidable erection in the outer hall, where, of course, they are of no service to visitors. They have not, indeed, being taken out of the brown paper parcels in which they came from the publishers. In the meantime almost all facilities for reference in the library itself are out of the question. Nothing, it is true, can exceed the obliging zeal of the attendants, but only an acrobat could properly get at, open, and read the books. When, as generally happens on a Saturday morning—the time of publication of the week's specifications—the elbowing of even a dozen visitors is superadded, the pressure is something extraordinary. This should not be. Whatever may be the injunctions to patience elsewhere, the library of the Patent Commissioners should not impose a perpetual penance upon those who habitually visit it. Everything connected with the grant of letters patent pertains to one of the highest prerogatives of the Crown, and our patent system has been in existence for nearly two centuries and a half. The present accommodations on the premises in Southampton-buildings are not only wholly inadequate to the wants of those who have occasion to resort there, but are altogether beneath the dignity of a great national establishment. The Patent Office reports show an annual surplus, moreover, of £20,000 extracted from the inventive talent of the land. Must inventors, their attorneys, and all others who may have occasion to consult the most valuable collection of technical works in the kingdom, be forced to creep, crawl, jostle, and stumble through a national library which, in all points of accommodation, would suffer in comparison with a second-hand book shop in Newgate-street? We hope not. The *Times*, seeking the total abolition of patents, might urge that the Patent Office library be left to neglect. But in this case, even if her Majesty were to abolish all patent privileges whatever, the library which Mr. Woodcroft has collected would, in point of real utility, deserve as careful protection as that of the British Museum. The Patent Library approaches more nearly to that of the Academy of Sciences, and surely such a collection of works deserves some amount of consideration at the hands of Government. We trust that early legislation will provide for the erection of a suitable building for the present library, and of sufficient size to accommodate all probable additions. With a constantly accumulating surplus in the hands of the Patent Commissioners, a surplus representing the exactions of our patent law and the forced contributions of inventors themselves, we trust it will not be long before we have a building worthy of the invaluable collection of works now forming the Patent Library.

LITERATURE.

Metallurgy: the Art of Extracting Metals from their Ores, and Adapting them to Various Purposes of Manufacture. By John Percy, M.D., F.R.S., Lecturer on Metallurgy at the Government School of Mines;—Fuel, Fire-Clays, Zinc, Brass, &c. With Illustrations chiefly derived from Original Drawings, carefully laid down to scale. London: John Murray, Albemarle-street, 1861.

[Second Notice.]

A very cursory glance at this volume is sufficient to show that it would be perfectly vain to attempt, within the limits of a review suitable for our columns, a critical survey of what are really the most important portions of it—viz., the detailed descriptions of the processes employed here and abroad in the extraction of metals from their ores, and of the apparatus used in carrying out those processes. These descriptions are so numerous, and so elaborately developed, that no single person, probably, will ever even read them all, much less attempt to sit in judgment upon their merits. Nor is it at all desirable that any single person should do so, since their obvious value lies, not in informing the general student, but in communicating to our practical metallurgists a deeper knowledge of the various branches of their art, each in his own particular sphere. Nor is it at all possible even to include within the scope of our present remarks those copious and multiplied chemical investigations and analyses, of an original character, with which the author has enriched his work. All we can say in reference to these parts of Dr. Percy's book is, that they constitute what is manifestly the most connected and valuable body of metallurgical knowledge ever amassed, either in this or any other country; and that they must necessarily secure for the author a splendid reputation. We should not say this if mere industry were alone sufficient for the production of such a work; but in all his disquisitions upon chemical actions and transformations, and no less in his critical examinations of the views of some of the most distinguished continental writers on metallurgy, he has displayed knowledge and capabilities which must command for him an unrivalled eminence, at least for some time to come.

It must not be supposed, however, that the whole value and interest of the present volume lie in those parts of the work just mentioned. On the contrary, the author has contrived to surround these technical and vital portions with considerations and suggestions of a much more general character, and this he has accomplished to such an extent that our present difficulty in noticing the work consists in compressing our remarks upon the chief of these into the space at our disposal.

The chapter on Fuel treats most copiously of its calorific power; of the kinds of wood employed as fuel, their composition, weight, treatment, &c.; of the composition and preparation of peat; of the composition and qualities of the various descriptions of coal; of charcoal, and the means of manufacturing it in various countries, and of both wood and peat; and of the composition, properties, and manufacture of coke. All these subjects are discussed with great fulness, and illustrated with engravings wherever necessary. In this chapter several subjects of great interest are considered. The first of those which we shall notice relates to that very curious question—"What is coal?" Our readers will remember the celebrated trial that took place in Edinburgh a few years ago for the purpose of deciding whether the Torbanehill mineral was or was not coal; and they will remember also that, although the jury ultimately decided that it was, the evidence of scientific men was found to be so contradictory that the judge was compelled to dismiss it altogether. Since that period the general question has undergone much discussion both here and abroad, but, as now appears, with no useful result; for we find Dr. Percy distinctly declaring that, in the present state of science, it is impossible to propose an exact definition of the term "coal," just as we found it impossible in our previous article to propose an exact definition of the term "metal," and for precisely the same reason. The nearest approximation to a definition of coal which the author can frame is the following:—"Coal is a solid mineral substance, more or less easily combustible, varying in colour from dark brown to black, opaque—except in extremely thin slices—brittle, not fusible without decomposition, not sensibly soluble in ether, benzole, chloroform, or turpentine; not containing sufficient earthy matter to render it incapable of being applied with advantage as a source of heat in ordinary fireplaces or in furnaces." This description would certainly exclude resinous matters, bitumen, and peat; but that it is a "description," and not a "definition," cannot be doubted. It certainly seems to be true, however humiliating it may appear, that notwithstanding all our scientific progress—nay, because of that very progress—we are unable to give a clear and compact definition of substances with which the experiences of every hour makes us familiar. When one of our foremost philosophers undertakes to tell us what "coal" is, he is obliged to write, as we see above, several lines of description, and to introduce into them such phrases as "more or less" this, "varying in" that, "except" in the other, and "not" several other things!

In this chapter on fuel Dr. Percy speaks very urgently upon a subject to which, if we mistake not, we drew attention several months ago, viz., the enormous waste of coal-slack in connection with the South Staffordshire mines. There is an enormous amount of this slack annually raised and wasted, and an enormous amount also left underground, because it happens to be a coal which, when in the state of powder, will not yield a coherent coke when heated in the usual way. In the *Colliery Guardian* of July, 1861, it is stated, on the authority of Mr. Nicholas Wood, that the waste at the Hetton and Black Bay collieries amounted to 160,000 tons, showing that the evil is by no means confined to South Staffordshire. It is of the latter district, however, that Dr. Percy speaks in the strongest terms, alleging that it is no libel upon it to assert that its magnificent beds of coal have been most barbarously treated. "The pits have generally been worked by contractors, called butties, under the superintendence of viewers, called ground-bailiffs. In consequence of the rapacity and rascality of many of the former, and the ignorance, inattention, and fraudulent connivance of many of the latter, an enormous amount of coal has been irremediably lost to the nation. Even at the present day the South Staffordshire colliery-viewers are frequently very imperfectly educated for their responsible duties, and the system of colliery management which still extensively prevails in this part of the country is a disgrace to the age." But the chief cause of loss is, of course, the difficulty of converting the slack into coke in a profitable manner; and, as Dr. Percy says, there is no doubt that, should any person be so fortunate as to succeed in converting this at present worthless material into good coke at a moderate cost, he would realise a large fortune, and he would, moreover, have the satisfaction of prolonging the industrial life of South Staffordshire, which has already began to suffer from the exhaustion of its fuel.

In 1854 a patent was taken out by Mr. Dawson for converting coal-dust and coke into solid blocks of fuel. The dust, moistened with water, was pressed into a cast iron box having a tightly-fitting cover, and the whole was exposed to a temperature of from 300 deg. to 700 deg. Fah. An experimental oven was erected near Whitechapel, and at Dr. Percy's request Mr. Dawson operated upon some of the thick coal-slack from West Bromwich, but the result, we are told, was unsuccessful. The author gives illustrated descriptions of various kinds of coke ovens, some of which are stated to be well adapted to this purpose, and he also reviews briefly all the multiplied patents which have been taken out with a view to its accomplishment, showing that several persons have not neglected to re-patent the inventions of others over and over again, and even their own more than once in some instances—so strongly does the protective spirit prevail over some men! But, as the author truly remarks, if persons will thus squander their money in spite of the marvellous facilities which, thanks to our excellent guardian, Mr. Bennett Woodcroft, now exist for obtaining gratuitous information on the subjects of patents, they have chiefly themselves to blame. The extent to which the thing is nevertheless done is really curious, and quite excites the irony of our author. "This gentleman," he says in one place, referring to Mr. J. T. Smith, who patented the manufacture of coke from "breezes" mixed with tar—"this gentleman acted wisely in *not* proceeding with his application." In another place he says, "Mr. Jabez Church obtained a patent for *Bethell's process*," with the addition of certain other things, and adds, "The patentee may be assured that his title to the exclusive right of this washing process with the object declared is not likely to be disputed, at least by persons possessing an elementary knowledge of chemistry." Again he says, "At the end of the same year (1857) Bethell's process was again patented by Carl Buhring." . . . "Mr. Jabez Church, acting on the principle of killing two birds with one stone, has combined in his single patent the two processes previously patented by Bethell and Bleibtreu." . . "In 1856 Mr. Budd's process was again patented not less than three times—the first time by A. Perpigna; the second time by Mr. R. A. Brooman, who asserts that the distinctive feature of his invention is 'to reduce the materials to a powder before mixing them, instead of first combining them and then reducing them to powder;' and the third time to Mr. L. S. Magnus. In 1858 a provisional specification of the same process was filed by Messrs. Yelverton and Bowen, who proceeded no further in the matter, and prudently retained the money which otherwise would have been expended in vain." After describing the coking oven of Messrs. Appolt, and stating that, according to the inventors, the cost is less in proportion to yield than in other coke ovens, he adds gravely that inventors are apt to be sanguine, and often in good faith ascribe merits to their inventions which experience proves either to have had no existence, or at least to have been much exaggerated: "We must, therefore, be cautious in admitting, without further confirmation, all the advantages enumerated by the Messrs. Appolt in favour of their oven."

The utilisation of the waste heat generated in certain manufacturing operations is another subject to which the author has given useful attention, and concerning which he offers important suggestions. There are two ways in

which heat is wasted in the coke manufacture; first, the direct loss by the escape of the heat actually developed during the coking process; and, secondly, the indirect loss by the escape, unburnt, of the carbonic oxide, hydrogen, and marsh gas existing in the gases which escape from the ovens. It should be observed, however, that these combustible gases are mixed with so large a proportion of carbonic acid and nitrogen, that it is not possible, according to Dr. Percy, to burn them *perfectly* by atmospheric air. With regard to the utilisation of the heat actually developed, however, and usually allowed to escape uselessly from the ovens, there can be no real difficulty; in fact we are told that a successful application of these gases to the heating of steam boilers has long been in operation at Seraing, and a description of the arrangements adopted for the purpose, derived from Valerius, is given by Dr. Percy. Methods of keeping up a uniform supply of heat to the boiler, notwithstanding the successive drawing of the furnaces, are, of course, employed, and Valerius states that the following interesting practical results are obtained from the combustion of the gases (for this is secured) and from the waste heat of three rows of ovens, containing eight each, a boiler being fixed over each row:—The combustion of the gases from thirteen ovens takes place at the same time, while the remaining ovens only contribute to the result by yielding sensible heat. Sufficient steam is raised for a condensing blowing engine, which works expansively at an average pressure, and supplies blast to two large furnaces, in which coke is the fuel used, and for a small steam engine of 10-horse power, which raises the charges on an inclined plane to the tunnel heads of these furnaces. The diameter of the blowing cylinder is 7½ft., the length of the stroke 8ft., the number of revolutions per minute 10, and the pressure of the blast 3¾ lb. on the square inch—results which, according to calculation, require 117-horse power. The saving of fuel thus effected is estimated at between nine and ten tons of coal daily. We commend these results to our readers.

The methods by which the waste gases of blast furnaces are utilised in this country and on the Continent are reserved by Dr. Percy for consideration in his future volume on "Iron, &c."; but, as furnaces are now expressly constructed for the purpose of generating carbonic oxide to be applied as fuel in various metallurgical operations, and as he thinks it probable that they may be adopted with advantage in this country, he describes two furnaces of this kind in the present volume in order that practical British metallurgists may become acquainted with their construction. The first of them is in use in the Mint and the Royal Porcelain Manufactory at Berlin; and the other at Ekman's Ironworks in Sweden, where it is used for reheating slabs and bars of iron. It is not practicable to describe these furnaces verbally, without the illustrations which Dr. Percy furnishes; but this is of no importance, because the price of the book before us is so moderate that no manufacturer interested in the subject will fail to procure it if he desires the information given. The author thinks both descriptions of furnace likely to prove efficient for the consumption of the small free-burning coal-slack before spoken of. As long ago as 1848, as soon as he received the drawings of the latter furnace from Mr. Ekman, Dr. Percy submitted them to the inspection of several ironmasters in South Staffordshire, but could not induce any of them to incur the expense of building a furnace for trial. Whether any have been since erected in this country he is not aware; but if it be true that the slack now wasted can be economised by means of them, they would certainly amply repay any one who would make the experiment. At any rate the furnace would be valuable for reheating purposes. Mr. Ekman assured the author that sufficient heat may be generated in it to melt wrought-iron by the hundredweight. The atmosphere of the body of the furnace may be made either *oxidising* or *reducing* at will, by suitably regulating the blasts.

There is yet one other suggestion of the author's concerning the utilisation of waste heat to which we must invite attention. In his observations on alleged improvements in the extraction of "zinc," near the end of the volume, he tells us that he has stood by the hot blast stoves of some of the great South Welsh ironworks, which are heated exclusively by the combustion of the waste gases of the blast furnaces, it has often struck him that this mode of heating would be peculiarly well adapted to zinc reduction furnaces. The temperature is remarkably uniform through the interior of these stoves, and there would appear to be no difficulty in raising it to a degree amply sufficient to reduce oxide of zinc; for he is assured that by suitably regulating the supply of gas and atmospheric air the fire-brick lining of the stoves even may be melted. It would be possible, he thinks, with the use of this gaseous fuel, to construct a zinc reduction furnace of large dimensions, either on the Silesian or Belgian principle, which should combine the most favourable conditions for the extraction of zinc from its ores, namely, a sufficiently high and perfectly equable temperature, with the capability of regulating it to a nicety.

Before passing finally from this valuable chapter on fuel, we must advert, with all possible brevity, to one or two other subjects touched upon by the author, and which will excite the interest of our readers. One of them is incidental to the author's description of the distillation of pit-coal at the Sulzbach Ironworks, and shows, as he says, how completely a great practical discovery may obtrude itself, as it were, upon the attention of men, and yet be unperceived. From the account of the Sulzbach Works, published by Gensanne, in 1770, it appears that the chamber in which the coal was distilled was essentially a gas-retort; and the gas which issued in a continuous current from a certain pipe must often have taken fire, and produced a luminous flame: but the idea of applying that gas to the purpose of lighting seems never to have occurred to those who observed it. Large gasworks were, in fact, in daily operation at Sulzbach, and yet the merit of the invention was reserved for Murdoch more than twenty years afterwards.

The last subject suggested to us by this chapter, which we shall mention, relates to that extremely absurd practice which the Admiralty engineers, as well as some other people who are not too well instructed in science, foolishly continue to pursue, viz., the practice of estimating the comparative evaporative powers of different kinds of coal by burning them all, one after the other, in one particular boiler. Dr. Percy puts the matter in this form:—"A particular boiler—it may be an old one—is selected for the purpose of experiment, and set over a particular fire-grate, &c. We will suppose two varieties of coal, say A and B, to be tested in this apparatus, and that, weight for weight, A is found to yield more steam than B; whereupon A is pronounced decidedly superior as a steam coal to B. But it is quite possible to conceive that, under another boiler, and with another form of fire-grate, &c., B might be found far superior to A. Experiments, indeed, have in some cases established that such is actually the case." It is only just to Mr. C. Wye Williams to state that all this was pointed out and insisted upon by him long ago. On one occasion, in particular, that we happen to remember, the disgraceful boiler used for the purpose of testing coal in Woolwich Dockyard excited his animadversions, and the absurdity of testing coals of different characters under the one set of circumstances was mentioned by him to the authorities. Whether Mr. Atherton, who *must* know perfectly well how fallacious such a test is, has since inaugurated a better system, we are unable to say; but it is very probable that he has not, for it is not an easy matter to reform old and bad habits in her Majesty's dockyard establishments. That the practice always has been, and always will be, intrinsically wrong, however, must not be lost sight of. But, on the other hand, it must not be forgotten that it is not always the highest evaporative power attainable from a coal under the most favourable circumstances that the Admiralty and other purchasers of fuel wish to ascertain. This information, however valuable it might be for some scientific purposes, is a theoretical rather than a practical result. What the proprietors of steamships want to discover is the particular class of coal that will produce the greatest evaporative effect *in the boilers of their vessels:* and the only thing they can ordinarily do in order to find out this is to select a boiler fairly resembling those in which the fuel is to be burnt, and try all the specimens of coal tendered to them in that one boiler. In a case like that of the Admiralty, however, where the consumption of coal is so prodigious, no pains should be spared to select the testing boiler judiciously, and nothing that is done in the way of experiment should be allowed to go forth unaccompanied by proper explanations and cautions.

(To be continued.)

RAILWAY MATTERS.

THE report of the Midland directors states that the traffic has increased £1,794 during the past half-year. The receipts for coaching amount to £105,221, showing an increase of £7,045; for minerals to £250,711, showing a decrease of £271; for merchandise to £426,854, showing a decrease of £5,678; for cattle to £17,382, showing an increase of £698. The available balance for dividend is £433,473, including £1,985 from the previous half year. The directors recommend the declaration of the following dividends (less income-tax), payable on the 1st of March, being at the same rates as those declared at the corresponding period of last year, namely, £3 10s. per cent. on the consolidated stock, £2 16s. 5d. per cent. on the consolidated Birmingham and Derby stock, £3 10s. per cent. on the consolidated preferential stock, £3 10s. per cent. on the Erewash Valley stock, and the usual dividends on the preference stocks, leaving a balance of £7,288. The completion of the portion of the Rowsley and Buxton line from Rowsley to Bakewell may be expected about the 1st of July next. It is expected that the Erewash Valley Extension to Clay-cross will be ready for passenger-traffic in a few weeks.

THE traffic receipts of railways in the United Kingdom amounted for the week ending the 1st of February, on 10,966 miles, to £172,171, and for the corresponding week of last year, on 10,853 miles, to £196,452, showing an increase of 213 miles and a decrease of £24,281. The gross receipts on the following fourteen railways amounted in the aggregate, on 6,406 miles, to £357,261, and for the corresponding week of 1861, on 6,274 miles, to £379,439, showing an increase of 132 miles and a decrease of £22,178. The decrease on the Eastern Counties Railway amounted to £196; on the Great Northern to £2,352; on the Great Southern and Western to £97; on the Great Western to £979; on the Lancashire and Yorkshire to £4,854; on the London and North-Western to £6,918; on the Manchester, Sheffield, and Lincolnshire to £1,734; on the Midland to £2,378; and on the North-Eastern to £3,794 —total, £23,302. But from this must be deducted £5, the increase on the Caledonian; £319 on the London, Brighton, and South Coast; £509 on the London and South-Western; £185 on the North British and £106 on the South-Eastern—together, £1,124; leaving the decrease, as above, £22,178. The goods and mineral traffic on those lines amounted to £197,997, and for the corresponding week of 1861 to £219,667, showing a decrease of £21,670. The receipts for passengers, parcels, &c., amounted to £159,267, against £159,772, showing a decrease of £505. The traffic receipts on 66 other lines amounted, on 3,660 miles, to £114,910, and for the corresponding week of last year, on 3,579 miles, to £117,013, showing an increase of 81 miles, and a decrease of £2,103. The falling off in the traffic of the past week as compared with the corresponding period of 1861 is almost entirely confined to the goods traffic.

THE report of the Lancashire and Yorkshire directors states that the expenditure on capital account for the half-year amounts to £193,590. The receipts of the company during the last half-year amount to £982,760, and for the corresponding half of 1860 to £1,031,631, showing a decrease of £48,871. The disbursements amount to £430,518, against £417,274, showing a decrease of £13,244. The balance of revenue applicable to the payment of dividend on the consolidated ordinary stock of the company is £323,481, and the directors recommend to the proprietors to declare a dividend out of this amount at the rate of 5 per cent. per annum, less income-tax, which will leave a balance of £21,141 to be carried forward to the next half-year.

THE North-Eastern Company's investment in the Tyne Docks already amounts to £600,000, on which 4 per cent. is paid. At the last meeting of the shareholders the directors were authorised to construct a line through the Team Valley to Gateshead, and also a branch railway to connect the company's Pensher branch with shipping places in the river Wear. The directors were authorised to proceed with a bill for the continuation of the Market Weighton Branch to Beverley, provided that £40,000 of the company's 4 per cent. stock was subscribed for by responsible parties.

THE Blackwall dividend is to be at the rate of 3½ per cent. per ann.

THE London and North Western dividend is to be at the rate of 4½ per cent. per annum.

THE London and South-Western dividend is to be at the rate of 5½ per cent. per annum.

THE Wansbeck Valley line is very soon to be partly opened from Morpeth to Scotch Gap, a distance of twelve miles.

THE Hereford, Ross, and Gloucester proprietors have approved the Bill for the sale of their line to the Great Western.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

2438. ETIENNE ROCHE, Rue d'Enghien, Paris, "A new medicinal preparation applicable internally for rheumatism and other disorders."—*Petition recorded 30th September*, 1861.

2935. THOMAS WILLIAM DAVENPORT and SAMUEL COLE, Balsall Heath, Worcestershire, "Improved compositions to be used in making buttons, beads, miniature and picture frames, and other articles susceptible of being moulded in a plastic material."—*Petition recorded 22nd November*, 1861.

2942. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "An improved apparatus for the multiplication of motive power."—A communication from Eugène Constant Marie Bonnier, Ile Bourbon (Indian Sea). —*Petition recorded 23rd November*, 1861.

34. JAMES HOWDEN, Glasgow, Lanarkshire, N.B., "Improvements in steam engines and boilers."—*Petition recorded 4th January*, 1862.

39. CHARLES WILLIAM SIEMENS, Great George-street, London, "Improvements in the means and apparatus employed for insulating and protecting telegraph conducting wires, and in apparatus for working the same."—Partly a communication from Dr. Werner Siemens, Berlin, Prussia.

68. BENJAMIN THOMPSON, Birmingham, "Improvements in ordnance and fire-arms, and in projectiles to be used therewith." A communication from Edward Heaton, Newhaven, Connecticut, U.S.—*Petitions recorded 9th January*, 1862.

74. FREDERICK MOORES, Warrington, Lancashire, "An improved method of obtaining motive power by means of water wheels."—*Petition recorded 10th January*, 1862.

86. WILLIAM WILKINSON, Charlotte-street, Fitzroy-square, London, "Improvements in ornamenting and decorating metals, glass, porcelain, parchment, and other skins, and in the materials and ingredients employed therefor, also in protecting silver and gold on said materials, and on surfaces or plates of glass or metal, or plates of glass and metal combined, applicable to works of art, furniture, jewellery, and other articles of a useful and ornamental character."—*Petition recorded 11th January*, 1862.

102. EBENEZER WILLIAM HUGHES, Parliament-street, Westminster, "Improvements in malleable cylinders used in engineering and architectural structures."

110. JOSIAH HARRIS, Ess Hill House, Newton Abbot, Devonshire, "An improved semaphore target marker."—*Petitions recorded 14th January*, 1862.

114. THOMAS TIMMINS and THOMAS SIMMONS, Birmingham, "An improved bath combining in itself the advantages of the hot air or Turkish bath with the vapour, slipper, hot and cold water shower bath."

116. HENRY DUNCAN PRESTON CUNNINGHAM, Bury, near Gosport, Hants, "Improvements in means and apparatus for protecting screw propellers from entanglement or being fouled by ropes or other bodies, also improvements in means or apparatus for closing up the screw aperture."—*Petitions recorded 15th January*, 1862.

117. JOHN BROOKE, Leeds, Yorkshire, "Improvements in the form of lubricators."

121. WILLIAM TRISTRAM, Bolton, Lancashire, "Certain improvements in power looms for weaving."—*Petitions recorded 16th January*, 1862.

125. JOHN MARTIN ROWAN, Glasgow, Lanarkshire, N.B., "Improvements in the construction of steam hammers."

127. NATHAN THOMPSON, St. Paul's-road, Camden Town, Middlesex, "Improvements in apparatus for stopping bottles."

129. ROBERT ROMAINE, Devizes, Wiltshire, "Improvements in apparatus to be used in cultivating land by steam power, and in steam boilers used for agricultural and traction purposes."—*Petitions recorded 17th January*, 1862.

131. THOMAS EMMOTT and JOSEPH TRAVIS, Vale Mills, Oldham, Lancashire, "Improvements in the manufacture of velvets, velveteens, and other similar piled fabrics."

133. EDWARD DAVIES, Warrington, Lancashire, "Improvements in apparatus for gauging and cutting soap."

134. WILLIAM HELME, Caldbeck, Cumberland, "A new or improved fire-lighter."

135. JAMES JOHN STEVENS, Darlington Works, Southwark, Surrey, "Improvements in 'point' indicators for railways."—*Petitions recorded 18th January*, 1862.

145. THOMAS WILLIAM JOBLING, Point Pleasant, Northumberland, "Improvements in the adaptation of locomotive engines to traction or haulage in mines."

147. EDWARD CHAMBERS NICHOLSON, Atlas Works, Lockfields, Surrey, "Improvements in the preparation of colours suitable for dyeing and printing."

148. JOHN WASHINGTON AGNEW, Windsor Chambers, Great St. Helens, London, "A new or improved kind of last capable of being adjusted to various sizes and to various shapes of toes." —A communication from Samuel Slater, London, Canada West.—*Petitions recorded 20th January*, 1862.

151. JOHN ADAMS KNIGHT, Symond's-inn, Chancery-lane, London, "Improvements in the permanent way of railways."—A communication from Hiram Carpenter, New York, U.S.

152. JEAN FURCY TOURRIER, Manchester-street, Manchester-square, London, "An improved method of, and apparatus for, warming adjoining houses by means of air chambers attached to grates in the party walls dividing such houses."

153. CHRISTOPHER BINKS, Gray's-inn, London, "Improvements in generating steam, in superheating steam, and in apparatuses employed therein."

155. HENRY BERNOULLI BARLOW, Manchester, "Improvements in machinery or apparatus for counting and indicating the number of revolutions of shafts or other articles, and for exerting power."—A communication from Arnold Caflish, Winterthur, Switzerland.

157. JAMES HYNDFORD RAWLINS, Hope Paper Mills, near Wrexham, "Improvements in machinery used in the manufacture of paper."—A communication from Oliver Woodworth, New London, Connecticut, U.S.

158. ALFRED JOSEPH MARTIN, High street, Bow, Middlesex, "Improvements in the treatment of fusel oil, and for various applications of the same to useful purposes."

159. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in street and road sweeping machines, parts of which are applicable to the separation of liquid from solid substances."—A communication from Victor Ferdinand Jeanneau, Cosne, France.

161. MICHAEL HENRY, Fleet-street, London, "Improvements in the mode of, and apparatus for, applying electricity to horology."—A communication from François Victor Guyard, Boulevart St. Martin, Paris.—*Petitions recorded 21st January*, 1862.

163. LOUIS MARTIN, Rue Gaillon, Paris, "Improvements in the treatment of mineral oils, and in the apparatus connected therewith."

165. FRANCIS WILLIAM GERISH, East road, City-road, London, "Improvements in printing presses."

166. EDMUND PAGE, Queen-street, London, "Improvements in laths for Venetian blinds, in painting such laths, and in raising and lowering Venetian blinds."

167. ALFRED JAMES BEER, Canterbury, Kent, "Improvements in the valves of steam and other motive engines."—*Petitions recorded 22nd January*, 1862.

172. JOHN WALLACE, Haldane's Mill, near Alexandria, Dumbarton, N.B., "Improvements in reaping machines."

174. WILLIAM HOOPER ROGERS, Crown-court, Old Broad-street, London, "Improvements in machinery or apparatus for cleaning coffee, rice, or any seed or grain having an outer hull and inner pellicle."—A communication from William Maxwell Greene, Tongoi, Chili, South America.

176. GEORGE ROGERS, Staines, Middlesex, "Improved mechanical arrangements for letting off water or other liquids from butts, vessels, or cisterns."

177. JOHN CRESSWELL JOHNSON, Nottingham, "Improvements in the manufacture of twist lace in twist lace machines."

178. ABRAHAM RIPLEY, Brook street, Lambeth, Surrey, "Improvements in the construction of pistons."

179. HENRY YATES, Cecil-street, Strand, London, "Improvements in machinery for bending, repairing, or renewing defective or damaged parts of iron rails."

180. JAMES GOWANS SERVICE, Glasgow, Lanarkshire, N.B., "Improvements in machinery or apparatus for cutting and scoring pasteboard and other similar material."—*Petitions recorded 23rd January*, 1862.

181. ALEXANDER WILLIAM WILLIAMSON, University College, London, "Improvements in tubulous boilers or steam generators."

182. JAMES HIGGIN, Manchester, "Improvements in machinery for retarding and stopping railway carriages."

183. JOHN CORNFORTH and BENJAMIN SMITH, Birmingham, "New or improved machinery for boring or drilling gun barrels and tubes and other articles having a cylindrical or prismatic figure, which said machinery may also be applied to other like purposes."

184. WILLIAM CLARK, Chancery-lane, London, "Improvements in the manufacture of artificial flowers, leaves, and fruit."—A communication from Joseph Dominique Alphonse Favier, Boulevart St. Martin, Paris.

185. JOHN LONGHURST, Ticehurst, Sussex, "Improvements in chains and chain cables."

186. JAMES ROCK, jun., Hastings, Sussex, "Improvements in common road carriages."

187. JOHN WARD GIRDLESTONE, Birkenhead, Cheshire, "Improvements in projectiles for fire-arms."

189. CHARLES GODFREY HALL, Regent-street, London, "Improvements in the manufacture of boots, shoes, and leggings."

190. Arthur Wallis and Charles Haslam, Basingstoke, Southampton, "Improvements in threshing machines."
191. John Alison, Brightland, Reigate, Surrey, "Improvements in apparatus for tilling land by steam power."—*Petitions recorded 24th January*, 1862.
192. Whitmore Baker, Downham, Norfolk, "Improvements in fire-arms, adapted to prevent their accidental discharge."
193. William Johnston, Glasgow, Lanarkshire, N.B., "Improvements in lamps."
195. Jean Claude Francois Mougin, Paris, "Improvements in barcelonnettes or cradles for children or for dolls."
197. Dickinson Edleston and Henry Gledhill, Halifax, Yorkshire, "Improvements in means, and apparatus for, finishing textile and other fabrics."
198. Edwin Augustus Curley, Green-terrace, New River Head, Clerkenwell, London, "Certain improvements in sewing machines."
199. John Wright, Rochester, Kent, "Improvements in constructing works below water."
200. Francois Joseph Lalmand Lefort, Bothey, Belgium, "Improved mechanical arrangements constituting a secret and invisible safety lock applicable to iron safes and other depositories."
201. Frederick Roberts, Maiden Newton, and Alexander Roberts, Frome Vauchurch, "Improvements in apparatus for ploughing or cultivating land."
203. Alexander Samuelson, Cornhill, London, "Improvements in hydraulic presses, and in the mode of working the same."—*Petitions recorded 25th January*, 1862.
206. Samuel Alfred Carpenter, Birmingham, "An improvement or improvements in covering and combining strips or bands of steel for crinoline or crinoline skirts."
207. Ralph Martindale, Handsworth, Staffordshire, "Improvements in globes and glasses to be used with hydro-carbon lamps."
208. Charles Weightman Harrison, Lorrimore-road, Walworth, Surrey, "Improvements in printing, stamping, embossing, perforating, and other like operations, and in the machinery or apparatus employed therein."
209. William Ore, Greenock, Renfrewshire, N.B., "Improvements in machinery or apparatus for the manufacture of sugar."
210. Joseph Smith, Spring-row, Keighley, Yorkshire, "Improvements in the construction of covered rollers used in machinery for preparing, roving, spinning, twisting, and doubling fibrous materials."
212. Thomas John Robotham, Burslem, and Nathan Hackney, Hanley, Staffordshire, "Improvements in purifying slip, glaze, and other potters' materials."—*Petitions recorded 27th January*, 1862.
216. James Hankins, Bristol, "A new composition or wash to be applied to marine and other steam boilers to prevent incrustation."
217. John Hunt, Birmingham, "An improvement or improvements in the manufacture of gas and other chandeliers."
220. Arthur Herbert Church, Great Portland-street, St. Marylebone, London, "Improvements in the means of preserving stone, brick, slate, wood, cement, stucco, plaster, whitewash, and colour wash from the injurious action of atmospheric and other influences, also in the application of colours to the surfaces of stone, brick, slate, wood, cement, stucco, mortar, clay, plaster of Paris, plaster, whitewash, and colour-wash, and in the retention of such colours thereon."
221. Charles Cullino, Downham Market, Norfolk, "Improvements in fire-arms."
223. George Henry Morgan and Edward Morgan, Grand Junction-terrace, Edgeware-road, London, "Improvements in carriages."
224. George Chapman, Rutland-street, Leicestershire, "Improvements in rotating circular knitting frames."
225. Gustave Joseph Nicolas de Ridder, Rue Pigale, Paris, "Improvements in railway carriages for the conveyance of travellers and goods."—*Petitions recorded 28th January*, 1862.
230. Thomas Clayton and William Smith, Knowlwood, near Todmorden, Lancashire, "An improved flyer."
232. Louis Alexandre Pulve, Passage des Petites Ecuries, Paris, "Improvements in fire-proof iron chests and strong boxes."
240. William Edward Newton, Chancery-lane, London, "Improvements in the boxes for the journals of railroad carriages and other axles."—A communication from Davis Henry Dotterer, Chicago, Cook, Illinois, U.S.
242. Matthew Collier, Failsworth, Lancashire, "Improvements in looms for weaving."—*Petitions recorded 29th January*, 1862.
246. Edward Alexander Ripplingille, Staple Hill, near Bristol, "Improvements in engines worked by steam or other fluid, and in pumps."
248. Henry Robottom and Richard Underwood, Robert-street, Hoxton New Town, London, "Improvements in watches and pocket chronometers."
250. William Clark, Chancery-lane, London, "Improvements in mechanical wrenches."—A communication from Messrs. Pierre Augustin Samuel and Auguste Toussaint Ozon-de-Verric, Boulevart St. Martin, Paris.
252. Adolphus Lahousse, Brussels, Belgium, "Improvements in the manufacture of wheels for wagons, locomotive engines, and other vehicles for railway purposes."—*Petitions recorded 30th January*, 1862.

Invention Protected for Six Months by the Deposit of a Complete Specification.

298. William Edward Newton, Chancery-lane, London, "Improvements in the manufacture of iron and steel."—A communication from John Gardner and Henry Richard Gardner, U.S.—*Deposited and recorded 4th February*, 1862.

Erratum

3202. For "George Tomlinson" read "George Tomlinson Bousfield."

Patents on which the Stamp Duty of £50 has been Paid.

333. Robert Tinkler, Penrith, Cumberland.—Dated 5th February, 1859.
380. Benjamin Burrows, Leicester.—Dated 10th February, 1859.
383. James Evans, Tarlton-street, Liverpool.—Dated 11th February, 1859.
342. Matthew Curtis, Manchester, and John Miller, Staleybridge, Lancashire.—Dated 7th February, 1859.
356. John Baldry Redman, New Palace Yard, Westminster.—Dated 8th February, 1859.
343. Joseph Lee, Monson-street, Lincoln.—Dated 7th February, 1859.
346. John Smith, Bradford, Yorkshire.—Dated 7th February, 1859.
406. William Edward Newton, Chancery-lane, London.—A communication.—Dated 12th February, 1859.

Patents on which the Stamp Duty of £100 has been paid.

441. George Mackay Miller and John Wakefield, Inchicore, Dublin.—Dated 28th February, 1855.
322. John Ramsbottom, Longsight, near Manchester.—Dated 12th February, 1855.

Notices to Proceed.

2449. John Adams Knight, Symond's-inn, Chancery-lane, London, "Improvements in the manufacture of boots and shoes."—A communication from Henry Port, New York, U.S.
2445. Robert Nightingale, Maldon, Essex, "Improvements in markers' butts or mantelets."
2447. John William Scott, Worcester, "Improvements in tools for the manufacture of leather and other rings, washers, and laces."—*Petitions recorded 1st October*, 1861.
2455. James Davis and Thomas Evans, Ulverstone, Lancashire, "Improvements in the construction of engines to be worked by steam, air, or gases."
2456. William Maltby, De Crespigny Park, Camberwell, Surrey, "Improvements in the manufacture of starch and starch gum."
2462. Charles Grey Hill, Commerce-square, High Pavement, Nottingham, "Improvements in machinery or in apparatus connected therewith in the manufacture of bonnet and cap fronts, rouches, and millinery or other trimmings."—*Petitions recorded 2nd October*, 1861.
2463. John Charles Dickinson, Blackburn, Lancashire, "Certain improvements in steam engines."
2467. Henry Law, Essex-street, Strand, London, "Improvements in machinery and apparatus for raising ships and other vessels out of the water, for the purposes of examination, cleaning, or repair, some of which are applicable to the docking of vessels for the same purposes."
2469. Robert John Ellershaw, Leeds, Yorkshire, "An improved machine for expressing oil."
2473. William Malam, Skinner-street, "Improvements in apparatus for the manufacture of gas."—*Petitions recorded 3rd October*, 1861.
2477. Charles Husson, Nantes, France, "An improved process for silvering looking glass in piles of several sheets superposed without interruption, which process consists in the use of a chemical powder."
2478. Adolphe David, jun., Nantua, France, "Improvements in preparing and fixing street and other inscriptions or lettering on metallic plates."
2480. George Knox, Skinner's-place, London, "An improvement in paper-making machines."
2486. Joseph Tweedale, Milkstone, Rochdale, Lancashire, "Improvements in machinery for preparing and spinning cotton and other fibrous substances."—*Petitions recorded 4th October*, 1861.
2487. John Lassley, Brown-Candover, Hants, "Improvements in the construction of ploughs, drills, scarifiers, and such like agricultural implements, the said improvements relating to the mode of guiding or steering the same."
2489. Ebenezer Partridge, Patent Axle Works, Smethwick, Staffordshire, "Improvements in hardening iron and steel, and a composition or substance to be employed therein."
2492. John Scott Collins, Liverpool, "An improved apparatus for reefing and furling the sails of ships and other vessels."
2494. George Nares, Portsmouth, Hants, "An improved method of effecting communication between places otherwise inaccessible to each other, by means of kites and an apparatus connected therewith."
2497. William Squire, Upper Montague-street, Bryanston-square, London, "An improved machinery for planing and shaping wood."—*Petitions recorded 5th October*, 1861.
2502. George Kelson Stothert, Bristol, "Improvements in condensing apparatus."—*Petition recorded 7th October*, 1861.
2505. Alfred Ford, Priory, Battersea, Surrey, "An improved method of forming waterproof fabrics by combining paper with woven or spun fabrics."—*Petition recorded 8th October*, 1861.
2523. William Palmer, Sutton-street, Clerkenwell, "Improvements in lamps and lamp wicks."—*Petition recorded 9th October*, 1861.
2539. Abraham English, Hatfield, Herts, "Improvements in reins or apparatus for preventing harnessed horses from falling."—*Petition recorded 10th October*, 1861.
2548. Samuel Ratcliffe Carrington, Stockport, Cheshire, "Improvements in hats and caps."—*Petition recorded 12th October*, 1861.
2573. Francis Bryan Baker, Sherwood-street, Nottingham, "Improvements in dressing or stiffening lace and other fabrics."—*Petition recorded 16th October*, 1861.
2588. Thomas Wild and Thomas Hodson, Heywood, Lancashire, "Certain improvements in the method of, and apparatus for, heating the 'feed-water' for steam boilers, and in employing steam produced by such means."—*Petition recorded 17th October*, 1861.
2632. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in apparatus for facilitating the passage of trains up steep gradients on railways."—A communication from Thomas Agudio, Turin, Italy.—*Petition recorded 21st October*, 1861.
2652. George Davies, Serle-street, Lincoln's-inn, London, "Improvements in railways, and in iron pavements and railways combined, parts of which improvements are applicable to the construction of railway chairs, and to cast iron pavements for ordinary streets."—A communication from Barzillai Coat Smith, Burlington, New Jersey, U.S.—*Petition recorded 23rd October*, 1861.
2727. James Lee Norton, Belle Sauvage-yard, Ludgate-hill, London, "Improvements in apparatus for raising water."—Partly a communication from William Aldon, Boulevart Bonne Nouvelle, Paris."—*Petition recorded 30th October*, 1861.
2743. Benjamin Mitchell, Greenwich, and William Brunton, Penge, Surrey, "Improvements in the construction of scissors and shears."—*Petition recorded 1st November*, 1861.
2855. William Henry Balmain and John Kean, St. Helen's, Lancashire, "Improvements in the manufacture of flowers of sulphur, and roll, and other forms of sulphur."—*Petition recorded 13th November*, 1861.
2935. Thomas William Davenport and Samuel Cole, Balsall Heath, Worcestershire, "Improved compositions to be used in making buttons, beads, miniature and picture frames, and other articles susceptible of being moulded in a plastic material."—*Petition recorded 22nd November*, 1861.
3078. Cromwell Fleetwood Varley, Fortess-terrace, Kentish Town, Middlesex, "Improvements in electric telegraphs."—*Petition recorded 4th December*, 1861.
3184. Joseph Henry George Wells, Sandhurst-villas, Binfield-road, Stockwell, Surrey, "Improvements in the method of and apparatus for pumping elastic fluids."—*Petition recorded 10th December*, 1861.
24. Edward Nugent, Brooklyn, Kings, New York, U.S., "Improvements in fire-arms."—*Petition recorded 3rd January*, 1862.
38. John Corlyon, Rolls-chambers, Chancery-lane, London, "An improved type machine."—*Petition recorded 6th January*, 1862.
69. Harry Barker, Belgrave, Leicestershire, "Improvements in safety lamps."—*Petition recorded 9th January*, 1862.
127. Nathan Thompson, St. Paul's road, Camden Town, "Improvements in apparatus for stopping bottles."—*Petition recorded 17th January*, 1862.
132. Thomas Newton, Manchester, "Improvements in sights for rifles."
135. James John Stevens, Darlington Works, Southwark, Surrey, "Improvements in 'point' indicators for railways."
138. William Louis Winans, Brighton, Sussex, "Improvements in the manner of mounting, and apparatus for manœuvring, cannon or ordnance on ships or vessels of war and floating batteries."—*Petition recorded 18th January*, 1862.
225. Gustave Joseph Nicolas de Ridder, Rue Pigale, Paris, "Improvements in railway carriages for the conveyance of travellers and goods."—*Petition recorded 28th January*, 1862.
298. William Edward Newton, Chancery-lane, London, "Improvements in the manufacture of iron and steel."—A communication from John Gardner and Henry Richard Gardner, New York, U.S.—*Petition recorded 4th February*, 1862.

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 8th February, 1862.

1622, 2d.; 1623, 3d.; 1624, 9d.; 1625, 10d.; 1626, 1s. 4d.; 1627, 3d.; 1628, 9d.; 1629, 9d.; 1630, 7d.; 1631, 3d.; 1632, 3d.; 1633, 1s.; 1634, 3d.; 1635, 3d.; 1636, 3d.; 1637, 10d.; 1638, 3d.; 1639, 7d.; 1640, 10d.; 1641, 3d.; 1642, 3d.; 1643, 9d.; 1644, 3d.; 1645, 1d.; 1644, 3d.; 1645, 9d.; 1646, 3d.; 1647, 3d.; 1648, 8d.; 1649, 3d.; 1650, 7d.; 1651, 3d.; 1652, 3d.; 1653, 9d.; 1654, 6d.; 1655, 3d.; 1656, 3d.; 1657, 6d.; 1658, 3d.; 1659, 3d.; 1660, 3d.; 1661, 6d.; 1662, 2d.; 1663, 3d.; 1664, 5d.; 1665, 1s. 2d.; 1666, 7d.; 1667, 6d.; 1668, 1d.; 1669, 10d.; 1670, 9d.; 1671, 11d.; 1672, 10d.; 1673, 3d.; 1674, 1s. 5d.; 1675, 3d.; 1676, 1d.; 1677, 7d.; 1678, 3d.; 1679, 9d.; 1680, 3d.; 1681, 10d.; 1682, 3d.; 1683, 3d.; 1684, 9d.; 1685, 2d.; 1686, 6d.; 1687, 3d; 1688, 3d.; 1689, 3d.; 1690, 7d.; 1691, 3d.; 1692, 3d.; 1693, 10d.; 1694, 6d.; 1695, 7d.; 1696, 3d.; 1697, 3d.; 1698, 5d.; 1699, 3d.; 1700, 10d.; 1701, 6d.; 1706, 2d.; 1660*, 2d.

*** Specifications will be forwarded by Mr. Bennett Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for The Engineer, *at the office of her Majesty's Commissioners of Patents.*

Class 1.—PRIME MOVERS.

(Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.)

1794. A. W. Harnett, *Guildford-street, Russell-square, London, "Steam engines, air engines, and pumps."—Dated 17th July*, 1861.

The inner surface of the cylinder and the outer surface of the piston and piston rod, all or either of them, are, according to this invention, to be so formed, by any mode of rifling, as to cause to be imparted to the piston a spiral movement when in motion.—*Not proceeded with.*

1797. J. Parker, *Bradford, and J. and B. Wells, Bowling, near Bradford, "Steam engines, boilers, furnaces, and apparatus applicable thereto."—Dated 17th July*, 1861.

The object of this invention is to obtain a more efficient or effective force of steam when applied as a motive power, or to economise the working of steam engines, and, consequently, to effect a saving in fuel; also to promote a better combustion of the gases. The invention consists in constructing the cylinders and pistons in such manner as to avoid dead points and friction, and to balance the pistons when in motion. Two or more cylinders of unequal diameters are cast together, side by side, opening to each other, with stuffing box covers at each end. The pistons are of diameters equal to the interior of the smallest cylinder, and of the same lengths as the interior lengths of the cylinders. The piston of the small cylinder has a longitudinal groove of suitable size and form to receive a corresponding longitudinal feather, tongue, or projection formed on the other piston or pistons, when their surfaces are placed together and caused to roll in contact with each other in the cylinders. The piston rods or axes passing through the stuffing boxes are geared together outside by equal wheels. The feather or tongue is made to project from the body of the piston, according to the area required for steam in the cylinder. Steam is admitted to the larger cylinder through a double-action conical equilibrium valve at one junction of the cylinder, where it acts upon the feather, tongue, or projection, causing the piston to rotate thereon, and is exhausted at the other junction, from which it may be conducted to another similar cylinder and piston to act in like manner, and thence, by means of a bracket wheel, returned to the lower part of the boiler. The ends of the pistons are received, and projections are formed, in the covers to enter therein, leaving space for steam on the inlet side to balance the piston. Tubes are placed in the boilers opening at each end of the fire bed, and arranged in such a manner as to cause the most intense heat of the fire to circulate therein to accelerate the generation of steam, and jets of steam may be introduced to promote circulation of the heat or flame. The door frames, dead-plates, and fire-bars are made hollow for the passage of atmospheric air to the furnace to promote combustion of the gases; such hollow grate bars by preference are made in two parts.—*Not proceeded with.*

1803. J. Trigwell, *Terminus-street, Brighton, "Slide valves."—Dated 17th July*, 1861.

The object of the present invention is to relieve slide valves (whether employed for the admission of steam or fluids) under pressure from the pressure acting upon the back or top side thereof, which, in the ordinary slide valves, produces greatly increased frictional wear and tear on the working faces, and more especially in locomotive engines, where a great increase of working pressure has from time to time been made.—*Not proceeded with.*

1818. P. Shaw, *Boston, U.S., "Hot-air engines."—Dated 19th July*, 1861.

The nature of this invention consists, First, in an arrangement of two single-acting cylinders, having their pistons coupled to a shaft with its cranks at right angles with each other, and with a furnace and its accessories centrally located between the said cylinders, and within an air-tight casing, which forms a reservoir for compressed and heated air, and which is so divided by partitions and diaphragm plates as to receive the cool supply air at and near the exterior of the reservoir, and to guide it inward toward the furnace in such a direction that it shall absorb the heat radiated from such parts of the engine as receive the products of combustion, those parts of the cylinders in which the pistons fill the bore being located without and upon the casting, and exposed to the atmosphere, and the other parts of the cylinder being located within the casing, so as to impart the heat radiated from them to the compressed air on its passage to the furnace. The invention also consists in a groove formed around the inner side of the cylinder at that part where the lower edge of the closely fitting portion of the piston comes at the lowest point in its downward stroke, which groove serves to receive the lubricating fluid which escapes past the packed portion of the piston, and also such as may be directly introduced into it by means of "oil pumps," &c. Also in the employment of an auxiliary valve operating to admit from the supply pump or receiver comparatively cool, pure, compressed air into the clearance spaces within, and connected with the cylinder, for the double purpose of balancing the pressure on the inlet valve into the cylinder, and to maintain the frictional surfaces of the piston and cylinder cool enough to be kept lubricated. Also in regulating the speed of hot-air engines by controlling the flow of the air under pressure to the engine pistons by means of a regulator operating to work a valve for this purpose. Also in the employment of a close receiver for the "exhaust," with a large radiating surface within the air-tight reservoir, into which air is forced, and then expanded by heat, for the purpose of imparting from its outer surface a portion of the caloric contained in the exhaust to the surrounding currents of incoming compressed air. The invention also comprises certain improved arrangements of the hot-air cylinder, and several other features, the details of which we cannot produce here.

1840. W. E. Newton, *Chancery-lane, London, "Engines for obtaining motive power by an explosive mixture of inflammable gases and air."—A communication.—Dated 22nd July*, 1861.

Air engines, as constructed hitherto, have possessed several defects, among which are, First, difficulties attending the heating operation; Secondly, apparatus of great volume, in proportion to the power produced, is required. The removal of these defects is the object of the present invention, and this is effected, first, by the employment, for heating purposes, of combustible or inflammable gases produced in the gas generator, and the introduction of these gases, when well purified and mixed with a suitable proportion of air, into the interior of the engines, where they are to be consumed. Secondly, by first compressing the gases and introducing them under pressure, so as to require very small engines in proportion to the power produced. These mixtures of gases are to be carefully cleansed, in order that they may not soil the engines, and they may be burnt either instantaneously in a mass or by continuous jets of flame. These two modes of operation will always necessitate the proper proportioning, mixing, and purifying of the gases. A mixture of any inflammable gases may be employed in the engines hereinafter described, the points of novelty in this invention being, first, the employment, for the purpose of carrying it into effect, of gases obtained from a gas generator, this being a point of great importance, as it is the only method of procuring inflammable gases at a cheap rate. Secondly, the employment of inflammable mixtures previously compressed. Thirdly, the method of heating the interior by inflammable gases mixed with air, which are then burned or exploded in the engine, either instantaneously, and in a body, or by continuous or intermittent jets of flame, whatever may be the nature or construction of the air, vapour, or gas-engine employed.

1848. W. Clark, *Chancery-lane, London, "Improvements in apparatus for the condensation of steam in marine engines, and in the particular application of parts thereof to the ship."—A communication.—Dated 23rd July*, 1861.

This invention relates to improvements in refrigerators used in cooling the injection water of marine engines; also in improved means of supplying sea water to such refrigerators by utilising the motion of the vessel in which the apparatus is applied; also in an improved arrangement by which the water of condensation, or the water produced by the condensation of the steam in the condenser, is re-conducted automatically into the boiler. The object of the said improvements is to obtain a supply of fresh water for marine boilers by utilising the fresh injection water from the ordinary jet condenser, which passes from the heating reservoir to the refrigerator, to be there cooled to the temperature of ordinary sea water by passing a current of sea water through the refrigerating tubes, which cooled water is conducted thence to the condenser and used as before for the purposes of condensation.—*Not proceeded with.*

Class 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

1780. O. J. T. Gossell, *Moorgate-street, London, "Combined locomotive engine and carriage."—A communication.—Dated 15th July*, 1861.

This express railway carriage (so called by the inventor) differs from the ordinary railway train in so far that it is a combination of the three principal parts of an ordinary train, and includes in one body, and mounted upon the same framing, a locomotive engine, a tender to carry water and fuel, and a carriage or compartments to receive a limited number of passengers. The whole of the carriage will not exceed 25ft. in length.—*Not proceeded with.*

1823. R. A. Brooman, *Fleet-street, London, "Propelling ships, &c."—A communication.—Dated 19th July*, 1861.

This invention consists in propelling ships and other vessels by the discharge of dry or superheated steam directly against the water. The dry or superheated steam is conveyed through pipes provided with cocks, and with adjustable nozzles, so that, by turning the nozzle and by allowing the steam to issue from the pipes at any particular part of the vessel at or below the water line, the vessel may be propelled in any required direction.

1837. A. Watson, *Johnstone, Renfrewshire, "Brake apparatus for common road vehicles."—Dated 22nd July*, 1861.

In carrying out this invention advantage is taken of the resistance which the horse exerts against the downward pressure of the vehicle to cause brakes to be applied to the wheels, and so increase the resistance to their turning. In one modification of apparatus for this purpose chains are passed from the ordinary breeching, or from an equivalent strapping passing round the hind quarters of the horse, forward to pulleys or levers carried by the shafts. From these pulleys or levers chains pass back to levers carrying the brake blocks, or an equivalent connection is made with the brake levers in such a way that, when the horse holds back, the chains will be strained, and will act on the brake levers, causing the brakes to be pressed against the wheels.—*Not proceeded with.*

1843. G. F. Griffin, *New Adelphi-chambers, London, "Permanent-way of railways."—Dated 23rd July*, 1861.

This invention cannot be described without reference to the drawings.

1788. J. Blinkhorn, *Chorley, "Apparatus for working railway signals."—Dated 16th July*, 1861.

This invention is carried into effect in the following manner:—The patentee joints to the permanent way or rails, at any desired positions, a number of levers in connection with other levers partly under the said permanent way or rails, and partly on one side, at a little distance from them. The levers jointed to the rails are inclined upwards, so that, when an engine, train, or carriage passes over them, they will descend, and act upon two projecting arms, which, acting on other levers, cause the release of a chain, wire, or other connection fixed to a balance lever attached to the semaphore, and cause the signal to be raised, which is afterwards held as long as required by a catch. At any suitable distance from the aforesaid levers he joints other levers to the permanent way or rails for giving motion to a chain-wheel connected by a chain, wire, or other means with another chain-wheel employed for operating upon the catch which holds the signal in its raised position, so that, when the engine, train, or carriage passes over this second apparatus, the signal is released and falls. For better protection in cases of engines or trains closely following each other he employs a supplementary catch, so that, if an engine or train passes the semaphore before the first one shall have passed the releasing apparatus, the supplementary catch shall prevent the signal from falling before the second engine or train has arrived at the releasing apparatus, or, in fact, holding the signal in the same position until any number of carriages or trains have arrived at the releasing apparatus. It is evident that when working the signal a bell may be struck at the same time, or the apparatus may ring a bell, or give any other signal that may be found requisite.

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

1777. B. BROWNE, *King William-street, London*, "*Machinery for smoothing and clearing spun thread or yarns, &c.*"—*A communication.—Dated* 15*th July*, 1861.

This invention is carried into effect as follows:—In a suitable framing a quantity of bobbins or creels containing thread or other spun material are placed loosely on pins or sheds; the thread is passed thence over and against suitable guide rollers, and twisted once round each of a series of small loose spindles or rollers mounted one over the other on a sliding frame or box; thence the thread passes around, between, and over other rollers to another roller, on to which it is wound in a finished state. The aforesaid sliding box or frame of small rollers has vertical reciprocating motion imparted thereto from a lever and friction wheel adjusted to the lower part of the framing of the machine. The axis of rotary motion of this said friction wheel is a pin passed through the upper end of a bell crank lever; the axis of vibration of the said lever is a pin or stud fixed to the framing of the machine, and to the lowermost arm of said lever a spring is affixed, the elastic force of which causes forced contact of the periphery of the friction wheel aforesaid, which is covered with leather, against the periphery of another wheel or long drum, which is mounted and revolves in suitable bearings, and is driven by a steam engine or other motive power. A similar arrangement of parts, in connection with a friction wheel operated upon by the aforesaid drum, is employed at the opposite side of the machine, so that the operator, by simply pressing his foot on the lower arm of the bent crank lever aforesaid, draws one or other of the friction wheels out of contact with the driving drum, and thus stops the action of the clearing or smoothing mechanism, which is in connection with each friction wheel. It is proposed to employ a separate set of clearing and smoothing rollers to each bobbin at each side of the machine. The foregoing arrangement is susceptible of various modifications: for example, instead of imparting reciprocating motion to the sliding frame or box containing the series of small rollers before mentioned, the said rollers may be attached to the upper part of a vibrating arm for clearing and smoothing the yarn, the said arm being furnished with a series of the loose small rollers before mentioned over and around which the yarn passes.

1778. A. J. *and* J. TOPHAM, *St. Pierre les-Calais, France*, "*Lace.*"—*Dated* 15*th July*, 1861.

For the purposes of this invention, in order that holes of any desired length may be produced in lace which is being made in a lace machine, and that such holes may be caused to be inclined to or be at angles to the back edge or the line of selvage of a breadth or piece of lace, an extra thread or threads, properly weighted, is or are used, which are caused to be linked in or attached to the lace which is being made in the machine, and at a distance from the threads which, for the time being, are producing the parts of the lace which bound or are next to the part where a hole is being produced, and such extra thread or threads are caused to link in with a bobbin or bobbin threads working or forming the sides where the hole is being produced, by which a bias or drag is induced towards the point where the extra thread, or the points where the extra threads, are attached, so that, in place of the hole being made straight down in the lace, the lace or fabric where the hole is being produced will be progressively dragged by the extra thread or threads towards the point or points, where it or they are attached. And in order that the hole should not be dragged open or expanded, and to obtain at the sides of the hole an appearance of an internal purl by such extra thread or threads, another extra thread is used as a lacing thread, by which the two sides of the hole are drawn towards each other, and produce the appearance of an internal purl.

1804. S. TAWELL, *Aldermanbury, London*, "*An improvement in, or an addition to, the selvages of laces, &c.*"—*Dated* 18*th July*, 1861.

The present improvement has for its object to supersede the subsequent operation of hand whipping, and consists in the introduction of a whipping thread by the machinery in the process of manufacture, either by passing the thread spirally round, or backward and forward through the holes of the selvage. The fabric thus made may be used plain, or may have any required fulness given to it by drawing and securing the whipping thread.

1805. O. ELLIOTT, *Manchester*, "*Looms.*"—*Dated* 18*th July*, 1861.

This invention can not be described without reference to the drawings.

1810. P. WILLIAMS, *Salford, and* T. PARKINSON, *Bury*, "*Carding engines.*"—*Dated* 18*th July*, 1861.

This invention consists, First, in the novel application of one or more rollers beneath the "licker in," such rollers having their surfaces subdivided by grooves in the line of circumference, and transversely in the line of axis, so as to form teeth or projections thereupon which act upon the cotton passing between them and the "licker in," in such a manner as to disengage and separate the impurities therefrom, which fall into a receptacle provided for the purpose. Secondly, the improvements consist in the novel application and use of an extra card roller, or cylinder placed before the usual first top card roller, and so driven as to cause it to take the cotton from the main cylinder. The cotton is then taken from the extra roller by the usual first card roller, and fed on to the main cylinder, by which arrangement a fuller separation of the dirt is effected, and the cotton passes, thus cleaned, through the carding engine as usual.

1812 G. COLES, *Gresham-street West*, J. A. JAQUES, *and* J. M. FANSHAWE, *Tottenham*, "*Apparatus to be used for brushing and dressing cloth.*"—*Dated* 18*th July*, 1861.

This invention consists in adapting to machines for brushing and dressing cloth a roller or rollers provided on their peripheries with elastic ribbed rubbing edges, which, when the rollers are set in motion, will rub, brush, or dress the surface of the cloth. These ribbed rubbing edges are arranged helically round the rollers, but the helical coils commence at or near the middle of the rollers, and are arranged in opposite directions, so that, when acting on the surface of the cloth, they may keep the same spread out or distended in a lateral direction from the centre. The elastic ribbed rubbing edges are made of india-rubber, but the peculiar form, dimensions, and arrangement of these working parts must depend upon the nature of the material to be operated upon, and the effect that it is desired to produce.

1827. E. T. HUGHES, *Chancery-lane, London*, "*Apparatus for manufacturing woven seamless gloves.*"—*A communication.—Dated* 2*nd July*, 1861.

Instead of the ordinary method of knitting gloves by circular or other machines on the system of meshes, the patentee weaves them in an ordinary loom with the assistance of the jacquard machine, the shape of the glove being made by pattern cards, and the material woven double, forming a kind of pocket. A number of gloves are woven at the same time, according to their size, and the width of the loom. When the piece is completed each glove is cut out or separated, and after being turned inside out the glove is obtained in a finished state.

1832. J. PLATT *and* J. BUCKLEY, *Oldham*, "*Machinery for spinning and doubling cotton, &c.*"—*Dated* 20*th July*, 1861.

This invention cannot be described without reference to the drawings.

1838. J. B. WOOD, *Broughton, near Manchester*, "*Shuttle pickers.*"—*Dated* 22*nd July*, 1861.

This invention consists in making from buffalo or other hides, parts of hides or other fibrous material, the picker in one solid piece or block, thus doing away with the necessity and inconvenience of folding the hide upon itself, and the use of iron or other wires to hold the parts in connection.

1844. T. GRAY, *Wandsworth*, "*Preparing flax from old materials for spinning, &c.*"—*Dated* 23*rd July*, 1861.

In carrying this invention into effect the patentee takes old tarpaulin or sail cloth or canvas, and old floor-cloth or oil or painted cloth, and other materials manufactured wholly or in part from flax, and boils the same in tanks or boilers in a strong solution of soda ash, or other alkali, for about the space of three hours, for the purpose of decomposing and removing from the material all mineral and resinous matters contained therein, and when the material has thus been sufficiently boiled to attain that object he then cleanses the said material by washing and rinsing it in hot or cold water until the material is freed from all impurities. The material so boiled and washed is then to be dried, after which it is to be cut into strips or pieces of a convenient size or sizes, which strips or pieces are then to be run through a machine known as and called a "breaker," with the cylinder working either dry or in water, as may be preferred, and according to the material, in such manner as that the woof or weft shall be torn or separated from the warp, and thereby securing a greater length of fibre and a saving of waste. The material after passing through the breaker is then to be passed through a tucker or revolving tenter hook machine for the purpose of opening the threads and preparing the material for the next process. The patentee then passes the material through one or more carding machines as often as may be required, according to the purpose to which the flax fibre is to be applied. The flax fibre so obtained is then in a fit condition for spinning purposes, or for making wadding, or for any other purposes for which botton or flax fibre may be used in manufactures.

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

1779. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Apparatus for cleaning rice.*"—*A communication.—Dated* 15*th July*, 1861.

This invention relates to a peculiar construction and arrangement of machinery or apparatus for cleaning rice, and consists in the application and use for that purpose of wire gauze, or perforated plates, and chambers or cases, in combination with detachable and adjustable stone blocks, the blocks and wire gauze or perforated metal surfaces being so shaped and disposed that, when combined, they will form a hollow cylinder or cone, in the interior of which revolves any suitable drum or beater. The wire gauze or perforated plates may either be introduced between the continuous edges of the stones, or inserted into the stones themselves, which, in that case, are cut away to receive the chamber of which the wire gauze or perforated plates form the inner surface. The object of these cases or chambers is to allow of the free escape of the meal, which, after passing through the wire gauze or perforated plate or plates, is removed or carried off from the chambers by tubes or spouts to a proper place of deposit. The same object may also be obtained by inserting crosswise at intervals within the length of one or more of the stones sections of wire gauze, wire cloth, or perforated plates, leaving open spaces behind, so that the meal may be withdrawn at intervals, or as fast as it is formed.

1821. W. *and* P. H. SAVORY, *Gloucester*, "*Winding apparatus, particularly adapted for steam ploughing, winding at pits, quarries, &c.*"—*Dated* 19*th July*, 1861.

This invention consists in applying certain mechanism to the barrel or cylindrical part of the horizontal boiler of a stationary or portable engine, for the purpose of winding ropes or chairs at pits' mouths, or for ploughing or other useful purposes. The patentees propose to place a drum or drums round the horizontal boiler, which drum or drums is or are caused to revolve by suitable wheels or gearing connected to the engine. They propose to construct a drum of wrought iron, with a suitable cast iron head or ring at one or both ends; this ring is to have teeth cast inside, to gear into a pinion or pinions on the engine or other shaft, and a part of the breadth of this ring is turned out true to run on a number of friction rollers on the barrel of the boiler. When two drums are used they may be constructed with a cast iron head at one end, and wrought at the other, with friction rollers as before. They propose guiding the rope on the drum in the following way:—A pulley is fixed on a horizontal spindle in a suitable frame to receive or bear the rope from the plough or other thing to be drawn; two other pulleys are fixed on the same frame on vertical studs or spindles, with grooves turned in each to fit the rope, and placed one on each side of the rope, so that the grooves of the guide wheel are opposite the periphery of the drum where the rope runs, and connected with suitable wheels to the internal gearing of the drum ring. The pitch of the screw is proportioned so as to move the frame during one revolution of the drum a distance corresponding with a little more than the thickness of the rope.

CLASS 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

1860. A. J. D. SEITZ, *Newcastle-on-Tyne*, "*Drying bricks, &c.*"—*Dated* 24*th July*, 1861.

For the purposes of this invention a closed drying room is constructed, provided with a ceiling having openings therein, closed by shutters, and having skylights. This room is fitted with benches constructed of flags, quarls, slates, or other porous materials, to receive the bricks or other articles to be dried, spaces being left between for the passage of barrows and workmen. In this drying room is arranged a system of pipes, heated, by preference, by means of the waste steam from the steam engine, as being more economical, but a separate boiler may be employed if necessary.—*Not proceeded with.*

1870. J. SIMMONS, *Battersea*, "*Construction of buildings to enable them to withstand the destructive action of fire.*"—*Dated* 25*th July*, 1861.

In carrying out this invention the inventor proposes to make the cast iron girders and columns used in supporting the various floors hollow, and to connect them together in such a manner as to form a clear water course throughout the whole series. The tubular columns he carries up from the basement to the roof, where he connects them with a water-tank that may cover any given surface of the roof, and these lines of columns he also connects with a series of hollow girders, which serve to carry the several fireproof floors. He brings down water from the tank to the basement of the building by suitable pipes running either outside the building or enclosed in brickwork, so as to be protected from the action of fire in the building, and at the basement he connects this supply with the vertical columns which carry the hollow girders. By this arrangement, should a fire occur in any part of the building, the adjacent hollow metal supports will become heated, and the water contained therein will be caused to circulate, a heated stream floating upward, and cold water taking its place, and absorbing the heat imparted by the fire to the metal. Thus the temperature of the metal will be effectually kept under, and a discharge of water on to the exterior of the metal will in no way affect its stability.—*Not proceeded with.*

1872. R. R. SWANN, *Blackheath*, "*A fire preventive ceiling and apparatus for the extinction of fire in warehouses, stores, depots, and buildings.*"—*Dated* 26*th July*, 1861.

This invention consists in providing each room in the building with a double or single ceiling, constructed of metal or other suitable material, the lower ceiling being perforated with numerous small holes of such number and size as to flood every portion of such room when the water is turned on. Between the double ceiling are inserted a number of perforated pipes or spreaders, of any length, form, or size, as may be found necessary, for the perfect distribution of the water injected through a suitable main pipe connected by stop-cocks or valves with a tank to be kept constantly full of water on the top of, or contiguous to, such warehouse, store, depot, or building furnished with this apparatus.—*Not proceeded with.*

1884. C. E. AMOS, *Grove, Southwark, and* J. FRANCIS, *Penrhyun Slate Quarries, near Bangor*, "*Machinery for dressing slates.*"—*Dated* 27*th July*, 1861.

This invention relates to a novel arrangement of machinery whereby roofing slates may be cut, trimmed, or dressed to the different sizes used for building purposes. The machine consists of a rectangular frame, which may, if necessary, be mounted on wheels for the convenience of transporting or removing the machine from one locality to another. This frame is provided with a fixed knife, and also suitable bearings for a lever or "sword arm," which carries a movable knife. The "sword arm" or lever is suspended by a spring or springs, so that, when in a normal position, the movable cutting edge is raised above the lower knife edge, and the two edges resembles a pair of open "shears," and act in the same manner. A treadle frame is attached by means of a link to a lever which is upon the same spindle as the "sword arm," and the knife edges are brought together by the pressure of the foot of the workman; or, if desired, the machine may be worked by mechanical power, by applying power to the treadle lever; or the treadle lever may be dispensed with and the power may be applied direct to the "sword arm." The spindle of the "sword arm" is made adjustable to compensate for wear in the cutting edge and other working parts, and a gauge plate with suitable marks or points, corresponding to the different recognised sizes of roofing slates, is placed on the framework so that the rough slates may be laid in their proper places and adjusted with facility.

1901. M. ALLEN, *Worship-street, Finsbury, London*, "*Improvements in the construction of buildings, and in materials and machinery to be employed therein.*"—*Dated* 30*th July*, 1861.

In carrying out this invention the inventor proposes to construct stair cases in such a manner as to economise the space they usually occupy, and to render the same fire-proof by insulating them from every internal portion of the building. This he proposes to accomplish by arranging the stairs in a semi circular or other recess in the outer wall of a building, extending from its foundation to the roof, and having no openings whatever on its inner side; this recess is made with openings as door-ways on its outer face, through which the stairs may be approached on one floor, and terminate on the floors by doorways or openings leading to balconies running along that part of the building in which the stairs are placed, and by means of which access is obtained to the several floors or flats. As regards the improved materials above referred to, they consist of burnt clay, cinders, slags, coke, culm, or clinkers, and other calcined substances of similar character thereto, and possessing an irregular woven porous surface, mixed with Portland or other cement or lime. As regards the machinery above referred to, it consists of a machine made in the following way for the better mixing and incorporating together the aforesaid materials or any other materials used in building:—The inventor takes a box or vessel, the under side of which is movable, in which he arranges horizontally a revolving shaft, having a number of knives, pegs, or rakes inserted or fixed therein; the materials to be mixed are thrown into the said box or vessel, and the shaft driven round until the whole of the materials have become thoroughly mixed together; the lower part of the box or vessel is then opened, and its contents allowed to flow out ready for use.—*Not proceeded with.*

CLASS 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defences, Gun Carriages, &c.

1781. W. RIGBY, *Glasgow*, "*Armour plates for defensive purposes.*"—*Dated* 15*th July*, 1861.

This invention consists in manufacturing and shaping such plates, First, by the process of hammering as is well understood, and, having reduced them to a suitable thickness by this means, finishing the same by rolling them down in suitable rolls to the thickness required, so as to impart a fibrous character to the iron composing the same.

1814. J. W. ROGERS, *Robertstown, Kildare*, "*Building ships and floating batteries, &c.*"—*Dated* 18*th July*, 1861.

The object of this invention is so to combine wood and iron in the building of ships and floating batteries, and in the covering of fortifications, as to render them impervious to shot, and, in the case of floating shot-proof structures, materially to increase their buoyancy. The invention is based on the fact that the resisting power of iron plates and planking is enormously increased when the same are set edgewise to receive the concussion, force, or weight against which they have to contend, in place of presenting a flat side to the strain. As an illustration of the mode of applying iron and wood according to this principle of resistance to the building of a ship of war the patentee commences with the keel, making first a longitudinal iron core of plates of wrought iron, cruciform in cross section. The plates are bolted to angle iron fitted into the four angles of the cross, and running from end to end of the core. The lower angles of the cross he fills in with parallel plates of iron, set up on edge, and alternated by planks of wood, such as teak or oak. This filling he secures in place by lateral screws and nuts. Upon the keel he builds up the hull of the vessel, forming it of lines of iron plates set edgewise, so that the breadth of the plates will give the thickness of the hull, and alternated with planks of teak or oak. These lines of plates and planks will take the varying curve of the cross sections of the vessel, and extend from the keel to the bulwarks, their inner ends filling the upper angles of the core of the keel. The plates and planks are secured together in groups by short screws passed through them, and also by the nuts of long screw tie bolts, which are placed at various elevations, and run through the plates and planks, extending a kind of break joint arrangement from stem to stern of the vessel, so as to tie together all the parts that go to form the hull. Across the ship and along the bottom and sides he arranges angle iron girders, and secures them in position by eye bolts projecting inwards from the longitudinal tie bolts before mentioned. The upper deck he constructs on the same compound principle as the hull, and continues it partly or wholly through the hull, so as to make a strong bond, strengthening the junction by longitudinal angle iron girders. In a line with the keel he lays a compound beam of wood and iron, and passes bolts through the keel and through the beam, so that it forms virtually an internal projection of the keel. By this means of placing together iron and wood he is enabled to gain an enormous resisting power in ships of war, to greatly reduce the cost of constructing shot-proof vessels, and materially to increase their buoyancy. This mode of constructing war vessels is also applicable to the building of ships for commerce, batteries, and fortresses, the arrangement of the walls and internal bearings being adapted to suit the different circumstances of resistance.

1824. R. A. BROOMAN, *Fleet-street, London*, "*Breech loading ordnance applicable to small arms.*"—*A communication.—Dated* 19*th July*, 1861.

This invention consists in the employment of a breech block or breech closer constructed with a chamber in front of larger diameter than the bore of the piece, and moved up and down to open and close the bore by toggles connected to a shaft worked by a detachable lever handle. Also in the employment in the chamber in the face of the block of an expanding ring, which, upon the firing of the charge, becomes expanded and renders the breech gas-tight.

1831. T. ROBERTS *and* J. DALE, *Manchester*, "*Gunpowder.*"—*Dated* 20*th July*, 1861.

This invention consists in a method of manufacturing gunpowder, whereby the inventors are enabled to use nitrate of soda in place of or in combination with nitrate of potash, and the principle here proceeded upon is to add thereto a substance which will effloresce, so as to correct the tendency of the other material or materials to become moist. Of these substances the inventors mention, for example, the anhydrous sulphates of soda and magnesia.—*Not proceeded with.*

1853. J. SIDEBOTTOM, *Harewood, near Mottram, Chester*, "*Fire-arms and ordnance.*"—*Dated* 24*th July*, 1861.

This invention relates to a previous patent dated 15th January, 1861 (No. 163), and consists in the application of a brake or brakes to the barrels of fire-arms and ordnance for the purpose of regulating or controlling the recoil, and the rotary motion imparted to the barrel during the recoil, by a curved scroll or other equivalent. These brakes may be applied by hand, or by the recoil of the barrel, or by both. When applied by hand, a friction clip applied to the barrel is tightened by a screw or other equivalent, or the bearings supporting the bevel may be tightened. When the brake is applied by the recoil the barrel acts on a lever or other equivalent connected to the brake, which is thus tightened.

CLASS 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

1789. R. JONES, *Camden-town London*, "*Safety lamps.*"—*Dated* 16*th July*, 1861.

This invention consists in fitting or providing safety lamps internally with a metallic cap or extinguisher jointed or hinged in close proximity to the wick or flame, the lower or hinged portion thereof being tapped for the reception of a screw which passes through the same in such manner that, upon turning the said screw in the direction necessary for locking the lamp, the cap or extinguisher is thrown back from the wick or flame, whilst, upon turning the same in the opposite direction for unlocking the lamp, the cap or extinguisher is caused by the friction of the screw passing through the joint or hinge to be brought forward and descend upon the wick or flame, and remain in that position whilst the screw is being withdrawn from the said hinge for the purpose of effectually extinguishing the light.

1791. D. HOLDER, jun., *Barnsbury, London*, "*Foot and kneeling stools.*"—*Dated* 16*th July*, 1861.

The inventor furnishes these stools with two or more surfaces or faces, and mounts them on axes, whereby either of the faces can at pleasure be presented for use.—*Not proceeded with.*

1793. W. PALMER, *Sutton-street, Clerkenwell, London*, "*Lamps.*"—*Dated* 16*th July*, 1861.

This invention consists in constructing the cupped pistons or plungers of presser lamps of a composition of glue and treacle, melted and cast in moulds, such pistons or plungers being of like form to the cupped leather pistons or plungers heretofore employed; but the patentee prefers that they should be of somewhat greater thickness, and not be quite so deep as those made of leather. The invention also consists in using a like composition in the manufacture of washers for those parts of pressure lamps which require to be made fluid tight.

1807. B. JOHNSON, *Kennington-park, and* W. H. ANDERSON, *Stockwell-place*, "*Pianofortes.*"—*Dated* 18*th July*, 1861.

This invention consists in constructing pianofortes in the following manner, and in adapting thereto certain parts not heretofore employed in their construction:—First, the patentees propose to construct pianofortes with a double "belly" or two "bellies," with perforated sounding posts between them to connect them together; this double "belly" is intended to enclose the "back" of the instrument from front to back thereof, and thus to form an air-tight wind-chamber, in connection with which are bellows and valves operated upon as hereinafter described. Secondly, they propose to employ three pedals in addition to the two ordinary pedals; one of these extra pedals is employed to cause a swell, and is so arranged as to raise the top of the instrument or valves placed therein, or both simultaneously. Another of the aforesaid extra pedals is employed for sounding octaves by the performer simply striking one note, the corresponding note necessary to produce an octave being connected to the first note of the octave by suitable mechanism operated upon by this last named pedal. Another pedal, which they call the very forte pedal, is employed for sounding octaves, raising the top or valve therein, or both; also for taking the damper off the string, and operating the bellows simultaneously. By thus constructing pianofortes the power of the instrument is considerably increased.

1808. M. E. GUAYMARD, *Paris*, "*Shirt-fronts, collars, and cuffs.*"—*Dated* 18*th July*, 1861.

This invention consists in applying an elastic resistant stiffening to shirt-fronts, collars, and sleeves, for which purpose the patentee interposes between thicknesses of the fabric, or in a fold of the same, a brass wire, suitably two silvered or galvanised, which, at the same time that it furnishes a well-defined projecting surface, also preserves the shape of the article to which it is applied.—*Not proceeded with.*

CLASS 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting Glass, Pottery, Cements, Paint, Paper, Manures, &c.

1776. T. COBLEY, *Menkels, Germany*, "*An improved process for the production or manufacture of fluo-silicates of tin, zinc, and baryta, and their application as pigments for glazing, enamelling, and in the manufacture of glass.*"—*Dated* 15*th July*, 1861.

In carrying this invention into effect the patentee proposes to form fluo-silicate of tin by dissolving the oxide of tin in fluo-silicic acid, or by decomposing a solution of a salt of tin by means of fluo-silicic; or, if a silicate of tin, he acts upon it by means of fluoric acid, and forms the fluo-silicate. He then heats the fluo-silicate thus formed with sulphide of ammonium, or sulphuretted hydrogen, so as to produce a sulphide. This sulphide he proposes to apply as a pigment, or glaze, or enamel, in the manufacture of porcelain, either in combination with lead, or separately, as the case may be. He proposes to form the fluo-silicate of baryta in the manner stated in his patent (No. 1732) dated 8th July, 1861; but, in addition there described, he proposes also to form it by acting upon silicate of baryta, either native or artificial, with fluoric acid. He proposes to apply this fluo-silicate of baryta, either with or without the fluo-silicates of zinc, as a substitute for lead in the manufacture of glass, or as a pigment or enamel in the manufacture of porcelain. He also proposes to apply it in the same manner in combination with fluo-silicate of tin. He proposes to form fluo-silicate of zinc by dissolving the oxide of zinc in fluo-silicic acid, or by precipitating a solution of a salt of zinc by the addition of the chemical equivalent of the said acid. He then collects the precipitate, and dries the same in any convenient way. When he can obtain a silicate of

zinc, either natural or artificial, he treats it, free from iron, with an equivalent of fluoric acid, and forms a fluo-silicate. In this way, instead of using the fluo-silicic acid, he proposes to use the fluo-silicate of zinc as a glaze, or pigment or enamel, either with or without baryta. One of the chief applications, however, which he proposes to make use of it is as a substitute for lead in glass manufacture, and he uses it either alone or in combination with baryta, by means of which he is enabled to produce a glass possessing peculiar optical properties, that is far more free from veins and striæ than glass as ordinarily made.

1783. E. G. DE LA PROVOTAIS, *Paris*, "*Extracting the fibres from genista scoparia (broom), and their application to manufacturing paper and fabrics, and also treating the washing waters so as to obtain dyeing products therefrom.*"—*Dated* 15*th July*, 1861.

The patentee claims, First, preparing ligneous fibres from genista scoparia (broom) for the manufacture of paper, pasteboard, and also of fibres intended to be converted into fabrics. Secondly, colouring products from the washing waters remaining after the treatment of the fibres.

1817. R. MUSHET, *Coleford*, "*Cast steel.*"—*Dated* 19*th July*, 1861.

This invention consists, First, in adding to and melting with any mixture of what the patentee describes as pulverised pig iron, cast iron, or refined iron, with pulverised iron ore or oxide of iron and oxide of manganese, with or without the addition of scrap iron or scrap steel, which mixture, when melted, produces cast steel, a quantity of pulverised wolfram ore, or a quantity of tungstic acid, or a quantity of deoxidised wolfram ore, or a quantity of an alloy of tungsten and iron containing also carbon, in order thereby to improve the quality of the cast steel produced. The invention consists, further, in adding to and melting with any mixture of pulverised pig iron, cast iron, or refined iron, with pulverised iron ore or oxide of iron and oxide of manganese, with or without the addition of scrap iron or scrap steel, which said mixture when melted produces cast steel, a quantity of pulverised chrome ore, or oxide of chromium, in order thereby to improve the quality of the cast steel produced. The invention further consists in adding to and melting with any mixture of pulverised pig iron, cast iron, or refined iron, with pulverised iron ore or oxide of iron and oxide of manganese, with or without the addition of scrap iron or scrap steel, a quantity of pulverised ores of wolfram and chrome mixed together, in order thereby to improve the quality of the cast steel produced. The invention consists, lastly, in adding to and melting with any mixture of materials which when melted produces cast steel, a quantity of a mixture of pulverised pig iron, cast iron, or refined iron, and oxide of manganese, with, firstly, pulverised wolfram ore, or tungstic acid; secondly, pulverised chrome ore, or oxide of chromium; thirdly, pulverised ores of wolfram and chrome mixed, or tungstic acid and oxide of chromium mixed, the addition of the said mixture to the said steel-producing materials being made in order to improve the quality of the cast steel obtained by melting the said steel-producing materials with the said mixtures.

1790. J. P. GILLARD, *Paris*, "*Improvements in the manufacture of soda, carbonate of soda, and hydrochloric acid, and in apparatus connected therewith.*"—*Dated* 16*th July*, 1861.

These improvements in the manufacture of soda, carbonate of soda, and hydrochloric acid, consists in submitting common sea or rock salt (chloride of sodium) in a suitable retort to a high temperature, and projecting at the same time on the salt in the retort jets or streams of superheated steam, hydrogen gas, carbonic acid, or carbonic oxide gas, or suitable combinations of either two or more of the said gaseous fluids, by which means the decomposition of the salt will take place, and hydrochloric acid be evolved, which may be drawn off from a proper condenser connected with the decomposing retort, whilst, according to circumstances, either soda, or a carbonate of soda, will be left behind in the retort. For superheating the steam or the other above-mentioned gaseous fluids the inventor causes them to pass through tubes formed of a suitable alloy of the platinum and iridium, which tubes are inserted in a proper superheating furnace, one or more layers of wire cloth made of the same iridised platinum being situated in the interior of the said tubes, through the meshes of which wire cloth the fluids to be superheated are obliged to pass before reaching the decomposing retort.—*Not proceeded with.*

1792. C. D. ABEL, *Southampton-buildings, London*, "*Certain new alloys of silver, with other metals, and the processes employed in their manufacture.*"—*A communication.*—*Dated* 18*th July*, 1861.

The patentee claims, First, the employment of ferrocyanide, or ferrocyanide of potassium, for the purification and reduction of the nickel employed for such alloys. Secondly, the employment of a galvanic current in the purification of such nickel, for aiding its solution, and for operating its precipitation. Thirdly, the employment of a ferrocyanide of potassium, or of ferricyanide of potassium, as fluxes or reducing agents in the formation of the alloys. Fourthly, the introduction of manganese into the before-mentioned alloys. Fifthly, the introduction into, and, when required, the subsequent elimination of phosphorus from, the before-mentioned alloys.

CLASS 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

1907. J. T. G. *and* P. RYLANDS, *Warrington*, "*Joining wire for telegraphic conductors, &c.*"—*Dated* 31*st July*, 1861.

In joining wire according to this invention the patentees twist together the ends of the iron wire (before galvanising it) in the same manner as the ends of the galvanised telegraphic wires are commonly twisted together, that is to say, they twist the end of each wire in a spiral around an untwisted portion of the other wire, leaving a short space between the two spirals. They afterwards wrap a strip of iron or iron wire around in the space between the two spirals, and heat and weld it into a solid mass; the wire and joints may afterwards be galvanised in the usual manner. Or, without wrapping the twisted joint round with a strip of iron wire, the twisted joint itself may be heated and welded. Or the wires may, as heretofore, be twisted together after galvanising, and perfect contact ensured by casting on to the joint a block of a suitable metal fusing at a comparatively low temperature. The mould in which this block is cast is so formed as to produce a block taper at the ends, so that it may pass freely through the insulators without the catching. With the same object, when making the joints by twisting, they make the ends taper, by preference, by flattening out the ends of the wires, so that, when twisted up, they will give the desired tapering form to the joint.

CLASS 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

1652. J. W. HARLAND, *Chorlton-on-Medlock, Manchester*, "*An improvement or improvements in the manufacture of wood and other types, or substitutes therefor, and also in the matrix or apparatus for producing the same.*"—*Dated* 28*th June*, 1861.

This invention relates, First, to the material of which the types are to be formed. The inventor takes paper, or the pulp of which paper is made, horn raspings or shavings, bone dust, wood shavings, or saw dust of the same, or other substances in a state of comminution. A quantity of one or more of the above substances being provided he saturates it with size or fish glue, or other suitable cement. The material thus prepared is next pressed into a matrix of a form to give it the shape of the type required. Mechanical pressure is next applied, which must be sufficiently great to make the material take accurately the shape of the matrix. The operation being performed, the type is removed from the matrix, and after being dried is, if necessary, reduced to the correct size for being used in the printing press. Secondly, the invention has reference to the matrices or dies in which the composition or material is to be moulded into the form of the type required.—*Not proceeded with.*

1653. J. W. GRAHAM, *Manchester*, "*Apparatus for cutting, shaping, and dressing stone, &c.*"—*Dated* 28*th June*, 1861.

This machinery consists of a bed or table upon which the stone is placed, and to which a reciprocating sliding motion is imparted by ordinary mechanical and self-acting means. Above this table a beam extends from end to end of the machine, upon which a framing is supported in such a manner as to be adjustable, and carrying an arrangement of bevel gearing in connection with toothed wheels, which are attached by means of cranks to a tool box containing the chisel or chisels, and placed at the required angle for cutting, and the upper portion of this tool box is furnished with a weight, by which means the chisel is caused to cut or chip the stone. When motion is imparted to the gearing the cranks will cause the chisel in the tool box to make a succession of strokes upon the stone, which, by the effect of the weight or hammer, will cause the stone to be cut or chipped to any form or size, which, together with the depth of the cut, may be regulated or controlled by the attendant. In order that the edge of the chisel may not become unequally worn it is turned half round at each stroke by the means of a crank or other convenient means, so that each side is presented alternately to the stone.

1655. D. B. WHITE, *Newcastle-on-Tyne*, "*Improvements in the mechanical compression of various substances, and in apparatus employed therein.*"—*Dated* 28*th June*, 1861.

This invention consists in causing a cylinder or vessel, open at bottom, and closed at top, and in which an air-tight piston or plunger works, to be lowered into water so that the pressure exerted by the water on the piston or plunger may cause it to rise in the cylinder or vessel, and so force the air or gas contained in the upper part thereof through a pipe or tube into a suitable receiver, where it will become compressed, and from which it may be taken for use as required. The inventor prefers to employ two such cylinders or vessels and pistons or plungers, and to lower them into the water alternately. In some cases, instead of forcing the air or gas into a receiver, he compresses it in the upper part of the cylinder or vessel, and causes the piston or plunger to be locked or held when at or near its highest point; the compressed air or gas may then be brought to the surface and used as required. For pressing substances or materials he places them in the upper part of the cylinder or vessel, which is then lowered into the water; the piston or tube will rise, as before, and compress the substances or materials between it and the top or cover of the cylinder or vessel, the air being expelled by a pipe or tube provided with a cock. Sometimes he connects an air pump or condenser to the pipe or tube, and produces a vacuum above the piston or plunger before lowering the apparatus into the water.—*Not proceeded with.*

1656. S. MIDDLETON *and* J. WRIGHT, *Bridge-street, Blackfriars*, "*Apparatus for the manufacture of boots and shoes.*"—*Dated* 28*th June*, 1861.

This invention is carried into effect as follows:—First, the inventors make a box of the shape of the boot, formed of any metal, preferably of cast iron. They construct this box in two halves, which are hinged and turn on a rod or bar of metal. It is then firmly fixed on a frame, which is capable of sliding towards a machine which screws the outer to the inner sole. The last with the boot or shoe on it is placed within this metallic box, and tightly screwed up by means of levers and screws or chains, or any other mechanical contrivance. The tacks or pegs are then put in all round, thus fixing the upper leather to the inner sole. When this operation is completed they take the last out of the box, and affix the outer sole with two or three pegs or tacks to keep it in position, and then place the last with the sole attached within the box, and screw it up, which action forces the outer sole close to the inner. The box is then turned at right angles to its former position, and brought in front of a machine, by which the outer sole is screwed to the inner, and the boot or shoe is then taken out and trimmed.—*Not proceeded with.*

1664. W. CLARK, *Chancery-lane, London*, "*A new locomotive apparatus having a movement resembling walking.*"—*A communication.*—*Dated* 29*th June*, 1861.

This invention is more especially intended to be applied to dolls and other toys, but may be applied to other uses. It consists in a frame or box supported upon legs and feet, which, by the action of a spring or other motive agent within the said frame or box, are caused to have an alternating step by step movement, resembling that of walking. It also consists in certain means by which the motor within the box is made to actuate the legs. Also in a certain construction of such legs and feet, each leg being formed of parallel bars, with the feet so applied that the foot may be placed flat on the floor, or other surface on which the walking is performed, at every step, and so ensure steadiness of movement. Also in a certain arrangement of the feet, whereby the apparatus is balanced and firmly supported on each leg and foot, while the step is being taken by the opposite leg and foot; and, further, in a construction of the legs, and means of operating the same, whereby the movement of the knee-joint is imitated. *Not proceeded with.*

1665. W. CLARK, *Chancery lane, London*, "*Excavating machinery.*"—*A communication.*—*Dated* 29*th June*, 1861.

The purpose of these improvements is more especially to adapt excavating machinery to deep tile draining. The invention consists in a certain mode of applying and operating a rotary spade wheel, whereby it is made capable of working with its axis below the surface of the ground, while driven by machinery above the surface. Also in certain improved means of cleaning and carrying away the dirt from the spades after they have raised it above the surface of the ground. Also in a certain construction of the framing of the machine to provide for the raising and lowering of the spade wheel. Also in certain means of gauging the line of descent of the bottom of the trench or ditch dug by the machine; and further in certain means of preventing the falling back into the trench or ditch of the dirt which may fall from the spades after having been raised above the surface of the ground.

1669. W. LIVESEY, *Park-village East, Middlesex*, "*Wet gas meters.*"—*Dated* 29*th June*, 1861.

This invention has for its object to connect the meter direct to the iron service pipes, without the use of lead or other flexible pipes or soldered joints; to regulate the opening and closing of the inlet and outlet pipes simultaneously; to ascertain the level of the water inside the meter without putting the meter out of action; to prevent the oscillation of the lights from any sudden increase or irregularity in the pressure; to prevent any injurious effect upon the registration from the meter being tilted or placed out of its level, and to simplify the index. The invention cannot be described without reference to the drawings.

1670. W. DINGWALL, *Dundee*, "*Fluid meters.*"—*Dated* 1*st July*, 1861.

This invention cannot be described without reference to the drawings.

1671. J. H. JOHNSON, *Lincoln's-inn-fields*, "*Apparatus for manufacturing and bottling aerated liquids.*"—*A communication.*—*Dated* 1*st July*, 1861.

In carrying out this invention it is proposed to employ three distinct apparatuses, which are so combined as to work simultaneously, and in concert with each other. The first apparatus is the gas generator, which consists of an upper and a lower glass or porcelain vessel, suitably protected by wire work, cane work, or other material in the usual manner. A stopcock serves to open or close the communication between the two vessels, and a pressure gauge in connection with the lower vessel indicates the pressure therein. The carbonate of soda is contained in the upper vessel, and is allowed to descend as required into the lower vessel, where the gas is produced by opening the stopcock before referred to. A flexible pipe, provided with another stopcock, connects the gas generator with the saturator, which is suspended at its middle on trunnions, so as to be capable of being conveniently oscillated or agitated. The gas is conveyed to the bottom of this vessel by an internal pipe, opening at its lower end into a small chamber, the top of which is perforated with a number of small holes. The liquid having been saturated in this vessel is forced out by the pressure of the gas through a flexible tube leading to the bottling apparatus, which may be of two kinds, namely, for filling syphons, or for filling ordinary bottles.

1672. J. POTTS *and* R. COX, *Birmingham*, "*Treating tubes used for posts for metallic bedsteads and other purposes, &c. &c.*"—*Dated* 1*st July*, 1861.

According to this invention the treatment of tubes for supports or posts of metal bedsteads and other purposes apply to such only as are required to be connected with cast iron or other metal joints. As, for instance, in the making of a tubular foot or post for a metal bedstead, the two tubes forming the upper and lower portion are laid in a sand or metallic mould, the space between them being filled up with molten iron or other metal (in the ordinary way of casting) for the purpose of forming the dovetail or other joint for uniting such posts to the side or end rails or other parts forming the bedstead. This invention has for its object the preventing the molten iron or other metal running through and filling or partially filling up the interior of the said tubes, which is objectionable, as it not only causes an unnecessary use of metal, but increases the weight of the finished article. And the patentees effect this by inserting in the ends of the tubes, in connection with the intended cast joint, iron or other metal discs, of the size in their diameter of the internal diameter of the tubular foot or post desired to be stopped; and such discs may be cupped or otherwise treated so that they may be readily forced in position, which in a general way is about a quarter of an inch more or less within the tube. These discs they purpose forming and raising with a new mechanical arrangement, which is also applicable for cutting out such like articles for other purposes, and which consists of an iron base with standards or side supports, resting on a wood, brick, stone, or other suitable base, with a horizontal shaft carrying the loose and fast pulley for controlling its motion (derived from steam, water, or other auxiliary power); on this shaft is a worm or pinion working in a wheel on the cam shaft, which works through a slot in the working bolt or main working part, so that, as the cam or eccentric revolves, so this part is made to advance or retire, or work up or down, according to the position in which the apparatus is required to be worked. But in general it is preferred to work this part horizontally, as it affords means for the work and scrap pierced out to fall as it is produced.

1674. L. H. SPENCE, *Hatton-garden, London*, "*Manufacture of paper bags or envelopes.*"—*A communication.*—*Dated* 1*st July*, 1861.

This invention cannot be described without reference to the drawings.

1678. J. POTTS, *Flint-street, Old Kent-road, London*, "*Machinery for sounding fog-bells, &c.*"—*Dated* 2*nd July*, 1861.

These improvements consist in producing a more full and clear sound from the bell when struck, without any variation in intensity, than can be obtained by any other plan hitherto employed. The improved machinery for this purpose may be described as follows:—An upright standard, having in suitable bearings a spindle, carries thereupon a weighted lever, to which is attached a segment of a tooth which gears in with a pinion, to which pinion motion is imparted by means of a clock machine. To the weight is connected, by means of a lever, a shaft working horizontally in two standard brackets. The shaft comes in contact with the clapper of the bell to be sounded.—*Not proceeded with.*

1681. H. H. BISHOP, *Leicester-street, Leicester-square, London*, "*Sewing machines.*"—*Dated* 2*nd July*, 1861.

This invention consists in a peculiar combination of mechanical parts for giving motion to the needle. For these purposes, in order to give the requisite up and down motion to the bar on the end of which the needle is fixed, such bar at its upper end is pin jointed to a slide, which is guided correctly in its motion by moving between fixed guiding surfaces. To the upper end of the slide one end of a connecting rod is attached by a pin joint, the other end of such connecting rod being attached to a crank or arm, formed or fixed on one end of a rocking shaft, which has its bearings carried by the fixed arm of the sawing machine. At the other end of the rocking shaft is another crank or arm, which, by a connecting rod, is connected to a crank on the driving shaft of the machine. In order to cause the work to move a distance between the succeeding stitches there is another rocking shaft used, which turns in suitable bearings, also carried by the fixed arm of the sewing machine. At one end of this rocking shaft an arm is fixed, the end of which is in contact with, or otherwise actuated by a suitable cam in such manner as to cause the shaft to rock slightly at the time the needle is in the fabric or fabrics, in order that, by another arm fixed at the other end of the rocking shaft, it may cause the needle bar and the needle to assume an inclined position in regard to the slide, to which, as before mentioned, it is connected by a pin joint. By these means the work is moved a distance each time the needle descends into it, so that, when the needle has been withdrawn by the movement of the slide, actuated by its rocking shaft, and the needle has been caused by the rocking shaft and cam again to assume a vertical position, the needle will, when it next descends into the work, pass through it at a distance from the point where it previously passed into the work.

1689. J. BENNIE *and* W. MOFFATT, *Johnstone, Renfrewshire*, "*Manufacture of heels, clog irons, horse shoes, chain-links, &c.*"—*Dated* 3*rd July*, 1861.

This invention consists in making the articles entirely of steel, instead of steel combined with iron, or iron alone, as hitherto. Or the articles may, by the present invention, be made of iron, and be case-hardened, to render them more durable. The improved apparatus to be used in making the articles comprises mechanism for effecting several distinct operations.—*Not proceeded with.*

1691. C. GILFOY, *Southampton*, "*Resisting and extinguishing fire in buildings or on board ship.*"—*Dated* 3*rd July*, 1861.

This invention consists, principally, in fitting or constructing the rooms of buildings, and the cabins, holds, or other compartments of vessels, with water tight or perforated ceilings, and providing such ceilings with pipes and union joints to which the engine hose or pipes from the main or other water service may be connected, so that, in the event of fire in any room or compartment, the ceiling above the same may be charged with water, and thus not only will the water be discharged through the perforated pipes or perforated ceiling directly on to the fire to extinguish the same, but the ceiling, being charged with water, will resist the fire, and prevent it from communicating with the storeys or compartments above.—*Not proceeded with.*

1692. R. JOLLY, *St. John-street, Smithfield, London*, "*An improved apparatus for heating, cooling, or drying, infusing, extracting, or absorbing vapours and gases for manufacturing, medical, or domestic purposes, and for preserving liquids and solids, alimentary or otherwise.*"—*Dated* 3*rd July*, 1861.

This apparatus or enclosure may be constructed any shape or size, movable for transit, or fixed, and upon any non-conducting principle, wholly or in part of pulp or fibrous substance woven, compressed animal or vegetable matter, or made to cohere with any liquid or waterproof matter, resinous, vitreous, or otherwise, the same being fixed especially round all angles and joints to exclude air, water, heat, or cold. Within the top or any other part of the inclosure is fitted a vessel or vessels, metallic or otherwise, corrugated, ribbed, angulated, or not, with curve, elliptical, circular, angular, or flat sides, ends, or bottom, or all of such a form as will cause the adhesion of vapours during the process of extraction. These vessels are provided with pipes, traps, and drains for quickly carrying off what is extracted, and may be used with a continuous flow or force of hot or cold water or air through pipes or not, or to be charged especially on the upper part with any liquid or solids mixed or otherwise, natural or artificial, producing heat or cold, according to temperature required; and these vessels may be double, or one within the other, and the space between may be exhausted or filled with any kind of liquid or solid, in like manner as the aforesaid vessel, or warmed by gas or any other means. Within the inclosure is placed, in movable cases or otherwise, any absorbing liquid or solid, which has an affinity for the particular gas or vapour which is required to be absorbed or extracted, and, to prevent the counter attraction, all metals used in the construction are covered by some fibrous material; also the enclosure may be used by exhausting therefrom the air by heat, steam, or pumping.—*Not proceeded with.*

1696. V. C. GIVRY, *Old Bond-street, London*, "*Sewing machines.*"—*A communication.*—*Dated* 3*rd July*, 1861.

According to this invention connecting arms, links, or connections are employed for transmitting motion, the same being jointed or properly connected to the parts from which they derive, and to those to which they communicate, their motion. For imparting reciprocating motion to, or actuating the needle, instead of a continuous rigid rod or bar, a connecting arm, bar, rod, link, or piece is used, jointed or connected at one end to the needle holder or carrier, and at the other end to a crank, disc, or wheel, or equivalent contrivance, from which it receives motion. The inventor prefers to construct the crank-disc with teeth on the edge, so as to form a toothed wheel, or combine it with a toothed wheel, and to fix it on a shaft to which motion is communicated by hand wheel, or by strap and pulleys, the driving pulley being on a shaft below the base-plate or table, and worked by treadle, or steam, or by other means. For actuating the presser-feeder or foot he uses cams, preferring to attach a cam on the toothed wheel whence the needle is driven, which cam, acting on a friction-roller attached to a lever connected to the foot or presser, lifts the latter at the proper intervals, while the feed or back motion is imparted to the foot by a cam on another toothed wheel below, and, in gear with the former, this cam acting on a friction roller on the foot which is brought back by a spring. The hook or bent hooked or holding needle which is under the table or base-plate may be adapted as a sewing needle, or for helping to form the stitch for knot stitching, or work in which two threads are required. This needle is actuated by a jointed arm, or series of arms, links, or bars, which it is preferred to accomplish by a cam on an upright shaft in gear with the horizontal shaft acting on a friction roller in a slotted arm guided by studs and brought back by a spring, there being at the end of the arms a bell-crank lever arrangement holding a grooved and bent needle, which works at an orifice in the table whereat the upper needle acts, and has thread led to it, through guide eyes, from a reel or spindle pivoted under the table. This arrangement may be adapted for working shuttles, adding or substituting a box-race or guide-groove at the place of one of the links.—*Not proceeded with.*

1698. J. KULL, *Switzerland*, *and* C. A. CASPAR, *Stanley-terrace, Studley-road, Stockwell, London*, "*Level measurements on an entirely new principle, called 'level balances.'*"—*Dated* 4*th July*, 1861.

This invention cannot be described without reference to the drawings.

1699. R. MILLS, *Bury*, "*Washing, wringing, and mangling machines.*"—*Dated* 4*th July*, 1861.

According to this invention, instead of making the bowls or rollers of wood, as heretofore adopted, the inventor makes them of cast iron, and covers the surfaces with zinc, tin, or other suitable metal. He casts them hollow with the shaft through and attached, and he injects steam into them to assist the drying of the goods. The said rollers are applicable to domestic machines, as well as those used by bleachers, printers, and others.—*Not proceeded with.*

1700. J. M. GALE, *Glasgow*, *and* T. KENNEDY, *Kilmarnock*, "*Taps or valves.*"—*Dated* 4*th July*, 1861.

This invention cannot be described without reference to the drawings.

1701. W. H. LUDFORD, *Stanley*, "*Brooms and scrubbing brushes.*"—*Dated* 4*th July*, 1861.

The patentee claims fixing the bristles or fibres of the said brooms and scrubbing brushes in continuous lines or rows, by forcing the said bristles or fibres into grooves, channels, or troughs made in the broom or scrubbing brush head, and securely holding the said bristles or fibres in their places by blocks or wedge-shaped pieces driven into the said grooves, channels, or troughs, and fixed by pins or screws.

1703. J. WEBSTER, *Gloucester-street, Pimlico*, "*Compositions used for lubricating railway and other axles.*"—*Dated* 4*th July*, 1861.

This invention consists in the production of a composition or grease which does not melt or run on the application of heat, even at very high ranges, and continued for a long time. For this purpose the inventor combines, by preference, at the rate of 4 lb. of tallow, palm oil, or other suitable oil or fatty matter, with 10 lb. of ley, containing about one-third of a pound of caustic soda from fifty to sixty per cent. strength. He boils these matters briskly for about one hour or more until the whole is reduced to eight or nine pounds, and is brought into that jellied state which is denominated a "jell," the peculiarity of which is that, upon any increased application of heat, it does not liquify or boil, but spurts out of the vessel. This state is well known to soap boilers, and separately is not of this invention. This preparation, whether obtained as above explained or otherwise, combined with oleic acid, or mixed oleic acid and stearic acid.—*Not proceeded with.*

1706. B. G. SLOPER, *Hackney, Middlesex*, "*An improved method of and machinery for amalgamating and for effecting the separation of gold from earthy and other matters containing the same.*"—*Dated* 4*th July*, 1861.

This invention is intended to effect the separation of particles of gold from earths and quartz, after being crushed to small particles or pulverised, by bringing mercury in contact therewith, as hereafter stated. The machinery consists of a hopper opening at bottom into a cylinder, placed horizontally or nearly so, and fitted with agitators secured to a vertical shaft made to revolve in the hopper. Inside the horizontal cylinder the inventor places and causes to revolve an archimedian screw, and crushed rock or auriferous earths are introduced together with mercury into the hopper. At the opposite end of the cylinder to that at which the charge is admitted there is an outlet into a vessel furnished with sieves of different degrees of fineness, and containing a set of channels or passages communicating at one end with a fan or blower, while they are open at the other to receive the mercury and gold in the state of amalgam, the air driven through them preventing the entrance of all matters of less specific gravity; the action of the vessel is assisted by a shaking or jogging motion being imparted to it. From the lower part of this vessel the amalgam falls into a cylinder, in which an agitator is caused to rotate, whereby the globules of amalgam are beaten into one mass, and until this mass is suffi-

ciently rich in gold it is pumped back to the hopper with fresh crushed quartz or auriferous earth to act and be acted upon as before.—*Not proceeded with.*

1705. M. A. F. MENNONS, *Paris*, "*Apparatus for the manufacture of ice, and for the refrigeration of solid and fluid masses in general.*"—*A communication*—*Dated 4th July*, 1861.

This invention cannot be described without reference to the drawings.

1707. B. FOWLER, *Liverpool*, "*Sewer and sink trap.*"—*Dated 5th July*, 1861.

This invention consists of a square or other suitably-shaped box, formed of iron, clay, or other suitable material, having the sides thereof flanging outwards from the bottom upwards, and having on the upper edge a ledge surrounded with a lap, upon three sides of which the lid rests when closed. The back ledge is formed a little lower than the front and side ones, and the back of the sides of the box is hollowed out to receive the lugs on the under side of the lid by which it is jointed to the sides of the box by a horizontal transverse pin or pins. The bottom of the box is formed with an oblong hollow truncated pyramid, which rises some distance inside of the box, and is open at the top. The grated cover or lid is cast with an oblong box in the centre, which, being open on the under side, surrounds the top of the truncated pyramid e-cape-port when closed, but is not in contact therewith, the inverted box being sufficiently large to allow the water to pass up into the inverted box on the under side of the lid, and escape through the opening on the top of the truncated pyramid into the sewer, the sediment remaining in the bottom of the box, from which it can be readily removed.—*Not proceeded with.*

1714. L. ROUGHTON, *Bedford-place, Old Kent-road*, "*Apparatus for extinguishing fire.*"—*Dated 8th July*, 1861.

In applying this invention to a warehouse of two or more storeys the patentee arranges, at different elevations, water pipes which shall be capable of discharging jets of water on to any desired floor. If the warehouse is situate in a town provided with a public supply at high pressure, he runs up a standard pipe from the street main, and connects therewith horizontal pipes from which he may lead branch pipes, distributing them over the building, either above or immediately below the different floors, and at suitable distances apart, so as to spread the supply equally over the whole of the building. In these branch pipes—supposing them to run along under the floor of the different storeys—he fits pendent valve boxes, which form vents for discharging the water in jets to the space below, and by suitable means in connection therewith he is enabled to act automatically, or without manual aid, in cases of imminent danger.

1711. J. E. M. DE PRADON *and* L. G. LECOQ, *Paris*, "*Apparatus for lighting.*"—*Dated 5th July*, 1861.

The essentially new principle of this improved apparatus which is more especially applicable to lighting the stage and house of theatres, is based on the application of the luminous rays sent back by direct and indirect interior reflection into capacities of the shape of pipes, allowing to conduct to the exterior the odours and deleterious gases resulting from the employment of gas, and its combustion in buildings and places in which it is essential that the deleterious gases of combustion should be expelled into the open air. And the invention consists in the employment of a pipe or conduit on which the gas burners are mounted, the whole being enclosed in a reflector, the interior of which will reflect the luminous rays and throw them on a polished or unpolished glass. Screens of various colours are placed at will in such a manner that the lighting can be obtained in the tone required.

1716. J. R. BLACK, *Summer-place, Onslow-square, and* H. W. SPRATT, *Walbrook-buildings*, "*Manufacture of boxes, cases, tubes, rings, &c.*"—*Dated 6th July*, 1861.

This invention consists in an improved mode of constructing and manufacturing boxes, cases, tubes, rings, and other such like articles (some of which have been usually made of pasteboard or thin wood and paper) by moulding and forcibly compressing into the form required pulp made from vegetable or animal fibres, in conjunction with earthy matter, starch, size, gum, oil, glycerine, resin, or other similar stiffening substance. The machinery employed is of the following construction:—The patentees employ a mould or die to receive the pulpy substance. They then employ one or more plungers to mould and forcibly compress it into the form required. The mould or plunger is pierced so as to permit the air and water to pass through it. When two plungers are employed they withdraw the first and supply its place with air driven through its centre. Before removing the second plunger the moulded article is delivered from the mould by another plunger, and is then removed into a drying room. In some cases they prefer to make the sides of the mould movable, and then this will be an additional operation, and will be effected previously to the action of the delivery plunger.

1718. T. WILSON, *Birmingham*, "*Movable spanners or screw wrenches.*"—*Dated 6th July*, 1861.

This invention consists in actuating or adjusting the movable jaws of movable spanners or screw wrenches by means of a screw, one part of which is right-handed, and the other part left-handed. One part of the said screw engages with the movable jaw and the other part engages with the body of the wrench, or with the fixed jaw of the wrench. Between the right and left-handed portions of the screw is a milled head or collar, in one or other direction; the movable jaw may be removed and adjusted to the required distance from the fixed jaw. The invention further consists in the arrangement or combination of certain parts of movable spanners or screw wrenches, and in the manner of putting together certain parts of movable spanners or screw wrenches.

1721. T. SMITH, *Bolton-place, Fulham-road*, "*Bells.*"—*Dated 6th July*, 1861.

This invention consists in constructing bells of glass by first casting them in a mould in a similar manner to metal bells, and then annealing them, so as to prevent them from cracking through sudden changes of temperature; or when the bells are of small dimensions the inventor sometimes forms them by the operation of blowing, or by pressing them in a mould from sheet glass when heated, so as to become plastic.—*Not proceeded with.*

1723. J. RIDSDALE, *Stoke Newington-green*, "*Inkstands applicable to the stoppers of bottles.*"—*Dated 6th July*, 1861.

This invention relates to those kinds of inkstands in which a portion of ink or writing fluid is raised into a dipping cup for use, and lowered therefrom when not required, by means of a stopper having a small hole formed through it, the said stopper operating as a piston, which, when depressed, forces the ink up the hole therein. Inkstands of this description are well known and in common use. Now this invention consists in an improved method of packing the aforesaid sliding stopper or dipping cup, by forming a groove or recess in the neck of the inkstand, or by forming two internal flanges therein, into or between which is placed a loose ring of vulcanised india-rubber, or other suitable elastic material. The sliding stopper aforesaid fits into the said ring tightly, and by these means is kept air-tight. The aforesaid elastic ring may, if desirable, be placed in a recess formed outside of the neck of the inkstand, and the dipping cup be formed as a cap, the inner surface of which fits tightly over the aforesaid elastic ring; when this is the case the patentee forms the aforesaid cap with a tube at the centre thereof, extending from the dipping cup at top to within a short distance of the bottom of the inkstand, so as to operate in a similar manner to the first-mentioned stopper for raising and lowering the ink as above stated. He proposes to adapt the foregoing arrangements either to the inside or to the outside of the necks of bottles, and form the stoppers thereof either as a solid plug, or as a cap fitting into or around the elastic ring for rendering the said stoppers air-tight.

1725. C. FARROW, *Great Tower-street*, "*Apparatus for affixing or applying capsules to the necks of bottles.*"—*Dated 6th July*, 1861.

For the purposes of this invention a number of small wheels are employed, and the bearings of the axles of the wheels are arranged so as to be capable of being moved to and from a common centre line, towards which they are constantly pressed by springs; the neck or mouth of the bottle or other vessel on which a capsule is to be fixed is, with the capsule upon it, placed between the wheels; the frame carrying the wheels and their bearings is rotated so as to cause the wheels to run round on the capsule while they are pressed against it, and thus the capsule is secured.

1728. G. TUTILL, *City-road*, "*Treating materials for the manufacture of banners and flags.*"—*Dated 6th July*, 1861.

The patentee claims the application to silk and other light materials to be made into banners, flags, bannerets, and streamers, of any of the solutions of india-rubber, either in combination or not with oil, to be followed by a coating of paint, as described.

1736. J. S. PARKINSON, *Loudoun-terrace, Kensington*, "*Perforated materials in combination with india-rubber.*"—*Dated 9th July*, 1861.

In carrying out this invention the inventor takes canvas, paper, felt, or other similar material of the required width, and surfaces the same on one or both sides by the usual process with india-rubber, with or without its usual compounds, and he vulcanises the same or not as may be desirable. He perforates the canvas, paper, felt, or other similar materials either before or after the above vulcanising operation by means of suitable machinery, and thus obtains any required pattern perforated through the substance of the same. If he so desires he embosses the parts left unperforated, and also proposes moulding fibrous materials to obtain a similar result.—*Not proceeded with.*

1731. R. HORNSBY, *Grantham*, "*Machinery for washing, wringing, mangling, and churning.*"—*Dated 8th July*, 1861.

In constructing washing machines, such as are described in the specification of a patent granted to the present patentee on the 10th October, 1860 (No 2468), and other washing machines which consist of a tub or vessel mounted on axes, so as to turn or swing thereon, in place of attaching a handle for working the machine to the tub itself as is usual, according to this invention, he fixes two handles on the axis of the tub outside the frame or standard by which the axis is carried; the handles project upwards from the axis, and are placed at an angle of about 45 deg. the one to the other. This arrangement enables the person using the machine without stooping (by passing the handles from hand to hand) to swing the tub through a much larger arc than that through which it would be possible to swing it (without bending the body) with handles such as heretofore employed. He makes the joint between the lid and the tub with felt or other soft material, and to force the lid in contact with the tub he places lugs on the tub inclined on the underside, and he employs a cross bar, also inclined at the ends, and which to fix the lid is placed thereon and turned round, so that its ends pass under the lugs; the inclines then press it down on to the lid. It is common to combine with washing machines mangling machines consisting of a pair of rollers running lengthways of the machine. Now, in order to keep the upper roller down towards the lower he employs the following arrangement of apparatus:—At the bottom of the framing of the machine, and at each end thereof, two horizontal shafts are mounted; each of these has a short arm on it, and rods connect these arms with the axis of the upper roller. Each of the horizontal shafts at one end carries a long lever weighted at its further end. The weighted levers which draw the rollers together are by this arrangement made to pass lengthways of the machine; they do not therefore interfere when it is desired to pass the machine through narrow doorways or openings, and the use of levers projecting at the upper part of the machine is also avoided. When levers so projecting are employed they are found to be very much in the way.

1733. T. T. MACNEILL, *Coelsnur-street*, "*Barometers.*"—*Dated 9th July*, 1861.

The object of one part of this invention is to multiply or increase the indication of the variable heights of the column of mercury in barometers to such an extent that the small variations in height, which are scarcely appreciable in barometers of ordinary construction, may be read off with the greatest facility. To effect this the patentee constructs a tube either wholly or partially of glass, and more or less of a greater length than the tubes of ordinary barometers. The top part of this tube is enlarged to a certain extent, and is closed, whilst the bottom portion is open, and is surrounded with either a closed casing of glass or any other suitable material, or with a solid mass of wood, cork, or any other suitable light substance serving as a float. This tube is filled with mercury, and then inverted in a vessel containing mercury in the ordinary manner in which barometers are prepared, so that a vacuum will thus be formed in a considerable portion of the upper enlarged part of the tube. If the tube is then left to itself it will sink into the mercury contained in the cistern until the buoyancy of the immersed part of the float at the bottom of the tube balances the pressure of the atmosphere on the top of the tube, plus the weight of the tube itself, when the tube will float or be suspended in the mercury contained in the cistern. The tube is maintained in its upright position by fixed rings through which it passes, which rings have pointed set screws guiding the tube during the vertical motion, so as to diminish friction, or the tube may be held in any other suitable manner. By the above described arrangement, according as the pressure of the atmosphere increases or diminishes, not only does the mercury rise or fall in the tube to the usual extent, but the tube itself sinks or rises to an extent varying with the proportion between the inside sectional area of the upper enlarged portion of the tube, and the sectional area of the float is immersed in the mercury.

1737. E. A. PENLEY, *Cheltenham*, "*Drawing boards.*"—*Dated 9th July*, 1861.

The object of this invention is to strain sheets of paper upon drawing boards without the necessity of using glue or other cement. The patentee proposes running an acute angular channel around the back of the board a short distance from the edge over which the edge of the paper is to be brought; wooden flaps are hinged on to the back of the board, and are provided with angular strips of wood to fit the before-mentioned channels. Thus it will appear that, as these hinged flaps are pressed down upon the edges of the paper which are turned over from the front, the entire sheet becomes tightly strained without the use of paste, glue, or cement. Metal pins or pegs may be placed beneath the flaps, to which the edges of the paper may be hooked before pressing down the flaps.—*Not proceeded with.*

1739. W. C. PARKINSON, *Cottage-lane, City-road*, "*Frictionless bearing for gas meters.*"—*Dated 9th July*, 1861.

According to this invention, instead of having the crank, flag, wire, and other similar movable parts, turned down at the end so as to run in a socket or bearing, as in ordinary gas meters, the patentee points the shaft, and places a piece of glass or other material, as flint, pot, china, stone, or earthenware, in place of the socket for the point of the shaft or spindle to work upon, thus reducing the friction to a minimum: also, the bearing cannot get fouled, as the ordinary spindles and bearings generally do, by the dirt that accumulates round them, as by the present invention the front of the shaft wears away the dirt as it accumulates.

1740. J. *and* G. E. KEATS, *Leek, Staffordshire*, "*Sewing machinery.*"—*Dated 9th July*, 1861.

The patentees claim, First, the means described for operating the shuttle, whereby they are enabled to adapt various sizes of shuttle to the same machine by merely changing the shell or carrier attached to the reciprocating slide. Secondly, actuating the needle bar and presser from the same cam, in the manner set forth. Thirdly, adapting to the same bridle-piece pressers capable of feeding the cloth either at right angles to, or in a line with, the course of the shuttle, and operating the same as set forth. And, lastly, they claim regulating the tension of the vertical needle thread by means of a coiled spring capable of adjustment, as described.

1741. C. COCHRANE, *Middlesboro'-on-Tees*, "*Improvements in treating gas in its passage from blast furnaces to the furnaces, stoves, boilers, or other heating apparatus where the gas is employed.*"—*Dated 9th July*, 1861.

This invention consists in applying to a blast furnace exhausting or forcing machinery, together with a scrubber or apparatus capable of diverting the gas after it comes from the head of the furnace into very numerous minute streams and divisions, and capable also of subjecting the gas when so divided to the action of water, in such manner as to remove all dust from the gas.

1743. J. GERMAN, *Friar-gate, and* G. N. BROWNE, *Derby*, "*Apparatus to be used in shampooing.*"—*Dated 9th July*, 1861.

This invention consists in combining a series of rollers—which are preferred to be as near as may be of a spherical form—suitably mounted in a holder or frame, in such manner that, when the holder or frame is passed over and pressed towards the parts of the body or limb of a patient, the rollers may indent and roll over and offer friction to the parts with which they are in contact, thus producing a kneading of every part of the surface of the patient over which the apparatus or rubber is passed, whilst, at the same time, the skin of the patient will not be liable to be injured or broken.

1749. J. C. B. SALT, *Birmingham*, "*Steel-plates, name-plates, &c.*"—*Dated 11th July*, 1861.

This invention consists in manufacturing the said plates or surfaces by first coating or covering with enamel plates or surfaces of cast or wrought iron or steel, and fusing the said enamel thereon, so as to form an enamel ground on the said plates or surfaces, and afterwards applying to, and fusing upon, the said enamel ground the inscriptions or devices to be produced, the said inscriptions or devices being made or produced in an enamel of a different colour from, and more fusible than, that of the enamel ground.

1753. W. WILKINSON, *Bayswater, London*, "*Improvements in manufacturing and ornamenting brushes, parts of which are applicable to ornamenting baskets and articles of furniture, and to protecting silver on glass.*"—*Dated 11th July*, 1861.

The primary object of this invention is the ornamentation of brushes, and the invention is carried into effect in the following manner:—The inventor takes two flat surfaces of, say, wood, coats each with glue, or other adhesive material, and presses the two together until they are firmly united, and further secures the same, if necessary, with rivets or otherwise. When the back of the brush is made in the manner before described he prepares it to receive the ornament by brushing a cement over it composed chiefly of glue, or other adhesive substance; he then takes a piece of waterproof cloth, or other fabric, coats it with a similar adhesive substance, and lays it on the back of the brush, where it is caused to adhere by pressure or otherwise; the superfluous matter is then cut off, and the edges, with the other parts of the brush, are stained or ornamented to correspond with, or form a contrast to, the back. The cloth he prefers to employ for this purpose is made from a pulp composed of cotton warp, hemp, wool, or other filamentous material.—*Not proceeded with.*

1754. T. G. MESSENGER, *Loughborough*, "*Valves.*"—*Dated 11th July*, 1861.

This invention consists, in the First place, of forming a chamber with a valve seat and valve constructed of brass, or other suitable material, the valve opening quite back, so as to give the same capacity in the valve as that which is in the pipe with which it is connected. Secondly, in constructing a spindle working through a stuffing box, or inside the chamber before mentioned, to which spindle the above valve is attached, and which said spindle forms the hinge of the valve; a toothed quadrant is fixed to the said spindle, and is acted upon by a worm or screw and wheel, or by a handle, or other suitable contrivance, so that the operator may be enabled to open the valve any required distance. Thirdly, in constructing a lid or door, which may be removed with ease and at pleasure (should the valve require cleaning or repairing) without disturbing the pipes or breaking a joint.

1771. G. TREBLE, jun., *Aldersgate-street, London*, "*Show cases.*"—*Dated 15th July*, 1861.

This invention consists in constructing cases for showing jewellery, chemists' articles, specimens, and articles generally with a sliding cover of glass, bent into the segment of a circle, fitted in a correspondingly shaped frame, and free to be worked from the back or front of the case. The frame carrying the glass moves in grooves in the side of the case.—*Not proceeded with.*

1770. T. WALKER, jun., *Otley, Yorkshire*, "*Apparatus for polarising light, applicable to microscopes, &c.*"—*Dated 15th July*, 1861.

This invention consists in the application of glass placed at certain angles in a suitable frame for polarising light.—*Not proceeded with.*

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

YESTERDAY IN BIRMINGHAM: *Low Prices of Iron: Demand for France: Speculation on Account of America*—PIG IRON TRADE: *Inactivity*—COAL: *A Drug*—COAL PIT ACCIDENTS IN THE PAST DECADE: *Returns for South Staffordshire and Worcestershire: A Marked Reduction*—WIDE-SPREAD RUMOURS: *Fears Removed*—GENERAL MANUFACTURING TRADES: *Condition Improved*—WOLVERHAMPTON CHAMBER OF COMMERCE—PROPOSED COTTON SPINNING IN KIDDERMINSTER—FATAL MACHINERY ACCIDENTS—THE PIT ON FIRE.

THE iron trade has not improved since our last. There are a few first-class houses where a slightly improved demand is being experienced; but the quantities ordered are very small, and the houses benefitted so few as to make their case an exception to the general rule. In the great depression in the American trade the French treaty is proving most valuable; for there is reason to believe that much of the iron that is being sent to London for export is ultimately unshipped in France. When the French ironmasters began to inquire about the prices at which they could procure malleable iron in a partially manufactured state—in the bloom, for instance, after leaving the hammer of the shingler—they were told that it would be a cheaper course for them to purchase the iron in a finished state. Recent experience is giving rise to the expectation that they have seen it desirable to act upon the advice then given. The demand is yet quite small, but, in the present bare condition of makers' books, it is quite perceptible. A little spurt is taking place through the disposition of some adventurous speculators to send iron to America in anticipation of a rise in the prevailing tariff. The home demand keeps miserably small. On every hand there is an effort being made to obtain a reduction in prices, and although some that are very low are being accepted, yet, in several departments, and in that of bars in particular, South Wales makers can send iron into South Staffordshire, and sell it at 10s. under almost the lowest prices accepted for South Staffordshire iron at the works; and the carriage from South Wales to Wolverhampton is 10s a ton; for not a few uses the South Wales iron in preference to that of this district; but the uses are not those to which best iron are usually put.

Very little, if anything, is being done in pig iron. Buyers continue to desire the quotation of lower rates, and holders are indisposed to yield. Coal is for the greater part still a drug.

The Parliamentary paper just issued shows that in the South Staffordshire and Worcestershire district the quantity of coal raised in 1851 was 5,590,000 tons, and the number of deaths in coal-pits 199, which was the largest number in the decade ending with 1860, in which year, although the coal raised was 5,100,000 tons, the deaths were only 143. The difference shows how great a saving of life may be fairly attributed to the increase in the number of mine inspectors, for in 1851 there were only four inspectors, whilst now there are twelve. It is gratifying to learn that Mr. Baker, who has the charge of the above-named district, has reason to conclude that the deaths in 1861 will be fewer than even in the previous year.

Connected with the iron trade of this district the loudest rumours have been heard all the week that, if they should prove to be correct, would have a depressing local influence; but, on Wednesday, in Wolverhampton it was stated that all accounts due were being met with all the ease and readiness previously displayed.

The general manufacturing trades are not better than they were a week ago. Some few are slightly improved on account of Canada, but the influence is not wide-spread. In tin-plates the speculation just referred to in respect of America is being felt; but the prices that makers are forced to accept are so low that, but for keeping the workpeople employed, they would not be accepted.

A few weeks since we cautioned the manufacturers of Wolverhampton and Birmingham against a firm in Manchester who, under a title to which they had no claim, were victimising some of the manufacturers of the former town. We now find that since then some Birmingham merchants have been attempted to be duped by some professed buyers in Manchester. A liberal order was received in Birmingham; but, upon the Manchester police authorities being communicated with, it was found that the correspondents were not to be trusted. Ironmasters and hardware merchants would do well to exercise more than usual vigilance relative to the trustworthiness of the orders that they receive from previously unknown firms who date from the cotton metropolis.

The council of the Wolverhampton Chamber of Commerce held, on Monday, their first meeting since the annual meeting of the chamber. The officers of the past year were re-elected. It was resolved that, when Mr. Cobden should bring forward his proposal for a committee to inquire into the expediency of introducing into this country the metric system of weights and measures, a petition in favour of a committee should be forwarded from that chamber. A committee was appointed to report the law of partnership. It was determined that sufficient information was not possessed to enable the council to support the application of the Worcester Chamber that the Board of Trade would grant to that city the privilege of a bonded port. No deputation is to be sent to the meeting of the Associated Chambers on the 19th inst., the opinion of the Wolverhampton Chamber having already been expressed on all the subjects about to be discussed. In reply to a communication from the Mercantile Law Amendment Society, the council expressed their more than readiness to support an application for the appointment of a chief judge in bankruptcy.

In Kidderminster a cotton spinning company was some time ago formed to find employment for the operatives thrown out of employment by the introduction of steam to carpet weaving, and to generally improve the condition of the town. On Friday the annual meeting was held at the company's mill. The report of the directors stated that they had appointed Mr. Newbigging, of Manchester, as manager. The bulk of the machinery had been obtained from Messrs. Walker and Hacking, of Bury. The whole of it had been delivered, and it was nearly fixed and ready for work. The whole of the plant is now in a state for almost immediate operation. The works, however, will not be started during "the very peculiar and unprecedented state of things which now exist in regard to the supply of cotton." After all the liabilities should be discharged, up to the time of starting there would remain a surplus of capital sufficient to carry on the undertaking with every advantage.

Several fatal accidents connected with machinery have happened since our last. A working engineer in Birmingham, aged only nineteen, was sewing a band, when the awl slipped and entered his left eye. On the fourth day afterwards he died. A *post mortem* examination of the body revealed that the implement had penetrated through the skull into the brain.—An accident very similar to that at Newcastle, by which the reading public were shocked, happening as it did so early upon the mammoth calamity in the same neighbourhood, occurred last Tuesday in Birmingham. Mrs. Sarah Stanley, the proprietress of the Stanley Saw Mills, in Birmingham, was stepping over a spindle in the mill when her dress was caught, and she was a mutilated corpse in an instant.—A boy, only thirteen years old, has been killed at Messrs. Sparrow's tin-plate works, Wolverhampton, by being drawn into a cog-wheel pit connected with some rolls for the manufacture of sheets for tin-plates. The boy was not without blame; but the pit was, in the opinion of the jury, inefficiently fenced.—A workman at Messrs. Walfords' Saw Mills, Wolverhampton, was reaching across a moving band that was working beneath the flooring when he became entangled, and, being drawn up to the drum, received injuries from which, in a few hours, he died.

Messrs Dawes' coal pit at the Blackheath Colliery, near Rowley Regis, that had fired from an unknown cause and killed three men, and that was fastened down, has been so far examined as to lead to the conclusion that the accident arose from the taking fire of the stables in the thick coal; but how engendered is not at present as certained. The boiler of the underground engine did not explode, a was at first supposed; and the men appear to have taken all ordinary and proper care, the fire having been raked out and the tools put away.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(*From our own Correspondent.*)

Northern Matters: *Depression of Trade: Derwent Ironworks: Miners on Mining Operations: Newcastle Municipal Topics: Street Railways*—The Metropolitan Sewage and Essex Land Reclamation Scheme: *Abandonment of the Undertaking for the present*—Scottish Shipbuilders' Association: *Armour Plating for Ships of War*—The Fall in Railway Revenue: *Calculations and Statistics.* The Mineral Traffic—State of Trade: *Sheffield; Doncaster: Manchester: Trade Outrage: State of Employment*—The Cunard Line: *The China*—Scottish Shipbuilding—Other Scottish Topics: *The Coal and Iron Trades: Association of Assistant Engineers*—Mersey Docks and Harbour Board—Institution of Engineers in Scotland.

Grumbling complaints continue to come to hand with respect to the state of trade on Tyneside; no doubt things are bad enough, but we think there is some tendency to exaggerate the present evils. Annexed are the results of certain testing experiments at Chatham with iron supplied by the Derwent Iron Company, who have entered into considerable contracts with the Government:—

PLATES.

ft. in. in. in.		tons.	cwts.	qrs.	lbs.
6 5½ × 27 × 27½ × 7-16	Proof strain length ..	18	3	0	0
	Broken at	18	12	2	0
6 5½ × 27 × 27½ × 7-16	Proof strain breadth ..	15	13	0	0
	Broken at	17	17	2	0
ft. in.					
7 × ½ — 30ft.	Proof strain	27	16	0	0
	Broken at	28	5	0	0
7 × ⅝ — 30ft.	Proof strain	27	13	1	21
	Broken at	30	10	0	0

ANGLE IRON.

ft. in in.		tons.	cwts.	qrs.	lbs.
3½ × 3 × 9-16	Proof strain	23	17	3	0
	Broken at	26	5	0	0
3½ × 3 × 9-16	Proof strain	24	4	0	0
	Broken at	27	10	0	0

It is reported that some arrangement has been made with the creditors of the unfortunate Northumberland and Durham District Bank, by which the Derwent Works will be carried on as usual, at least for the present. A gentleman of experience in mining and manufacturing operations is about to revalue the whole establishment. On Saturday a meeting of delegates from the various collieries in Northumberland and Durham was held at Newcastle to discuss the present system of mining operations. The result of the deliberations was the adoption of a series of resolutions, the first of which described the existing method of working coal and ironstone mines as "dangerous to the lives and injurious to the health of the miners;" and it proposed that, with the view of effecting a change, petitions, pointing out remedies for the evils complained of, should be forwarded to both Houses of Parliament as speedily as possible. The form of memorial agreed to was that which has been published as emanating from a previous meeting in the same place; and a secretary and executive committee were selected to make the necessary arrangements for its presentation. On the question of inspection, which was also discussed, it was decided to recommend that there should be ten Government inspectors for the two Northern counties; and while it was admitted that Mr. Matthias Dunn was a most efficient and experienced officer, a general opinion prevailed that he had too extensive a district to superintend. The proceedings of the Newcastle Town Council at its last meeting referred to several matters of more or less interest. A letter was read from the Tyne Improvement Commissioners soliciting a conference with the council with regard to the river dues, and was referred to one of the committees. On the subject of the Whittle Dean water supply a report presented was considered too meagre, and was referred back to the committee, to whose consideration the question had been entrusted, with instructions to inquire into the whole matter more in detail, and state their views as to the propriety of the council having independent works of their own. The council granted permission to Messrs. Samuel and Bruce, of London, to construct a street railway from the east-end of Neville-street to the extremity of the borough boundary on Scotswood-road, the Town Improvement Committee being empowered to enter into the necessary negociations. The Newcastle Chamber of Commerce has adopted a report strongly recommending the establishment of complete railway communication between the North Eastern system and the quayside.

The "Metropolitan Sewage and Essex Land Reclamation" scheme seems to have fallen through, no one appearing before the standing orders revising barrister on behalf of the bill deposited. This result is probably due to the course adopted by the Metropolitan Board of Works, who failed to give that support to the project to which the promoters considered that they were entitled. There is no doubt that the utilisation of the enormous mass of sewage which London produces daily is a problem of very great interest and importance, but its solution in a financially successful point of view is a matter of extreme difficulty. The present period is also unfavourable to the prosecution of enterprises the economical results of which are at all doubtful.

At the last monthly meeting of the Scottish Shipbuilders' Association Mr. Lawrence Hill, of Port-Glasgow, read a paper on "Armour-plating for ships of war, with illustrations of the several methods that have been adopted for forming the sides of war-ships to carry armour plates, and also the modes adopted for backing and fastening the armour to the hull of the ship." Mr. Hill commented also on the usual methods of jointing the armour with bevelled edges, triangular and square grooves, and feathers, half-checks, and ridges; and also upon the cost of the very broad heavy plates—15ft. long by 3½ft. broad, weighing between four and five tons, and costing as much as £50 per ton—used in covering the sides of our present armour-clad ships. The objection to narrow armour plates was usually understood to be that the joints were the weakest parts, of which the fewer the better; but if some method could be found of making and fastening armour plates of 1½ to 2 tons weight, costing not above £15 to £20 per ton, so as to be as strong at the seams as at the centre, one great difficulty and enormous expense would be overcome. It would be a great matter to save £30,000 on the armour of a vessel like the Warrior. And he concluded by proposing a mode of making and securing armour plates of the sizes recommended, by which the seams were actually made the strongest parts of the armour, and all bolt-holes—another source of weakness in the present modes of armour-plating—were avoided. Mr. Hill next exhibited and described the drawings of a new governor for marine engines. The one he described was, he believed, the only one of the kind, and had been fitted into a screw steam yacht of about 300 tons, built by his firm about two years ago; and he was informed by the owner that it was an excellent governor, remarkably sensitive, and not liable to derangement.

The declension in the railway traffic, to which The Engineer was one of the first to direct attention, has attracted so much notice that we have been at the pains of preparing some special statistics on the subject. Subjoined are the weekly receipts for the first five weeks of the current year:—

	Miles open.		Receipts.
Week ending January 4	10,048	..	£463,265
„ „ 11	10,059	..	458,730
„ „ 18	10,059	..	460,619
„ „ 25	10,059	..	458,732
„ February 1	10,066	..	472,171

In the corresponding period of 1861 the totals stood thus:—

	Miles open.		Receipts.
Week ending January 3	9,846	..	£454,248
„ „ 10	9,846	..	452,240
„ „ 17	9,846	..	459,338
„ „ 24	9,846	..	476,917
„ „ 31	9,853	..	496,452

In the first two weeks of the year there was an increase of £9,017 and £6,490 respectively; in the third week there was a decrease of £1,281; in the fourth week a decrease of £18,185; and in the fifth week a decrease of £24,281. Things have, therefore, been going on from bad to worse week by week. The comparative receipts per mile have been as follows:—

	1862. £	s.	d.		1861. £	s.	d.
Week ending January 4	46	2	1	..	46	2	8
„ „ 11	45	12	1	..	45	18	8
„ „ 18	45	15	10	..	46	13	1
„ „ 25	45	12	0	..	48	8	9
„ February 1	46	18	2	..	50	7	8

The present state of things has been long anticipated, and at last it has come: when it will pass away is quite another matter, and whatever course affairs may take there will be depression and suffering, we fear, for many weary weeks.

There is, on the whole, a more cheerful feeling at Sheffield. There is some improvement to notice in the orders for edge tools and heavy goods of a similar description; the steel trade continues moderately brisk, especially for sheet and crinoline steel, and the demand for files has increased during the last week or two. Birmingham merchants are ordering more steel goods required for the South American and other distant markets, and the orders from Birmingham for steel and files also show some indications of reviving business. The Continental demand is improving, and from Scotland advices are also more favourable. Considerable numbers of men have been discharged from the Great Northern Railway works at Doncaster, and many more, it is stated, are also under notice to leave.

The trade outrages, which have conferred such a discreditable notoriety on Sheffield, seem to have extended to Manchester. On Saturday night an attempt was made to blow up a portion of the brick-making works of Messrs. Hadfield and Atkins, Cheetwood, but only a comparatively small amount of damage was done. The proprietors of the works have recently patented a machine for making bricks, and about a week ago they put up a machine made by Messrs. Farmer and Broughton, Adelphi-street, Salford. The machine receives the clay direct from the mine into a hopper; and in one process the clay is ground, pulverised, moulded, and turned out in well made bricks. It can make 15,000 bricks in ten hours, or, in other words, it does the work of twenty-four men and six boys under the old system; and the bricks are walled as soon as they leave the machine. The special advantages of the machine are that it enables those using it to sell bricks at from 2s. 6d. to 3s. a thousand, the present price of hand-made bricks being 9s. per thousand; and that brick-making can be carried on with it all the year, whereas now the average time during which bricks can be made is only twenty weeks in a year. The state of employment somewhat improved at Manchester in the week ending Wednesday, there being fewer operatives altogether out of employment, and fewer on short time.

The China—the last addition to the Cunard fleet—has arrived at Liverpool, having, although during the earlier part of the voyage she encountered a stiff head wind, made the run from the Cloch Lighthouse, near Greenock, to the Bell Buoy, at the mouth of the Mersey, in 12h. 26m., with steam at 12 lb. pressure, being at the rate of 14 nautical or $16\frac{1}{10}$ statute miles per hour throughout. The China is fully barque-rigged, and is fitted with Cunningham's patent reefing apparatus; and also with Clifford's patent apparatus for lowering her boats, two novelties in the Cunard Company's mail steamers. In length the China measures about 350ft. over all, being 326ft. between perpendiculars; her moulded breadth is 40ft. 6in., and her depth is 27ft. 6in. She is a three-decked ship, with fully 8ft. in height between the floor and the ceiling of each of them; and her saloons, which are also 8ft. high, are fitted up under a hurricane deck, running from stem to stern of the ship. The main or after saloon is about 70ft. in length by 20ft. wide; the forward saloon is of equal breadth, but shorter. In front of this latter is the post-office, or letter-sorting apartment, a commodiously fitted up "snuggery," of considerable dimensions. The saloons, like those of the other Cunard mail steamships, are richly furnished. The sleeping berths for passengers are on the main deck, below the saloons, and the Board of Trade measurement for passengers in the China gives space for 268 first-class and 771 second-class, or forward passengers. It may be well, also, to state that she has been reported on measurement, by the Government Shipwright Surveyor, as competent to carry 1,500 troops, without dismantling her saloons, or taking down her after cabins. The China, like the Scotia and the Persia, is an iron built ship, strongly framed, and amply secured by water-tight bulkheads. Her gross tonnage is 2529·01 tons; allowance for propelling power 989·40 tons; registered tonnage 1539·61. She is propelled by two engines on the oscillating principle, with an aggregate of 550-horse power. The China was built and engined by Messrs. Robert Napier and Sons, of Glasgow. She is to start from Liverpool on her first voyage for New York with the mails on the 1st of March.

It may be interesting to add, while we are on shipping topics, that Messrs. Caird and Co. have contracted to build a first-class paddle steamer for the Glasgow and Dublin Steam Packet Company. She will be 236ft. long and 26ft. broad, and will be called the Lord Clyde. Her engines, of 300-horse power, will be supplied by the builders. Last week Messrs. Tod and McGregor launched from their building yard a new screw steamer called the Caledonia, which is intended to take the place of the United States, lately lost, and which had been built by the same eminent firm for the Anchor Line. She will consequently be employed in the Montreal and New York trade. The dimensions of the Caledonia are as follow:—Length of keel and forerake, 252ft.; breadth of beam (moulded), 33ft.; depth (moulded), 22ft. 9in.; tonnage (old measurement), 1360. She is to be propelled by a pair of direct-actioned engines of 135-horse power nominal.

As regards other Scottish matters, we may state that in a pit now in course of being put down by Messrs. Anderson and Gilmour, at Kilmarnock, a stratum of gas coal, equal to the coal got from Lesmahagow, has been reached; the stratum is 3ft. in thickness. A meeting of ironmasters was to be held at Glasgow on Wednesday to take into consideration the propriety of extinguishing a certain portion of the furnaces. Annexed are the weekly shipments of pig iron this year from Scottish ports, as compared with the corresponding period of 1861.

	1862. Tons.		1861. Tons.
Week ending January 4	7,707	....	5,202
„ „ 11	8,882	....	7,280
„ „ 18	9,308	....	9,266
„ „ 25	8,915	....	9,771
„ February 1	9,917	....	7,748
„ „ 8	11,122	....	7,083

The shipments thus far this year have, therefore, been 55,857 tons, as compared with 46,350 tons in the corresponding six weeks of 1861, showing the large increase of 9,301 tons. The home consumption must have been greatly curtailed, or ironmasters would not talk of blowing out furnaces, although stocks are very large. Circular schedules have been served on the several coalmasters in the neighbourhood of Glasgow, at the instance of Sir George Grey, to bring out the construction and ventilation of the various coal workings in the district, in common with all similar concerns in the United Kingdom. At the last meeting of the Glasgow Association of Assistant Engineers Mr. Y. W. Haldane read a paper on "Marine Engines." A lively discussion ensued on the varieties of these engines, their application for various purposes, and on the peculiarities of their details. A working model of a steamship was then exhibited by Mr. Russell, illustrating a new principle of propulsion by the combined force of air and steam without the intervention of machinery, the invention of Mr. Parker, of London. Papers were announced for next meeting on "Giffard's Injector," and on "Surface Condensers."

We must not forget our worshipful friends of the Mersey Docks and Harbour Board. At the last meeting it was agreed to accept the tender of Messrs. Haigh and Co. for a roof and slide doors for the shed upon the south-west quay of Sandon Dock at a cost of £2,292. It was agreed to grant an application made by Messrs. Jolliffe for permission to place two steam-tugs on the Great Float. Mr. Rees, in moving in accordance with previous notice for a return of the cost of the construction of the Sandon and Brunswick graving-docks, as far as practicable, and the revenue derived from each during the three financial years ending the 21st June, 1861, separating the revenue derived from sailing vessels from that of steam-vessels, said he did not wish to throw any impediment in the way of the construction of other graving-docks; on the contrary, he felt, and he was sure the Board had had abundant evidence, that new graving-docks were required to carry on the trade of the port, which had been sadly interfered with from the want of such accommodation. As they were now about to expend about £300,000, however, in the construction of new graving-docks, he thought it behoved them to ascertain what rates should be charged, in order that the new docks might be made self-supporting, because otherwise, if they were to pay 4¼ per cent. upon the £300,000 which they were going to borrow to make graving-docks that would only pay 2½ per cent., the difference would have to be made up in dock rates. He had a conversation the other day with an eminent shipbuilder, who saw no reason whatever why the graving-docks should not be self-supporting. It appeared that, when the last rates were arranged, they were put at 25 per cent. below the maximum rate which that Board could charge, but it might be found that the present rate was quite sufficient. If necessary, however, with respect to the steamers, which now only paid about one-half of their real tonnage, he thought some alteration might be made. His opinion was that those docks ought to yield 7 per cent. upon the cost of construction, because, in addition to the original cost of them, repairs were constantly required; and, therefore, there ought to be a percentage to cover such a contingency. The corn trade had expressed their willingness to pay 7½ per cent. for certain special accommodation which was being provided for them, and he did not see why any other business should not pay in the same way. The motion was agreed to.

At the last meeting of the Institution of Engineers in Scotland Professor Macquorn Rankine read a paper on some experiments made in a ship of the United States navy on the expansive working of steam. A vote of thanks was passed to the learned professor, who stated that Mr. Zerah Colburn, of London, deserved their thanks, as, but for data which that gentleman had furnished, the institution would not have had the paper which he had communicated. Mr. J. F. Spencer, from Newcastle, read a paper on the mechanical and economical advantages and disadvantages of surface condensation, and also received a vote of thanks. The discussion on both papers was adjourned for a month.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£ s. d.	Dis. p. ct.
IRON, English Bar and Bolt:—			
in London	per tn	5 15 0	3
in Wales	„	5 0 0	„
in Liverpool	„	5 10 0	„
Staffordshire Bars (Deliv. into boats at wrks; Nom. rates last qr. day for favourite brands)	„	7 0 0	1½
Sheet, Sngl.	„	8 10 0	„
Dbl.	„	10 0 0	„
Hoop	„	8 0 0	„
Rod, round	„	7 0 0	„
Nail Rod, sq	„	7 5 0	„
SHIPPING IRON, (Delivered in Liverpool 10s. per ton less)			
Staffordsh. Bars	„	7 0 0	2
Sheet, Single	„	8 15 0	„
Double	„	10 5 0	„
Hoop	„	8 5 0	„
Rod. Round	„	7 [illegible] 0	„
Nail Rod. Square	„	7 5 0	„
IRON, Rails, in Wales, cash	„	5 7 6	nett
„ „ 6 months	„	5 10 0	„
Old, to cut up	„	0 0 0	„
Railway Chairs, in Wales	„	4 0 0	„
in Clyde	„	3 15 0	„
Pig No. 1, in Clyde	„	2 8 6	„
3-5ths No. 1 & 2-5ths No. 3		2 8 9	„
No. 1, in Wales	„	3 8 9	„
No. 1, in Tyne and Tees	„	2 12 0	„
Ditto, Forge	„	9 0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	„	3 10 0	„
Welsh Forge Pig (all Mine), at the Port	„	3 5 0	„
Acadian Pig, Charcoal	„	7 10 0	„
Scotch Pig, No. 1, in London	„	3 0 0	„

		£ s. d.	Dis. p. ct.
IRON, Swedish, Indian assortments	per tn	11 5 0	2
Russian CC N D to arrive	„	16 0 0	„
STEEL, Swedish Keg, ham.	„	15 10 0	2½
Ditto, rolled	„	15 0 0	„
Faget	„	17 0 0	„
SPELTER, on the spot	„	18 2 6	nett
To arrive	„	18 5 0	„
Hard, remelted	„	17 0 0	„
ZINC, in sheets	„	24 0 0	„
COPPER, Tile, 14 to 28 lb.	„	102 10 0	2
Tough Cake	„	102 10 0	
Sheathing and Bolts	per lb.	0 0 11½	„
Sheet	„	0 0 11	„
Bottoms	„	0 1 0	„
Old	„	0 0 9½	„
Yellow Metal	„	0 0 9¾	„
Burra	„	100 0 0	„
Russian do.	„	101 0 0	„
LEAD, British Pig	„	20 15 0	„
Spanish	„	19 10 0	„
W. B.	„	21 .0	„
Sheet	„	21 15 0	„
TIN, English Block, nom.	„	120 0 0	„
Bar	„	121 0 0	„
Refined	„	122 0 0	„
Foreign Banca	„	124 0 0	„
Straits	„	119 0 0	„
TIN PLATES, Charcoal, IC	per bx	1 9 0	„
Ditto IX	„	1 15 0	„
Coke, IC	„	1 3 0	„
Ditto IX	„	1 9	
Do. at Newport, 1s. pr bx less		—	
Do. at L'pool, 6d.		—	„
CANADA, Plates	per tn	12 0 0	2
QUICKSILVER	per bt	0	

Rails.—The inquiry continues good, and prices remain firm at our quotations.

Scotch Pig Iron.—There has been but little animation in the market during the past week, and the price of Mixed Nos. has slightly given way, closing flat with sellers at 48s. 10½d. for cash, and 49s. 6d. three months open.

Spelter has been dull of sale, and but few transactions reported; the nearest price on the spot is £18 2s. 6d., or 2s. 6d. lower than last week's price.

Copper.—The business in this article since the reduction has not been very brisk.

Lead firmer, and quoted 5s. higher.

Tin.—English in fair demand. Foreign continues dull, and but little done in it. Banca and Straits may be had £1 lower, viz., £123 and £118 respectively.

Tin Plates in good demand.

Feb. 13th, 1862. Moate and Co., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s. £ s.	1862. £ s. £ s.
Teak	15 10 17 0	15 0 16 0
Quebec, red pine	3 10 4 10	3 5 4 0
yellow pine	3 0 4 0	3 0 3 15
St. John, N.B., yel.	5 0 5 10	5 0 5 10
Quebec, oak, white	5 0 5 10	5 0 5 10
birch	3 10 4 0	4 0 0 0
Memel	0 0 0 0	0 0 0 0
elm	3 10 4 15	3 10 4 15
Dantsic, oak	3 10 6 0	3 10 6 0
fir	2 15 3 10	3 0 4 0
Memel, fir	3 10 4 0	3 10 4 0
Riga	3 5 3 10	3 10 3 15
Swedish	2 10 2 15	2 15 3 0
Masts, Queb. rd pine	5 0 6 0	5 0 6 0
yl. pine	5 0 6 0	5 0 6 0
rd pine	0 0 0 0	0 0 0 0
Lathwood, Dants, fm	6 0 6 10	6 0 7 0
St. Peters.	8 0 8 10	9 0 9 10
Deals, per C., 12 ft. by 3 by 9 in.		
Quebec, wht. spruce	13 0 18 0	15 0 19 0
St. John, wht. spruce	13 0 16 0	15 0 17 10

Per load—	1861. £ s. £ s.	1862. £
Yel. pine, per reduced C.		
Canada, 1st quality	17 0 18 10	17 10 19 0
2nd do	12 0 12 10	13 0 13 0
Archangel, yellow	13 0 14 0	14 0 15 0
St. Petersbg. yel.	12 0 13 10	12 10 13 10
Finland	9 0 10 0	9 10 10 10
Memel	10 0 15 0	10 0 15 0
Gothenburg, yel.	10 0 11 10	10 0 12 10
white	9 10 10 0	9 10 11 0
Gefle, yellow	10 0 11 0	11 0 12 10
Soderhamn	10 0 10 10	11 0 12 10
Christiania, per C 12 ft by 3 by 9 in., yellow	22 0 25 0	22 0 24 0
Deck plank, Dnts per 40 ft. 3 in.	0 4 1 4	0 14 1 4
Staves, per standard M		
Quebec, pipe	60 0 70 0	80 0 85 0
puncheon	16 0 18 0	16 0 18 0
Baltic, crown pipe	160 0 170 0	170 0 180 0

SCOTCH PIG IRON REPORT.

			s.	d.	
No. 1	Gartsherrie	.. ..	55	0	f.o.b Glasgow.
„ 1	G.M.B.	.. ..	48	3	„ do.
„ 3	Do.	.. ..	47	3	„ do.
M. Nos.	Do.	.. ..	47	9	„ do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths „ 3 .. G.M.B.	Cash prompt	49	0	per ton.
	1 mo. open	49	3	do.
	2 mos. „	49	6	do.
	3 „ „	49	9	do.

MANUFACTURED IRON.

	£	s.	d.	
Bars, Govan	7	0	0	
„ Common	6	17	6	
Drumpellar, Common	6	17	6	
Do. Best	7	17	6	
Plates and Sheets	9	0	0	to £10.
Rails	7	5	0	
Pipes	5	0	0	
Chairs	4	0	0	

Glasgow, 12th February, 1862.

There has been no change in our market during the past week. The price has scarcely varied 3d. per ton. Speculation has been limited, owing to the uncertainty as to the result of the negociations pending amongst the ironmasters regarding blowing out a number of their furnaces. A meeting was held to day, and again adjourned for a week, until the intentions of some absentees were known.

Shipments last week were 11,122 tons, against 7,083 tons in the corresponding week of last year. Shaw, Thomson, and Moore, Metal Brokers.

SOCIETY OF ARTS.

February 5th, 1862.

Dr. A. W. MILLER, F.R.S., in the Chair.

ON IMPROVEMENTS AND PROGRESS IN DYEING AND CALICO PRINTING SINCE 1851.

By Mr. F. CRACE CALVERT, F.R.S.

(Continued from page 102.)

WHILE on this mode of producing purple aniline I may say that blue die may also be obtained with the above insoluble purple residue by boiling it several times with hydrochloric acid diluted, say ten parts of commercial acid to 100 parts of water, when the purple is converted into a blue dye.

Mr. Charles Lauth also published, on the 24th Dec., 1860, an ingenious method of obtaining purple aniline, which I shall describe when treating of blue colours obtained from aniline.

Red dyes obtained from aniline, called fuchsine, azaléine, roseine, &c.—The production of the fine colour, which bears the popular name of magenta, was first observed by Mr. Natanson, in 1856, and more especially by Dr. Hofmann when preparing cyantriphenyldiamine, by the action of bichloride of carbon on aniline. But it was Mr. Verguin who first brought it forward to the trade as a dyeing agent, and his mode of preparation, which was patented in April, 1859, by Messrs. Renard and Franc, of Lyons, is the following:—Into a glazed iron pan are introduced 100 parts of aniline and 60 parts of anhydrous bichloride of tin, and the whole is heated for fifteen or twenty minutes, at a temperature of about 392 deg. The dark red liquor thus produced is left to cool, when it becomes thick and glutinous; it is then mixed with boiling water and filtered; to the filtrate is added chloride of sodium, which determines the precipitation of fuchsine, as it is insoluble in saline solutions. Magenta was afterwards prepared by C. Greville Williams, with permanganate of potash, and by Dr. D. Price, with binoxide of lead; nitric acid and nitrate of mercury were also successfully employed. These different methods of preparing magenta were followed by several other patents, purporting to obtain the same results, and amongst them I may cite that taken on the 10th December, 1859, by Mr. Rudolph Heilman, in which the employment of arsenic acid is mentioned, and one also for the employment of the same agent on the 18th of January, 1860, by Dr. H. Medlock. As it is probable that this agent is the best suited for producing magenta, commercially, I will give a sketch of the process. Dr. Medlock heats two parts of aniline with one of arsenic acid to about 250 deg., and when the red colour is produced it is mixed with boiling water and allowed to cool. The red colour is thrown down by saline matter, washed, and dissolved in methylated alcohol, or the mass is digested in hydrochloric acid diluted with water, and the clear fluid solution is saturated with an excess of soda which precipitates the colour, while the arsenious acid is held in solution by the alkali. Magenta is a rather powerful organic base which is sparingly soluble in water, but its solubility is increased by the presence of an acid. It leaves a brittle mass, having a beautiful golden green metallic reflection when its alcoholic solution is left to spontaneous evaporation, and this is not peculiar to magenta, as the whole of the coal tar colours, when in a high state of purity, present the same appearance. Purple aniline differs from the red, not only in its composition, which is as follows:—

Purple.	Red.
$C_{26}\ H_{17}\ N_3\ O_2$	$C_{26}\ H_{20}\ N_4\ O_4$

but also because the fuchsine dissolves in ammonia and in sulphuric acid with a yellow colour, and is discoloured by sulphurous acid, whilst the purple is unaffected by those reagents. Silk or wool is dyed with fuchsine by simply adding some of the colour to a slightly acidulated bath. The dyeing colour of this material is so great that ten grains will dye two square yards of silk.

Of late years many attempts have been made to fix another colour obtained from coal tar, called rosalic acid ($C_{19}\ H_6\ O_3$), but up to the present time I believe all attempts have failed, with the exception of rosalate of magnesia, which was employed for some time in calico printing.

Blue colouring matters from Coal Tar.—I have already drawn your attention to the blue colouring matter patented by Mr. Girard, and carried out practically by Messrs. Renard and Franc, of Lyons. Mr. Lauth also has observed that, if an alcoholic solution of red aniline, and especially azaléine, is heated with a reducing agent, such as protochloride of tin, or still better with aldehyde or hydruret of benzoïle, a blue colour is produced even at ordinary temperatures. This blue colour is soluble in water, alcohol, and acetic acid, but does not resist the action of mineral acids, alkalies, or light.

Mr. Willm has recently published an interesting paper on this aniline blue, which not only shows how aldehyde acts, but exhibits the composition of the blue itself.

Azaléine.	Aldehyde.	Water.
$2\ (C_{36}\ H_{20}\ N_4\ O_4)$	$+\ 5\ C_4\ H_4\ O_4$	$+\ 8\ HO$
Blue or Oxyphenylanilide.	Acetate of Ammonia.	
$= 3\ (C_{24}\ H_{11}\ N\ O_2)$	$+\ 5\ C_4\ H_3\ (N\ H_4)\ O_4$	

Therefore the triamine azaléine has been transformed into a monamine blue, by a new chemical reaction, for aldehyde not only acts as a reducing agent, but converts a part of the nitrogen into ammonia.

Bleu de Paris.—Recently Messrs Persoz, de Luynes, and Salvétat called public attention to a new blue which they had produced, and to which they gave the name of Bleu de Paris; this they prepared by heating for thirty hours, in a sealed tube, at a temperature of 365 deg., one part of anhydrous bichloride of mercury with two parts of aniline. The blue thus produced can resist the action of weak acids and alkalies, but assumes a red hue when acted on by these agents in a concentrated state. Sulphurous acid has no action upon it, and it dyes animal fibres with facility.

Bleu de Mulhouse.—MM. Gros-Renaud and Schaeffer have lately published an interesting process for obtaining from the red aniline, called azaléine, a purple and a blue. It consists in dissolving in a litre of boiling water fifty grammes of white gum lac in powder, and eighteen grammes of carbonate of soda, to which is added fifty grammes of an alcoholic solution of azaléine. After an hour's ebullition the red colour is transformed into the Bleu de Mulhouse.

Azuline.—This beautiful blue colour, which resists the action of the strongest acids, and which was introduced into this country at the latter end of 1860 by Messrs. Guinon, Marnas, and Bonnet, of Lyons, is prepared by them from phenic acid, and, when pure, presents itself under the form of copper-bronze coloured crystals, soluble in alcohol, to which they communicate a magnificent blue colour, slightly tinged with red. The following is the process for dyeing silk and wool:—To an acidulated lukewarm bath of water an alcoholic solution of azuline is added, and the silk or wool worked in it until it is of the required shade. It is then transferred to another bath of boiling water, strongly acidulated with sulphuric acid, when the purple colour is dissolved, leaving a most brilliant and permanent blue upon the material. The dyed silk or wool is washed repeatedly, passed through a bath containing a little tartaric acid, and dried.

Chinoline Blue.—Mr. C. Greville Williams introduced in the spring of last year a fine blue colour, which he obtained by boiling together a substance derived from quinine or cinchonine, called chinoline, with iodide of amyl. The resulting product is boiled with water, and then with potash, for a quarter of an hour, filtered to separate the resinous matter, when a gorgeous blue is obtained, with scarcely any shade of red. This colour is so fugitive that its use has ceased.

Green Colours from Aniline.—Although it has been known to chemists that aniline would yield a green colour under certain oxidising agents, up to the present time all efforts to dye silk or wool commercially with it have failed, but to avoid having to refer to this green colour again I may mention that Messrs. Samuel Cliff, Charles Lowe, and myself, patented on the 11th of June, 1860, a most easy and practical method of producing it under the name of emeraldine, on cotton fabrics, specimens of which I have the honour to show you. The process consists in printing an acid chloride of aniline on a cotton fabric prepared with chlorate of potash, and in a few hours a beautiful bright green gradually appears, which only requires to be washed. If the green fabric is passed through a solution of bichromate of potash, this colour is transformed into a dark indigo blue, called by us azurine.

Naphthaline Colours.—The beautiful solid hydro-carbon naphthaline, which has yielded such a long category of substances to the chemists, has up to the present time yielded nothing of practical importance to the dyer, with the exception of a case which I shall mention presently. From it the following coloured derivatives have been obtained, namely, chloroxynaphthalic acid, perchloroxynaphthalic acid, carminaphtha, naphthalamine nitrosonaphthalin, naphthamien, and a body of purple colour. It is to Mr. Perkin that we owe the knowledge of several of these substances and their colour-giving properties. In my laboratory a fine purple colour has been obtained from naphthalin, which dyes with facility silk and wool, and the process is so far perfected as to enable me to show you some silk dyed, and a piece of calico printed with it.

A few months ago the scientific world were startled by the announcement, from a French chemist named Z. Roussin, that he believed he had discovered the means of making from naphthaline the important colour-giving principle which I have already mentioned to you when speaking of madder called alizarine, and what strengthened his belief was, that he thought he had succeeded in removing two equivalents of oxygen from binitronaphthaline, and transforming the nitrogen thereof into ammonia, leaving, as a residue,

Binitronaphthaline	$C_{12},\ H_6,\ N_2,\ O_4$	
Minus oxygen		$-\ O_2$
Plus hydrogen		$+\ H_6\ H_2$
EQUALS		
Alizarine	$C_{12},\ H_6,$	O_6
Plus ammonia	$N_2,\ H_6$	
Plus water		$2HO$

The simple process which he devised to obtain a crystalline substance which gave a red colour with an alumina mordaunt consists in dissolving slowly binitronaphthaline in concentrated sulphuric acid, and raising the temperature gradually to 392 deg., when he adds granulated zinc in successive small portions. After a short time sulphuric acid is given off and the conversion of binitronaphthaline into a red colouring matter is effected. All that is now required is to dilute the liquor with eight or ten times its volume of water, and carrying it to the boil, filter, and allow the whole to cool, when Mr. Roussin's so-called alizarine deposits under the form of fine red or orange coloured crystals. Although this product possesses some properties similar to those of alizarine, it differs from it in many of its chemical reactions, and also because it does not furnish the purple and chocolate colours given by alizarine with iron, and iron and alumina mordaunts. Still these results, arrived at by Mr. Roussin, are so remarkable that it is to be hoped that he will persevere in his endeavours to solve this interesting problem.

I cannot conclude this part of my paper without drawing the attention of those interested in the subject of colours to a series of valuable papers, which have recently been published in the Memoirs of the Institute of France, by my eminent and learned master, M. Chevreul, on the comparative affinity of various colouring matters for different fibres, on the influence of various mordaunts, on divers colouring matters, and, lastly, on the influence of the solar light on such dyed fabrics.

CALICO PRINTING.

The art of calico printing depends upon so many branches, of mechanical as well as of chemical science, that it is impossible for me to give detailed information of all the improvements which every department of this manufacture has undergone during the period embraced by this lecture, but I shall draw your attention to a few of the prominent points that have come under my notice.

Engraving of Rollers.—This branch of calico printing has made great progress. Not only have the engravings acquired sharper outlines and finer details, but the methods of engraving have greatly multiplied. I may cite as instances the application of the principle of the pentagraph, by Messrs. Smith, so as to trace patterns on the surface of rollers. Also, calico printers have extensively availed themselves of Mr. Locket's improvements for producing the groundwork of prints, or as they are termed "covers," by applying "eccentric engraving," or etching, which produces with facility most complicated patterns on a varnished roller, by means of a diamond point guided by machinery. Another improvement, highly interesting in a scientific point of view, is the application of galvanism to the diamond tracer. By combining the galvanic action with an eccentric motion most beautiful and delicate engravings may be produced. This is done by tracing the pattern with varnish on a zinc cylinder, which is so placed in the engraving machine that, as a needle passes over its surface and comes into contact with the zinc, the galvanic current is established, and by simple machinery causes the diamond to trace the corresponding pattern on the copper roller. The communication is so rapid and precise that a great saving of time is effected. But if mechanical art has greatly assisted the engraver chemistry has rendered him equally important services by enabling him to abandon costly and cumbrous modes of impressing by force the designs on the cylinder, substituting for them a great number of etching processes. By some of these processes, as by every other addition to the resources of the engraver, an entirely new and beautiful class of engraving is produced, unattainable by any other known means. For instance, owing to various improvements, rollers of 43in. in circumference and 44in. long have been introduced, enabling the calico printer to produce cheaply large furniture patterns.

En passant, I wish to call your attention to an application which has been made of a process greatly admired by many of you at the Exhibition of 1851, invented by Mr. John Mercer, the eminent calico printer, by which the beauty of dyed and printed goods was increased by passing the cotton fabrics through a strong solution of caustic lye, and afterwards through a weak solution of sulphuric acid, and then thoroughly washing. If this process has not been generally adopted it is no doubt owing to the contraction which the cotton fibres experience under the above chemical influences, but the increased strength which the fibre thus acquires has been turned to good account by enabling the printer to use it as a substitute for what is technically termed the "blanket," that is, an endless cloth which passes over the engraved rollers with the goods to be printed. This material is found by its strength to resist better than most others the heavy strain which the blankets have to undergo during printing.

Singeing.—I shall here also allude to two improvements effected by Mr. John Thom, of Manchester. The first, applicable to all kinds of cotton or woollen fabrics destined for printing or dyeing, consists in an improvement in the singeing or removing the nap from fabrics. The usual mode is to pass the fabrics either through a gas flame, or over a semicircular heated iron plate. In the latter case, however, a large amount of fuel was wasted in maintaining the heat of the plate, owing to the free radiation of heat into the atmosphere, and to its absorption in the currents of cold air in contact with the plate. Mr. Thom's invention remedies these defects by inclosing the plate under a brick arch, so that no air can enter the chamber except that which passes with the piece, and that limited quantity is, by a proper arrangement of flues, conducted into the furnace which heats the plate. The drawings which I have the pleasure to show you will fully explain this arrangement.

Sulphuring.—The second improvement of Mr. Thom was devised some years ago, but it is only recently that it has come into general use amongst printers. It is especially applicable to mixed fabrics, such as *mousselines-delaine*, which require, after they have been singed and before they are printed, to be bleached. This was formerly effected by hanging, for several hours, the moist pieces in chambers filled with sulphurous fumes, and is now performed by Mr. Thom's process in a few minutes, by passing them over a number of rollers confined in a chamber filled with the same vapours.

Thickening Substances.—It will be readily understood that it is necessary that the mordaunts or colours to be printed should be of sufficient consistency to remain on those parts of the fabrics when they are left by the rollers, so as to produce sharply-defined patterns, and, as a great variety of chemical products are employed, a great variety of thickeners becomes also necessary. Thus flour, starch, farina, various natural gums, albumen, lactarine, gluten, and several preparations of flour and starch called calcined farina, and patent gums are used. For details of the improvements effected in patent gums I must refer you to the lecture which I had the honour to deliver, on the 21st December, 1852, before this society.

Madder Styles.—Although there has been no marked change in this important branch of calico printing, still there are one or two departments in which considerable improvements have been effected to which I desire to draw your attention, and to enable you better to understand the nature of these improvements I shall describe them in the order in which they come into play in the production of this class of goods. The first is the improvement in patterns arising out of the before-mentioned advances in the art of engraving. Secondly, a saving in the quantity of mordaunt used; for the fact which I have already stated with reference to commercial alizarine, viz., that weaker mordaunts are required, has been proved by Mr. Pincoff to hold good with all the other preparations of madder, the strength of the mordaunt required to obtain the same intensity of shade being less in proportion as the colouring matter is purer. It is also advisable that I should here state that the mordaunts generally used for madder styles are the pyrolignites, or acetates of iron and alumina, which, under the influence of "ageing," to be described presently, are so decomposed or modified as to leave on the cloth either an insoluble oxide or subsalt, which becomes the intermediate agent for fixing on the fabric the colouring matter called alizarine—iron giving from a dark purple to a light lilac, alumina from a dark red to a pink, and a mixture of these two mordaunts a variety of chocolate tints. Thirdly, the most important improvement which has taken place in this branch of printing, viz., a great saving of time and labour in the fixing of mordaunts by ageing, was first practically carried out by Mr. Walter Crum, the eminent scientific calico printer. Dr. Schunck says that, "On the proper ageing of printed goods depends, in a great measure, the success of many styles; should a room be too hot or too dry imperfect fixation of the colour ensues, and meagre and uneven tints are obtained in the subsequent operations. To give a further idea of the importance of this step in calico printing I may state that 'ageing-rooms,' as they are called, are in several print works of enormous dimensions, and are generally separate buildings. Those of Messrs. Edmund Potter and Co., and Messrs. Thos. Hoyle and Co., may be particularised as forming quite a feature in their works." The process of ageing in calico printing is that by which a mordaunt, after being applied to a cotton fabric, is placed in circumstances favourable to its being completely incorporated with and fixed in the fibre. It has generally been found desirable that calico printed with a mordaunt should, before dyeing, be exposed to the atmosphere for some time in the ageing-room in single folds, which, generally speaking, requires several days, the object being, as before stated, to liberate the acetic acid from the acetates of iron or sulpho-acetate of alumina, and to oxidise the oxide of iron. It was for many years believed that oxygen was the only necessary agent, and, although some printers had observed that moisture facilitated the process, this fact was not generally known until Mr. John Thom, of Manchester, claimed the introduction of moisture as an important agent in the phenomena of ageing in a patent which he took out in 1849. The first printer, however, who, as far as I am aware, practically applied this principle, was Mr. Walter Crum, F.R.S. But I cannot better show you the great saving effected by the judicious employment of steam in this process than by giving you, in Mr. Crum's own words, the particulars of the plan adopted at Thornliebank print works:—

"A building is employed 48ft. long inside and 40ft. high, with a mid wall from bottom to top running lengthwise, so as to form two apartments each 11ft. wide. The manner in which they are fitted up will be understood by reference to the drawing.

"In one of these apartments the goods first receive the moisture they require. Besides the ground floor it has two open-sparred floors 26ft. apart, upon each of which is fixed a row of tin rollers, all long enough to contain two pieces of cloth at their breadth. The rollers, being threaded, are set in motion by a small steam engine, and the goods to be aged, which are at first placed in the ground floor, are drawn into the chamber above, where they are made to pass over and under each roller, issuing at last at the opposite end (on the right-hand side of the drawing), where they are folded into bundles on one (at a time) of the three stages which are placed there. These stages are partially separated from the rest of the chamber by woollen cloths.

"While the goods are traversing these rollers they are exposed to heat and moisture, furnished to them by steam, which is made to issue gently from three rows of trumpet-mouth openings. The temperature is raised from 80 deg. to 100 deg., or more, of Fahrenheit—a wet-bulb thermometer indicating at the same time 76 deg. to 96 deg., or always 4 deg. less than the dry-bulb thermometer. In this arrangement 50 pieces of 25 yards are exposed at one time, and, as each piece is a quarter of an hour under the influence of the steam, 200 pieces pass through in an hour. Although workpeople need scarcely ever enter the warmest part of this chamber, a ventilator in the roof is opened when there is any considerable evolution of acetic acid.

"The mordaunt, as already explained, does not become fully "aged" by this process alone, although as much so as if it had hung a whole day in cold air. It has received, however, the requisite quantity of moisture (about 7 per cent. of the weight of the printed piece), and is thereby enabled, if an iron mordaunt, to take oxygen from the air, and to become changed (with time) into the sesquiacetate and sesquihydrate of iron. In order to be sufficiently aged, it must be left one or two, or even three, days in an atmosphere still warm and moist.

"It had fortunately been ascertained long before, at Thornliebank, that exposure in single folds after moistening was not necessary. Mr. Graham's experiments on the diffusion of gases through small apertures had served to suggest that for the absorption of the small quantity of oxygen required the goods might as well be wrapped up and laid in heaps. Accordingly, in the operation in question, the moistened goods are carried in bundles into the building on the opposite side of the mid-wall already mentioned, and deposited there upon the sparred floors which are placed there at heights corresponding with the stages in the first apartment on which the goods are folded down. Upon these floors seven or eight thousand pieces may be laid at a time, and, as each piece is 25 yards long, 100 miles is therefore the quantity that can be stored at once. It is necessary, of course, that an elevated temperature, and a corresponding degree of moisture, be preserved in the storing apartments day and night, and 80 deg. Fah. is sufficient, with the wet bulb at 76 deg. To effect that object a large iron pipe is placed along the ground-floor underneath, and moderately heated by steam, while a row of small jets in the same position are made to project steam directly into the air of the apartment. The whole building is defended from external cold, and consequently from condensation of steam, by a warmed entrance room, and by double windows and double roof. Small steam pipes are also placed at other points where they seem to be required; and the apartment with rollers is specially heated when not in use by a couple of steam pipes, which are placed under the ceiling of the ground floor.

"The process of ageing, as thus detailed, was in operation at Thornliebank in the autumn of 1856. About a year afterwards it began to be adopted by other printers, and now it is already in use at, at least, sixteen different printing establishments in Scotland and in Lancashire."

(To be continued.)

THE FALL OF HOUSES AT HACKNEY.—The coroner's verdict in this case is to the effect that the fallen houses were constructed of inferior materials.

PERMANENT WAY.

At the ordinary general meeting of the Institution of Civil Engineers of Ireland, held on Wednesday, February 12th, 1862, in the Museum Building, Trinity College, Dublin, M. B. Mullins, Vice-President, in the chair, Mr. James Price, Resident Engineer of the Dublin and Belfast Junction Railway, read the following paper "On the Relative Advantages of Various Forms of Permanent Way Used in Ireland, Especially with Reference to the Mode of Fastening the Joints."

The consideration of the best form of permanent way is a subject of growing importance to railway engineers. The vast extent of railways now constructed in the British Isles, must direct attention to the perishable part of their construction, viz., the permanent way, the renewals of which require a larger expenditure than is likely henceforth to be spent in the primary construction of new lines, and which outlay must be met by the revenues of the shareholders, whose sensitive pockets will soon indicate how much care and thought their engineers have devoted to this subject.

Any defects in the permanent way at once produce damage in another very costly part of the concern, viz., the rolling stock. Again, the safety of the line is mainly dependent on the absence of such defects, as also the comfort of travellers whose luxurious moods, put on for the occasion, should not be ruffled by irritating jolts fatiguing to the body and confusing to the brain, and what not. To encourage travelling and increase receipts we must have our railways steady and smooth. It is not purposed to bring before you anything very new, or much theory on this essentially practical subject, though there is no doubt that correct theory, based on observation, leads to improving results, and directs the channel in which this as all other practical subjects should move, without limiting their necessary latitude. But it is my object to bring forward my views and experience that it may draw out from others theirs in return—either to controvert or otherwise—so that the matter may be properly viewed in all its lights. I have often found in engineers a notion that permanent way is a thing so simple and brought to such perfection that there is hardly any need for the many improvements coming out from time to time. After the many difficulties in making a line — first, procuring the Act; then those serious engineering difficulties—want of funds, unsatisfied land-holders and owners, bad foundations, sinking bogs, &c.—being overcome, large spans crossed, proper ballast procured, when the rails, straight and symmetrical, the result of English skill and coal and iron,-and the sleepers, square and new, appear, the permanent way seems a perfection, and yet it has often the greatest imperfections, and, greater than all, it belies its name, and is not at all permanent, whereas the other works generally are, or should be so. Of all parts of a railway the rail, which is its very essence, bears the brunt, and along its edge receives the shock of that ponderous machine whose roll is like the track of an earthquake. Stand at the nearest distance for safety from a dashing express, and consider that mankind is enjoying himself within that avalanche, and look below at what directs the mass, bears its weight, and in many cases receives undoubted blows, one may thus, for a moment, at least, realise the awful responsibility placed upon those narrow bars and mouldering sleepers called permanent way.

In considering the rails we must be struck by the rapid advance made in the process by which such a mass of iron, and that not of a very malleable description, can be rolled out to such a length as is at present attained; the lengths of rails have gone through many stages, from the 3ft. metal plate to 12ft., 15ft., 18ft., and even to 30ft. I know not whether this length has been exceeded. How greatly this must lessen the cost of maintaining lines from the diminutions in the number of joints is evident, as it were, to compensate for this. The weight of engines has proportionally increased from the Rocket—the father of all engines—6 tons, to the present 30 tons, and so must add to tear and wear. Even small engines, looking so light, such as tank engines, are found to contain, compactly put together, a great mass of iron, and standing on a short length, severely test permanent way and bridges. This increase of weight is, in a measure, due to the greater thickness of the iron in the boilers required by the change for the use of a pressure of 50 lb. to 60 lb., to that of 100 lb. to 150 lb. While on this part of the subject I may mention that some information is much required as to how much of the weight of engines is borne by each pair of wheels, and the best way of apportioning their weight. The weight upon the leading and trailing wheels will always be in a given proportion in the steam engine, but the actual amount varies with the strength of springs as compared with that of driving wheels.

A rail on cross sleepers is unquestionably a girder, on longitudinal sleepers it is not so, and is, or ought to be, supported equally throughout. As to the relative advantages of each, it appears that most engineers are in favour of cross sleepers, and not without good reason; on longitudinal sleepers the rail must be, at least, strong enough to carry the load over a short space, otherwise the slightest failure in the timber would lead to the breaking of the rail, and a very slight increase in depth will make it strong enough to span the usual spaces of cross sleepers. Again, we are more certain that the rail bears at equal intervals, and that its supports are equally unyielding, from the packing being confined to the ballast under the cross sleepers. For my part, if I have a girder, say for a bridge, strong enough, I would prefer that the abutments were equally unyielding to any uncertain support all along under the girder. Above all other considerations in favour of cross sleepers is the certainty that the gauge and cant of the rail are truly preserved. There are many other reasons in favour of cross sleepers, such as better drainage, easy removals, and facility for using native timber, which are merely necessary to mention. I will, therefore, speak of the rail as a girder, resting on supports at regular intervals. It might be well, in the first place, to inquire what these intervals should be. Perhaps this is a matter not at all attended to, and yet of the utmost importance. It has struck me as remarkable that whereas there is such a difference between the strength and stiffness of various rails, from a low bridge rail, 3½in. high, to a high, double-headed, or girder rail 5in. deep, the spaces of sleepers are, in every case, 3ft.; it seems as if it was all done, not by rule of thumb, but by rule of legs or paces. In the case of a stiff rail, by adhering to this rule, there is not only a waste of timber, but a positively worse line. Many may have remarked, in going over a line where a deep rail is used, a hardness which it is not easy to account for—this hardness is found to be not only unpleasant but injurious to rolling stock; it is, in reality, a vibration vertically. If we suppose the driving-wheel of an engine to stand immediately over a sleeper, there will be a depression occasioned by the compression of the timber and yielding of ballast, which let us call x; then let the wheel move to centre of space between this and another sleeper. It is quite plain the weight is now borne equally by each sleeper, and the depression of each will be a, being the depression which would take place under half the load. a is greater than ½x, and the depressions in centre will be a + deflection of rail; therefore the deflection of rail should equal $x-a$, in order that the wheel may move on a straight line, and not on a line having a vertical undulation. If the depression is equal when weight is over sleeper, and when in centre of interval, it will be nearly so for any point between. If these conditions be not fulfilled it is evident there will be an undulating line of motion. Where rail is too stiff for spacing of sleepers the latter will sink, and where rail is too flexible for the spacing it will bend. This is, no doubt, of small variation from the straight line in ordinary roads, but when a train is moving at about 40 miles per hour it becomes 40 times per second, which is a considerable vibration for such a mass to undergo. The springs modify this. This can be remedied by altering the spacing of the sleepers. Having tried experimentally what takes place by setting a level to bear on indices fixed on the rail in the above-mentioned positions, I found in case of a girder rail of I section 4½in. high, that the rail was too stiff for the spacing of 3ft., the sleepers being 9in. × 4½in.; and that a better road would be made by spacing sleepers 3ft. 6in. apart, and saving, in this way, an immediate outlay, and the present value of future repairs (about £80 per mile).

I do not mean to say that the relation between the stiffness of the rail and the spacing of the sleepers can be in this manner ascertained to a nicety, but that there is a relation between them which is worth considering. Of course the nature of the ballast and other circumstances modify the result when a driving wheel rests upon a sleeper 8in. × 4in. the depression varies from $\frac{1}{15}$in. to $\frac{1}{16}$in., and is generally proportional to base of sleeper. In the case of a bridge rail I found an opposite curve, and then the remedy would be to put sleepers closer together and smaller—a few inches makes the difference as deflection varies. With cube of interval the stiff rails are much more nearly correct.

The rails principally used in Ireland are, bridge rails, Vignoles rail, or girder rail. The Barlow broad flanges rail, on iron sleepers at joints, I believe universally condemned; the double-headed rail in chairs is coming more into use. Considering the rail as a girder, no doubt the Vignoles rail and the double-headed are the strongest forms. The former is becoming a favourite in the north, and it has the advantage of simplicity, and requiring no intermediate chairs; the latter has the advantage in its capability of being turned, to gain which it is necessary that the bottom be kept from resting on iron, and that it be deep enough to form a girder even when the top is so much worn that it requires turning. The bridge rail is inferior to both as a girder, but has a much wider base, and, from the sides being vertical and square to top and bottom, can be, perhaps, more perfectly rolled than any other form. But their relative advantages mainly depend upon the way in which each kind can be jointed. This is the most important part of my subject. I believe the requirements of a good joint can be easily stated: a freedom to expand and contract longitudinally, and that every other motion be prevented efficiently and permanently. The double-headed and Vignoles rail have this advantage over all others, viz., that they alone can be fish-jointed in the proper sense of the word as applied to rails. The principle of fish-jointing is very simple. The plates are portions of wedges drawn against top and bottom by the bolts. When the weight comes over the joint the rails deflecting nip the fish-plates, the weight not coming on the bolts, which are merely useful in holding plates together; thus small girders are formed, held rigidly. Except for the short interval, if any, between ends of rails, the fish-plates also stiffen joints laterally, though not so much as could be wished. Vignoles' rail stands on a narrow base, and is thus in danger of capsizing When timber is in use for some time there is apprehension of this taking place. The Government inspectors are now becoming very firm in requiring some fastening at the joints more secure than mere spikes. You may observe there is very little room in the flange for a bolt. At most a small bolt only (viz., ¾in.) can be used, which is quite incapable of holding rail in its place. They are found to have started after a few months' use. I have been led to apply this chair which I invented for repairs of bridge railroads, to this rail also. All the inspectors seem to approve highly of it. Mr. Barton has just got them to lay on the Clones and Cavan branch. The great advantage derived is the giving of a broad base near the joint, and the application of a large bolt entirely outside or partly enclosed in the flange. I much prefer the former, as it is known that the notching of the rail not only weakens it by loss of the iron, but also injures the adjoining parts. I am indebted to Mr. Anderson for the result of some of his experiments on this subject, by which it appears that a bar 2½in. by ½in., is weakened by being punched with a ¾in. hole—instead of having had the same hole drilled—to an amount of 14 per cent., which shows that ½in. of the iron all round is damaged to about half its strength. No doubt this effect is much greater in the hard iron now rolled into rails. Wherever we apply the fastening for holding down the rail that part of flange should be left whole, and the flange should be punched or notched only on intermediate sleepers to prevent travelling.

The great puzzle with bridge rails is how to make the joints. The old modes, one after another, have been found defective—some were bolted down through long chairs, which caused the sleeper to rock; some through a short chair, which cuts into the sleeper. In both cases the bolts were drawn, and the flanges of rails frequently broken at bolt holes; in fact most rails removed are found broken or cracked at this place. It has appeared to me that the source of failure lies in the fact that no bolt larger than ¾in. can be used when bolts pass through flanges, but the fact that a ¾-in. bolt is insufficient to hold down rails does not make it conclusive that a bolt of twice and a half that section would be also insufficient. On this principle I designed the chair I now exhibit, by which means a much larger bolt can be applied, and without any danger of breaking off the flange, as the strength of the bolts prevent all jerk, and the washers diffuse the force over a larger portion of the flange. Of course, if the flange had not been previously bored, it would be still stronger, but as this chair is meant mainly for repairs of existing lines the absence of bolt holes is an advantage I do not calculate on. You may also perceive that the wide bearing on the sleepers gives increased steadiness, and causes the sleepers to last many years longer. With this chair is also used a compressed oak dowel, which, though not an essential part, yet is very useful in giving solidity to the joint. It is forced in by driving down rails upon dowel with a mawl, and then drawing it right home by force of bolts. The dowels are so tight that, after six months' use, they expand ½in. on being withdrawn. The cost of this dowel is very small. I do not pretend that there is any great ingenuity in this arrangement, but I do say that it is practically a good joint, easily applied, and the only one I know of that can be so applied to existing lines. I have tried the amount of motion allowed by this joint by fixing pieces of wax on the ends of adjoining rails, and with a pencil embedded in one and a card in the other. The motion of the joint was marked on the card after the passing of a train, the length of line marking the vertical motion, and the thickness of line the lateral motion. I found, after a number of trials, the relative vertical motion to be less than one-fourth of that which took place in an ordinary bridge rail-joint equally new. In the case of fish-joints this motion was rather less, but the lateral motion round a curve greater. In the former case I found no lateral motion.

I know there are other chairs proposed and used for bridge-rails; the best of them is allowed to be Mr. Harty's, which, though applicable to new lines, is difficult to apply to those existing, from the fact of their requiring a re-arrangement of sleepers and new holes having to be drilled in rails. I had not the pleasure of hearing Mr. Anderson's—I am sure very good—paper on this chair; but those who have must be quite familiar with the principle of Mr. Harty's chair, now almost universally adopted for new lines laid with bridge rails. There are various forms of cast iron chairs, some very ingenious. On this subject I have no experience, so I will not speak. I am not, however, partial to cast iron for bearing anything of a jerk. I therefore prefer my own, as I should to all others for simplicity. This chair may also be used at half its length with two bolts instead of four, and it is applicable to half round native timber. This is almost, if not quite, as good as the long chair; but where square timber is used the chair should cover the timber. The sleepers are found not to rock under the long chair. It appears that the joint is so solid that the pressure comes upon the sleeper as it does on an intermediate sleeper, and acts at once on centre. It is certain that one side of the sleeper cannot go down without bending the washers and chair. The arrangement underneath, in lieu of the ordinary crab-nut, is worth noticing; it was designed for longitudinal sleepers, as the timber outside base of rail is so slight as not to be depended upon for securing a crab-nut to. This washer has slot holes to allow for any unevenness in the distance apart of the holes when bored; the washer will thus always fit to a pair of bolts, and can be placed across the grain of timber, and so will not cut into it. The surface which bears against the wood is double that of an ordinary pair of crabs, and the weight, including a pair of nuts, is 1¼lb. less than that of a pair of large crab-nuts, and therefore in the double joint there is a saving of 7 lb. The plate, moreover, can be used again and again, and is not condemned as scrap, which is the case with old crab-nuts. In longitudinal sleepers the fastening is so made independent of the outer portions of the sleeper. In case of longitudinal the half chair is quite sufficient.

RAILWAY MATTERS.

The Merthyr, Tredegar, and Abergavenny line is expected to be open by the beginning of May. It is expected that the line will be leased at 5 per cent. to the London and North-Western.

The report of Mr. J. Beattie, locomotive engineer of the London and South-Western Railway, states that a considerable saving has been effected in the quantity and cost of fuel used. During the last half-year 22·9 lb. of coal and coke were consumed per train mile, at a cost of 2·041d., and for the corresponding half of 1860 25·3lb. of coal and coke were consumed per train mile, at a cost of 2·413d.; so that, with an increase of 122,139 miles, the total cost of fuel has been £2,259 less.

The report of the Great Southern and Western directors states that the total traffic receipts for the half-year ending the 31st of December last amounted to £225,847, and for the corresponding half of 1860 to £218,493, showing an increase of £7,353. The net surplus revenue for the half-year amounted to £101,722, out of which the directors recommended that a dividend at the rate of five per cent. per annum be paid to the proprietors of the consolidated stock of the company, which would leave a balance of £13,297.

A memorial in favour of the Halifax and Quebec line, addressed to Lord Palmerston, has been placed in the Liverpool Exchange, where it has been numerously and influentially signed. The memorial represents the desirableness of completing a line of railway between Halifax and the Grand Trunk Railway, and states that the project was favourably reported on by Lord Durham, then Governor-General of British America, so long ago as 1838. Of this line 370 miles have already been all but completed; and the memorialists ask for Government aid to construct the remainder, as recent events have shown the immense importance of such a line as a defensive measure, and as such the memorialists claim for it Imperial aid.

The report of the Great Western shows that the total receipts on joint revenue account of the Great Western and West Midland Railway Companies from the 1st of July to the 31st of December, 1861, amounted to £1,212,201, and the working and other expenses to £473,233, or 42·5 per cent.; the rent charges of six branch lines amounted to £16,850, and the interest on the joint capital expended to £7,609, leaving a net balance of £714,510 to be divided between the two companies, in the proportion of 82½ per cent., or £589,471, for the Great Western, and 17½ per cent., or £125,059, for the West Midland Railway Company. As this is the first half-year's working on joint account, a correct comparison of receipts and expenses cannot be made with the corresponding period of the preceding year. The Great Western dividend is to be at the rate of 3 per cent. per annum.

The report of the London and North Western Directors shows that the disposable balance at the credit of revenue amounts to £621,220, as against £691,505 for the corresponding half of 1860, and the dividend recommended amounts to £605,828, against £663,944, leaving a balance of £15,392 for the next account, against a balance of £27,561 carried over for the corresponding half of 1860. The directors recommend the payment of a dividend for the past half year at the rate of 4¾ per cent. per annum, carrying forward £15,391. The capital account shows that £36,759,666 had been received, and £36,409,032 expended, leaving a balance of £350,634. The directors request the votes of the proprietors for new works at several stations on the company's line, amounting to £66,598; for carrying stock, £100,000; for stations on the Holyhead line, £1,750; and for the Lancaster and Carlisle line, £545.

The gross receipts of the Great Northern for the half-year ending the 31st of December amount to £768,684, including five months' receipts of the Nottingham and Grantham, and for the corresponding period of 1860 to £709,183, showing an increase of £59,501. The gross expenditure amounted to £367,811, against £366,494, showing an increase of £1,317. The excess of receipts over expenditure amounted for the past half-year to £400,873, and for the corresponding period of 1860 to £342,689, showing an increase of £58,184. The fixed charges amount to £228,131, against £200,290, showing an increase of £22,841. The balance available for dividend on the original and A and B stocks amounts to £186,297, against £153,862, showing an increase of £32,435 over the corresponding half of 1860. The directors recommend a dividend on the original stock at the rate of £7 15s. per cent. per annum, giving £3 17s. 6d. for the half year; on the B stock, £3 per cent for the half year, making up 6 per cent. for the year; and on the A stock, £4 15s. per cent. for the half year, leaving a balance of £423. The dividend for the year 1861 on the original shares amounted to £5 15s. per cent., against £5 8s. 9d. for 1860, and on the A shares £5 10s. per cent., against £4 17s. 6d. per cent. in 1860.

In the House of Commons, Mr. Bentinck, the other evening, asked the President of the Board of Trade whether, in consequence of the repeated recurrence of railway accidents, it was the intention of Government to introduce, during the present session, any measure founded on the report of the Committee on Railway Accidents which was laid upon the table of the House in 1858. Mr. M. Gibson said it did not appear, from the reports which had been made by the inspectors on recent railway accidents to the Board of Trade, that any new circumstances had arisen during the past year to render desirable the interference of Government in the management of railways. Therefore it was not the intention of the Government to introduce any Bill on the subject. He might state that although two very lamentable accidents occurred during the past year, in which a number of lives were lost and persons injured, the total number of accidents during 1860-61 was less than in any year, except 1857 and 1858, since 1851, notwithstanding that the total mileage over which traffic was conveyed had increased by 50 per cent., and the total number of passengers 100 per cent. In consequence of the late tunnel accident it was deemed right to circulate among the railway companies copies of Captain Tyler's report on the subject, which contained several useful suggestions, and the Government would in future pursue the same course of affording such information to the companies as seemed desirable.

The report of the London and South Western directors states that the net revenue for the half-year amounts to £198,261, making the balance available for dividend £199,018. The directors recommend a dividend at the rate of 5½ per cent. per annum. The gross earnings of the company for the half-year exceed those of the corresponding period in 1860 by £39,242, the additional mileage open being only five and a half-miles, namely, the Exeter and Topsham branch. The total receipts for the past half-year, ending the 31st of December, amounted an 400¼ miles of railway, to £606,139; the working expenses to £260,008; the taxation to £27,277; and the net revenue to £319,853, showing an increase of £39,242, in the total receipts, £18,959, in the working expenses, a decrease in the taxation of £733, and an increase in the net revenue of £21,015. The relaying of the permanent way on the main line, and on some of the branches, has been steadily proceeded with during the past half year, and the sum of £10,000 has been charged to revenue on that account. The renewals on the main line are now nearly completed, and the permanent way is throughout in good working order. The doubling of the remainder of the Southampton and Dorchester line between Wimborne and Doncaster is also in progress under the order of the Board of Trade, and will be charged against capital. On the Exeter Extension line 34 miles out of 50 (the entire length from Yeovil to Exeter), have now been doubled and opened for traffic. The works on the Exeter junction line are completed, and, the narrow gauge rails having been laid down on the Exeter and Crediton line, there is now an unbroken communication from London and all parts of the South-Western Company's system to Crediton. The works on the Kensington bridge line are in progress. The whole of the 4½ per cent. preference stock has now been taken up. The average rate of interest on the company's debenture debt is 4·23 per cent.

TRACTION ENGINES.

A CONTRIBUTOR to the *Mark Lane Express* writes as follows on the use of traction engines in towns:—Many a funny story has been told, and the verdict of the jury finding the *steam horse* guilty of frightening a pair of *shying horses* is not without its merit in a comical sense. A thrifty Scotch parson engaged a Highlandman to manage his glebe, and attend to his pony and cow. The latter was but recently purchased from a parishioner at no great distance from the manse, and unfortunately turned out to be a "run-away," preferring the more liberal treatment of her old quarters to the somewhat stinted allowance of the glebe, having oftener than once stolen a march upon "the minister's man," and "run awa' hame," as it is termed in the vernacular of the North. Of this vice Donald was well advised, as also to keep the stable door shut, and a sharp outlook about watering time, the practice in winter being to let the cow and the pony out together to drink at the watering-trough. Of course no candle was allowed in the stable. One evening very late a summons came to the minister to pay a sick-bed visit. Donald, in his haste to saddle the pony without loss of time—so the story runs—owing to the night being pitch dark, saddled the cow. Fortunately, or unfortunately, it was to the very farmhouse from whence Crummy had recently been bought that the parson was now bound. Accordingly, no sooner was he mounted and began to apply the spur, than, Gilpin-like, away they went, the cow never stopping until she reached her old home, when she began to bellow lustily, to the terror of the cowherd, who was outside waiting the arrival of the minister. Somewhat analogous to this is the case of a metropolitan jury putting the saddle upon the wrong horse. In these times of steam locomotion the case is an interesting one, and therefore let us look at the matter with daylight a little more closely, for, when this is done, some rather startling principles will be found involved.

Long ago, when traction engines first began to work on common roads and streets, statutory provision was made by Parliament legalising steam traffic of this kind, thus imposing upon horse trainers and owners of carriage and other road horses the imperative duty of training them so as not to shy at steam. The principle of the old statute was confirmed by one of last session (24 and 25 Vic., cap. 70), relative to tolls on common road locomotives; but, in defiance of the spirit of these statutes, a London jury have recently decided a case which, if its principle is carried out as a precedent, prohibits traction engines travelling either on street or common road. This somewhat startling decision was evidently pronounced on the plea that they (traction engines) frighten horses. As it is the general principles involved in the case that we purpose discussing, it will be unnecessary to mention the details as to the parties in the process, &c. It will be sufficient if we, for example, briefly mention that a pair of omnibus horses shied or took fright at a traction engine in one of the streets of the metropolis, and that twelve worthy citizens made the discovery that it was the engine that frightened the horses! and not the horses that shied at the engine; *ergo*, they saddled the steam horse accordingly.

Having had a long experience in the rearing, training, and in the general management of horses, and having, perhaps, paid more attention to the physiology of this noble animal than all the twelve jurymen in question, we do not hesitate to say that they (the jury) ought to have pronounced their verdict against the owner of the omnibus for driving two shying horses in the streets of the capital, to the danger of the lives of her Majesty's loyal subjects. We shall not say positively, not having gone into the precedents of the two horses, but we believe, had the necessary evidence been produced, the finding should have been that they were two confirmed shyers —"habit and repute"—at steam engines; and, if such can be proved, even at this date, the animals, granting that they belonged to her Majesty, ought not to be allowed to run the streets of the metropolis or any other town, or even permitted to travel on common roads in the provinces.

In principle, running carriage or other horses in our streets that shy at traction engines is clearly a violation of statute. The man who cannot see the soundness of this conclusion is unfit to sit as a juryman upon any case of this kind; for, when statute makes provision that traction engines shall be allowed to travel on common roads and in streets, it is manifestly the legal duty of every one who owns a horse to train the same so as not to shy at a traction engine. A foal will shy at anything—even its own shadow. It will shy, for example, at the Lord Mayor of London, an alderman, a common councillor, or even at any of the twelve jurymen themselves, just as fast as at a traction engine. If John Bull has a son so innocent as not to know this much of the physiology of the horse the practical course is to return him back to school to finish his education, for such children are wholly unqualified to be abroad at more than "arm's length" from their parent's side. As the foal keeps close to its dam's side until it learns to see things in a familiar and harmless light, so they ought to be kept at home until they learn to put the saddle upon the right horse.

Even granting there had been no statute legalising steam traffic on common roads, the conclusion that the traction engine frightened the horses is obviously one that belongs to a bygone age. It is a well-known fact that the horse assumes an attitude of defence, and even terrifies wicked boys, chasing them out of his pasture; and when we first read the arguments and the finding of the jury, the beautiful description of this noble animal given by the inspired penman in Job (xxxix. 20-25) rushed to our mind, the steam-horse being on the stage, playing off the performance thus: "The glory of his nostrils is terrible. He paweth in the valley, and rejoiceth in his strength: he goeth on to meet the armed men. He mocketh at fear, and is not affrighted," &c. &c. A second consideration, however, brought us to the question, did Samson do it wilfully, with a malicious intention of overturning the omnibus with its driver? or did he set about clearing the road of antiquated rivals, as if the whole belonged to himself by virtue of statute laws and the rights of progress? But when we came to the plain matter-of-fact on both sides of the question, we must confess the conclusion of the jury appeared to us to belong to "Gulliver's Travels" rather than the passing history of the period in which we live; for a traction engine, like all other inanimate bodies, is a very harmless and innocent traveller on the road, and ought to have been acquitted accordingly, far more so than the thousands of high-spirited and vicious horses in the British capital.

Some horses shy from acquired habit. There are thousands of young colts in the provinces that acquire this bad habit from feeding in grazing grounds through which railways pass. The moment the train comes up, for example, away they gallop as if the engine were at their heels like a bull-dog. With this those who farm along lines are too familiar. Oxen and sheep often acquire the same habit. Railway travellers, as well as farmers, must be familiar with the sight of cattle taking fright at the train. It is often difficult to break animals off from this vicious habit, and many horses never give it up. We could instance several cases of this kind from our own experience. Others acquire the habit, not from anything they see or hear, but from some mishap in the driving or management. Put a strange, ruthless lad to drive the team in hay or corn harvest, for example, and the horses will be home before him, or in the ditch, &c. Others, again, shy from defective vision. Farmers get rid of such cattle as fast as they possibly can. To appearance they are often fine animals, and when they find their way to the capital, or any other of our large towns, as they generally do, the consequences require no comment, whether they are employed in omnibus work, in cab, private carriage, &c. Their owners may be very proud of them. They may have good reason to be so, as regards outward appearances and effective duties in harness; still, they have one fault that unfits them for roadsters—they shy at things, and therefore nothing can be more reprehensible than to acquit them, and bring in the things at which they shy guilty. The Duchess of Richmond the other day, for example, was thrown from her wagonette, the horse having shied at some wattles in the public market. But the report now going the round of the newspapers makes no revelation of her grace finding the wattles guilty, or raising an action against their owner for damages to cover the injury sustained! Should the horse shy a second or third time, the probability is he will then find his way to London for omnibus, carriage, or other like work; and although hardly a day passes without some mischief being done by horses shying, it is surprising that much more harm is not done from this source, considering the immense number of shying horses in our streets, from one or other of the above causes.

But, because shying horses are thus allowed to gallop about in our streets, is that any reason why traction engines should be prohibited from travelling at their well-timed mechanical pace, every part moving with as much regularity as the pendulum of a clock? Because frolicsome fillies and wild colts have acquired in our provinces the habit of "cocking their tails," "pricking their ears," and snorting at the sight of a railway train or anything of the kind, is that any reason why, when they fall into the hands of a wealthy alderman or common citizen who is proud of his carriage and stud, that he should "cry havoc, and let slip the dogs of war" against the steam horse?—that such men should be allowed publicly to band together in solemn league, purposely to strangle statute law, and overturn the wheel of progress the moment it makes its appearance in our streets? When our thoroughfares are so over-crowded as often to be "impassable for hours in succession," and when the steam horse makes his timely appearance to relieve us of the chief cause of this hubbub and interruption to through traffic, the conduct of those who are thus conspiring to set law and progress at defiance is in the highest degree reprehensible.

It is just about time that those who have been making themselves extremely busy for some time past in the metropolis to expel traction engines from the streets, on the plea that they frighten horses, were beginning to investigate the *rationale* of their conduct, both from a practical and scientific point of view. We might well reason the matter with them were their minds open to conviction; but, when they prove themselves as little acquainted with the philosophy of their own carriage cattle as with the more simple physiology of the steam horse, the more prudent course appears to be to leave them to acquire the necessary information in the school of experience.

We have already shown that the legalising of steam traffic in our streets by statute involves the imperative duty on the part of the public to train horses so as not to shy at traction engines when they meet or pass them. In practice nothing is more simple than to train horses thus, generally speaking; for it is one of the many characteristics in the natural history of this noble animal to brave any danger if properly trained; or, in the language of the inspired penman already quoted, "He mocketh at fear, and is not afraid. He saith among the trumpets ha, ha!" With the whole paragraph in sacred writ, so often quoted by naturalists, our readers must be familiar, otherwise we should give it *in extenso*. To overlook the important truth which it embodies, in judging of the question under discussion, is highly culpable. Indeed, the vast majority of horses in the capital are already so trained, and do not shy at traction engines. We have walked alongside engines from the one side of the metropolis to the other, purposely to examine the very question. There are still, however, a great many that do shy, and these ought to be prohibited from travelling in the streets by direct statute. In other words, an Act of Parliament is required to compel the exception to comply with the general rule, or abide by the consequences. The fact that the majority of horses do not shy is proof positive in favour of traction engines, and against those that do shy, while it further proves that the latter should be trained not to shy. Why should there be any difference? No doubt there are a number of vicious horses who have acquired the confirmed habit of shying that would not be easily broken off from this most dangerous vice; but just so much the more imperative is the public demand for express statutory means to prohibit their appearance in the streets, for it is only then that shying in reality becomes a vice. Bring a wild horse from the plains of Persia, and he will shy at man perhaps more readily than at a traction engine. The fleetness of the horse is the natural gift of his Maker given him for self-preservation; and when he has recourse to it, and gallops off, it is but the instinctive exercise of a natural law, and, therefore, is not a vice. Under domestication the natural law remains in force. It is not the galloping off, therefore, that is the vice acquired, but the nervous excitement that induces it when such becomes untractable.

Since the above was written Mr. Silverstone's case at Bury St. Edmunds, as reported in the *Mark Lane Express* of the 3rd inst., confirms in the most substantial manner the necessity of statute expressly framed so as to prohibit shying horses running in our thoroughfares and public highways, to compel horses to be trained not to shy at traction engines, and to teach ignorant magistrates to respect the statute laws of the realm. It is true that in the locomotive statute of last year (the 24 and 25 Vic., cap. 70), clause 8 states that "Every locomotive propelled by steam, or any other than animal power, to be used on any turnpike road or public highway, shall be constructed on the principle of consuming and so as to consume its own smoke; and any person using any locomotive not so consuming its own smoke, shall, on conviction thereof, before any two of her Majesty's Justices of the Peace, forfeit any sum not exceeding five pounds for every day during which such locomotive shall be used on any such turnpike road or public highway;" and also that clause 13 runs thus:—"Nothing in this Act contained shall authorise any person to use upon a highway a locomotive engine which shall be so constructed or used as to cause a public or private nuisance; and every such person so using such engine shall, notwithstanding this Act, be liable to an indictment or action, as the case may be, for such use, where but for the passing of this Act such indictment or action could be maintained." But it is equally true that Mr. Silverstone's engine does not fall under the latter clause, for it is obviously one of those useful locomotives contemplated by the statute, and for which the statute makes provision; in other words, it is not a public or private nuisance, but, on the contrary, one of those engines for which the Act expressly makes statutory provision; and that, as clause 8 has reference to construction only, that, as the engine was manufactured prior to the passing of this statute, and that, as it was travelling in terms of a previous statute, the decision of the magistrates of Bury St. Edmunds for the first offence is exceedingly harsh, if not highly reprehensible, and subject to redress. Mr. Silverstone and M. T. R. perceive that the clause specifies "shall be constructed on the principle of consuming and so as to consume its own smoke," so that the use of coke is not compliance with statute. The engine must be altered, and made to consume its own smoke, and the common law of the land will allow a reasonable time to effect this change of construction. The question thus at issue is a very interesting one to the manufacturers of traction engines, as also to all who use them, and as Mr. Silverstone does not appear to have been aware of this, it occurs to the writer of this that the decision has been given under an erroneous notion, and that there ought to have been no fine, but only expenses for the first offence. The statute of last year, quoted above, is extremely faulty, for it ought to have made provision for the changes in the constuction or existing engines which it was rendering imperative, and thus have saved their owners from being at the mercy of magistrates who are evidently bent upon strangling not only this statute, but all the previous statutes authorising locomotive engines to travel on public highways, if it is true, as stated in the report in the *Mark Lane Express*, that the Mayor of Bury St. Edmunds should declare that the Bench founded its judgment on the plea "that they really must put a stop to the dangerous practice of driving engines about the town;" for such a statement, and, indeed, the general conduct of the Bench, stands diametrically opposed to the preamble of the statute, which is as follows:—"Whereas the use of Locomotives is likely to become common on Turnpike and other Roads," &c. The schoolmaster abroad is evidently much wanted at Bury St. Edmunds, to teach the magistrates which of the two is a nuisance—the traction engine, or the shying horses—for, like the minister's man, they have, unquestionably, put the saddle on the wrong horse.

MISCELLANEA.

MR. ROEBUCK'S motion for leave to bring in a bill for the protection of trademarks has been agreed to.

THE Commissioners of the International Exhibition will occupy their new offices in the Exhibition building on and after Monday next.

AN additional number of hands have been placed on board the 91-gun iron-plated ship Caledonia, under construction at Woolwich, to hasten her completion.

By the last advices from Jamaica a Bill was before the Legislature providing for the establishment in the harbour, by means of a joint-stock company, of a floating dock or gridiron capable of taking up steamers and sailing vessels of large tonnage.

THE Java, target ship, has been brought down to Portsmouth Harbour from Porchester Lake, and berthed alongside Portsmouth Dockyard, where she is having other sample armour plates (from the Lancefield and Parkhead forges) affixed to her sides for testing purposes.

MR. SANDERSON, chief engineer of the Bombay, Baroda, and Central India Railway Company, having been relieved of his duty, Mr. W. C. Bayley has taken charge of the northern and larger portion of the line from Ahmedabad to Bulsar, and Mr. Matthew of the southern portion.

THE iron-cased ship Triumph, 50, building at Pembroke, has had her name changed to Prince Consort. An effort will be made to launch her in June. She will be armour-plated from stem to stern. Her engines, of 1,000-horse power (by Maudslay, Sons, and Field), are nearly completed.

THE Glasgow screw frigate, 3,038 tons, with engines of 600-horse power, has made her official trial trip. The mean of six runs gave a speed of 13·2 knots, the maximum number of revolutions 60; pressure of steam, 20 lb.; vacuum, 25in.; draught of water forward, 17ft. 10in., and aft 19ft. 6in. It will be seen by these figures that the ship was at a light draught.

A SELECT COMMITTEE to report upon the subject of fires in the metropolis has been nominated as follows:—Mr. Hankey, Mr. Cowper, Mr. Locke, Mr. Cave, Mr. H. B. Sheridan, Mr. Cubitt, Mr. Lewis, Mr. Peacocke, Sir J. Paxton, Mr. Benyon, Mr. Alderman Salomons, Mr. Tite, Mr. W. Miller, Mr. Vance, and Mr. G. Clive; with power to send for persons, papers, and records; five to be the quorum.

AN experiment is being made upon malleable cast iron as a material for boilers. A small boiler 4ft. long, 7in. diameter, ⅜in. thick, and intended to bear a test of over 1,700 lb., or ¾ ton per square inch, has been cast whole by a maker of malleable castings. Malleable cast iron is made from cast iron of good quality, decarbonised by exposure to a high heat while surrounded with oxide of iron.

THE Barosa, 21, screw corvette, 1,700 tons, 400-horse power, underwent a trial on the part of Government, at the measured mile off Maplin Sands on Friday. Her engines are built by the firm of Bolton and Watts. The results of the trial were as follow:—Average speed, 12¼ knots per hour; pressure of steam, 20 lb.; vacuum, 25½; revolutions, 64; Griffiths' screw propeller, 24ft. pitch, 16ft. diameter; draught of water forward, 16ft. 6in.; aft., 19ft.

THE segment of a ship's side, weighing fifteen tons, and representing a portion of the broadside of the Warrior, built entirely of iron, has been received at Woolwich from Messrs. Fairbairn and Co., of Manchester, and has been forwarded to Shoeburyness, to test the power of resistance in competition with a target of equal depth and dimensions, backed by timber instead of iron, and faced with iron slabs. This experiment, it is stated, is intended to decide the advantage of building ships exclusively of iron.

THE Queen has been pleased to appoint the Right Hon. Lord Kinnaird, K.T., the Hon. Fulke Egerton, Nicholas Kendall, Esq., Henry Austin Bruce, Esq., John St. Aubyn, Esq., John Davie Fergusson Davie, Esq., Edward Headlam Greenhow, Esq., M.D., and Philip Henry Holland, Esq., to be her Majesty's Commissioners to inquire into the condition of all mines in Great Britain to which the provisions of the Act 23rd and 24th Victoria, cap. 151, do not apply with reference to the health and safety of persons employed in such mines.

AN experiment is being made at the Manchester locomotive station of the Manchester, Sheffield, and Lincolnshire Railway, to employ metallic packing instead of hemp in the stuffing-boxes of locomotives. Small brass rings are applied (cut into segments) around the piston-rod, light springs being employed to keep the rings tight. It has long been necessary to keep two men at the station, one throughout the day and the other throughout the night, constantly employed in packing the locomotive piston-rods with hemp. At Crewe even this staff of packers is insufficient.

THE French ironmasters in and about St. Dizier have, it is stated, orders to keep them busy for two years. How grateful they should be! It is said that orders have been received at St. Etienne to the amount of 10,000,000f., but a difficulty is experienced in executing them. The weavers have become railway labourers and miners. They have adopted a laborious profession for a regularly paid salary, though they do it with regret, as they feel that they must lose much of their manufacturing skill. It appears that the railway contractors in the neighbourhood have taken advantage of this state of things to accelerate the completion of the unfinished lines.

THE following appointments of naval engineers have been made since our last:—W. H. Lowman, first-class assistant-engineer, to the Fisgard, for the Rapid; Peter Butler, first-class assistant-engineer, from the Asia, to the Cumberland, as supernumerary; George A. Patterson, J. R. R. Potam, F. M. C. Richards and Thomas Vickery, acting second-class assistant-engineers, to the Asia, as supernumeraries; Richard W. Topp, confirmed as first-class assistant-engineer, supernumerary of the Indus; John Bolas, confirmed as second-class assistant-engineer in the Nile; H. Bunting, confirmed as second-class assistant-engineer in the Hero; Peter Butler, promoted to engineer supernumerary in the Cumberland; William W. Webber, confirmed as first-class assistant-engineer in the Shannon; Peter Wood, chief-engineer to the Cumberland, to the Indus, for the Rattlesnake; George Elliott, acting second-class assistant-engineer to the Indus for the Magicienne; and John Phillips, second-class assistant-engineer, confirmed in the Ohio.

THE testing of the armour-plates from the works of the Thames Iron Ship Company, the Atlas at Sheffield, and the Lancefield at Glasgow, were brought to a conclusion on Friday. The plates as usual were affixed to the sides of the Java, and the practice took place from the guns of the Stork at 200 yards range. They were merely plates selected at each of the works by the Government Inspector from those manufactured in accordance with the right reserved by the Admiralty in their contracts with the manufacturers, and their testing was, therefore, unattended by any point of interest to the public. The "hammered" plate, however, supplied by the Thames Iron Shipbuilding Company proved to be so superior that it will very probably be the cause of re-opening the question of "Hammered *v.* Rolled" armour-plates.

THE London and North Western Railway Company having been convicted by the magistrates at Lichfield for having an incorrect weighing machine in their possession, appealed to the Court of Queen's Bench. It appeared from the case that the weighing machine in question was at the Lichfield station, and was a weigh-bridge used in weighing goods in trucks, &c. The machine had a patent adjusting apparatus, so constructed that the machine might be made to balance to the greatest nicety, but when it was examined by the inspector, although it was in gear it did not balance, but was incorrect to the extent of 21 lb. Mr. Justice Wightman said the conviction could not be supported. The machine required adjustment before it could be properly used, but that did not make it an incorrect machine within the Act of Parliament. Mr. Justice Crompton said he doubted whether the machine had been properly examined. His lordship said he did not think the machine was an incorrect machine, merely because it required adjustment before it could be properly used; on the contrary, he thought it was the beauty of the machine that it was made to secure peculiar correctness.—Judgment for the appellants.

NOTES FROM NEW SOUTH WALES.

We have advices from New South Wales to December 21. There is little fresh to notice with respect to the miscellaneous public works in progress in the colony, but some details of interest invite attention with regard to railway and telegraphic progress. The tramway in Pitt-street, Sydney, has been finished for more than a month, but had not been opened for traffic. The delay was principally caused by the arrangements which had to be made in altering the times of starting the trains, so as to allow the tramway cars to run to and from the Circular Quay between the arrival of one train and the departure of another. The tramway was, however, advertised to be opened before the end of last year; a contract for the horsing of the trucks having been taken by J. Woods. The first trial of the lines was anything but favourable. Near the Redfern terminus there are some sharp curves, and, owing to the outer rail not being sufficiently raised, the car was two or three times thrown off the rails. This defect was at once remedied by raising the outer rail at the curves to the required height. At other parts of the tramway the rails have had to be taken up in consequence of their bungling upwards, caused in some places by the cambering of the wood, which was used in a green state, and in others by the expansion of the iron, to remedy which several of the rails had to be cut at the ends. The principal cause of the wheels of the tramway cars coming so easily off the rails was the narrowness of their flanges, which were only $\frac{3}{8}$in. in depth. The object in making the flanges so small was, not only that the correspondingly shallow fall in the rails would cause the least possible interference with the surface of the roadway, but also that the cars might be got easily off the rails and restored to them, which is frequently necessary upon the street railways in England, and which it was doubtless supposed would be required on the Pitt-street tramway. It did not appear to have been known by Mr. Train, who provided the rails and cars, that the Tramway Act, passed by the Colonial Legislature last session, compelled all other vehicles to make way for the tramway cars, and that as, excepting these cars and the railway trucks, there would be no traffic on the line, it would never be necessary to lift the vehicles off the rails. In order to secure the car-wheels from slipping off the rails, they have been turned and a portion of the tyre taken off, thereby increasing the depth of the flanges. Since these alterations the cars traversed and retraversed the line satisfactorily without once coming off the rails.

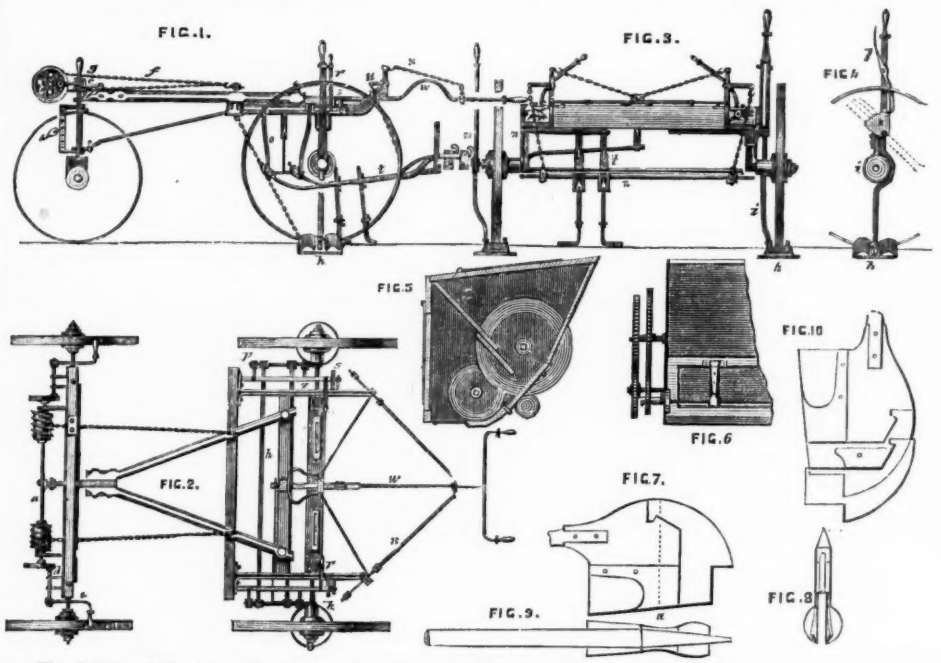
The works on the railway extensions contracted for by Sir M. Peto and Co. are fast approaching completion. The Western extension to Penrith is the most forward of the three, and was to be opened for traffic as far as Rooty Hill, five miles beyond the Blacktown station, before the close of December. No buildings have yet been erected, and it is expected that for the present only goods will be conveyed on the new line. The station is within a mile of the Western road, and it has been connected with it by a well made road. By making use of the railway as far as Rooty Hill, the teams will save 25 miles of the distance between Sydney and Bathurst. There is not much work requiring to be done on the remaining portion of the western extension, which will, no doubt, be completed considerably before the contract time—the 1st of May next. The northern extension was expected to be finished as far as Black Creek before the end of January, but that portion is not likely to be opened for traffic before the date specified in the contract—the 1st of March. On the southern line there is a great deal of work to be done; but the heavy cuttings and embankments promise to be completed before the viaduct across the Nepean River, at Menangle, is erected. This structure will consist of iron girders resting on four stone piers, of 150ft. span, the extreme length between the opposite embankments being 1,912ft. The ironwork for the viaduct, which was cast at Sir M. Peto and Co.'s factory at Birkenhead, was shipped in the Oakland and the Indian Ocean, which vessels sailed from Liverpool in November, and will probably land their cargoes in March. Considerable progress has been made with the piers for the viaduct, the sandstone for which is obtained from a quarry a short distance from the site. The contractors have till the 1st of January, 1863, to finish the southern extension, and no portion of the line will be opened for traffic until it is completed to Picton.—The result of recent debates in the Colonial Assembly upon the question of railway extension has been the rejection of Mr. Arnold's scheme of continuing the locomotive line to Goulburn, and of constructing tramways to the north and the west. A resolution, proposed by a western member, was carried, in favour of expending £250,000 upon the northern and upon the western locomotive lines contemporaneously with the expenditure of the same sum upon the Southern line; and, the Government having brought down an estimate in pursuance of that resolution, the above sums were voted by the Assembly. Upon the estimates for railway extension being considered, the items for horse-railways to the west and north were negatived; the sums of £60,000 for a horse-railway from Blacktown to Windsor, and £20,000 for a railway from East Maitland to Morpeth, were carried; as were also the sums of £40,000 for a bridge over the Hunter at Singleton, and of £70,000 for a bridge over the Nepean at Penrith. The select committee of the assembly appointed to inquire into the improvements in railway construction recommended by Mr. Bell, the city engineer, and by Mr. Caporn, have taken a great quantity of evidence, the above gentlemen and also Mr. Whitton having been examined at great length. Both Mr. Bell and Mr. Whitton will require to give further evidence, and as the proceedings of each meeting have to be written out and printed before the next is held, the investigations of the committee are likely to extend over a considerable period. The opinions of Mr. Whitton and Mr. Bell are diametrically opposed on engineering matters, it is consequently difficult to see how the committee can arrive at a satisfactory conclusion, or how there can be much weight attaching to their recommendation. The inquiry last year into Sir M. Peto and Co.'s contracts, by the committee of the whole House, led to no practical result whatever, and the scarcely less voluminous evidence now being taken by the select committee promises to be equally profitless.

Several new telegraphic lines are to be proceeded with this year. The longest of the proposed extensions will be that to the Burranggong gold-fields, which will probably be carried from Orange through the Lachlan, should the diggings at the latter place continue to be the centre of a large population. A line is also to be taken from Tenterfield, the most northerly telegraph station in this colony, across to Grafton, which will bring the Clarence River district into communication with Sydney. The southern ports of Wollongong and Kiama are to have telegraphic wires, which will probably branch from the southern line, near Douglas Park, about twelve miles beyond Campbelltown. The other extensions will consist merely in stretching second wires upon the present posts, from Scone to Muswellbrook, and from Newcastle to Singleton. All the telegraphic extensions carried out under the votes of last session are finished and in use. During a recent debate in the Assembly, when the estimates for telegraphs were under discussion, Mr. Arnold stated that the lines throughout the colony paid an interest of 5 per cent. on the outlay, besides the working expenses. Two years since, when the only telegraphic line was that to Melbourne, the net return was 16½ per cent. The lines recently constructed have consequently diminished the remunerativeness of the establishment; they have, however, in other respects, conferred great advantages on the community.

PRIEST AND WOOLNOUGH'S MACHINERY FOR DRILLING AND HOEING LAND.

Fig. 1 shows a side elevation of a horse hoe with a fore steerage attached, according to the invention of Priest and Woolnough, of Kingston-on-Thames; Fig. 2, plan of same; Fig. 3, back view of same; Fig. 4, side elevation of turntable and lever, different views of which are also shown in Figs. 1, 2, and 3; Fig. 5, a right-hand side view or elevation of a manure box; Fig. 6, a back view of same; Figs. 7, 8, 9, and 10, plans and sections of drill coulter, so much of a horse hoe and drill with improvements attached being therein shown as will serve to explain the nature and operation of the invention. The ordinary fore carriage steerage is so well known that it is unnecessary to explain more than the details of the improvement.

PRIEST AND WOOLNOUGH'S AGRICULTURAL MACHINERY.



a is a shaft fixed in front of steerage posts; *b*, *b*, are screw sheaves hung on the same; *c*, *c*, are internal gear wheels, and *d*, *d*, pinion wheels gearing into same; *e*, *e*, crank handles, by which the man regulates the steerage from either side; *f*, *f*, are chains fixed to and wound round the screw sheaves *b*, *b*, and attached at the other end to the frame of the implement; *g*, *g*, are friction rollers through which the chains pass. When the crank handles *e*, *e*, are moved to and fro to regulate the steering, the chain is wound on one sheave to the same extent as it unwinds off the other, so that to whatever angle the steerage may be guided with regard to the hoe, it may always be held perfectly rigid in that position until again required to move it. *h*, in Figs. 1, 2, and 3, shows the improved turntable in different positions under the travelling wheels. *i*, Fig. 4, is a side view of the lifting lever, a back view of which is also shown in Fig. 3; *j*, the fulcrum of the lever; *k*, the ratchet; and *l*, the palls. It will thus be seen that when the lever is pulled down, as indicated by the dotted lines, the turntable is released from the wheel, and the lever retained in its place by the ratchet and palls. *m*, Fig. 3, shows a similar contrivance, fixed outside the travelling wheel on the axle of the hoe. This lever requires to be slotted where it fits on the axle, so as to admit of the turntable being carried clear of the wheel tyre; it is best also to fix the turntable to the lifting lever, so as it may yield more or less according to the nature of the ground. The plan of raising or lowering the bars that carry the fixed ends of the levers of drills and horse hoes is thus arranged: *n*, *n*, are the two horizontal bars; *o*, *o*, the swing or pendant irons; *p*, *p*, the cranks fixed on the shaft *q*; *r*, *r*, handles also fixed to the shaft *q*; and *s*, the rachet and palls. When the handle *r* is pulled down, the cranks *p*, *p*, and pendant irons, *o*, *o*, are raised, so that the horizontal bars *n*, *n*, may be set at any inclination required, the shaft *q* being retained in its place by the ratchet and palls *s*, *s*. *t*, *t*, are the hoe levers; *u*, *u*, cranks fixed at side of frame; *w*, the steerage handle, all of which are connected by the chains *x*, *x*, so that, when the steerage handle *w* (which is jointed in the middle, as shown, Fig. 2) is depressed, the hoe levers and hoes are lifted out of the ground.

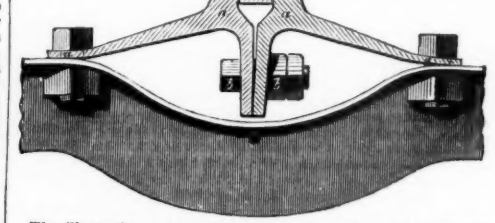
Fig. 7 is a side elevation of an improved drill coulter; Fig. 8, a front elevation of same; Fig. 9, section across a^1, b^1; and Fig. 10, another side elevation, showing the shoe or wearing part detached, the dotted lines indicating the size and shape of the coulter when the detached shoe is fitted in its place. The shoe is fastened by an iron or wooden peg.

Fig. 5 is the elevation of the off side of a manure box, and Fig. 6, back view of same. c^1 is the oscillating door; d^1, a shaft running the width of the box, which shaft receives motion from the gear wheels at the side; e^1 are bearings in which the shaft revolves.

The shaft is provided with small eccentrics or cranks where it passes through the door hinges f^1. It will thus be seen that as this door is kept in a continued state of agitation by being moved to and fro in a rapid manner, as above described, the manure is continually being pushed forward on to the delivering barrel g^1, which receives and delivers it either in rows or broadcast, as required.

LANE'S PERMANENT WAY.

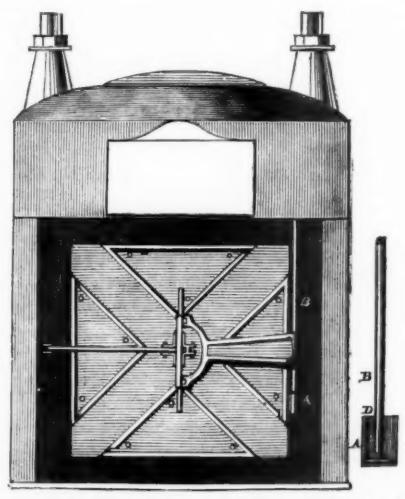
This invention, by Mr. Michael Lane, of Reading, has for its object improvements in the permanent way of railways. For these purposes longitudinal bearers of wrought iron are used, and they may be of any desired length, and they may be employed at intervals along the rails of a railway, but it is preferred that they should be continuous. The lengths of which the longitudinal bearers are composed, and the lengths of rails supporting and held thereby, may, when desired, be so laid as to break joint. The bearers are each composed of two separate parts, one outside and one inside of the rail, and the two parts are both rolled or formed to a similar section. Each of the two parts of a bearer consists of a plate, by preference of about 6in. in width, but this may be varied, and the plates may be of any desired length. These plates rest on the ground at a slight inclination from the side of the rail which they support. That edge of each plate which comes next the rail is turned downwards to the extent, by preference, of about 3in. or 4in. At the sides of the turned-down parts of the two plates, and near the upper surface where the rail is received between them, grooves are formed, one in each plate, and by preference angular grooves, so that when the two grooves of the two parts of a bearer come opposite each other they will form a dovetailed space between the two turned-down parts of the plates of which a bearer is composed. These plates are connected together at intervals by screw bolts and nuts, the bolts passing through the turned-down parts of the plates. The rails used with these bearers are rolled with an under web or projecting rib, which is of a dovetailed section, or of such other section as will correspond with the space produced by the grooves in the two parts of which a bearer is composed. The under surfaces of the rail near the outer edges press on and are supported by the plates of the bearer, the under surface of the rib or projection under the rail not coming quite down to the bottom of the dovetailed space. It will, therefore, be understood that a rail will be held securely between the two plates of a bearer which press the rail on each side, and, by reason of the dovetail or other section of the under part of the rail corresponding with the under cut or dovetail form of the space between the two plates or parts of which a bearer consists, the rail will be prevented rising; and it will also be understood that pressure on the rail will, by pressing down the bearer, tend to cause the rail to be held more and more tightly between the two parts of the bearer.



The illustration represents a transverse section of a rail and bearing plates of the forms preferred. *a a* are the two bearing plates, which are connected at intervals by means of screw bolts and nuts *b*. The under web or rib of the rail *c* is shown to be of a dovetail section, which is gripped securely by the corresponding angular faces of the bearing plates, so that the rail *c* is more and more prevented rising in proportion as it is more and more pressed downwards into the space between the nipping or gripping surfaces of the bearing plates *a a*. This holding down of the rail, it will be seen, is consequent on the web or rib being of a greater width than the narrowest part of the space formed between the nipping or gripping surfaces of the bearing plates, aided by the mode in which such bearing plates are connected together in order to admit of their coming closer together when pressed down. The bearing plates rest by their outer edges a^1 on the ground, but at intervals transverse iron or other sleepers are used as shown at *d*, and secure the outer edges of the bearing plates thereto by screw bolts or otherwise so as to prevent the rails and the bearing plates getting out of gauge.

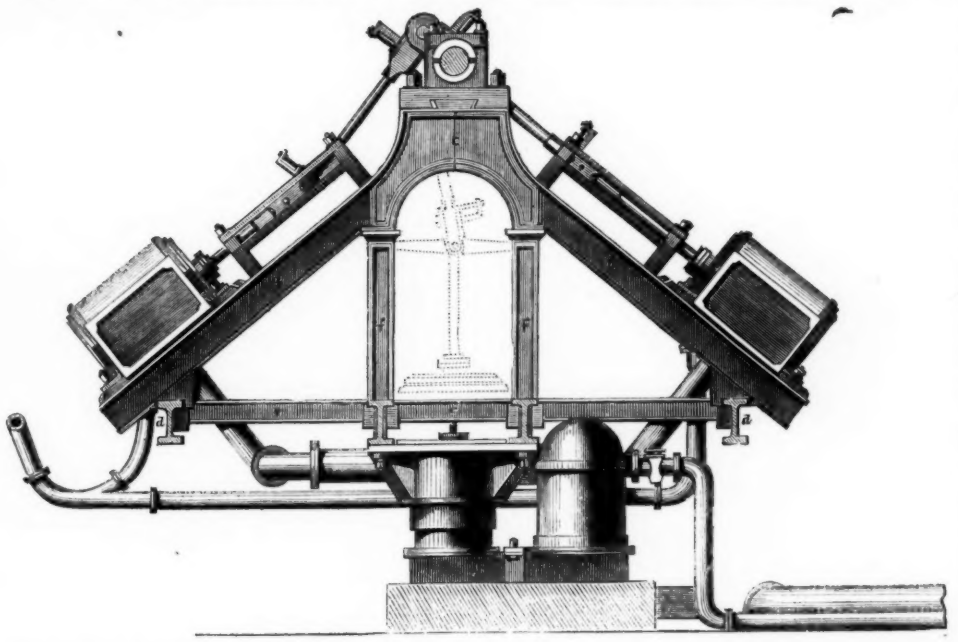
PARKINSON'S FRICTIONLESS BEARING FOR GAS METERS.

Fig. 1 represents an elevation of a dry gas meter with this invention, by W. C. Parkinson, of Cottage-lane, City-road, E.C., applied thereto, and Fig. 2 is a sectional elevation of the frictionless bearing.



A piece of glass, flint, pot, china, or other like material C is enclosed in a metal casing A. The wire B is pointed at its lower extremity, and passes through a hole D made at the top of casing A, and rests on the glass C. The hole D serves to keep the wire in its position, but the whole weight and consequently the friction is only on the point of the wire B, and the glass or other similar material C, and it is therefore reduced to minimum.

McNAUGHT'S METHOD OF SUPPORTING DIAGONAL ENGINES, &c.



This invention, by William McNaught, of Manchester, relates particularly to a certain description of direct acting steam engines, being principally applicable to "diagonal" condensing engines with either one, two, or more cylinders, and consists in such an arrangement of framing, dispensing with the usual stone foundations, the stability of the engines depending upon the "side walls" of the engine-house. It is proposed to attach, by bolts or other convenient means, the framing of the engine to the "side walls," and also provide transverse beams extending from each "side wall" to assist in supporting or carrying the engines; such beams may be of iron or other material, as desired, so long as the principle of the invention be maintained, and that the firmness of the engines depend chiefly upon the "side walls" of the engine-house instead of the ordinary expensive and inconvenient stone foundations. The air pump and also the condenser may be supported or suspended from the said cross beams.

Fig. 1 is a side elevation illustrating the improvements in supporting steam engines. The framing is constructed and consists in two principal pieces *a* and *b*, with two vertical stays *f*, *f*, bolted or otherwise joined together at *c*; this framing is secured to transverse beams *d*, *d*, *d*, *d*, which are securely fixed in the side walls of the engine-house, and also fitted and bolted thereto. The tie beams *e*, *e*, *e*, are provided to secure the transverse beams; these beams may be formed in one piece and fixed above or below the transverse beams, or a strong plate may be used instead of the tie beams. Although four transverse beams are shown a less or greater number, as may be considered requisite, may be used. The vertical stays *f*, *f*, should be double, and joined with diagonal braces, and secured to the framing and side wall to give greater stability. These stays may be used as fixings for the guides of a third cylinder, or for the air pump, if worked direct from the crank pin. Although two vertical stays are shown and described a single central one may be used, to which the two principal pieces *a* and *c* are to be bolted. The air pump *g* is fixed to the two centre transverse beams, and may be either single or double acting; in this case it is represented as single acting, and motion is communicated by an eccentric on the crank shaft, but it may, if preferred, be worked direct from the crank pin. Or, in the event of running at very high speed, two or more smaller air pumps may be used, so as to mitigate and divide the shock, and these may be worked by an eccentric or eccentrics or any other means. The engine is here represented as a single expansion engine with two cylinders placed diagonally, such being generally preferred, and fitted with superimposed "cut-off" slide valves. The "cut-off" valves are actuated by a separate eccentric, and each eccentric actuating two valves, and may be made to actuate so many valves as there are cylinders to the engines; but the engine may be made to work on the compound principle by allowing one or more cylinders to pass their steam to the other cylinder or any number of cylinders, and from thence into the condenser.

CORROSION OF CAST IRON TUBBING IN COAL PITS.

The flooding of the Pemberton Pit has called attention to the corrosion going on in the cast iron tubbing of pit shafts. The late Mr. Robert Stephenson has mentioned that in some cases he was compelled to renew cast iron tubbing which had been down but 12 or 14 years, and where, too, no sulphur was found in the water. There is only one mine now at work on the north bank of the Tyne, viz., the Walker, and the water is kept back by cast iron 'tubbing' at the high main and metal coal seams. The water thus kept back has mixed with the pyrites in the mine, and is of a highly corrosive character. This influence is at work, eating silently but surely into the iron, which is thus rendered daily less able to resist the pressure of upwards of 100 fathoms of water. The miners are at work at lower seams than those just named, and, should the tubbing give way, every soul would perish, for the waters would rush in with the velocity of a cataract, against which nothing could stand. In 1815 such a catastrophe did occur. On the 8th of May the water broke in from above into the Heaton Main Colliery, and drowned 75 persons. Their bodies were not recovered for upwards of nine months, and with the first body brought up was found the bone haft of a knife, the blade having been completely destroyed by the corrosive action of the water, which had also nearly destroyed a watch.

When the defective segments were removed lately from the Pemberton Pit the water poured down the shaft, thundering and roaring, at the estimated rate of 2,000 gallons per minute. The segments were apparently good, and were covered with a thick coating of soot upon the surface, but this proved to be the metal reduced, by the combined action of the water and the smoke which ascended through the shaft, to a substance of the consistency of black lead, and is easily cut through with a knife. The segment, which was originally three-quarters of an inch thick, had thus been reduced at the points of fracture to below one-eighth of an inch in thickness. Other segments are more or less affected in the same way, some portions being a quarter of an inch and others half an inch thick. In this case only the surface next the air in the shaft appears to have been acted upon, the water issuing from the feeder being brilliantly clear; in fact it is that which is supplied to the people of Sunderland. This tubbing has been up about 35 years.

As regards the Walker tubbing, that is exposed to the double action of the corroding water on the one side, and the corroding smoke and damp on the other; and, supposing that the action on each side were equal, it would last half the time of the Pemberton Pit tubbing, but from the evidence furnished by the Heaton Main accident of the destructive power of the water kept back by the tubbing at Walker it is probable that this tubbing will not last much more than twelve years. It has been now down about ten years, so that unless the water be removed we may expect the floods of this subterranean lake will suddenly disgorge themselves into the Walker Pit shaft, carrying with them the utter destruction of property and life.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

Thursday, February 13, 1862.

Mr. Francis Campin, President, in the chair.

ON THE METHODS OF ILLUMINATING LIGHTHOUSES.

By George B. Jerrand, C.E.

The author commenced his discourse by directing the attention of the meeting to the vast importance of being provided with adequate means of illuminating the lanterns of lighthouses, and briefly reviewed the past history of those structures with reference to the modes of lighting which have, from time to time, been adopted.

If it be desired to illuminate the whole space surrounding any spot a lamp or candle suffices, but if a certain part only of the horizon is desired to be illuminated, without losing any rays, it then becomes necessary to adopt some mechanical contrivance to collect the rays which are not proceeding in the desired direction, and to pass all on together to the spot to be illuminated. This was successfully carried into practice by M. Teulerè, of France, in the Corduan Lighthouse, where he applied paraboloidal reflectors at the backs of the lamps. This is called the catoptric system from a Greek word which signifies a mirror. The efficiency of the paraboloid form depends upon the following properties of the parabola by the revolution of which the surface of the reflector is generated. If a right line be drawn from the focus of a parabola to touch the curve, and at the point where it touches a tangent be drawn, from which another line, making, with the tangent, an angle equal to that made by the line from the focus, is also drawn, then will the last line be always parallel to the axis of the curve. Hence, if a luminous point be placed in the focus of the reflector above described, it follows that all the rays proceeding therefrom will be collected and sent forward as a parallel beam; it is, however, necessary that there should exist some divergence, otherwise the light would scarcely be perceptible at a distance, and this divergence is obtained by the use of a lamp of which the flame is of some definite diameter.

The author then proceeded to describe the mechanical arrangements and the method of constructing catoptric apparatus.

The attention of the meeting was next drawn to the dioptric system of distributing the rays of light, which is by refraction, being illustrated by the apparatus prepared to illuminate the Portland breakwater, which was placed upon the table and illuminated throughout the evening.

The author then proceeded to discuss the relative merits of the electric and lime lights, the latter being illustrated by a small lime light in action, and also to explain the nature and advantages of the magnesium light, which was also experimented upon.

The dioptric apparatus on the table was lent by Messrs. Wilkins, of Long-acre, and several lime lights suitable for the illumination of lighthouses, &c., were furnished by Messrs. Standly, of Cockspur-street. The reading of the paper was followed by an animated discussion in which Messrs. Leadbeater, Gumpel, Rawlinson, Walton, Yarrow, the president, and the author of the paper took part.

Tests of Gas.—At the last meeting of the City Commissioners of Sewers, Dr. Letheby submitted his quarterly report of the quality of the gas supplied to the City by the Great Central Gas Consumers Company during the quarter just expired. He stated that 321 experiments had been made on the illuminating power of the gas, 232 of them at the Laboratory of the London Hospital, and 89 at the Laboratory in Finsbury-square. The results were that at the first-named place the illuminating power of the gas was equal to that of 13·58 sperm candles, or 15·52 wax of standard consumption; and, at the second, it was equal to that of 13·13 sperm, or 14·01 wax. These numbers give a mean proportion of rather more than 11 per cent. above the requirements of the Metropolis Gas Act of 1860, and about 27 per cent. above the standard of the Great Central Act of 1851. The average illuminating power of the gas for the whole year had been a little less than this, namely, 11·97 sperm, or 13·68 wax. These were the results of 1,253 testings, of ten observations each. The difference in the aggregate result at the two places, nearly two miles apart, had only been about 36·100 of a candle, showing that the illuminating power of the gas was of a permanent quality. Its chemical quality had also been good as regards the absence of sulphuretted hydrogen and ammonia. Mr. Saunders suggested that the gas should occasionally be tested about two and four o'clock in the mornings. In reply to Mr. George Walter, Dr. Letheby said the cost of testing the gas followed the event; if the result went to prove that the quality was equal to the standard, the expense fell upon the person at whose instance the test was applied; if otherwise, on the gas company. The court then adjourned.

LAW INTELLIGENCE.

VICE-CHANCELLOR'S COURT, Feb. 14.

(Before Vice-Chancellor Sir W. P. Wood.)

HILLS *v.* THE LIVERPOOL UNITED GASLIGHT COMPANY.

Judgment was given in this case, which came before the court upon a motion for an injunction to restrain the defendants from manufacturing and purifying gas according to the invention of the plaintiff, comprised in his patent of November, 1849, as modified by the subsequent disclaimer and memorandum of alterations; and also from using renovated and reoxidized purifying materials, according to or in imitation of the same invention for purifying gas, and from infringing the plaintiff's patent.

The patents of the plaintiff have been the subject of much litigation, and the validity of his invention has been recently established by the Lord Chancellor in the case of "Hills *v.* Evans," which was argued at great length in December last.

Mr. Rolt, Mr Grove, and Mr. Marten appeared for the plaintiff upon the present motion; Sir Hugh Cairns and Mr. Druce for the defendants.

The Vice-Chancellor said that the plaintiff sought to restrain the defendants from proceeding to purify gas in the manner described in the bill, in infringement of the patent the validity of which was now secured to him by the judgment of the Lord Chancellor in "Hills *v.* Evans." The question was, in reality, whether a substance which had been used by the defendants was a substance the use of which constituted an infringement of the plaintiff's patent. The invention claimed by the plaintiff was the purification of coal gas "by passing it through precipitated or hydrated oxides of iron." Considerable doubt had arisen upon these words as to whether they were sufficiently large to include the native oxides elaborated by the laws of nature, as opposed to what might be termed the artificial oxides produced by the hand of man. It was admitted that the validity of the patent had been established, but it was said that it had been established on the ground that natural oxides were not included in it. His Honour, after referring to the judgment of Baron Bramwell in the Court of Exchequer, and to his own judgment upon a former occasion, said that the view of the Lord Chancellor in "Hills *v.* Evans' was much more favourable to the plaintiff than that taken in either of those judgments. His lordship, instead of contrasting artificial oxides with native oxides, preferred to take "precipitated" as opposed to "hydrated" oxides. In this view every precipitated oxide, whether natural or artificial, would be included in the patent, and the plaintiff would no longer be embarrassed by the use of the term "hydrated." Upon the first branch of the case, he should direct an issue to determine whether the material used by the defendants was a precipitated oxide of iron or not. Upon the second point which had been argued, he was of opinion that the plaintiff was entitled to an injunction restraining the defendants from renovating or reoxidising the purifying materials used by them by means of exposure to air, so that they might be used over and over again.

It was arranged that the issue should be tried before this court, without sending the plaintiff to a court of law.

COURT OF EXCHEQUER, Feb. 14.

(Sittings at Nisi Prius, at Guildhall, before the Lord Chief Baron, *and a Special Jury.)*

BEATTIE *v.* THE LONDON AND NORTH-WESTERN RAILWAY COMPANY.

Mr. Serjeant Parry and Mr. Joyce were counsel for the plaintiff, Mr. Hawkins, Q.C., Mr. C. E. Pollock, and Mr. Shaw Lefevre appeared for the company.

This was an action to recover compensation for an injury the plaintiff received when travelling on the defendants' line of railway. The plaintiff is a letter-sorter in the employment of the Post-office, and was travelling in the discharge of his duties by the Irish night mail train from Rugby to the North on the 4th July last, when, as it was alleged, by reason of the imperfect state of the boiler, it exploded as it passed under a bridge near Stretton station, forcing off the dome of the engine, which struck with great force against the pier of the bridge, carrying away a great part of the brickwork, and communicating such a severe shock to the train that the plaintiff was thrown from one end of the Post-office van to the other, and his head severely injured. The fireman, it appeared, was unfortunately killed. The actual loss incurred by the plaintiff by reason of the accident, inclusive of loss of salary, seaside expenses, and medical attendance, amounted to only £23 7s. The plaintiff complained of having received a concussion of the brain, which for some weeks prevented him from following his employment, and put him to much pain and inconvenience; and by the advice of his medical man he was obliged to go to the seaside for three weeks.

Captain Tyler was called, and stated that, having examined the engine, he was satisfied that the explosion was caused by reason of the weakness of the plate on the left side of the boiler, and that the boiler might have been tested by hydraulic pressure, or taking out the tubing and examining the inside of the engine.

The engine was built in the year 1851, and up to 1857 ran 196,000 miles, when it was carefully examined, and no defects were discoverable; it was put on again to work, and from that time up to the accident in July travelled 137,000 miles. Some portions of the boiler, when it exploded, were $\frac{1}{4}$in. in thickness, and it was working at a pressure of 115 lb. to the square inch.

The defence was that the defendants were not responsible for the accident, inasmuch as they, through their servants, had been guilty of no negligence in the management of their traffic.

Mr. Beyer, a locomotive engineer, who formerly was in the employment of Sharp and Co., the engineers, at Manchester, said that he remembered the engine in question being made by them, with nine others, for the company, the whole of them being first-class engines, and manufactured of Low-moor iron—the very best iron for the purpose—and that, having had great experience in the examination of boilers after they had been in use, the injured boiler showed the same form of corrosion that all had exhibited; that he never knew hydraulic pressure applied to old boilers, and it would be dangerous to do so, as some parts would suffer by the test.

Mr. Henderson, the foreman of locomotives at Camden station, was called, and said that he remembered the engine in question, 249, and seeing her on the 4th of July, when it was in first-class condition; that, after every journey performed by an engine, the driver of it had to make a report to him in writing of the state it was in; that every engine was examined before it was allowed to start on a journey, and that if repairs were needed they were done at once.

Mr. Rowland, the foreman at Wolverton, swore that he had carefully examined the engine in 1857, and made a man named Griffiths get into it with a light, and run it along the seams, in order that he might see from the outside whether there was any defect. The inside was thoroughly scraped, and new tubes put into it. There was undoubtedly some corrosion of the boiler plates.

Mr. Sturrock, the locomotive engineer to the Great Northern Railway, said that if he thought they had a boiler in their use that would not stand a pressure of 300 to the square inch he would break it up as useless, but he did not approve of testing a boiler by hydraulic pressure, even of 180 to the square inch; that the corrosion in the present case was more rapid than he had ever met with before, and he could not account for it.

Mr. Bovill said that the boiler had been ruptured from the plate being eaten away in a furrow near the seam. The iron had not materially altered in its strength; very little structural alteration went on in the iron itself. A portion of the boiler-plate was tested at the Arsenal at Woolwich after the accident, and stood a strain of 22 tons to the square inch.

Mr. Nasmyth said that it appeared to him that the corrosion was caused by a galvanic action, in consequence of copper and brass being present with the iron in the water, and he could not have apprehended that the action should have concentrated on some particular spot.

In answer to a juror, the witness said that it may have happened that corrosion had set in in 1857, and had escaped detection at the time of the examination.

Other witnesses were called, and,

After Mr. Hawkins had summed up his evidence,

The jury intimated that they were satisfied, and had resolved upon finding for the plaintiff, subject to any direction upon the law of the case that his lordship thought proper to lay down to them.

His lordship said that there was no doubt as to the cause of the accident. The boiler was insufficient, burst, and injured a passenger who was travelling on the railway. He condemned very strongly loading a case with scientific evidence in the manner that had been adopted in the present case, and he deprecated either an attack or a defence being made in such a manner by a large and powerful body of men, having the control of a long and inexhaustible purse, that no ordinary man could, with the smallest prospect of success, meet them upon equal terms. If he lost his cause the expense of the litigation ended in his utter and total ruin. The whole question for the jury was whether they thought that the company had adopted all that they reasonably ought to have done to insure the safety of the public in respect of the possibility of an accident. The company were only bound to take all reasonable care, and nothing more. If they had done that the plaintiff was not entitled to recover; if, on the contrary, they had not done so, the only question would be one of compensation.

Verdict for the plaintiff for £123 7s.

COURT OF COMMON PLEAS, Guildhall, Feb. 15 to 18.

(Sittings at Nisi Prius, before the Lord Chief Justice *and a Special Jury.)*

FORD *v.* THE LONDON AND SOUTH-WESTERN RAILWAY COMPANY.

Mr. Macaulay, Q.C., Mr. Manisty, Q.C., Mr. Hindmarsh, Q.C., and Mr. Macrory were for the plaintiff; and Mr. Bovill, Q.C., Mr. Hawkins, Q.C., and Mr. Johnston were for the company.

The plaintiff sought to recover damages for injuries which he had sustained on the South-Western line by reason of the alleged negligence of the defendants. It is within the recollection of our readers that on the 28th of January, 1861, a fearful accident occurred near Wimbledon station. A train ran off the line; the tender and the next four vehicles ran down the embankment of the Epsom branch line; the next two carriages passed the place at which the others had left the line, and turned over. In one of these was Dr. Baly, who in some unaccountable manner fell through the doorway just before it turned over, and was instantaneously killed. About nineteen persons were hurt, some of them seriously, and among these was the plaintiff, whose shoulder and ribs were broken, and who was in other respects injured in his body, and consequently in his business as a woollen factor in Cheapside. In proof of the negligence of which the company was accused, it was said that the speed was too great, it being taken into consideration that the train was passing a junction; that the permanent way was defective; that the brake power was not sufficient; and that the tyre of one of the wheels of the tender was insufficiently fastened to the wheel. Almost every point in the case relied on by the plaintiff was strenuously contested by the defendants. The witnesses were examined and cross-examined with considerable energy, and in one or two instances with some slight degree of acrimony. Even among the jury an occasional dispute arose and differences of opinion were expressed; in fact it was a case of "war to the knife." The desks of the court were covered with beautiful models of wheels, axles, tenders, and rails; and in the space outside, opposite the Guildhall, were the actual wheels, axles, and other portions of the injured train. On Friday the case for the plaintiff was concluded, and on Saturday Mr. Bovill addressed the jury at great length on behalf of the defendants. He said there were some accidents which could not be prevented, and denied that in the present instance there was any negligence. The engine driver, the stoker, and the guard of the train in question were called; also Mr. Strapp of the London and South-Western, and Mr. Woodhouse of the London and North-Western Railway.

The real question was whether or not the defendants had been guilty of negligence. Probably no case which ever came before a jury was fought with more energy. Almost every point raised was argued. Facts and theories were disputed on either side. Witnesses of every genus and species were called; practical and scientific men of the greatest eminence crowded the court. Such gentlemen as Colonel Yolland, Sir Charles Fox, Mr. Nasmyth, Mr. M'Connell, Mr. Bidder, Captain Huish, Mr. Strapp, Mr. Bovill, and Mr. Woodhouse were examined and cross-examined in the most minute and exhaustive manner, and the view contended for by the company, that there were some accidents which could not be prevented, was elaborated and commented upon at great length. The plaintiff pointed out several causes which contributed to the accident. The defendants said that it was attributable to none of these, and asserted their inability to assign any reason for the train leaving the line. Mr. Bovill, it is true, said that an axle might have become bent during the journey. This theory, however, was not very strongly urged by the company.

Mr. Hawkins summed up for the defendants, and Mr. Macaulay, who was labouring under a severe cold, which, he good-humouredly said, rendered the position of his auditors as disagreeable as that of the tenants of a brake-carriage, replied on the whole case with great minuteness.

After hearing the observations of the learned Judge,

The jury found a verdict for the plaintiff—Damages £1,500.

COURT OF EXCHEQUER, Feb. 19.

(Sittings at Nisi Prius, at Guildhall, before the Lord Chief Baron *and a Special Jury.)*

HORSFALL AND OTHERS *v.* LYNALL THOMAS.

Mr. Edward James, Q.C., Mr. Brett, Q.C., and Mr. J. B. Aspinall appeared for the plaintiffs; Mr. Honyman and Mr. Maclachlan appeared for the defendant.

This was an action on a bill of exchange for £233 10s.

The plaintiffs are the owners of the Mersey Steel and Iron Works, and were employed by the defendant, a gentleman who for many years past has paid much attention to the construction and manufacture of ordnance, to make for him a large steel gun. The right to begin, owing to the pleadings, was with the defendant. The gun was to be manufactured for £372, and, according to the defendant's case, it was to be constructed on the principle of "no cure no pay" if it burst. The defendant wished to have the gun rifled, for which the plaintiffs were to charge him £95 in addition to £372, and he gave two bills for £233 10s. each, the first of which he paid, and upon the other he was now sued. It appeared that during the process of boring the gun a flaw was discovered, and the plaintiffs, by letter, informed the defendant of that fact, and that the original flaws, although diminishing, were not wholly disappearing, and that it might take half an inch more radius than had been ordered by the defendant to get rid of them, and that it might be necessary to continue the boring to 7½in. or 8in. The defendant then telegraphed to Messrs. Fawcett and Co., who were rifling the gun for the plaintiffs, telling them that if there was a continuous flaw round the bore the plaintiffs were not to go on with the gun. The answer by the plaintiffs was that the flaws were not continuous, but merely unsightly, and did not impair the strength of the gun. The gun, when ready, was forwarded to Shoeburyness to be tried, under the directions of the usual Government officials, and the first day the gun was fired many times, the charges of powder varying from 23 lb. to 28 lb., and the projectiles weighing from 168 lb. to 175 lb. The defendant wrote to the plaintiffs the result of the first trial, and spoke in glowing terms of the power and correctness of the gun. At an elevation of 30½ deg. a 174 lb.-shot, backed by 28 lb. of powder, was carried very nearly six miles—10,075 yards. Upon the second trial the authorities required the gun to be fired a certain number of times, and at the sixth shot, when charged with 25 lb. of powder and a 168 lb.-shot, it burst.

The Lord Chief Baron said he was of opinion that the defence set up was no answer to an action like the present upon a bill of exchange. All the plaintiffs undertook to do was to make a gun, and nothing more. From the correspondence (which was very voluminous) it was clear that the gun had been made on the "no cure no pay" principle. The gun appeared to have been one of very considerable merit, and had been severely tried.

Mr. Honyman said the real complaint was, the gun was so defective that the plaintiffs had put a plug into it to conceal the defect, and had not communicated that fact to the defendant.

The Lord Chief Baron said the defendant had a remedy by a cross action.

Ultimately the verdict was entered for the plaintiffs for £240.

OUR ARTILLERY PROSPECTS.

(From the *Dublin University Magazine*).

Having minutely studied all the peculiarities of the Armstrong system, we believe that Armstrong guns, whether field-pieces or heavy ordnance, are and must be defective, as the very consequence of natural laws. Our opinion, however, is of minor consequence on this point. The main matter for present consideration is not what Sir William Armstrong fancies he *can* accomplish, but what he *has* already accomplished; and, having regard to what he has already done, whether Parliament next session will be warranted in granting him a further subsidy. Such are the main questions for consideration; and, despite the strenuous endeavours of Sir William Armstrong's party, we think the public will insist on their being considered. To this end there can be no tribunal so fair and efficient as a Parliamentary Commission. Not a select committee, which would be a tribunal too little independent of extra-parliamentary influences, but a *commission;* not necessarily composed of members of Parliament, but gentlemen who, from their technical and scientific knowledge, would be qualified to speak with authority on the scientific issues.

Sir William should be clearly made to understand that the British public will stultify themselves if they rest satisfied with any so-called investigation by the Ordnance Select Committee or the War Office.

Since rumours of the failure of the Armstrong system have found their way into print we regret to notice a system of ingenuity much to be deprecated—one that cannot prove ultimately advantageous to any person or any interest. The Admiralty in October declined to receive any more of the 100-pounder Armstrong gun *for the present.* This fact was officially announced, and is, therefore, well known. Since then Sir William seems to have been cultivating a crop of experiments, the results of which—ostensibly successful and extensively published—tend to confuse still more the already embarrassed evidence on this all-important subject. For example, about two months ago an announcement headed "breech-loading ordnance" appeared in the *Times*, intimating that a large breech-loading gun of Sir William Armstrong's construction, but having the apparatus for closing the breech arranged to work from the side, was tried for quick and continuous firing by the Ordnance Select Committee, that the time occupied in firing fifty-one rounds was only twenty-one minutes and fifty-six seconds, and that the escape of gas at the breech was effectually prevented. Accepting, for the purposes of argument, these facts as they stand—conceding this breech-loading gun to be eminently successful in all respects—would not the plain inference be, judging from the statement that the gun in question was not only constructed by Sir William Armstrong, but that it was an Armstrong gun—according to definition *the* Armstrong gun, in respect of which so much adverse criticism has appeared, and in behalf of which Parliament voted two millions. Not a bit of it. The gun in question is made on the Prussian model, with the means of breech closure invented by Messrs. Church and Goddard superadded.

Nobody doubts that Sir William Armstrong may, in the end, make a satisfactory gun if profusely furnished with public money, and if abolition of the patent laws be accomplished; but why this concession and revolution in favour of any individual? and why does the War Office make it a point of honour to recognise the merits of no guns except his? Captain Blakely has again and again offered to manufacture, at his own expense, a piece of ordnance, the shell of which should penetrate a target equivalent in resistance to the Warrior. Why has his offer not been accepted? Mr. Lancaster has long succeeded in perfecting his system, as explained by us in February, so that spiral oval shells may be fired successfully from oval-bored guns. His guns can discharge all the ordinary ammunition of the service in addition to their own. Why, then, is the Lancaster system kept so assiduously in the background?

Enough has been said, we fancy, to prove that an inquiry, minute and impartial, is urgently required. That there will be an investigation of some sort we do not doubt; and we may be pardoned for giving utterance to the hope that the daily press may not be made the cause of embarrassment or confusion to the tribunal of investigation, wherever it may be installed, and of whatever sort it may be.

Here, whilst on this topic, it is lamentable to contemplate the flood of error which the *Times* newspaper has caused to be circulated in respect of the two artillery constructors, Whitworth and Armstrong. For example, in regard to the first, the *Times* newspaper, quoting from a Manchester paper, caused the announcement to go forth that Mr. Whitworth's experiments, conducted at Southport in July, 1860, were eminently successful. We do not overmuch like to employ the words "success" and "failure" because of their indefiniteness; but only by a long stretch of fancy indeed could Mr. Whitworth's experiments at Southport be called successful. After firing near one hundred shots at a target a thousand yards off the target was not once hit. More than a dozen friction tubes were exploded before the eighty-pounder could be fired; all the friction tubes were launched violently backwards; and the major part of spent cartridges had to be dug out of the eighty-pounder by a handspike. Mr. Whitworth is a good mechanician, and when he turned his attention to artillery and small-arms much was expected of him. He has been liberally supplied with public money, and has in every way had a fair field.

The public have been misinformed in regard to the achievements of this gentleman as a manufacturer of fire-arms; and we have to express our regret that the *Times* has been foremost in promoting the misconception.

It is time the reign of misconception should end. The practical issue is, that whilst the French have good broadside guns for their navy, and whilst Captain Blakely is arming the land and sea forces of Spain with good rifled ordnance, England has not at the time being one single accepted piece of rifled ordnance. The Admiralty have done their duty so far as in them lies. They refuse finally to recognise the Armstrongs presented to them by the War Office and Ordnance Select Committee. But is it not a folly that the Admiralty should be in any way dependent on the War Office and Ordnance Select Committee for the choice of their armament? Would it not be more rational that the Admiralty should have their own technical staff of artillery constructors, engineers, laboratory officers, &c., for themselves? Naval guns involve special conditions which naval men surely may be expected most clearly to perceive. Thus, a recent letter from Captain Halsted first made known the startling fact, that be the Armstrong ordnance ever so successful as engines of projection, they necessitate such 'tween-deck height that ships would have to be built on purpose to hold them. And all this sacrifice in behalf of guns that even in the greatest emergency cannot be loaded at the muzzle, cannot fire any ammunition but their own, cannot discharge red-hot shot or shells filled with molten iron, dare not use cartridge a trifle too short for fear of bursting the gun; and at any moment may do, as they have done, blow down rear right-hand men if provided with side apertures; and, if made on the upward aperture construction, blow their vent pieces, as on board the Excellent, clean through the deck.

Of course these observations are made in the fullest cognisance of Sir William Armstrong's two rejoinders in the *Times*. We have studied these documents carefully, and fail to perceive that they disturb the adverse evidence previously adduced in any particular. Sir William's last rejoinder was a most ingenious document. Sir William cites the practice of a heavy gun made by him; but which, indeed, was wholly different from *the* Armstrong gun by definition. Now whether this new gun—the shunting gun, as it has been called—be good or bad, we do not propose to argue. All we wish to state is, that it wholly and absolutely differs from the Armstrong gun; and that Sir William never attempted to make this variety of ordnance until practice has demonstrated the inefficiency in certain respects of the real Armstrong weapon. This is a fact which would never have been gathered from Sir William's own explanations.

We have already stated that, if the Armstrong guns in their smaller forms do not answer, then, *a fortiori*, can they not answer in any larger form. This conclusion is naturally deduced from a consideration of the principles involved. It might be theoretically possible that a gun of some given pattern should be reliable enough as a field-piece, but that it should fail on a larger scale. Our contemporary, the *Saturday Review*, imagines this to represent the case of the Armstrong guns. Taking for granted the demonstrated insufficiency of the larger Armstrongs—a thing sufficiently proved by Sir William's endeavours to mix up shunting ordnance with considerations of his own original weapon; proved, moreover, by his own admissions last year before the Society of Civil Engineers—the *Saturday Review* concludes that the thorough efficiency of the Armstrong field-pieces may be considered as demonstrated by the experience of the Chinese campaign. We should like to be able to adopt this view of the case; but it is diametrically opposed to our evidence. It is wholly repugnant to the high testimony of Sir Howard Douglas, and it is, as we shall presently show, inconsistent with the report of the Chinese correspondent of the *Times* newspaper. Again, Major Hay being called upon to give evidence favourable to the Chinese practice, damages the cause his observations were meant to serve. "It would have been most surprising," he states, "if slight alterations had not suggested themselves in both guns and ammunition, considering that they were being tried for the first time, and that they were most jealously watched by all. In fact, from the instructions I received before leaving England, it was my duty to point out the slightest defect. This I did; and I was glad to observe, in a recent visit to the Royal Arsenal, Woolwich, that these defects had all been remedied in a manner which experiments had proved to be most successful."

Again, in another part of Major Hay's letter we find the expression:—"The guns never ceased firing because of any casualty to our men." The tenor of this letter is, we say, most damaging when regarded as the answer—the best that could be given as is fair to assume—to the statements brought forward by us in February last; published in the *Mechanics' Magazine*, vouched by Captain Halsted, and lastly, by that very high authority, the late Sir Howard Douglas. It is fair to assume that Major Hay would have testified, had he been able, that breech-pieces did not fly out, that Armstrong guns had not to be withdrawn, no matter from what cause, that fuses did not spontaneously ignite *in transitu;* and that none of our men suffered casualties by the dispersion of lead from Armstrong shells fired over their heads.

He acknowledges the necessity for effecting slight alterations both in guns and ammunition. What were they, and why not allow the public to judge as to their gravity? He pronounces confidently as to the result of experiments at Woolwich; but in what manner can experience gained with recent ammunition rebut the allegation that Armstrong shells and fuses cannot withstand storage and climatic vicissitudes?

Hear what Sir Howard Douglas testified concerning the alleged danger from lead dispersion in a letter addressed to the *Dublin University Magazine*:—

"I have good information," he wrote, "respecting the real performances of the Armstrong guns, which entirely corroborates what you state of the lead having blown off, to the great peril of the troops lying down in front, and over whose heads the shells were projected; and that danger is now so manifest that it will not, I think, be again attempted. This will be a serious disability in war, for batteries have often occasion to fire over advanced works."

In reply to this precise testimony, Sir William Armstrong and his friends have not adduced one positive denial. What then is the inference? Strangely enough, the China correspondent of the *Times* has been popularly thought to have established the character of the Armstrong field-pieces in the Chinese campaign; and this despite the following positive testimony. We quote it verbatim:—

"At 6 A.M, on the 14th" (August, 1860), wrote poor Mr. Bowlby, "the whole army was afoot, and soon after that hour the march commenced. The guns were in front, with 200 rifles in skirmishing order under the command of Major Rigaud. Then followed the first brigade, consisting of the Royals and 21st, followed by the second, the Queen's 60th rifles, and 15th Punjabees—the division being under the command of Sir John Michel. The second division halted on the ground occupied by the first on the previous night. Just at the angle where the river bent to the right, a casemated battery had been formed by the Tartars, in a creek on the south bank, with a view of taking the allied troops in flank. At a turn of the stream three-quarters of a mile lower down, another battery was visible, whose fire crossed that of the creek guns. The first of these batteries fired the previous day on a reconnoitring party, so it was resolved to silence it before commencing operations against the intrenchments. Two of Baring's Armstrongs were detailed for the purpose, and at twenty minutes past six they opened on the Chinese at 250 yards. The enemy were not slow in replying, and for ten minutes a very pretty duel was carried on. The range seemed too close, so three of Desborough's 24-pounder howitzers were ordered to the front, and in five minutes the Chinese fire was silenced."

Here, then, is the record of one who had pronounced very favourably on the merits of Sir William's field-pieces on a previous occasion. How damaging is his present testimony? Here we confessedly have guns that could not defend themselves at 250 yards, because—and the reason is most amusing—"*the range seemed too close,*" whereupon a howitzer battery had to be brought in front (a euphemism, for "the Armstrong battery had to be withdrawn"), and "in five minutes the Chinese fire was completely silenced."

It is impossible, we think, to weigh all this evidence, gathered from independent sources, without coming to the conclusion that the Chinese experience very far from justifies the common belief in the safety and thorough efficiency of the Armstrong field-pieces. That they shoot correctly no one doubts, that they shoot fair is a necessity, being rifled, that the segmental shell is deadly against troops is demonstrated. Conceding all this, however, the Armstrong field-piece and ammunition may both be still defective, and as to the larger guns now being made by Sir William, whether good, bad, or indifferent, they are fundamentally different from the original Armstrong gun—the weapon that has been fancied to have achieved so complete a success.

Sewage of Towns.—Mr. Brady's motion for a select committee to inquire into the best means of utilising the sewage of the cities and towns of England, with a view to the reduction of local taxation and the benefit of agriculture, has been agreed to.

Wheatstone *v.* Wilde.—This famous case, growing out of the alleged infringement of Professor Wheatstone's telegraph patents, broke down on Monday, in the Court of Exchequer, at Guildhall. At the sitting of the court the jury intimated that it was impossible for them to try the cause properly on account of its complication. The learned judge said that if the case only involved the consideration of a number of different issues, so that each patent might be separately considered, a jury might then properly try it; but the difficulty in the present case was that the jury would have to take into their consideration the whole of these different patents at once, and that it would, he thought, be utterly impossible for any but a scientific man to grasp such a complication of facts. A long consultation then ensued, and it was finally agreed to refer the whole matter.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

COKING SLACK COAL.

SIR,—In your last number (Feb., 14), and in your second notice of "Percy's Metallurgy," I find the following passage relating to the enormous waste of coal in the South Staffordshire collieries:—

"But the chief cause of loss is, of course, the difficulty of converting the slack into coke in a profitable manner, and, as Dr. Percy says, there is no doubt that, should any person be so fortunate as to succeed in converting that at present worthless material into good coke at a moderate cost, he would realise a large fortune, and he would moreover have the satisfaction of prolonging the industrial life of South Staffordshire, which has already began to suffer from the exhaustion of its fuel."

To me this passage is incomprehensible, and, so far as I can guess at its meaning, it is astounding as emanating from such an authority as Dr. Percy, and as being endorsed by you—at this somewhat advanced period of the 19th century. Why, or how, any doubt should or could exist as to the possibility or practicability of making good coke from "slack," and in a "profitable manner," too, I cannot imagine, unless the ideas of profit are something far beyond Hebraic. If people had no fabulous ideas of profit, and were content with a fair and reasonable remuneration, somewhat above the average of most commercial undertakings, there could be no difficulty in the case. I have yet to learn that it is the rule that persons who are "so fortunate" as to succeed in converting "worthless" materials into good and useful products, at a "moderate cost," realise "large fortunes." I take that to be the exception as regards inventions and discoveries in general. I do not anticipate large fortune in this case; but if any coal owner in South Staffordshire will send me an average sample of his "slack" (not a picked sample), I will undertake to convert it into good coke, fit for smelting the best gray pigs, at such a cost per ton as no sane man would think objectionable—the coke so made to bear any chemical analysis and to stand any comparison with the best coke now made either for iron-smelting or for any other purpose. I can only make coke, at present, upon a very small scale. My apparatus is quite a miniature affair, which is a great disadvantage in all respects, financial and otherwise; but if the huge mass of material described by you were worked up on the spot it could be better and more cheaply done. I will add that, by an increase of cost by no means ruinous, the coke may be made as free from sulphur as carbo ligni—Dr. Percy's "irony" nevertheless and notwithstanding. Only two conditions are requisite. Ovens of a different construction to any that I have seen, heard, or read of, and an inexpensive and speedy preparation of the slack. P. H.

Maryport, February 17th, 1862.

EXPANSIVE STEAM ENGINES.

SIR,—I have read with great attention the letter "V. P." addressed to you "On the Practical Use of Steam Expansively in Marine Engines," and, as he invites a free discussion, may I ask you to insert my views on the subject in your next.

I agree with "V. P." when he says "Expansion resembles a kingdom having good laws badly administered," but there are some points on which I cannot agree with him, especially as applied to marine screw engines.

The principles advocated by him I find are, 1st, a high speed of piston; 2nd, a comparatively long stroke and a high pressure with an early cut off.

I think the present speed of piston might be increased with advantage, but I am not prepared to go so far as 600ft. to 800ft. per minute. I believe you, sir, in an article lately on "Fire Engines," condemned the churning of the steam that was going on with such a high speed of piston, and I think that 400ft. per minute is quite sufficient. He says, "all screw engines should be geared." I humbly submit they should not. "V. P." wishes to avoid complication; I consider it an exceedingly complicated arrangement to gear screw engines—it takes up a great deal of room (a serious drawback in ships), is very liable to get out of order, and, though the arrangement proposed by "V. P.," may take the sudden strains off the engines from the action of the sea, it will throw it on to the teeth of the wheels, which are more liable to fracture than any of the parts of the engine, it is more expensive than direct-acting engines, much heavier, and (but this "V. P." may take but little notice of) much dirtier.

With reference to a long stroke, I am averse to those engines with such an absurdly short stroke, but I am well aware that they are only used on account of the very limited space, and though "V. P." asserts that the stroke should never, under any circumstances, be less than the diameter, he ought to know that it is not always practicable. He prefers the dimensions of two to one; I would prefer one-and-a-half to one, and for this reason. I believe that the steam would not be so liable to condensation, for the prevention of which "V. P." so justly insists upon every precaution being taken.

I think he is quite right in advocating an high pressure with an early cut off, and I trust the day is not far off when a pressure of 100 lb., and afterwards superheated to about 450 deg., and surface condensers, shall be in general use.

In the tenth paragraph of his letter he says, "the whole engine must be constructed of enormous size and weight to enable it to sustain the violent strains and shocks due to the admission of steam of a very high pressure at the beginning of the stroke; in consequence we see two, three, and four cylinders resorted to in order that the high steam may act on a very small piston first, and, as it becomes weakened by expansion, may have a larger and larger piston to act on. A very good plan, were it not for the weight, complication (and consequent liability to get out of order), and expense due to such an arrangement, besides the enormous increase in surfaces with which the steam must come in contact, to each of which it is sure to impart more or less of the precious heat, which it should be our endeavour to impart to, not take from it.

Again he says, "I would never recommend the employment of less than three, but, where admissible, four cylinders are far better, and will be found, in the long run, well worth a little extra expense and weight." These cylinders, it appears, are not to expand from one to the other, but the steam does all its work in each cylinder. I do not see how he reconciles these two statements, for the arrangement is almost the same in each. His plan I certainly prefer of the two; but I consider two cylinders are quite sufficient, and will do their work better than any arrangement of three or four.

February 19th, 1862. J. S. F.

AGRICULTURAL LOCOMOTIVES.

SIR,—In reply to Mr. Butlin's letter in THE ENGINEER of the 14th inst., headed "Portable Engines," I beg to state for the information of Messrs. Butlin, Pullan, and any other gentlemen who may kindly interest themselves in my patents for improvements in the construction of locomotive engines, that the object of that portion of Aveling and Rawlinson's patent to which Messrs. Butlin, &c., allude, is to prevent priming in ascending steep inclines, and to avoid the necessity of using either a long pipe to convey the steam from the steam chamber to the cylinder, or for conveying the exhaust from the cylinder to the funnel, and to this end the working cylinder is placed in a steam dome, or chamber, and brought to the forward part of the engine in the manner set forth in the drawings which accompany the specifications.

The above improvements apply only to locomotive or traction engines, and are not intended or designed for portable engines.

I have endeavoured to attain the same object by placing a screw under the smoke box of engine for raising and lowering the boiler. The first agricultural locomotive built for me by Messrs. Clayton, Shuttleworth, and Co., in 1859, was, and is so arranged, but experience has proved that by the arrangement above specified the complication of the screw can be got rid of. In my opinion, unnecessary complication has been, and is, the great fault in engines.

Rochester, Feb. 20, 1862. THOMAS AVELING.

[An application of an old invention to a new purpose—at all events, a purpose so little different as in the case of a portable and a traction engine—is not tenable.—ED. E.]

BOILER EXPLOSIONS.

SIR,—The alleged phenomenon to which your correspondent, Mr. Wenham, draws attention in your last impression, in relation to the cause of boiler explosions, is one which, I venture to say, merits the most careful investigation. If it can be shown that conditions exist under which water may be heated many degrees above the boiling point without ebullition, starting at last suddenly into steam, we are possessed of a fact of the very highest significance in connection with this important subject, and it is unaccountable that the authoritative statement of it should have attracted so little attention among engineers. That such conditions do exist seems to be accepted by chemists as an established fact. The following quotation will be found in Professor Miller's "Elements of Chemistry," vol. i., p. 246:—"The experiments of Donny have thrown light upon some of the causes by which ebullition is facilitated. He has found that the presence of air in solution singularly assists the evolution of vapour. * * * * By long boiling of the water the air becomes nearly all expelled. In such cases the temperature has been observed to rise even as high as 360 deg. in an open glass vessel, which was then shattered with a loud report by a sudden explosive burst of vapour."

Taking this statement for granted, the wonder no longer remains that boiler explosions should take place at all, but rather that they are not of more frequent occurrence.

If the statistics of violent explosions were collected it is not too much to say that nineteen out of every twenty would be found to have occurred at one of two particular junctures—either during the time the engine is at rest, or immediately on starting after an interval of rest. Among the more disastrous ones the most usual time is early in the morning, when work has just commenced, or is about to commence. The simple bursting of a boiler from over-pressure, combined with bad construction from bad rivetting, or defective plates, and, it may be added, from shortness of water, is a common enough occurrence during the hours of work, seldom doing any great amount of injury. The damage soon gets repaired, and the outside world hears little of it. The true explosion, however, which startles the public mind by its terrific power and destructive consequences, is quite another affair, and I do not remember to have ever seen a report of any accident which could be said properly to belong to the latter class, having taken place while the engine was in mid career, with one exception, viz., the recent one at Rugby.*

Now if what chemists state is correct, and Mr. Wenham's hypothesis is a true one, it needs no long explanation to show that these violent explosions ought to occur exactly when they do occur. It is precisely at the times above indicated that the water will be most likely to have attained the point of danger. While the engine is at rest, with the fires low, or banked up, and the safety valves eased, the water will simmer for a time, and boil off all the air, until at last ebullition ceases, and the entire mass remains motionless. When the fires are again urged, and the safety valves screwed down to working pressure, then, if at all, will this mysterious action come into play—the water will become superheated till it reaches an unstable equilibrium, and will be ready to flash into steam the moment its quiescent state is disturbed.

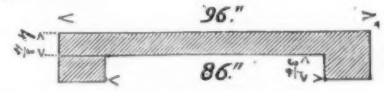
I have only to add that, having been long under the same impression as your correspondent, I have several times tried the experiment as described by Dr. Miller, but without success. A failure, however, very often only implies that the requisite conditions have not been complied with, and I am quite willing to accept the quotation given as a strictly correct statement, although difficult to verify. It is, in fact, recorded on the same page that the phenomenon is not easy to reproduce, and it is, perhaps, a fortunate circumstance that it is so. The subject requires investigating with a care proportionate to the importance of the question which it involves. I am quite aware that other theories have been recently advanced which are well worthy of consideration, still, there is room for another and, it may be, a better one.

Buckingham-street, Adelphi. R. HOWSON.

THE HARTLEY ENGINE BEAM.

SIR,—You will oblige me by inserting the following calculation of the Hartley Colliery beam in answer to a corresponpent in last week's ENGINEER. As an introduction I may state, for the instruction of some of your younger readers, that the strength of a beam increases as the square of the depth d, directly as the breadth b, and inversely as the length L; and if the two former dimensions be taken in inches, the latter in feet, the breaking weight of a cast iron beam 1ft. long between supports, loaded in the middle, and 1 square inch section S, for common good cast iron about 2,000 lb., then the weight W, that will break any other rectangular beam $= \frac{bd^2\,S}{L}$. A beam 1ft. long, 1 square inch section, fixed at one end and loaded at the other breaks by $\frac{1}{4}$ S, or 500lb.

The Hartley beam was, at the cylinder end, 18ft. long, and consisted of two similar parts, joined by the gudgeons, and each half may, for the easier calculations' sake, be represented as having the subjoined imaginary section through middle, the loss in strength by the hole for the main centre being fully made up for by the boss. This is the common, and, for practical purposes, convenient, mode of treating this matter.



The formula used for a beam of this shape is

$$W = \frac{(BD^2 - bd^2)\,\frac{1}{4}\,S}{DL}$$

In this case we have: B = 8″, D = 98″, $b = 3\frac{1}{2}$″, $d = 86$″, L = 18ft., and $\frac{1}{4}$ S = 500 lb. Hence the breaking weight

$$W = \frac{[(8 \times 941{,}192) - (3{\cdot}25 \times 636{,}056)]\ 500}{98 \times 18} = 1{,}548{,}286\text{ lb.}$$

As to the load at end of beam, or pressure on cylinder piston, I am unable to tell exactly. One of the witnesses at the inquest said it was 108,640 lb.; hence, for each half of this compound beam, 54,320 lb.

It is stated that the cylinder is 86½in. diameter, equal to an area of 5876·5in.; hence, by dividing this area into 108,640 lb., we get 18½ lb. as total pressure per square inch of piston, vacuum included. The engine worked with 10 lb. above the atmosphere, as it seems. Actual load on each half-beam was 54,320 lb.; hence the beam was loaded with $\frac{54{,}320}{1{,}548{,}286} = \frac{1}{28{\cdot}5}$ of its breaking weight, so that if, first, the casting had been sound; secondly, the metal well distributed; and, thirdly, no undue strain thrown on the beam by driving the main centre too tightly on, or by a sudden and very severe shock, or by extremely cold weather, it would have been strong enough. I have seen several statements from people who profess to know all about it to the effect that this beam, under ordinary working circumstances, was loaded to more than half its breaking weight. Would they now, as the ice is broken for them, please to come forward and tell us what they have got in support of such statements. P. J.

London, 18th February, 1862.

* We have heard of dozens if not hundreds of such cases.—ED. E.

PATENT TRIBUNALS.—PREPARATION OF CASES FOR TRIAL.

SIR,—Having submitted in my last letter that preliminary investigation prior to the granting of patents ought not to be carried further in principle than it is at present, although it requires to be made more effectual in practice, I propose now to draw attention to the importance of making the preliminary investigation of cases for trial much more thorough and precise than it is at present.

In Mr. Newton's excellent description of "the operation of the proposed tribunal" there seems to underlie the whole of his remarks a tacit assumption of a distinct preparation of each case for trial. And this appears to me quite natural, as I know he has been turning his attention to this subject for some time past. So long ago as November, 1859, in an article headed "Hints for Patent Law Reformers," he suggested "the appointment of a properly qualified officer to prepare, with the aid of the parties to the suit, a special case for trial." And then, in pointing out the advantages of the plan, he said, "To say nothing of the probability of an amicable arrangement being come to when the points at issue are brought together and put clearly and succintly into writing by a perfectly independent authority, the tediousness of patent trials would be got rid of, as no extraneous evidence would be allowed, and the cost and anxiety attendant on every stage of the proceedings would proportionately be diminished."

Knowing that some provision of this kind existed in Scotch law, I inquired of a barrister, practising in Edinburgh, what was the exact nature of the provision; his reply was as follows:—The mode in which issues are adjusted and settled is regulated by the following section of 13 and 14 Vic., c. 36, "And be it enacted that, when in the course of any cause before the court of session, matter of fact is to be determined and an issue is to be adjusted in reference thereto, it shall be the duty of the pursuer (plaintiff) to prepare and lodge in process the issue he proposes, and it shall be the duty of the defender to prepare and lodge in process any counter-issue required by the nature of his defence. And the Lord Ordinary (equivalent to a Vice-Chancellor or Puisne Judge), before whom such cause depends, after causing issues to be prepared and lodged as aforesaid, shall forthwith appoint parties to attend him at chambers, or shall order the cause to the roll for the adjustment of an issue or issues for the trial of such cause or of such matter of fact arising therein as is to be determined by jury trial. And if such issue or issues be not adjusted and settled with the consent of parties at the meeting or enrolment so fixed, or at a second such meeting or enrolment for the same purpose, if such second meeting or enrolment shall be appointed by the Lord Ordinary, the Lord Ordinary shall immediately report the matter to (the judges of) the Inner House (Court of Appeal), by whom such issue or issues shall, upon such report, be adjusted and settled."

I am not able to speak from any knowledge of the working of the Scotch law, but I observe that Macfarlane, in his work "On Issues" (to which I was referred by the barrister alluded to), seems to regard the Scotch practice as not required in England, because of the supposed efficiency of our system of special pleading.

But what say English barristers of experience in patent matters as to such efficiency for settling the questions to be tried in patent causes? Mr. Grove in his recommendation of a special court for patents, says, "All the interlocutory matters, such as the settling particulars of breaches and notices of objections, would be more fully gone into and more satisfactorily settled by such a court than they are in the present scramble before a Judge at Chambers."

He evidently sees the necessity of improving the present practice in order to get cases fairly tried on their merits. And I have heard similar remarks made by other barristers experienced in patents. Whatever may be the value of special pleading in ordinary cases it is not adapted for patents. Then, if this be so, it is necessary to find a substitute for it. And the question arises—Is it possible to adapt the Scotch system to the purpose?

Now, looking at the instances relating to patents given in the work of Macfarlane and Cleghorn, I certainly find some difficulty in recognising in them the best mode of carrying into practice the principles established in the introductory part of the work. But this is no reason why the same principles should not admit of being carried out in a manner better suited to the ideas of persons so far acquainted with English practice with reference to patents as to be enabled to see distinctly wherein the fault of our present system lies, and what is required to amend it.

My own conviction is that it would be possible, in all patent cases, for a competent judge or judges to settle the issues to be tried (on the principle of the Scotch system), so as to get rid of much irrelevant matter now introduced in our courts of law to the great prejudice of all the parties concerned.

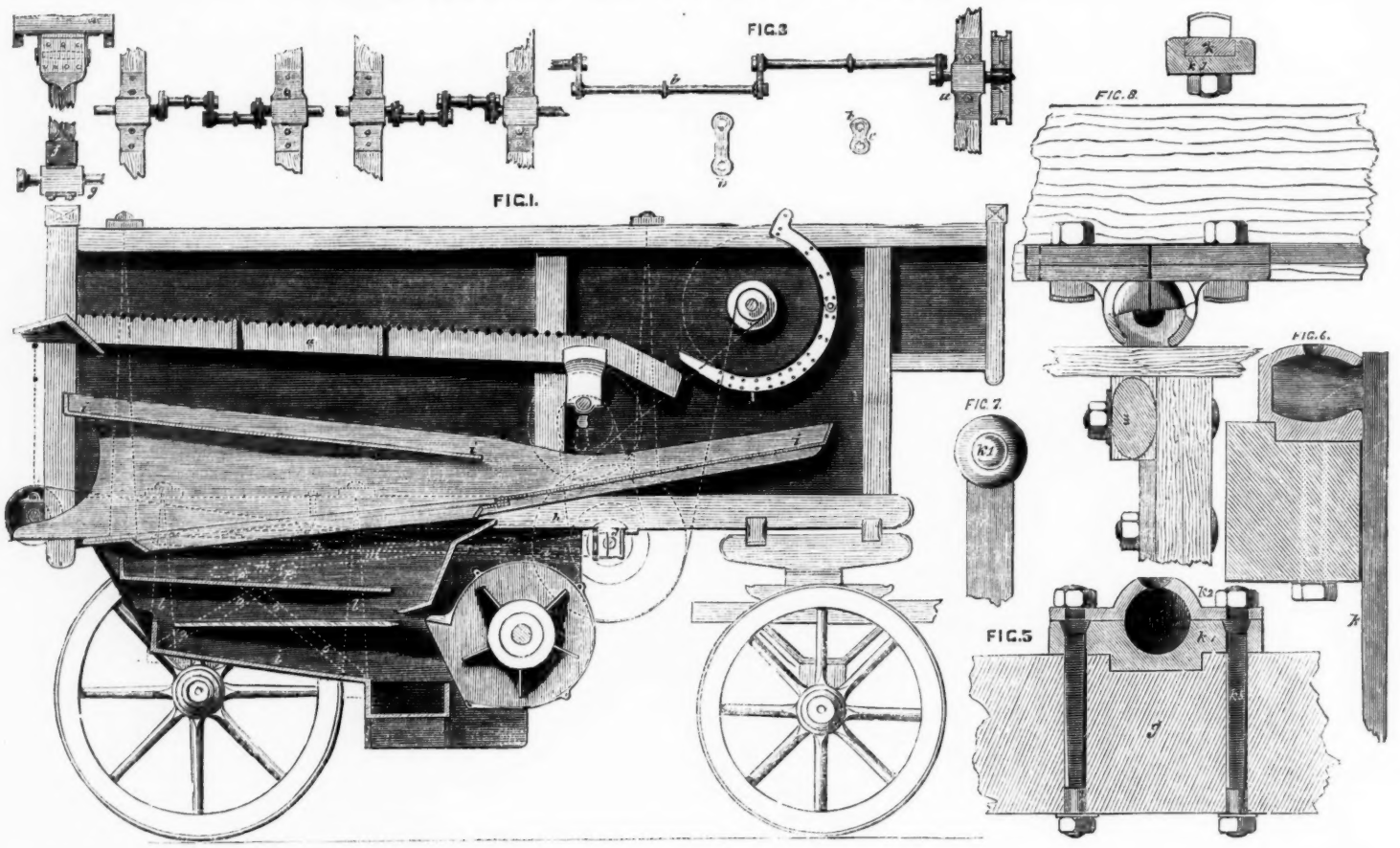
WILLIAM SPENCE, Assoc. Inst. C.E.

50, Chancery-lane, W.C., 19th February, 1862.

THE operation of fixing the 12-in. and 8-in. teak planking to the sides of the armour-plated screw frigate Royal Oak, 51 guns, under construction at Chatham Dockyard, is now completed, and preparations have been commenced for firing the massive slabs of iron, which will encase the vessel from stem to stern, as soon as these have been received from the contractors, by whom they are at present being prepared. The vacant space on the eastern side of the slip on which the Royal Oak is building is now being converted into a large workshop, which will be covered in with glass and iron roof, for the reception of the whole of the powerful machinery to be used in drilling, planing, shaping, and otherwise preparing the armour plates and fixing them to the vessel's side. It was at first decided to bend all the plates cold, and a hydraulic machine sufficiently powerful to perform that operation has been received from the firm of Messrs. Baillie, Westwood, and Campbell, but, as one machine will not be able to prepare the slabs of iron with the celerity required, a portion will be formed into shape hot, the necessary furnaces and machinery being built adjoining the shed under which the Royal Oak now lies. The defects in the Defence, Resistance, and some others of the iron ships, in having only their broadsides plated with iron, will be remedied in the Royal Oak, every portion of which will be encased in iron, the plates in the parts most exposed to shot being 4½in. in thickness.

TRAFFIC RECEIPTS.—The receipts of railways in the Kingdom amounted for the week ending the 8th of February, on 10,066 miles, to £467,026, and for the corresponding week of last year, on 9,853 miles, to £483,640, showing an increase of 213 miles, and a decrease of £16,614. The gross receipts on the following fourteen railways amounted in the aggregate, on 6,406 miles, to £350,479, and for the corresponding week of 1861, on 6,274 miles, to £367,364, showing an increase of 132 miles and a decrease of £16,885. The decrease on the Eastern Counties Railway amounted to £769; on the Great Northern to £1,448; on the Great Western to £300; on the Lancashire and Yorkshire to £5,225; on the London and North-Western to £3,303; on the Manchester, Sheffield, and Lincolnshire to £1,445; on the Midland to £2,780; on the North-Eastern to £3,061; and on the South-Eastern to £641—total, £18,972. But from this must be deducted £325, the increase on the Caledonian; £101 on the Great-Southern and Western; £439 on the London, Brighton, and South-Coast; £1,043 on the London and South-Western; and £179 on the North British—together, £2,087; leaving the decrease, as above, £16,885. The goods and mineral traffic on those lines amounted to £197,784, and for the corresponding week of 1861 to £216,807, showing a decrease of £19,023. The receipts for passengers, parcels, &c., amounted to £152,695, against £150,557, showing an increase of £2,138. The traffic receipts on 67 other lines amounted, on 3,660 miles, to £116,547, and for the corresponding week of last year, on 3,579 miles, to £116,276, showing an increase of 81 miles and of £271. The falling off in the traffic of the past week as compared with the corresponding period of 1861 is chiefly exhibited in the goods traffic on the principal lines, and shows that the decrease has been caused by the depression of trade in the manufacturing districts. The traffic receipts of the past week show a decrease of £5,145, as compared with those of the preceding week ending the 1st inst.

HORNSBY'S THRASHING MACHINES.



This invention, by Richard Hornsby, jun. of Grantham, has for its object improvements in thrashing machines. The shakers of thrashing machines are commonly formed of a series of bars (or boxes) placed side by side, and connected at each end to cranks driven in unison, so that when at work the bars rise and fall alternately, that is to say, when one bar is up the bars next to it are down, and when the first bar falls those next to it rise, and so on. The bars or boxes also receive from the crank a to-and-fro motion, the forward motion taking place when the bar is up, thus it will be seen that the thrashed straw which is thrown on to the shaker is kept in constant motion so as to shake out the grain, and is at the same time carried forward until it falls off at the end of the shaker. An objection to shakers of this description is, however, that when the motion of the bars or boxes is sufficient well to shake the straw, the same will travel so rapidly from end to end of the shaker, that the corn will not be thoroughly separated ucless the shaker be of considerable length. To obviate this inconvenience Mr. Hornsby does not, as heretofore, work the cranks at the two ends of the shaker in unison, but connects the cranks at the further end of the shaker to the bars or boxes by means of connecting rods, and drives the two crank axes at different speeds, usually by a band and pulleys. When this arrangement is made the action of the bars at the entrance of the shaker where the straw is first thrown upon it is precisely as heretofore, but at the further end of the shaker it is only occasionally that the motion of the bars is suitable for carrying the straw forward, that is to say, it is only from time to time that the forward motion of the bars or boxes takes place, when they are raised; from this cause the straw is detained on the shaker, which consequently may be made shorter than heretofore.

Fig. 1 is a vertical and longitudinal section of a thrashing machine, in which the shaker is arranged according to the invention; *a a* are the shaker boxes, of which there are usually four in the width of the machine; they consist, as usual, of long and narrow open frames of wood, with cross bars passing from side to side of them. These boxes have each a bracket fixed to it at its inner end, which carries a bearing in which a crank of short throw on the axis *b* is held. There are four of these cranks on the same axis, and they are so arranged that when one shaker box is at its highest position that next it is at its lowest, and *vice versâ*, and the direction rotation is such that the boxes move forward when they are raised. The crank axis *b* is driven from the drum or beater shaft which first receives motion by means of straps, one of them marked *c* passing around a pulley on the beater shaft, and also a pulley on the axis *d*, and this has another pulley upon it, which is encircled by the strap *e*, which also passes round a pulley on the crank axis *b*; so far the arrangement is an ordinary one. In place, however, of carrying the further end of the shaker boxes, as heretofore, they are pin-jointed to connecting rods *f* (one is shown separately at Fig. 2), which at their other ends are connected to and are actuated by cranks on another axis *g*, and this is driven at a different speed from the axis *b*, so that, as before mentioned, it is only occasionally that the up-and-down and onward motions of the shaker boxes at this end of the machine are so timed as to carry the straw forward, and consequently the straw is detained on the shaker. The axis *g* is driven by means of a third pulley on the axis *d*, from which a cross band *h* is taken to a pulley on the axis *g*. It is found convenient to drive the axis *b* at a speed of about 160 revolutions per minute, and the axis *g* at 180 revolutions or thereabout per minute. The direction in which the axis *g* is driven is of no great importance.

In place of arranging the cranks at the entrance end of the shaker so that the bars or boxes may rise and fall alternately, they may be so arranged as to cause them all to rise and fall at the same time, as the progress of the straw at this end of the shaker will be sufficiently ensured by the force with which it is thrown out from the drum; and when it gets towards the centre of the shaker, it will then rest on portions of the bars or boxes which rise and fall alternately, and so it will be carried forward. The cranks at the two ends of the bars or boxes may, in this case, either be driven in unison or otherwise, as is found most convenient. The simultaneous rising and falling of the bars or boxes may, if preferred, be at the exit end of the shaker in place of at the entrance end. In this case, when the straw has arrived at the end of the shaker, it will no longer have any tendency to travel forward, but the discharge will depend on its being pushed off by the accumulation of straw behind. This arrangement allows the straw to remain a comparatively long time on the shaker; the straw will nevertheless be thrown off before it accumulates to an inconvenient extent.

In thrashing machines the grain is led from one part of the machine to another by inclined boards, to which a vibratory motion is given. These vibrating boards are usually actuated by cranks, and the cranks employed for this purpose, as well as those employed for working the straw shaker, have heretofore been forged on their shafts. Now, according to this invention, such crank shafts are made in several pieces, which are keyed or fixed together, the crank arms being fixed to the sections of the central shaft, and the crank pins to the crank arms. One advantage of this arrangement is, that it allows of the crank pins being case-hardened without difficulty.

Fig. 3 is a plan of a portion of one of the cranked axes for actuating the shaker, *a* is a section of the central shaft; it is made by preference in wrought iron and case-hardened; it is shown with a collar in the middle, and works in a wooden bearing. *b, b*, are the crank pins; they are similar in construction to the portion *a* of the shaft; the brackets of the shaker boxes which embrace the crank pins are also by preference of wood. *c, c*, are the crank arms; these do not require to be case-hardened; they are bored to fit on the ends of the pieces *a* and *b*; they are keyed in their places, and the keys are prevented escaping by nuts screwed on to the pieces *a* and *b* beyond the ends of the keys.

In Fig. 1 the inclined boards for leading the grain about from place to place are marked *i, i, i^1, i^1*; they are carried by two separate wooden frames, which are suspended by suspension rods from the frame; they both receive their vibrating motion from the same crank axis *d*, to which they are connected by connecting rods, each frame *i*, i^1, having two connecting rods, one at each side of the machine. The crank axis *d* is shown separately at Fig. 4; it is made up in pieces, as already described, as respects the axes *b* and *g*. The inclined vibrating boards above mentioned are hung on suspending bars or rods, and the connections between these bars or rods and the parts to which they are attached have heretefore been made by means of cylindrical pins or axes working in bearings of corresponding form.

According to the invention the pins or axes are made spherical in place of cylindrical, or, at any rate, are of larger diameter at the centre of their length than at each end, so that the bearing, being of corresponding form, the oil with which it is lubricated may lay in the hollow of the bearing; whereas, when the cylindrical bearing is employed, it rapidly works out at the ends, so that these bearings require lubricating much more frequently than when hollow bearings are employed. *k, k*, Fig. 1, show the suspension rods by which the frame carrying the inclined boards *i* are suspended; there are four such rods, two on each side of the machine; and *l. l*, show the suspension rods by which the frame carrying the inclined boards i^1, i^1, is hung. The upper end of one of the suspension rods *k, l*, with its upper bearing, is shown at Figs. 5, 6, and 7. k^1 is a stud formed on or fixed at the upper end of the link; k^2 is the upper, and k^4 the lower part of the bearing; k^5 are bolts by which it is secured to the framing. The lower end of one of the links *k*, at the outer end of the machine, is shown at Fig. 8; the corresponding parts of the other link *k* and the links *l* are quite similar; k^6 is a ball connected by a stem to the frame in which the inclined boards *i* are fixed; k^7, k^7, are two pieces which fitting together form a socket for the ball k^6. The pieces k^7 are secured by bolts k^8 to the suspension rod *k*. Heretofore the connecting rods which communicate motion from the crank to the vibrating boards have been made of metal and jointed to the frame carrying the vibrating boards; according to this invention, however, they are made of flexible wood, and fixed to the frame carrying the vibrating boards. When this system is employed the elasticity of the wood will be sufficient to allow the crank to revolve freely.

In Fig. 1 of the connecting rods giving motion to the frame carrying the inclined boards *i* is marked *m*; there are two such rods, one on each side of the machine; and one of the connecting rods, of which there are also two for giving motion to the frame carrying the boards i^1, is marked *n*. The method in which the rods *m* are attached to the frame is shown at Fig. 8; it will be seen that they are rigidly attached to the frame by bolts; their other ends are firmly attached to connecting rod heads, also of wood, which embrace the crank pin of one of the cranks on the axis *d*. The connecting rods *n* are similarly connected with the crank, and the manner in which they are connected with the frame carrying the boards i^1 is shown in the illustration; *o, o*, are plates of iron fixed to the wooden frame to strengthen it; these have each projecting horizontally from them ledges an inch or so in width, on which the end of the connecting rod lays, and bridge pieces *p, p*, bolted at each end to the connecting rod, pass over the ledges and so secure the rod to the frame. Plates of metal are laid on the connecting rod at top and bottom where the bolts pass through it to prevent the bolts cutting into the wood.

The Patent Laws.—Mr. Ricardo has given notice that, at the end of a month, he shall move for a committee to consider the policy and operation of the patent laws.

Iron Shipbuilding on the Tay.—Messrs. Gourlay, Brothers, and Co. have just completed a screw steamer called the Scotia for the Dundee, Perth, and London Shipping Company of 795 tons, o.m.; length over all, 230ft.; breadth, 28ft; depth, moulded, 17½ft.; built of best boiler plate, and classed twelve years at Lloyd's. She is propelled by a pair of engines of the aggregate of 140-horse power, fitted with double expansion valves and boilers suitable for 25 lb. pressure. This vessel is to be an addition to the above company's fleet of steamers running between London and Dundee, and is fitted up exclusively for passenger traffic. Messrs. Gourlay, Brothers, and Co. have recently finished a ferry paddle-boat, built of steel plates, for the Scottish Central Railway Company; length, 120ft.; breadth, 19ft.; draught of water, 2ft. 9in.; engines of 40-horse power collectively; to ply between Newport and Dundee. They are also building an iron sailing vessel for a Liverpool firm for the Valparaiso trade; length, 170ft., keel and forerake; breadth, 28ft.; depth of hold, 18ft. 3in.; to have good and handsome accommodation for passengers; class at Lloyd's twelve years.

Pier at Blackpool.—The directors of the Blackpool Pier Company a short time since invited plans for a pier to be sent in. This led to a sharp competition, which resulted in the selection of the design of Messrs. Burch, of Parliament-street. The pier will be of iron, 1,350ft. in length, and 24ft. wide. The main body is to be in spans of 60ft., the main girders being supported upon clusters of piles placed in a vertical position. The piles will be of cast iron, with columns 12in. in diameter, and of an average thickness of 1¼in. These piles will be fitted with screws 2ft. 9in. in diameter, and will be braced and secured longitudinally, transversely, and diagonally, by tie rods and struts. The main girders will be so placed as to be out of the sea way, and underneath them will be fixed, transversely, wrought iron girders, upon which will be laid the planking for the roadway. The parapet of the pier will consist of plate girders which, while possessing greater durability than lattice girders, will afford the great advantage of forming a continuous seat. The head will be of a rectangular shape, and will be sufficiently strong to allow of its being used by vessels in all weathers. One feature which must not be omitted is, that there will be several ornamental houses which can be used as sheltering places or as shops. The pier is to be completed in six months from the date of the commencement of the works, and is expected to be opened in October next.

Important New Works at Chatham.—The total sum which it is intended to expend during the present year in the improvement of Chatham Dockyard, exclusive of the large amount already voted for that purpose, is nearly £50,000. In addition to the present dock accommodation it is intended to construct five new docks at Chatham, three of which will be of 500ft. in length, and two of 400ft., and each capable of receiving the largest vessels in the service. Three large basins, communicating with each other, are also intended to be formed at the eastern end of the existing yard, the largest of which will have an area of 30 acres, with a length of 2,000ft. and width of 700ft., the two remaining basins covering 22 acres and 7 acres respectively. The depth of water in each basin will be 30ft. at neap tides. By far the most important part of the intended improvements, however, will be the embankment of the river to prevent the filling up of the existing channel-way. This will be accomplished by means of convict labour, the estimated cost of the work already contemplated being £85,000, which includes the cost of the cofferdams for executing the work within free from water. The river from the locks at the entrance to the basins, towards Sheerness, will be deepened to form a channel 600ft. wide and 27ft. deep at half-tide, which will give 31ft. at neaps and 55ft. at spring tides. The sum to be expended in deepening the river, according to the plan already decided upon, is £45,000. As soon as the whole of the alterations and improvements now in progress, as well as those decided upon, have been carried into effect Chatham Dockyard will be the most commodious of our naval establishments, while its protection from hostile attacks will be amply secured by the powerful batteries and fortifications now being erected in its vicinity.

TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

T. B——N.—*So are we.*

SUGGESTOR.—*We shall be glad to hear from Mr. Kendall.*

S. H.—*You must look to the Commissioners for an answer.*

A MERTHYRIAN.—*No catalogues are issued by the firms mentioned by you.*

G. R. (St. Thomas-gardens.)—*The idea has been many times suggested, and was patented nearly 100 years ago.*

A CONSTANT READER.—*Several communications upon the gyroscope have appeared from time to time in* THE ENGINEER. *We know of no work on the subject.*

T. E.—*Sir William Armstrong's patent for hydraulic machinery was taken out in 1846, and has, therefore, expired. We are not aware that it has been renewed.*

C. M.—*We do not know that it has ever been exactly determined under what pressure of water, or, rather, air, a man can live. Divers have worked, we believe, at a depth of 120ft.*

G. F. G. (Smethwick.)—*The subject has been argued, ad nauseum, during the last two years, in almost every scientific journal. We have published several letters on the Injector during the last f w months.*

C. W.—*By visiting the Patent-office Library you will find many such patents. As to your next question, such rails do not generally wear in the way you describe. If the change of shape is apparent in occasional instances, you may conclude that the pressure of the wheels "draws" or extends the iron in the head of the rail, and as the bottom is firmly fastened, the rail may be distorted.*

J. R.—*You have not stated your question intelligibly, but we presume you desire to know how much lap is to be given to a valve of given lead and throw, in order to cut off at any given part of the stroke. There is no way so good as to make a large scale diagram, laying down the position of the piston at which the steam is required to be cut off, giving also the centre line of the connecting rod, the path of the crank pin, and the circle described by the eccentric. With lines to represent the ports, the proportions of the valve may then be soon found by trial.*

A SYMPATHISER. — *Many thanks, and we should be glad if our correspondents were as attentive, generally, as you appear to be. The account of the brick machine was taken by our correspondent from one of your own local papers, and it may be that it was only an advertising "dodge" after all. The Chatham presses are to work, we learn, at 2,000 lb. per inch. The allusion to the employment of steam from condensing engines was, certainly, a slip of the pen. The Manchester engines appear to be in much need of "economisers," and, perhaps, you will be good enough to describe Green's.*

A. T.—"*Nominal horse-power*" *is a very indefinite term, and it is not easy to say which rule, for calculating it, is "most correct." We prefer the Glasgow rule, which is to square the diameter of the cylinder in inches, and to point off the right hand figure, for the horse-power, the engine being supposed to have two cylinders. Thus, a pair of 50-in. cylinders would be* (50 × 50 = 2,500) 250-*horse power. There is no such thing as a rule for ascertaining the length of a connecting rod. It should, if possible, be from* 3½ *to* 4 *times the length of the stroke, but if the engineer is cramped for room, a length of twice, or, even* 1½ *times the length of the stroke has often to be adopted. The arms of a governor do not need to be of a precise length for any given number of revolutions, but for* 30 *revolutions per minute, the length should not be less than* 42*in., while* 45*in. is better. For* 60 *revolutions, say* 11*in. from the centre of pin to centre of ball. For* 50 *revolutions* 16*in., and for* 40 *revolutions* 2*ft.*

SUPERHEATING APPARATUS.

(*To the Editor of The Engineer.*)

SIR,—Will any of your correspondents be kind enough to say wh at kind of packing is best for engine glands for superheated steam?

Northampton, February 19th, 1862. ALLCHIN AND SON.

HOBSON'S HAMMERS.

(*To the Editor of The Engineer.*)

SIR,—On the 2nd of April, 1861, Mr. Winton and I took out a patent for improvements in hammers. As part of our improvements we claim the cylindrical equilibrium valve which Mr. Hobson claims in his patent, of which there is an engraving in your paper. I am at present manufacturing these hammers. The number of the patent is 809.

THOMAS WILLIAM COWAN, Assoc. I.N.A.

Bridge-street, Greenwich, S.E., Feb. 18th, 1862.

PUMPING THROUGH MAINS.

(*To the Editor of The Engineer.*)

SIR,—I shall feel obliged if you can give me a little information on the following subject.

Suppose I have a pump—either a plunger or bucket—drawing water from a well 20ft. deep, and raising it 50ft. above the surface, is a rising main valve necessary to the effectual working of the pump; or, if not necessary, is it advantageous to employ one, and to what extent? Again, if the valve is not necessary, will an air-vessel, fixed in the rising main, act as well or nearly as well without the valve as with it? the necessity for the air-vessel being owing to outlets for fire-hose being on the rising main at different points. HYDRAULICS.

[*We should prefer the valve in the rising main.*—ED. E.]

OPEN SAND CASTINGS.

(*To the Editor of The Engineer.*)

SIR,—I was much pleased at meeting, in your last number, with the remarks of your correspondent on the engine beam castings at the Hartley Colliery, which I fully expected would have been highly deprecated in the evidence given on the inquest, as it is quite certain that no castings of any magnitude should ever be made in open sand, as, under the most favourable circumstances, they have only about two-thirds the strength of covered castings, which have the benefit of clean skiming, rising runners, and proper feed-heads, without all which no such casting can be depended upon, even up to the strength above named.

Again, the fracture itself furnishes strong evidence against the way in which it was cast, for its appearance, as described, very much resembles No. 1; when, had the same metal been run into a covered mould, its fracture would have been much more like No. 2 pig iron, and no practical founder would ever think of making a casting where strength was so great a desideratum wholly of No. 1 iron. V.

Greenwich, February.

ESTCOURT'S METALLIC RAZOR STROP.

(*To the Editor of The Engineer.*)

SIR,—I should feel obliged if any of your correspondents can inform me of the nature of the composition used in the above strop. This strop was never patented; and, as it is no longer in the market for sale, it is possible that some of the workmen who were engaged in its manufacture will be able to give the required information. N. P. GIVEEN.

February 19th.

MEETINGS NEXT WEEK.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, 25th February, at 8 p.m. Renewed discussion upon "Iron-plated Ships." By Joseph D'A. Samuda.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.—Thursday, at 7 p.m., "On the Supply of Power for Acting Prime Movers." By Mr. A. F. Yarrow.

SOCIETY OF ARTS.—Wednesday, at 8 p.m., "On the Art of Constructing Turkish Baths, and their Economy as a Means of Cleanliness." By David Urquhart.

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THE ENGINEER.

FRIDAY, FEBRUARY 21, 1862.

RAILWAY ACCIDENTS AND THE LAW.

NOT only would it be a great simplification of the law but it would, we believe, save the money of railway companies, if they were made liable for all injuries both to persons and property while in their care, except only when positive carelessness could be shown on the part of the killed or injured, or in cases of "force majeure." At present an "accident suit" is little better than a Windham lunacy inquiry. A wheel, an axle, or a rail breaks, or a bridge falls, or a boiler bursts, on a railway and one or more persons are killed or injured. Compensation is applied for and generally refused, although had the same deaths or injuries resulted from a collision, the railway directors would hardly fail to accede to any moderate demands. Collisions are, indeed, the only class of accidents for which railway companies appear to consider themselves responsible. But to proceed: an application for compensation being refused, a suit for damages soon finds its way into the courts, where it is resisted by the defendants with all the resources of litigation, backed by all the capital of a great public company. On one side it is attempted to be proved that the breakage in dispute was the result of conspicuous negligence; on the other, that it occurred only through some occult influence, wholly beyond the range of human prevision and control. The swearing is terrible, and the wear and tear of conscience necessarily enormous on both sides. Thus in the suits growing out of the accident at the Tottenham station, on the Eastern Counties Railway, witnesses swore to the existence of cracks in iron tyres which were still sound, and in the suit of Freemantle *v.* the London and North Western Railway, a barn having been burnt by a spark from a locomotive, one witness, it is understood, received £180 for swearing, with considerable energy, that the construction of the locomotive was such that no sparks could possibly have been thrown from it at all! In the great case of Pym *v.* the Great Northern Railway Company, where £13,000 damages were awarded for the loss of a single life, the evidence as to the negligence of the company's servants just sufficed for a "touch and go." It was held, and is held in all such cases, that if there was no negligence there was no liability, and the thing was to prove the negligence. It was proved to the satisfaction of the jurors—consisting, probably, of the usual number of farmers, tradesmen, and other enlightened citizens to whom verdicts in such cases are commonly left. In other cases where rails have broken, and with no less visible evidence of the cause of failure, other juries have brought in verdicts for the defendants. In both cases the jurors, we are sure, are conscientious and endeavour to do their best, but there is seldom any positive trustworthy evidence on either side to guide them. Counsel are free to dilate, on the one side, upon over-worked servants, lax discipline, and general recklessness, and, on the other, upon "crystallisation," "electrical action upon iron," and other equally questionable matters. Here was a case, last week, of Beattie *v.* the London and North Western Railway Company. A locomotive boiler had burst while the engine was running on the defendant's line near Rugby. One or two men were killed, and the plaintiff, a post-office clerk, was injured. He sued for damages—moderate damages we may suppose, inasmuch as, besides an alleged concussion of the brain, the injuries he had sustained had caused him an expense of but £23 7s. As the Lord Chief Baron of the Exchequer told the jury, "the Company were only bound to take all reasonable care, "and nothing more. If they had done that the plaintiff "was not entitled to recover; if, on the contrary, they had "not done so, the only question would be one of compensation." Not a particle of actual negligence was proved on the part of the Company, and yet they were cast by the jury in £123 7s. damages. Here was a boiler, just like all other boilers on the railway, so far as anything was known, but which after explosion was found to have been severely and extensively corroded on the inside of the plates of the cylindrical barrel. So far as known, the iron was originally of the best quality, and the boiler had been well made by one of the principal firms of locomotive makers in the kingdom. And there was no evidence whatever that the boiler had been carelessly maintained. It was made in 1851, and when in 1857, and after running 196,000 miles, the tubes were taken out, no defects were discoverable. Yet, only four years afterwards, during which it had run 137,000 miles, the iron had become eaten nearly through. Of this silent corrosion there was no external evidence. True, had it been suspected in any particular spot, the boiler could have been cut into, or, to adopt Captain Tyler's *naïve* suggestion, the tubes could have been taken out, just to see if there might not be some defect or other. So, too, said the Captain, the boiler might have been tested with the hydraulic press—a test which, if carried to 200 lb. per inch, would only injure the boiler, while if carried to 125lb. it would not prove that the boiler was safe at 130lb. Indeed, all that could properly be said was that the corrosion was altogether unexpected and out of the ordinary range of probable occurrence; that it could not have been foreseen nor even discovered, except by extensive and costly dissection of the engine—a treatment, too, to which a thousand engines might be subjected before one such defect would be found. Yet the jury either disregarded the charging of the Lord Chief Baron, or else found, in the fact of the explosion, a proof of negligence on the part of the company. The defendants had doubtless had enough of the suit and did not care to appeal.

The case of Ford *v.* the London and South Western Railway Company, just settled, was still more remarkable. The plaintiff was injured by the accident which cost the life of Dr. Baly. A coroner's jury was unable, after a very lengthy inquiry, to find any cause whatever for the train leaving the line at Wimbledon. Whether the line had got out of gauge, or whether a tyre had worked loose, or whether one of the points was broken before the disaster, no one could say. Any negligence was entirely presumptive, for so far as was known, all the conditions were, as nearly as possible, the same as those under which hundreds if not thousands of railway trains daily pass through junctions all over the kingdom. The line might have been in a trifle better, or worse condition than usual, but there appears to have been no evidence, setting aside the actual occurrence of the accident, to show that it was in a notably unusual condition, likely to lead to accident and requiring immediate attention and repair. There was no substantial evidence that the railway company were at all blameable, or rather, that they had failed to do all that could have been expected of them. Nor do we suppose the jury, when they gave damages for £1,500, took any other view of the case. We can only suppose them to have returned the verdict they did upon the conviction that, except in case of carelessness on the part of killed or injured passengers, or in cases of "force majeure," railway companies should always take the whole liability of their conveyance. Dr. Baly's relatives can hardly fail to avail themselves of the result in the case just settled.

Considering the present state of the law, bearing in mind also the comparative infrequency of railway casualties and the consequently small extent to which they affect railway companies in the aggregate, and keeping in view the enormous stake which the parties actually sustaining injuries have in such cases, it is to be wished that, by due legislation, railway companies might be made, at once, to assume the whole liability in the case of the destruction or injury of persons or property while in their care, the only question left open being the amount of compensation. A very small insurance fund would provide against such accidents, and the companies would, we believe, actually profit by the arrangement.

"A STEAM REGENERATOR."

THE editorial brains of at least three of our technical contemporaries appear to have been wool-gathering. Under the respective heads of "Economic Generation of Steam," "The Steam Regenerator," and "Fuel Saving Steam Apparatus" two leading articles and a grandiloquent paragraph have been dedicated, by the journals in question, to a contrivance which, from their descriptions, would appear to be a common feed-water heater for heating the water delivered by a surface condenser. Such a contrivance, although of doubtful novelty, and, as it appears to have been applied, of still more doubtful general utility, might, perhaps, have furnished an opportunity for a common-place notice from a newspaper paragraph-monger, but this has not satisfied our contemporaries. One of them launches forth as follows:—

"Improvements in the application of steam power, and in the generation of steam, are so frequently introduced that unless some radical change is proposed we are apt to regard this class of invention as comparatively unimportant, upon the consideration that the adoption of many such inventions will be necessary to produce any appreciable alteration or economy; and from the universality of this feeling the advantages derivable from really valuable discoveries are but too often lost to the public. In the *Mining Journal* of May 11, 1861, we described a new steam regenerating apparatus, by the use of which the exhaust steam was returned to the boiler instead of being suffered to escape into the atmosphere, as is usual, the result being that, in addition to considerable economy, great regularity of working and additional safety are likewise secured. The apparatus has now been practically tested on a large scale, the results actually obtained being even more satisfactory than those originally anticipated. The invention originated with Mr. Imray, an English engineer, and Mr. Pigna, an Italian engineer, the practical details being perfected by Mr. Datichy, a French mechanician of long experience. The apparatus is applicable to all kinds of boilers, and can be so easily adapted to them that the stoppage of the engine is scarcely requisite; it consists of a surface condenser, in which the steam, after having performed its duty in the cylinder, is just condensed, and thence forced back by a small auxiliary pump into the boiler, passing first into a supplementary tube within the boiler-flue. The advantage of this arrangement will be apparent; the exhaust side of the piston being always in direct communication with the condenser, in which an almost perfect vacuum always exists, the effective force of the fresh steam upon the piston is, of course, increased. But this is not all; the deposit of incrustation in the boiler is entirely prevented, as the same water, constantly distilled and re-distilled, is used over and over again, the sole additional supply requisite being that to compensate for the unavoidable leakage at joints, packings, and valves; and so small is this quantity that, whilst the feed-water usually exceeds twenty-five gallons daily per horse power, less than one quart daily suffices when the regenerating apparatus is employed. The regenerator has been for some time in successful operation at several factories in Paris, and is now in constant use at Collinge's axle factory, Westminster Bridge-road, where the results obtained, as stated by the principal of that firm, fully bear out those promised by the inventors. The engine employed at Messrs. Collinge's is a high-pressure engine of 12-horse power, and not only is increased regularity in the working of the engine secured by the apparatus, but it was shown by actual experiment, before a large number of scientific gentlemen, that whilst only thirty-two strokes per minute were obtained when the steam was supplied in the ordinary way, upon applying the regenerator fifty strokes per minute were at once made, under precisely similar conditions. The economy in favour of the regenerator is upwards of 42 per cent.; and, with regard to the consumption of fuel, it has been found that the same amount of power can invariably be obtained with 17 cwt. of fuel when the regenerator is used as with 37 cwt. without it. We understand that the patentees intend forming a company for manufacturing the apparatus, and furnishing it to the users of steam power for half the profits produced by them during the continuance of the patents. The saving is estimated at £5 per horse power per annum, so that manufacturers will be but too glad to have the apparatus applied to their boilers."

Not to be outdone, another metropolitan editor delivers himself in this wise:—

"Mr. Imray, engineer (Collinge and Co.), has fitted to his engine a new apparatus, which is termed a steam regenerator. The invention comes from Italy, and was originally planned by M. Pigna, engineer. Mr. Datichy, a French mechanician, improved upon its details, and Mr. Imray has perfected the entire working operation of the affair. The experiments, which we were invited to witness, were made upon a 10-horse power non-condensing engine, used to drive the lathes in Messrs. Collinge's factory in the Westminster-road. The merits claimed for this invention consist in conducting the steam, after it escapes from the piston, to a condenser. This steam is then condensed by surface condensation. A stream of water plays round the condenser, flowing from jets. A pump forces the condensed steam, as water, into what is termed a regenerator. This regenerator is a tube in the furnace round which the flames play, and thus reheated, it passes into the boiler. The secret, therefore, consists in using the steam a second time. The patentees argue that by employing the condensed steam the feed-water, which usually exceeds twenty-five gallons daily per horse power, is reduced to less

than one quart per diem, being the quantity required to make up for the unavoidable leakages at joints, packings, and valves, thus saving 99 per cent. on the feed-water, and a consequent reduction of boiler surface and capacity. Next, that no cold water being thrown into the boiler, and all the feed-water being perfectly pure, and distilled by its continual circulation, there can be no sudden changes of temperature, and no deposit or incrustation; in fine, none of those evils which cause waste, burning, scaling, and too frequently explosions of boilers, with all their fearful and fatal consequences. And lastly, that, from the reduction of the quantity of feed-water, from the increase of effective steam-pressure caused by the vacuum formed in the receiver, and from the complete prevention of deposit and incrustation in the boiler, there results a proportionate saving of fuel—a saving which amounts, it is said, to 50 per cent. for high, and 32 per cent. for low pressure engines. If these results can be assured this apparatus must effect a great saving in fuel. Mr. Smith, C.E., states that out of 37 cwt. of coal ordinarily burned in the furnaces daily, 20 cwt. have been saved, the engine applied to do the same relative work. Other calculations were given, showing that the engine consumed 68 cwt. in a given time as a non-condenser, but, using the condensing apparatus, only 45 cwt. was used. With 62 revolutions per minute, the indicator gave 6·6, with 64 revolutions 5·53, steam used 601·5. Mr. Imray, it appears, has no pecuniary interest in the invention beyond that of saving fuel in the work done by the engine in his factory, and it is his belief that this new method is a great success. We regret not having it in our power to compare this apparatus with other fuel-saving inventions, or the best working surface condensers. The boilers in Messrs. Collinge's factory generate steam for a steam hammer, and, therefore, with proper indicators to measure the steam used by the engine only, it is next to impossible to furnish the consumption per nominal and indicated horse power per hour. It was declared by the experimenters that no engine had ever yet consumed so small a quantity of coal *pro rata*. We cannot certify to this statement, but it may, nevertheless, be true. The boiler was on the Cornish principle, and the tube, or regenerator, which occupied nearly one half the depth and length of the furnace, was fixed beyond the bridge. Taking the calculations of many day's working, and admitting that 32 per cent., as estimated, can be saved in fuel on low-pressure engines, we have a highly satisfactory performance. But we have recently shown that fully 100 per cent. has been gained by economically-worked boilers. Using fresh water seems to answer very well, and as long as condensed water can be put into the boilers, it is certain that a higher, comparatively speaking, power can be attained. We have Rowan's engines on this latter principle, and Randolph and Elder, and several others, economise water by high pressure of steam. Without more practical experience of M. Pigna's regenerator we could not undertake to pronounce it superior to systems now in operation. This regenerator is fitted to several engines in France, and the reports of French engineers are highly commendatory. The apparatus can be fitted to any boilers; and herein consists its utilisation, for it can be tried, and, if disliked, taken off again, without incurring any great expense. All our inventors in this department are aiming to raise the greatest force of steam on the smallest quantity of water; and the less the water, the smaller the quantity of fuel required for its expansion. Superheating of steam by carrying the steam pipes from the boiler to the machine is one mode of raising its elastic force, and the same thing is done by conveying the mate-in pipes round the up-take or chimney. Every scheme has the same object in view, namely, to gain heating surface, whether applied directly to the boiler, or to the steam in the pipes. The regenerator or big tube, here described, in the furnace receives the condensed steam from a pipe inserted nearly its whole length; and as this water is let into the tube at one end, it has to return to the other end before it passes into the boiler. During this progress it is heated by the action of the fire on the tube, and must pass into the boiler in a heated state, probably at the boiling point. Herein consists the difference between this invention and others. M. Pigna returns the steam back into the boiler after condensation, submitting it to the heat of the fire on its passage, whilst other inventors superheat the steam itself after leaving the boilers. We should be glad to hear of this regenerator being applied to a marine engine, for its simplicity is a recommendation; and, if 32 per cent. of fuel can be saved on old engines by its adoption, it is worth a trial. Of course, if a boiler were made, and properly constructed, to work this apparatus, better results might be expected, and the temptation to take it up would be enhanced. Having given a description of this new engineering achievement we must now leave it to those interested to see the apparatus at work; and, if they believe in a saving of 32 per cent. in fuel, we shall not be long before we have a report on its action in marine engines. Engineers, generally speaking, are slow to take up these fuel-saving machines; but we are now living at a period when those who use coal and sacrifice space needlessly will be supplanted by cheaper rivals. Economy in wear, tear, and fuel is the order of the day.

A third notice is as follows:—

"At Messrs. Collinge's axle factory, Bridge-road, Lambeth, experiments have been made with a steam regenerator, patented by Mr. P. Pigna and Captain Fernandez. Without diagrams it is difficult to convey a correct idea of the invention. A pipe receives all the steam that ordinarily escapes after acting on the piston, and condenses it in a receiver forming almost a perfect vacuum, which increases the effective force of the steam on the piston. By means of a special pump the condensed steam is sent through the regenerator, and thence by a second pipe into the boiler, which it reaches completely regenerated, and ready to act again on the piston in all its original force. The regenerator is applicable to all steam engines, without alteration to the engines themselves; and among the results claimed for it are a saving of more than 99 per cent. of the feed-water, a proportionate reduction in the bulk and weight of boilers, and a saving of 50 per cent. in the fuel required for high-pressure engines, and of 32 per cent. for low-pressure engines. The honour of the invention is said to belong, as regards its scientific portion, to Mr. J. Imray, an English engineer, and to Mr. P. Pigna, an Italian engineer; and, as regards its practical details, to Mr. F. Datichy, a French mechanician. The experiments were considered highly satisfactory.

The proprietors of the "Regenerator" will doubtless feel themselves indebted to us for thus widely disseminating the "opinions of the press" in favour of their invention (?), and will, we trust, excuse us for adding our own. A surface condenser is an excellent thing in its way, although its application to the steam engine originated neither with an Italian engineer nor a French *mecanicien*. As for heating the water distilled by a surface condenser beyond the 100 deg. or 105 deg. up to which it is already heated when it quits that apparatus—"that depends." If the boiler does not work up the heat from the furnace, a good deal being left to go up the chimney, a portion of this heat may, doubtless, be entrapped by a feed water heater. Here, however, the feed pump must be between the condenser and the heater, else whatever is gained in heating the feed water will be lost by impairing the vacuum. This arrangement, we are given to understand, is that actually adopted in the contrivance under notice, the "special pump" being no more than the feed pump. But while boilers which do not work up their heat had best be re-set at once, no feed water heater has any business in the flue. The utmost that could be saved in coal, by heating the feed water from 100 deg. to 212 deg., *even supposing that no heat otherwise available for evaporation were employed*, would be 10 per cent., and of this no contrivance of the kind to which the ingenious foreigners in question can possibly lay claim, is likely to save one half—or say 5 per cent. of the whole fuel used. To talk of "a saving of 99 per cent. in feed water," by means of a surface condenser, is only another (and certainly an ambiguous) mode of stating that, as every one should know, such a condenser always returns nearly the whole of the condensed steam, to be worked over and over continuously. In this, *per se*, there is no economy at all. In the particular experiments in the Westminster Bridge-road we have reason to fear that any "saving in feed water" was much more than counterbalanced by a lavish expenditure of champagne and stronger potations provided for the obfuscation of those who were invited to attend. We fear that the ingenious inventors have committed a mistake in their arrangements for bringing their invention properly before the public, but we must admit that either they or their coadjutors have succeeded well in the audacious juggling whereby at least three London technical newspapers have been led to disclose the ignorance of their conductors in believing that the notorious superiority of a condensing engine over a low-pressure non-condensing engine depended upon a new-fangled Italian contrivance, "improved" by a Frenchman, and "perfected" by an English machinist.

LITERATURE.

Metallurgy: the Art of Extracting Metals from their Ores, and Adapting them to Various Purposes of Manufacture. By John Percy, M.D., F.R.S., Lecturer on Metallurgy at the Government School of Mines;—Fuel, Fire-Clays, Zinc, Brass, &c. With Illustrations chiefly derived from Original Drawings, carefully laid down to scale. London: John Murray, Albemarle-street, 1861.

[Concluding Notice.]

Notwithstanding the lengthy notices of this volume which we have already placed before our readers, we have still to draw their attention to several other chapters of great importance. The first of these treats chiefly of such natural refractory materials as are employed in the construction of crucibles, retorts, furnaces, &c., we say chiefly, because it is not exclusively devoted to these refractory substances. "Blue bricks," for example, obtain notice in this chapter on account of the extent to which they are prized by engineers for certain purposes, and because the mode of glazing may be interesting to the metallurgist. These bricks, which receive their name from the dark grey glaze on their surface, and which are made of brick-earth of the usual kind, are fired in close kilns, having been previously dusted over with "iron scurf"—the substance produced by the wear of the siliceous grind-stones employed in grinding gun-barrels, &c., consisting, of course, of an intimate mixture of fine stone and iron. In firing the iron becomes deoxidised, and, combining with the silica, forms silicate of protoxide of iron: it is this compound which forms the glaze. It should also be observed that this chapter does not include accounts of many natural mineral substances, such as those constituting igneous and metamorphic rocks, which are used in the construction of furnaces. But these will receive particular notice in later portions of the work, in connection with those metallurgical operations in which they are specially employed. This chapter, however, includes most valuable articles on fire-clays; crucibles of various kinds, with their covers, stands, and tongs; Deville's blast furnace for obtaining high temperatures; Fire-bricks; and Sand and Sandstones. We cannot afford space for remark upon the manner in which these subjects are treated, but must just refer in passing to the author's account of the origin of the word "crucible," which seems to be due to the superstitious practice of the alchemists of marking these vessels with the sign of the cross; and, as Latin was the language in which they wrote, the derivation of the name from *crux, crucis*, &c., was easy. Hence also the term "crucial experiment." The use of superstitious signs themselves seems to exist still among physicians, for Dr. Percy tells us that the prolonged tail of the letter *R*, which is intended as an abbreviation for "Recipe" in their prescriptions, is a relic of the astrological symbol of Jupiter. We must also add, in reference to this chapter, that the author has not been deterred by a false sense of propriety, or by a desire to avoid the appearance of interestedness, from stating freely what he has found to be the respective merits and demerits of the various descriptions of chemists' crucibles now on sale by various makers. He speaks of them with perfect freedom, and with manifest impartiality—a circumstance which adds not a little to the practical value of his book to experimenters.

The next chapter, which is upon copper, occupies nearly 300 pages, and comprises so much deep and diversified knowledge that it would be vain for us to attempt to give anything like a sufficient account of its contents without proceeding to greater length than we can at present go. To touch upon a few of its more salient and superficial, but nevertheless important, features is all that we can do. One of the most interesting of these occurs in the author's discussion of the combination of copper with carbon. Karsten, in his now celebrated German work on metallurgy, alleges that when pure copper is imbedded in lamp-black, and exposed first to a strong red heat during several hours, and afterwards to the melting point of copper, it may combine with as much as, but not more than, 0·2 per cent. of copper. Copper containing this maximum proportion of carbon is distinguished, he says, by its pale, yellowish red colour and very strong metallic lustre, and at a low red heat it crumbles under the hammer. When the proportion of copper does not even exceed 0·05 per cent. the copper cannot be forged or rolled at a high temperature without splitting into laminæ and readily cracking at its edges. On the contrary, we are told, the presence of carbon scarcely affects the tenacity of copper at ordinary temperatures. The rigidity and brittleness which copper containing carbon acquires when hammered out cannot be removed by annealing at low temperatures, and on this account such copper is said to be unsuited to fine plated work on the old system of plating with gold or silver. While making all these statements, Karsten admits that it is very difficult to determine with certainty the highest amount of carbon which may be taken up by copper, but that the two substances do combine, and with the above results, he distinctly lays down. We have here, then, a very important metallurgical fact put forward, and one to which Dr. Percy has wisely given great attention. In the first place he finds fault with the method of analysis adopted by Karsten in arriving at his opinions upon this subject, and then proceeds to detail a number of experiments which seem to point to the conclusion that the effects which Karsten attributes to the presence of carbon in the metal may really have been produced by silicon and phosphorus, taken up from the carbonaceous material employed by him. He shows, in fact, that when copper is exposed to a long-continued high temperature in contact with carbon in admixture with silica or phosphate of lime, it will take up silicon or phosphorus; and further, that when "best selected" copper contains only a very minute proportion of various foreign matters—amongst which silicon and phosphorus are mentioned—it may be re-melted in a crucible, and cast into ingots capable of being rolled without cracking at the edges. After this the author records a number of further experiments which do not settle the question whether copper melted under, or exposed to a high temperature in contact with, charcoal, does or does not combine with carbon; but from which it appears pretty certain that the quantity taken up, if any, is exceedingly minute. The experiments prove, however, that comparatively pure copper *is not rendered brittle* by such a process, and that the brittleness observed by Karsten, and attributed by him to the carbon, really results, therefore, from some other cause or causes. This is a very important point to have established, and we have no doubt that the author will push his inquiries into the matter forward, notwithstanding the difficulty of the analyses involved, until he has succeeded in settling all the doubts which he has so ingeniously and usefully raised.

The cessation of copper-smelting in Cornwall affords the author occasion for offering some very significant and useful hints to the mining interest. He opposes the notion, which is contended for by some writers, that the Cornish adventurers in copper mines were the victims of a conspiracy on the part of the Welsh smelters, and sums up the truth of the matter by saying that copper-smelting can be conducted with greater profit in Wales than in Cornwall, and that that is the only reason why the manufacture has failed in the latter district and flourished in the former. The only proper way to manage a business of any kind wisely is to produce the article, whatever it may be, as economically as may be, and then to fix a fair remunerative price upon it. "So the miner," he says, "should determine the value of the ore which he raises, irrespective of the profit which it may ultimately yield to the smelter; and he has no right to impute injustice to the smelter who declines to inform him of the gains arising from the metallurgical treatment of the ore, and to allow him to participate in those gains, which often depend entirely upon the exercise of individual skill and the possession of sound commercial knowledge." He also contends, and doubtless with truth, that whatever the profits of copper-smelting may have been in former times, it is certain that the smelters of the present day do not, in general, realise more than they are entitled to expect. At any rate, their profits cannot be considered as the regulating element of the market. All the principles of sound political economy are adverse to such a notion.

The author gives two reasons for pronouncing Swansea a most eligible site for copper-smelting works. In the first place, it is a good seaport, and is situated at only a short distance from Cornwall and Devonshire, the two counties in which the most copper ore is raised; and is also easily accessible to vessels containing ore, or products containing copper, from South America, Australia, and other parts of the world. And secondly, extensive collieries exist in its immediate vicinity, from which an abundant supply of coal can be obtained at a low price. Many of the smelters are themselves engaged in the working of collieries, and are thereby enabled to dispose of their coal to the greatest advantage, the large being sold at a good profit either for home consumption or exportation, and the small, which is often dirty from an admixture with shale, being reserved for the copper-furnaces. Dr. Percy also points out—for he is not debarred from doing so by his remonstrances with the Cornish miners—that it is advantageous both for the mine-adventurers and the smelters, that the process of smelting should be carried on in a locality where copper ores of various kinds may be procured, for it is well known that copper can frequently be extracted at less cost by smelting several ores in admixture than by smelting a single ore by itself. There are other localities in the vicinity of Swansea—Neath and Llanelly, for example—which share in a greater or less degree the advantages which Swansea enjoys as a site for copper-smelting. The copper-works near the Lancashire coast are also well situated for the importation of ores, for the exportation of copper from Liverpool, and for supplying the great local demand in Lancashire and the West Riding of Yorkshire; but they cannot obtain coal at the same price as Swansea and its neighbours. Moreover, the Swansea smelters enjoy the privilege of pouring dense volumes of thick sulphurous and arsenical smoke, from comparatively low chimneys, into the atmosphere, destroying vegetation with impunity for a considerable distance around. This privilege has now become an established right, which would not readily be conceded in many other parts of the kingdom. The evil is submitted to, we are told, by the inhabitants with "unmurmuring resignation;" but we are not on that account to suppose that the copper-smoke is innoxious. It has been calculated that no less than 65,000 cubic metres of sulphurous acid—a gas most injurious to vegetation—are ejected daily from the Swansea works, and not a blade of grass will grow on the hills exposed to it. The sulphuric acid contained in the smoke is probably more injurious than the sulphurous acid, as every drop of rain, in

falling through the smoke, becomes a solution of *oil of vitriol*, which, alighting upon foliage, is rendered more corrosive by the subsequent evaporation of a portion of the water. The value of the sulphur annually dissipated in this way was estimated by Le Play at £200,000. Various attempts have been made from time to time to lessen the nuisance and injury occasioned by this copper-smoke, and to turn the sulphurous acid which it contains to account by applying it to the manufacture of sulphuric acid; but, although large sums have been expended upon schemes for the purpose, all attempts hitherto made have proved unsuccessful. Dr. Percy gives a description of several plans that have been tried, with the view, apparently, of bringing the objects to be accomplished well before the reader. He despairs, however, of seeing the evil abated unless some economical system of extracting the noxious constituents of the smoke, without in any degree interfering with the working of the furnace, can be put in practice. It is some small satisfaction to know, under these circumstances, that by means of the dense white cloud which perpetually hangs over Swansea and its vicinity "occasionally beautiful effects are produced in the landscape when the rays of the sun fall upon it, especially towards evening." We fear, however, that even this poor æsthetic benefit is enjoyed less by the poisoned inhabitants of Swansea than by the spectators who view it from the distant hills or the British Channel.

We have seen that Dr. Percy is not slow to speak a good word for the Welsh copper-smelters when they merit it; we have now to show that he does not spare them from censure when they incur it. That absence of "science" which we lately heard lamented at Sheffield is manifest in Wales as well as in Yorkshire. The elimination of certain foreign metals during the Welsh process of copper-smelting is a subject which, according to our author, has been unduly neglected—probably, because it could only be properly investigated by a skilful analytical chemist, would be very laborious, and would require that the experimenters should have constant access to copper works in order to be able to select with due care every specimen intended for analysis. "If one of our great Welsh smelters," he says, "could be induced to take an interest in the *science* of his *art* for its own sake, and quite irrespective of any consideration of pecuniary gain, many important questions concerning the metallurgy of copper would soon be decided." The science of metallurgy in this country has hitherto, we are further told, not only not received much encouragement from the men who have amassed great wealth by the practice of metallurgic arts, but has frequently had to encounter their strenuous opposition; and in this case, as in all such cases, "their opposition has been proportionate to their *ignorance* of the principles of the processes which they were engaged in carrying on, and their dependence upon the brains of others for the successful management of their works." This is precisely what we are continually discovering among our engineering friends, we are sorry to say. And so is this, too:—"It is this class of men, moreover, who affect superior knowledge, and delude themselves with the notion of their being exclusive possessors of mysteries—a class which, it is hoped, is doomed to speedy extinction." We really think Dr. Percy must have been on intimate terms with a few engineers as well as metallurgists. But, no; it is the old world-wide experience—ignorance and conceit blustering arm-in-arm along, thrusting knowledge hither and humility thither! It is gratifying to know, however, that matters are mending everywhere in this respect—among our metallurgists no less than elsewhere. "Within the last twenty years I have witnessed," says our author, "great changes in the views of many of our smelters, especially the ironmasters, concerning the value of the science of metallurgy. In several of the great ironworks skilful chemists have been successfully engaged in investigating problems of interest; and, with but few exceptions, the results have been freely disclosed." There seems reason to suspect, however, that some of the important problems connected with the copper manufacture have been already solved within the precincts of copper-works, and the results regarded of too much commercial value to be divulged.

We shall mention but one other subject suggested by this chapter on copper, viz., the presence of gold, which is often detected in that metal, more especially, perhaps, in that derived from South American ores. Dr. Lyon Playfair communicated to the author a curious fact concerning this question. At large chemical works, where sulphate of copper was prepared by dissolving copper in sulphuric acid, an insoluble residue was produced in the process, which had been put aside from time to time, and had not, fortunately, been thrown away. A small sum was offered by certain persons for this residue, which had not previously been regarded as of much value. Suspicion was excited, especially by the quarter from which the offer proceeded, and it was declined. The residue was examined, and found to contain £700 worth of *gold!* This chapter on copper concludes with a mass of valuable facts and suggestions concerning copper sheathing, to which we drew attention some weeks ago.

The next chapter is upon zinc, and abounds in novel information concerning this very useful metal and its combinations. We must pass it over, however, without remark, pausing only to mention for a moment, by way of warning, the deadly nature of arseniuretted hydrogen—a gas generated, as many of our readers know, by the action of hydrochloric or dilute sulphuric acid upon zinc containing arsenic. This gas, as we have intimated, is a deadly poison, and the lives of two chemists at least have been destroyed by it. The author states that death, attended with great suffering, occurs in the course of a day or two after the inhalation. "The warning cannot be too often repeated, that of all compounds of arsenic, this is one of the most insidious and poisonous."

The last chapter is upon brass, that term being here applied to all alloys consisting essentially of copper and zinc, although it should properly be confined, as the author admits, to such of them only as are either decidedly yellow or have the yellowish tint characteristic of brass. An alloy of a different kind possesses a peculiar interest from the fact that, after "dipping" in nitric acid, its colour so closely resembles that of fine gold, that it is scarcely possible to distinguish one from the other, even when seen side by side. This alloy consists of about 95 per cent. of copper, and 5, or somewhat less, of aluminium. The close resemblance of this material to gold was ascertained several years ago in the Metallurgical Laboratory under Dr. Percy's care, and he has frequently mentioned it in public, and exhibited specimens of it. It does not seem, however, to have received much attention, probably because the beautiful gold-coloured surface of the alloy tarnishes, and can only be preserved by a covering of varnish or lacquer. The author's remarks upon Muntz's metal are very full and very interesting. Strange to say, however, notwithstanding his careful researches in our patent archives—or, to speak more accurately, his examination of the small blue-book "abstracts," published under Mr. Bennett Woodcroft's care—he seems not to have discovered that Muntz's invention, from which a handsome fortune was derived, was patented by a Mr. Collins as long ago as the year 1800, or thirty-two years before Mr. Muntz's first patent was obtained. In that year Mr. Collins obtained a patent for what he called red, yellow, and white sheathing; the first consisted of eight parts of copper and one part of zinc; the second of *one hundred parts of copper and eighty of zinc*, which required a low red heat for working; and the third of sixteen parts of tin, sixteen of zinc, and one of copper. The second of these, which we have placed in italics, is manifestly Muntz's metal, its per centage of copper being 55 to 56, and that of zinc 44 to 45, whereas in Muntz's patent the copper may be varied between 50 and 63 per cent., and the zinc between 50 and 37 per cent. The existence of Collins's patent seems to be unknown to Dr. Percy, and, most fortunately for the late Mr. Muntz, was equally unknown apparently to the copper-smelters who vainly attacked his patent rights.

This consideration leads us to observe that Dr. Percy, like some other intelligent persons, seems disposed to go astray from sound principles of political and social economy as soon as the evils associated with our existing patent laws—some of which are avoidable while others are unavoidable—come before him; and he will no doubt see with satisfaction that Mr. Ricardo is about to move for a Committee of the House of Commons to consider "the policy and operation" of those laws. "It is not consistent with common honesty that the Crown, any more than an individual, should sell the same article," says our author, "to two or more persons, and coolly leave them to fight for the possession of it. Grievous injustice of this kind has been, and is, so frequently perpetrated in the name of the law, that it is high time the reckless system of issuing letters patent should be amended in accordance with recognised principles of justice." This is an extreme view of the case, and, like all extreme views, is unfair and unphilosophical. The Crown does not sell the same thing to two or more persons; it sells nothing to any patentee; it merely extends its protection to a man upon certain representations and oaths of his own; and on certain well-understood conditions of forfeiture. Dr. Percy himself, in language which we noticed in our previous article, supplies the truth of the matter, saying, "if persons will squander their money in spite of the marvellous facilities which, thanks to my friend Mr. Bennett Woodcroft, now exist for obtaining gratuitous information on the subject of patents, *they have chiefly themselves to blame*." It is idle to transfer this blame to the patent laws; and worse than idle, because it gives a false direction to legitimate efforts for reform. We are happy to say, however, that Dr. Percy is far too just and sensible a man to lend himself to those wild schemes of confiscation and lawless plunder to which Sir William Armstrong's late speeches have given open countenance: "That a man who has worked out an original and valuable process from his own brain, and who may have incurred great expense in bringing it to a practical issue—it may be after years of protracted toil and anxiety—should have secured to him by law during a moderate term the exclusive privilege of reaping the substantial reward of his own invention appears to me," he says, "as just and reasonable as that an author should be protected against piratical and unprincipled publishers." This, we submit, is a very just fundamental view of the patent question, and if steadily kept in mind by our legislators, will effectually keep us protected from the piracy and fraud to which the abolition of the patent laws would expose every inventor in the land, and in the interests of which Sir William Armstrong—the best-rewarded inventor of the age—strangely enough considers it reputable to exert himself!

We will conclude these notices of Dr. Percy's masterly and unrivalled work with two remarks. First, it would be a great advantage to the public if the Commissioners of Patents would make more extensively known (by advertisement and otherwise) those valuable little volumes of "Abstracts of Specifications of Patents" to which Dr. Percy, and many other authors, find it so convenient and profitable to refer; their general circulation would do more than any legislation will succeed in doing, and with no injury to any one, in the way of preventing that re-patenting of old inventions which has created so loud and so injurious an outcry. Secondly, the value of the work before us would be much increased if the index at the end were made more copious and perfect. We have found it very difficult already to revert to many points of interest that struck us on going through the volume, owing to the imperfections of the index. As the book is essentially a work of reference, this defect should be remedied in the new edition which will, no doubt, be speedily demanded.

The Late Mr. Hodgkinson.—A number of gentlemen, to wit: J. P. Joule, LL.D., F.R.S., E. Schunck, F.R.S., James Heywood, F.R.S, John Hawkshaw, C.E., F.R.S., Joseph Whitworth, F.R.S., R. P. Greg, F.G.S., Thomas Turner, F.R.C.S., G. R. Stephenson, C.E., Robert Rawson, and E. W. Binney, F.R.S., have presented a bust of the late Professor Eaton Hodgkinson to the Manchester Literary and Philosophical Society, of which body Professor Hodgkinson was formerly president, and in whose transactions many of his most valuable formulæ first appeared.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

2512. Isaac Evans, jun., Cefn Mawr, Ruabon, Denbighshire, "An improved miners' lamp."—*Petition recorded 8th October*, 1861.

2797. Theodore Schwartz, New York, U.S., "Improvements in the construction of air engines or air motors."—*Petition recorded 7th November* 1861.

2811. David Cowan, Hungerford-street, Strand, London, "Improvements in the construction of pneumatic subaqueous tubes for passenger or goods traffic, and in machinery for the manufacture thereof."—*Petition recorded 9th November*, 1861.

2923. James Harrow Jeffs, Tottenham Court-road, London, "Improvements in the manufacture of collars, shirt fronts, cuffs, hats, bonnets, vests, and other articles of wearing apparel."—*Petition recorded 21st November*, 1861.

3023. William Pellew Bain, Blackwall, Middlesex, "Improvements in protecting ships' bottoms from fouling."—*Petition recorded 2nd December*, 1861.

3079. Marc Antoine Francois Mennons, Rue de l'Echiquier, Paris, "Improved natatory apparatus."—A communication from Léon Lejuste, Rue de Canteleux Douai, France.

3080. Marc Antoine Francois Mennons, Rue de l'Echiquier, Paris, "A new or improved combination of microscopic photographs and lenses with certain precious stones or imitations thereof."—A communication from Louis Henri Bouillette and Jean Amable Hyvelin, Rue Michel-le-Comte, Paris.—*Petitions recorded 9th December*, 1861.

3205. Timothy Morris and Robert Weare, Birmingham, and Edward Henry Cradock Monckton, Fineshade, Northamptonshire, "Improvements in submarine and other telegraphic communication, and i apparatus connected therewith."—*Petition recorded 21st December*, 1861.

3273. Jean Baptiste Cretal, Saint Malo, France, "A new process of colouring smoking pipes."—*Petition recorded 31st December*, 1861.

39. Alfred Vincent Newton, Chancery-lane, London, "An improved manufacture of cigars."—A communication from William Chevers, Knoeland, New York, U.S.—*Petition recorded 6th January*, 1862.

58. Henry Cook, Manchester, "An improved mode of, and apparatus for, transmitting despatches and small articles by the agency of electricity."—A communication from Gaetano Bonelli, Milan, Italy.—*Petition recorded 8th January*, 1862.

66. Joel Haywood Tatum and William James Williams, New York, U.S., "Improvements in the manufacture and structure of wicks, and in the application of the same to the manufacture of candles."—*Petition recorded 9th January*, 1862.

78. Louis Petre and Edward Samuel Tucker, Waterloo-road, London, "The application of velvet, plush, cloth, leather, American cloth, oil cloth, and other such like substances alone and in combination with other materials for advertising show boards, show cards, window tickets, and all such uses."—*Petition recorded 10th January*, 1862.

81. Thomas Ramsay, Newcastle-on-Tyne, "Improvements in the manufacture of coke."—*Petition recorded 11th January*, 1862.

108. Thomas Harrison, Birmingham, and John George Harrison, Kirby Ravensworth, Yorkshire, "Improvements in ploughs."—*Petition recorded 14th January*, 1862.

113. William Cleland, St. George's-hill, Everton, Liverpool, "Improvements in treating and utilising certain materials used and products obtained in the manufacture of gas, and in apparatus connected with the said treatment."—*Petition recorded 15th January*, 1862.

123. Thomas Myers, Bloomsbury-square, London, and Edward Myers, Millbank-street, Westminster, "An improved composition for preventing rust on bright steel, iron, brass, or metal surfaces."

124. Robert Dunlop, Cwm, Avon, Taibach, Glamorganshire, "Improved means for facilitating calculations."—*Petitions recorded 17th January*, 1862.

141. Leonard Barbat, Rue Sainte-Appoline, Paris, "A new and improved fabric applicable to the manufacture of hats, bonnets, and other like articles."—*Petition recorded 20th January*, 1862.

169. Joseph Hinks and Adam Dixon, Birmingham, "A new apparatus for warming and drying boots, shoes, or slippers, which apparatus is also applicable for racking or storing boots, shoes, or slippers, for exhibition or otherwise."

170. Jonathan Aldous Mays, Regent-square, St. Pancras, London, "Improvements in envelopes and other wrappers."

175. Henry Owen, Albert-terrace, Islington, London, "Improvements in the manufacture of stockings and other articles of hosiery."—*Petitions recorded 23rd January*, 1862.

205. Joseph Lillie, Duke-street, Adelphi, London, "Improvements in the method of protecting ships' bottoms from fouling, and in materials to be used therefor."—*Petition recorded 27th January*, 1862.

214. Henry Hughes Treffass, St. George's-terrace, Barnsbury Park, Islington, London, "Improvements in the construction, use, and employment of the kaleidescope."

226. William Edward Newton, Chancery-lane, London, "Improvements in engines to be employed by pumping or forcing air or water, or for other purposes where a rectilinear motion is required."—A communication from Wellington Lee, New York, U.S.—*Petitions recorded 28th January*, 1862.

231. Francois Delamare de Boutteville, jun., Fontaine-le-Bourg, Seine Inférieure, France; "Improvements in machinery applicable to the spinning of fibrous substances."

234. Thomas Meriton, Leadenhall-street, London, "Improvements in marine and other boilers for generating steam."

239. William Edward Newton, Chancery-lane, London, "Improvements in printing machinery."—A communication from Richard March Hoe, New York, U.S.

241. George Bedson, Manchester, "Improvements in wire fences."—*Petitions recorded 29th January*, 1862.

243. George Phillips, sen., and George Phillips, jun., Holborn-hill, London, "Improvements in the distillation and rectification of alcohols or spirits."

244. Matthew Allen, Worship-street, St. Leonard's, Shoreditch, "Improvements in the construction of buildings for the prevention of fire, and in the materials to be employed therein and therefor."

245. Theophilus Gontard, Rue des Vieux Augustins, Paris, "Improved truss plates producing an upward pressure."

247. James Firth, Flush Mills, Heckmondwike, near Leeds, Yorkshire, "An improvement in finishing mohair cloth."—*Petitions recorded 30th January*, 1862.

253. David Littlehales, Brearley-street West, Birmingham, "An improved plastic compound as a substitute for papier maché."

255. John Silvester, West Bromwich, Staffordshire, "Improvements in pocket and other spring balances."

256. Francis Baggett, Birmingham, and John Sanger, Aston, near Birmingham, "An improvement or improvements in breech-loading small arms."

258. John Dodge, Little Portland-street, London, "Improvements in C springs for carriages when used without a perch."

259. William Walton, Manchester, and Frederick Walton, British Grove Works, Chiswick, "Improvements in the manufacture of wire cards."

260. George Mehrtens, Charles-street, Hampstead-road, Middlesex, "Improvements in ladies' stays, and in the bodies of ladies' dresses."

261. John Hargreaves, Clifton-cottages, Clifton-road, Peckham, Surrey, "Improvements in the manufacture of pipes or tubes for conveying water, gas, acids, sewage, enclosing electric telegraph wires, and for other purposes, which improvements are also applicable to the manufacture of other vessels and articles, and in the machinery or apparatus connected therewith."

263. Charles Pontifex, jun., Shoe-lane, London, "Improvements in apparatus for cooling or heating fluids or liquids."

267. Alexander Forsyth, Glasgow, Lanarkshire, N.B., "Improvements in the manufacture of frames and in tablets used for advertising purposes."

268. Charles Veronique, Rue Thaitbout, France, "An improved wrapper garment."—*Petitions recorded 31st January*, 1862.

270. Leon Fauvel, Paris, "Improvements in apparatus for indicating the existence of escapes in gas tubing, and for stopping the continuance thereof."

271. Robert Burkhardt and Carl Doebler, Manchester, "Improvements in aolian harps."

275. Friedrich Wilhelm Daehne, Swansea, Glamorganshire, "Improvements in furnaces used in the manufacture of zinc."

276. Thomas Cook, Coburg-road, Old Kent-road, Surrey, "Improvements in machinery for punching, cutting, and pressing metals and other materials."

277. John Harris, Store-street, Tottenham Court-road, London, "Improvements in mattrasses, squabs, pillows, and other like articles of furniture."

278. Thomas Cook, Coburg-road, Old Kent-road, Surrey, "Improvements in machinery for folding envelopes."

280. Francis Riesbeck and William Becker, Aldermanbury, London, "Improvements in locks or fastenings for bags, portmonnaies, and other like articles having metal frames."—*Petitions recorded 1st February*, 1862.

282. Lawrence Hill, Port Glasgow, Renfrewshire, N.B., "Improvements in applying armour plating to war ships."

284. Charles William Lancaster, New Bond-street, London, "Improvements in strengthening cast iron ordnance."

286. James John King, Chase-lodge, Lavender-hill, Wandsworth-road,

Surrey, "Improvements in the fastenings of bedsteads, which fastenings are also applicable to other portable framework."

287. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in machinery for spinning."—A communication from Henri Schlumberger, Guebwiller, France.—*Petitions recorded 3rd February*, 1862.

290. GEORGE MANWARING, Southampton, Hants, "Improvements in flushing apparatus for closets, sewers, and other water services."

293. JAMES LEE NORTON, Belle Sauvage Yard, Ludgate-hill, London, "Improvements in beating, stretching, and drying fabrics, and in the apparatus employed therein, part of which apparatus is also applicable for thrashing linseed."—Partly a communication from William Aldon, Boulevart Bonne-Nouvelle, Paris.

295. JOHN GREENWOOD, Portland Mills, Bradford, Yorkshire, "Improvements in means or apparatus for preparing and combing wool and other fibres."

297. JAMES WEBSTER, Birmingham, "Improvements in gas fittings."—*Petitions recorded 4th February*, 1862.

299. DANIEL GALLAFENT, Stepney Causeway, Middlesex, "Certain improvements in the mode or modes of generating or producing elastic vapours to be used as a motive power."

300. WILLIAM EDWARD TAYLOR, Enfield, near Accrington, Lancashire, "Certain improvements in carding engines."

301. JOHN KING, Chadshunt, Warwickshire, "Improvements in lubricators for lubricating the moving parts of machinery."

302. EDWARD FISHER SMITH and THOMAS SWINNERTON, Dudley, Worcestershire, "Improvements in the manufacture of coke, and in kilns or ovens for the manufacture of coke."

303. JOHN BROWNING, Minories, London, "Improvements in aneroid barometers."

304. HENRY ASHWORTH, Littleborough, Lancashire, "Certain improvements in machinery or apparatus employed in spinning cotton or other fibrous substances."

305. EDWARD HARRISON, Oldham, Lancashire, "A certain compound or certain compounds to be used as a substitute for gunpowder."

307. JESSE LEE, Church Gate, Leicestershire, "Improvements in traction engines."

308. JOHN BELLAMY PAYNE, Chard, Somersetshire, "Improvements in the the treatment or preparation of hemp, flax, and other analogous fibrous substances for spinning."

309. ALFRED VINCENT NEWTON, Chancery-lane, London, "An improvement in fire-arms"—A communication from Caleb Hannum Bradley, and Gideon Miles, West Chester, Pennsylvania, U.S.—*Petitions recorded 5th February*, 1862.

310. CHARLES CALOW, Newton Heath, near Manchester, and JOHN WILLIAM HIRST, Manchester, "Improvements in slide valves for steam engines and other similar purposes."

312. JAMES PITKIN, Clerkenwell, London, "An improvement in aneroid barometers."

314. ROBERT SHORTREDE, Brighton, Sussex, "Improvements in the construction of ships of war with armour plates."

316. MICHAEL HENRY, Fleet-street, London, "Improvements in obtaining and applying motive power, and raising and forcing fluids, and in apparatus employed therein."—A communication from Louis Coignard, Boulevart St. Martin, Paris.

318. EDWARD TAYLOR BEELHOUSE and WILLIAM JOHN DORNING, Manchester, "Improvements in the construction of hydrostatic presses suitable for packing and compressing cotton and other materials."

320. JOHN TONKIN, jun., Pool, Illogan, Cornwall, "Improvements in the manufacture of gunpowder."—*Petitions recorded 6th February*, 1862.

Invention Protected for Six Months by the Deposit of a Complete Specification.

357. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in smoothing irons."—A communication from Charles Jean Baptiste Eugène Cailloué, Paris.—*Deposited and recorded 11th February*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

401. GEORGE BETJEMANN, GEORGE WILLIAM BETJEMANN, and JOHN BETJEMANN, Upper Ashby-street, London.—Dated 12th February, 1859.

404. HENRY GARDNER, Old Quebec-street, Portman-square, London.—Dated 12th February, 1859.

412. JOSIAH LATIMER CLARK, Haverstock-hill, Middlesex.—Dated 14th February, 1859.

435. JOHN JAMES RUSSELL, Wednesbury, Staffordshire.—Dated 16th February, 1859.

439. JOSEPH BREEDEN, Birmingham.—Dated 16th February, 1859.

451. CHARLES GARTON, Bristol.—Dated 18th February, 1859.

505. JEAN HENRI GUILLAUME DANIEL WAGNER, Paris.—Dated 24th February, 1859.

408. JAMES PARKINSON, Manchester.—Dated 14th February, 1859.

427. RICHARD COOKSON, Layton Hawes, near Blackpool, Lancashire, and CHARLES WILLIAM HOMER, Castle Hill, near Northwich, Cheshire.—Dated 16th February, 1859.

468. GEORGE PAUL, Glasgow, Lanarkshire, N.B.—Dated 21st February, 1859.

440. JOHN EASON, Oxford-street, London.—Dated 16th February, 1859.

445. PIERRE EDOUARD FRAISSINET, Paris.—Dated 17th February, 1859.

446. THOMAS CATTELL, Euston-square, London.—Dated 17th February, 1859.

Patent on which the Stamp Duty of £100 has been paid.

355. SAMUEL BARLOW WRIGHT, Parkfields, Stone, and HENRY THOMAS GREEN, Moreton, Staffordshire.—Dated 10th February, 1855.

Notices to Proceed.

2488. JOHN EDWARDS, Aldermanbury, London, "Improvements in the manufacture of buttons."—*Petition recorded 5th October*, 1861.

2505. JOHN CHAPLIN WILLSHER, Petches, Finchingfield, Essex, "Improvements in the construction of combined thrashing and dressing machines."—*Petition recorded 7th October*, 1861.

2507. WILLIAM CATFORD, Chard, Somersetshire, and JOHN SHERWOOD WHEATLEY, Nottingham, "Improvements in the manufacture of bobbin, net, or twist lace."

2510. WILLIAM SIMPSON, Calais, France, "Improvements in the manufacture of twist lace made in twist lace machines."

2512. ISAAC EVANS, jun., Cefn Mawr, Ruabon, Denbighshire, "An improved miners' lamp."—*Petitions recorded 8th October*, 1861.

2514. ROBERT WILLIAM SIEVIER, Guildford-street, Russell-square, London, "Improvements in batteries for the purposes of war."

2516. WILLIAM SMITH, King-street, West Smithfield, London, "Improvements in apparatus for measuring and regulating the pressure of gas."

2525. THOMAS TIDMARSH, Dorking, Surrey, "An improved artificial manure."—*Petitions recorded 9th October*, 1861.

2530. WILLIAM MOULD and JOHN HALL, Belmont, near Bolton, and SAMUEL COOK and WILLIAM HENRY HACKING, Bury, Lancashire, "Improvements in machinery for manufacturing healds or harness used in looms for weaving."

2532. JAMES STEVENS, Birmingham, "Certain improvements in connectors and adjusters for connecting and adjusting crinolines."

2534. BENJAMIN BROWNE, King William-street, London, "A new improved spring."—A communication from Perry Green Gardiner, New York, U.S.—*Petitions recorded 10th October*, 1862.

2541. ROBERT RICHARDSON, Great George-street, Westminster, "Improvements in the manufacture of railway fastenings, and a mode of preparing rails and fish-plates to receive them."

2544. NUMA STRAM, Ashby-street, Northampton-square, London, "Improvements in watches."—*Petitions recorded 11th October*, 1861.

2545. JOHN CLARK, Glasgow, Lanarkshire, N.B., "Improvement in electric telegraph apparatus."

2552. HENRY NELSON, Manchester, "Improvements in machinery or apparatus for punching washers for throstles and other similar purposes."—*Petitions recorded 12th October*, 1861.

2559. HENRY JOHN DISTIN, Great Newport-street, Leicester-square, London, "Improvements in metal musical wind instruments."

2561. BENJAMIN TAYLOR and CHARLES EDKINS, Birmingham, "Improvements in porterobes, or dress suspenders, and also in apparatus for the suspension of curtains, draperies, and other articles."

2562. FREDERICK BURNETT HOUGHTON, Clarendon-terrace, Kensington, Middlesex, "Improvements in apparatus employed in reducing straw and other vegetable substances in the manufacture of pulp for making paper."—*Petitions recorded 14th October*, 1861.

2565. CORNEILLE WYNANTS, Saint Josse ten-Noode, Belgium, "An improved chase for printing presses."

2567. WILLIAM ROSS, Glasgow, Lanarkshire, N.B., "Improvements in constructing taps or valves."—*Petitions recorded 15th October*, 1861.

2572. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "An improvement in plates for the table."—A communication from Victor Antoine Marcelin, Paris.

2574. THOMAS FORSTER, Sparrow Hall, Streatham, Surrey, "Improvements in re-working waste vulcanised india-rubber."

2579. JOSEPH LISTER and DAVID MYERS, Caledonian-street, Bradford, Yorkshire, "Improvements in lifting or hoisting apparatus, whereby to insure the safety of the cage or article lifted when a rope or chain breaks or is overwound, and in hoists generally as applied to mills, warehouses, and other buildings."—*Petitions recorded 16th October*, 1861.

2584. WILLIAM WELCH, King-street, Southsea, Portsmouth, Hants, "Improvements in marine screw propellers."—*Petition recorded 17th October*, 1861.

2610. THEOPHILE LEPEINTEUR, Paris, "Improvements in fastenings for gloves, belts, and other articles."

2611. THOMAS FEARNLEY, Arcadia-street, Manningham, near Bradford, Yorkshire, "Improvements in steam hammers."—*Petitions recorded 19th October*, 1861.

2621. COLIN MCDOUGALL, Manchester, "Improvements in connecting and fastening the bands of covered steel or other materials used for crinolines."

2625. FRANCIS ALTON CALVERT, Manchester, "Improvements in engines to be propelled by compressed atmospheric air or steam."

2626. JOSEPH SCOTT PHILLIPS, College-crescent, Finchley-road, London, "A new method and apparatus for the propulsion of vessels through the water."—*Petitions recorded 21st October*, 1861.

2666. ROBERT ANDREW BOYD, Southwark, Surrey, "Improvements in apparatus for singeing pigs."—*Petition recorded 24th October*, 1861.

2700. GEORGE MOWBRAY GILBERT, Albany-terrace, Britannia-square, Worcester, "Improvements in preparing blue colour, and in apparatus for applying such colour to water."—*Petition recorded 28th October*, 1861.

2877. EDWARD LOOMES, Whittlesey, Ely, Cambridgeshire, "Improved machinery for moulding bricks, tiles, and other like articles."—*Petition recorded 15th November*, 1861.

3140. WILLIAM RODRIGUES ROGERS, Gray's-inn-road, London, "An improved mode of constructing dovetail joints."—*Petition recorded 14th December*, 1861.

61. JOHN BRUNT, Rue Petrelle, Paris, "Improvements in gas meters."—*Petition recorded 9th January*, 1862.

191. JOHN ALISON, Brightlands, Reigate, Surrey, "Improvements in apparatus for tilling land by steam power."—*Petition recorded 24th January*, 1862.

207. RALPH MARTINDALE, Handsworth, Staffordshire, "Improvements in globes and glasses to be used with hydrocarbon lamps."—*Petition recorded 27th January*, 1862.

234. THOMAS MERITON, Leadenhall-street, London, "Improvements in marine and other boilers for generating steam."—*Petition recorded 29th January*, 1862.

243. GEORGE PHILLIPS, sen., and GEORGE PHILLIPS, jun., Holborn-hill, London, "Improvements in the distillation and rectification of alcohols or spirits."—*Petition recorded 28th January*, 1862.

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 15th February, 1862.

1702, 10d. ; 1703, 3d. ; 1704, 3d. ; 1705, 5d. ; 1706, 3d. ; 1707, 3d. ; 1708, 9d. ; 1709, 3d. ; 1710, 3d. ; 1711, 9d. ; 1712, 1s. 2d. ; 1713, 3d. ; 1714, 6d. ; 1715, 7d. ; 1716, 3d. ; 1717, 3d. ; 1718, 10d. ; 1719, 3d. ; 1720, 6d. ; 1721, 3d. ; 1722, 3d. ; 1723, 6d. ; 1724, 3d. ; 1725, 9d. ; 1726, 3d. ; 1727, 7d. ; 1728, 3d. ; 1729, 3d. ; 1730, 3d. ; 1731, 1s. 7d. ; 1732, 3d. ; 1733, 11d. ; 1734, 3d. ; 1735, 10d. ; 1736, 3d. ; 1737, 3d. ; 1738, 3d ; 1739, 5d. ; 1740, 1s. 4d. ; 1741, 1s. 4d. ; 1742, 1s. 4d. ; 1743, 5d. ; 1744, 4s. 9d. ; 1745, 3d. ; 1746, 3d. ; 1747, 2d. ; 1748, 3d. ; 1749, 3d. ; 1750, 1s. 7d. ; 1751, 8d. ; 1752, 9d. ; 1753, 3d. ; 1754, 5d. ; 1755, 1s 1d. ; 1756, 6d. ; 1757, 1s. 1d. ; 1758, 9d. ; 1759, 3d ; 1760, 3d. ; 1761, 9d ; 1762, 7d. ; 1763, 3d. ; 1764, 3d. ; 1765, 3d. ; 1766, 6d. ; 1767, 10d. ; 1768, 3d.

*** Specifications will be forwarded by Mr. Bennett Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

(Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.)

1851. T. HUGHES, *Birmingham*, "*An improved steam generator.*"—*Dated 24th July*, 1861.

In giving effect to this invention the improved steam generator may be so constructed as to be placed wholly or partially horizontally, diagonally, or vertical, as preferred, and will be found applicable as well for marine and locomotive engines as for stationary engines. But for simplifying the description, and defining the various parts of its construction and proportion, the patentee describes his invention as adapted for an upright position, for supplying high-pressure steam to an engine, say of 10-horse power, the proportions hereinafter given being generally suitable, as determined from present experience. He constructs a base or bottom plate, say of cast iron, about three feet square, and an inch and a quarter thick, with a hole in the centre, with a raised rim or flange, into which he fixes a strong wrought or cast iron tube, and which tube may diminish below the plate or otherwise, and be conducted away for receiving the water supply hereafter to be referred to. This wrought or cast iron centre tube has four projections, more or less as desired, and which projections are formed about three feet square up from the base plate, and have waterways formed through them to the centre tube. And this same arrangement he also forms at the top of the centre tube, which may be about eight feet high, the top being open and formed with a wide projecting flange for supporting the steam chest, which must be made of boiler plate in the ordinary way, and he prefers it to be of a circular dome shape. And from the side or top of the steam chest the blow-off valve may be placed, as also the steam pipe for conveying the steam to the engine. To the projecting radial waterways, projecting out from the main central tube, he applies coiled tubes by means of a right and left hand coupling ; these tubes he prefers being of good gas or steam tubes, of the description known as welded iron gas or steam tubes, about two or two and a half inches in diameter, and from fifteen to eighteen feet long, more or less, bent into an open coil about ten inches in diameter, and which coiling process contract the length to about five feet, which admits of their being connected, as before stated (from their ends being screwed), by a collar tapped with a right and left handed screw, one part of the collar screwing over the end of the tube, and the other over the corresponding radial projection formed on the centre tube. About two feet from the base or lower plate he places the furnace bars, building up the brickwork in such a way as to support them, and which brickwork he continues up around the spiral tubular coils, leaving sufficient room for the blaze to ascend and play through, around, and between them, as also up against the bottom of the steam chest, the brickwork extending up high enough to partially surround the steam chest for about one-fourth or one-third of its height. At the back or side, just under the steam chest, he prefers forming a bridge that the flame may pass over and descend, and at or about the part where it enters the regular draftway, or flue to the chimney stack, he prefers placing a small draftway from the furnace, in order that a small flame may pass through and ignite, and thereby consume the smoke that may escape over the bridge. When the apparatus, as herein described, has been filled up with water so as to fill up and rise through the centre and spiral tubes some little way into the steam chest, this condition is to be maintained by the ordinary force pump or other means, with valves and floats as may be required, to maintain and indicate a due and proper supply of water as fast as generated into steam, the fresh supply of water being heated to economise and facilitate its conversion into steam. Thus it will be seen that the patentee is enabled to generate steam rapidly, and with a greatly reduced proportion of coal.

1867. D. SPINK, *Eastbourne*, "*Steam engines*"—*Dated 25th July*, 1861.

This invention has for its object the regulating of the pressure of steam on the pistons of steam engines when it is cut off from the boiler, and is effected in the following manner:—The inventor proposes employing a separate vessel or vessels in connection with the cylinder and steam pipe of the boiler, the pipe having a valve or valves to cut off the steam in the separate vessel or vessels from the boiler at the beginning of each stroke of the piston. At each end of the separate vessel is also a regulating valve to admit the steam gradually to press alternately on either side of the piston, so that, if the steam enters the separate vessel of one-eighth capacity of cylinder, for instance, say at twenty-five pounds pressure, and then is cut off from the boiler, and is allowed to expand through the entire stroke, it has a pressure of about ten pounds per square inch maintained throughout every portion of the stroke of the piston in the cylinder, so that nearly the same effect is produced as would be by cutting off the steam in the cylinder at one-eighth of the stroke, with the important advantage of an unvarying pressure throughout. The regulating valves are opened and closed alternately to allow the steam to enter either end of the cylinder from the separate vessel, and are worked by cams or eccentrics.—*Not proceeded with.*

1919. R. BENTON, *Great College-street, Westminster*, "*Apparatus for obtaining rotary motion by the use of the gravitating power of solid or fluid matter.*"—*Dated 2nd August*, 1861.

This invention consists in the use of two sets of balance bars, which the patentee calls major and minor bars ; the major bars are formed with cranks at each end thereof, and have a movable weight within or upon each crank, and each weight being at least double that which is attached to one end of the minor bars. The whole of the apparatus is so arranged as to be in a perpetual state of equilibrium, except the weights attached to the end of the minor bars, and which said minor weights will be perpetually suspended on the descending side of the orb or axis to be kept in motion. Another part of this invention consists in dividing the orb or axis into sections mounted on separate standards with minor driving wheels, whereby the power of each section or standard is communicated by chains or other convenient means to the main driving shaft on which one or more driving wheels may be placed. He also employs spherical circular guides for the purpose of maintaining the major bars in a vertical position, and thereby preserved in a perpetual state of equilibrium. He also places ratchets fixed on the face of the said guides, whereby the major parts are prevented from rebounding when they change their positions. He also employs finger guides whereby the opening of certain latches, and the action of the aforesaid major bars, are secured and rendered simultaneous by one and the same movement.

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

1874. F. JOHNSON *and* B. HOCKING, *North-street, Smith's-square, Westminster*, "*Securing or fastening nuts for railway fish-plates, &c.*"—*Dated 26th July*, 1861.

This invention consists in dividing the point of a screwed bolt or pin longitudinally to an extent sufficient to enable a thin metal wedge to be inserted therein, for the purpose of expanding the point of the bolt after it is in position and the nut has been screwed on. The wedge piece should be of a width not exceeding the diameter of the bolt at the bottom of the threads at the part where the slot is formed, and the patentees prefer to form a slot or long hole in the upper part or portion of it to admit of a split-pin being passed through it. They also drill a hole through the point of the screw across its diameter for the purpose of receiving a split-pin or cotter to hold the wedge in its proper position. When the nut has been screwed on into the required position the wedge is inserted into the point of the bolt, and the cross split-pin is then inserted into the hole and through the wedge, which is thereby secured.

1882. W. H. HARFIELD, *Royal Exchange-buildings, London*, "*Constructing and propelling ships and vessels.*"—*Dated 27th July*, 1861.

For the purposes of this invention, in order to use a paddle-wheel in the centre line of a ship or vessel, and to work in a close case in water, the surface of which is at a lower level than the surface of that in which the vessel floats, the bottom of the ship or vessel is to be built with a hollow groove or inverted trough from end to end thereof. The sides of such inverted trough or groove are preferred to be upright, and parallel, and of a depth somewhat less than to the water level in the paddle-wheel case. This inverted trough is constructed with suitable metal framing, and plated with metal plates in like manner to that in which iron ships or vessels are now built. On each side of this inverted trough a groove or keel may be formed Intermediate of the length of this inverted trough or groove is constructed an air and water-tight chamber of suitable dimensions for receiving the paddle-wheel. This air-tight chamber is open at bottom and closed at top, there being, however, a man-hole capable of being closed air-tight at the top, in order to admit of persons getting into the paddle-wheel case or chamber ; this paddle-wheel chamber or case is constructed with metal framing, and plated over in like manner to that practised in building iron ships or vessels. By thus constructing a ship or vessel with a hollow groove or inverted trough of metal along the bottom, and a chamber for the paddle wheel of metal, great strength in the construction of a ship or vessel may be obtained. The paddle-wheel shaft turns in bearings supported at the sides of the chamber or case, and the shaft or axis passes through stuffing-boxes into the interior of the ship or vessel, in order that the air in the chamber may not escape, and that, when the water is allowed to rise in the paddle-wheel case to a level corresponding with the line of floatation of the ship or vessel, the water may not pass into the ship or vessel, as in many cases the paddle-shaft will be below the level of the exterior water.

1889. W. *and* D. BUSBY, *Liverpool*, "*Street or road rails.*"—*Dated 29th July*, 1861.

In carrying out this invention the inventors form the top of the rails with slightly raised guiding feathers on either side of the bearing surface, and shape the said bearing surfaces to the form and breadth of tyre best adapted for the streets or roads where the rails are laid down, and which may be concave, convex, angular, or other form, but more generally, and by preference, a perfect plane. The bottom, or under side, when resting on transverse sleepers, is perfectly smooth, but, when longitudinal sleepers are used, have tapering flanges on either side to fit over the same. Running angularly from the vertical sides between the guiding feathers and flanges, or feathers and under side, are small countersunk holes or apertures, through which and into the sleepers are passed the fastening bolts or spikes.—*Not proceeded with.*

1890. R. RILEY, *Hull*, "*Fusee signals.*"—*Dated 29th July*, 1861.

These fusee signals consist of cotton or other combustible substance saturated in spirits of wine, turpentine, naphtha, or other inflammable spirits, and are attached to the ordinary fog signals. The means or apparatus for applying them to the rails consists of a portable tube placed or passed through an opening or hole in the floor behind the wheels of the van of a train, which tube extends nearly to the surface of the rails. The fog signal is attached to a rod by a leaden lip or tongue, and the fusee ignited. Then the rod with the signal is passed down the tube, and the signal smartly pressed on to the rail by the guard or attendant, the spring clips holding it thereon as usual, and the rod is separated therefrom by the movement of the van.

1891. W. MELROSE, *Millwall, London*, "*Railway wheels.*"—*Dated 29th July*, 1861.

This invention relates to an improved method of connecting the tyres of railway wheels to the spokes and nave thereof, and consists in forming the tyre in a novel and improved manner for that purpose, that is to say, instead of simply rolling a bar with a flange at one side thereof only, as heretofore practised, the patentee proposes to form a bar with two flanges, produced by passing the bar whilst hot between rollers so shaped as to make two longitudinal grooves in the bar opposite to each other, bounded at the outside by a flange, so that these parts of the bar in cross section would be of the shape of the letter **T**, or the entire bar would be of the shape of the letter **H**, one flange being shaped in the ordinary way to roll on the rails of a line of railway, the other flange being employed to connect the spokes and nave of the wheel to the rim or tyre as follows :—He takes a bar of the above mentioned shape, and joins the two ends in the usual way for forming the tyre of the wheel. He then removes, by means of a slotting machine, certain portions of the inner flange to receive the spokes of the wheel, say eight or more in number, and he proceeds to connect the spokes and nave to the tyre as follows :—He forms the spokes and nave aforesaid in two parts ; or, in other words, he forms or shapes two similar pieces of wrought iron, each with eight or more spokes connected together by a ring or flange, and a nave or boss projecting only on one side of the arms, the other side or surface being perfectly flat ; the flange on the spokes fits into the grooves in the tyre, the spokes fitting into the recessed parts of the inner flange of the said tyre, so that one half set of spokes and nave are inserted into the tyre at one side thereof, and the other half set of spokes and nave are inserted into the opposite side of the tyre, and the two halves connected together by screws or rivets passed either through the spokes or nave, or both. By thus constructing railway wheels the tyre is securely connected to the spokes, without the aid of screws or rivets for that purpose.

1900. A. PARKES, *Birmingham*, "*Sheathing metal for ships.*"—*Dated 30th July*, 1861.

This invention consists in combining a very small per centage of tin or aluminium with sheathing metal composed of copper and zinc.—*Not proceeded with.*

1908. H. J. WALDUCK, *Manchester*, "*Apparatus for retarding and stopping railway engines and carriages.*"—*Dated 1st August*, 1861.

The nature of this invention consists in applying the brake, or the power by which the momentum of the railway engine and carriages is to be overcome, to a distinct intermediate rail or plate placed between the ordinary rails of the railway. This intermediate rail or plate may be connected to the side rails by cross sleepers, or otherwise ; or it may be fixed independently of them. The object of applying the brakeing power to a separate rail or plate is to relieve the rails on which the wheels run of the wear and tear caused by applying skid brakes on the rails or by brakeing the wheels.—*Not proceeded with.*

1917. G. EDWARDS, *Park-road Villas, Battersea*, "*Propelling by traction carriages and other vehicles on railways, tramways, and other roads.*"—*Dated 1st August*, 1861.

This invention consists in the employment of ropes for traction. These ropes are placed parallel to the roads, and each one has its ends joined so as to form what is called an endless rope. The ropes are put in motion by any power or fixed engine. When a considerable length of rope is required the inventor divides it into more than one length or section, and passes each end of each section of the rope over pulleys or drums to give it the tension required, as also for the purpose of communicating the power of the fixed engine to the rope. This power is communicated by means of drums, at one or each end of the section, being made to revolve by their connection with the fixed engine. These drums are arranged in relation to the working shaft of the fixed engine so as to be connected and disconnected at pleasure, and this is effected by means of a brake disc or wheel being fixed to the working shaft of the engine, while the drums are only connected with it when they are brought in contact with the disc by means of levers or screws. The disconnection is effected at pleasure by the same means. Thus the movement of the ropes may be connected and disconnected while the first engine is still working.—*Not proceeded with.*

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

1852. F. MILLS, *Heywood*, "*Machinery for carding cotton, &c.*"—*Dated* 24*th July*, 1861.

This invention consists in hinging the set screws to the bottom of the brackets in such a manner that the ends of the said set screws shall project through the flange of the bend, where they are secured by the means of lock nuts, thus preventing the possibility of wear in the threads of the screws, and always maintaining the parts in good working condition.—*Not proceeded with.*

1859. R. THRELFALL, *Bolton*, "*Apparatus for spinning cotton, &c.*"—*Dated* 24*th July*, 1861.

This invention relates to the self-acting mill, and consists in an improved mode of governing the copper faller while the yarn is being coiled on the spindles at the time the carriage has receded to the roller beam; and also in an improved mode of receding the carriage at any desired speed according to the number of the yarn to be spun.

1861. J. PLATT *and* W. RICHARDSON, *Oldham*, "*Gins for cleaning cotton from seeds.*"—*Dated* 24*th July*, 1861.

This invention consists in exposing the delivering rollers to the action of a current of air, whereby they are prevented from "lapping," and the collection of the material from one or from a series of machines is facilitated. To this end the inventors use a fan, which exhausts air from a casing adapted to the said rollers, and this fan may be employed in conjunction with one machine or with a series.—*Not proceeded with.*

1862. H. COOK, *Manchester*, "*Apparatus for punching or making the pattern cards used in weaving figured fabrics.*"—*Dated* 24*th July*, 1861.

This invention cannot be described without reference to the drawings.

1865. B. BROWN *and* R. HACKING, *Bury*, "*Spinning cotton, wool, silk, &c.*"—*Dated* 25*th July*, 1861.

This invention applies to a certain description or manufacture of spinning machines called throstles or throstle frames, in which a horizontal rack and pinion or toothed wheel is employed, in connection with the ordinary heart wheel, for effecting the lift of the copping rail, in order to regulate the winding of the yarn on to the bobbins. Hitherto this rack, which extends across the throstle and operates upon the copping motion on each side, that is, upon each set or row of spindles, has been formed all in one piece or casting, and having the rack teeth cast with it, whereas this improvement consists in so arranging this motion that the regularity and certainty of the lift of the copping rail may be effected to the utmost by simply having the racks of teeth made separate and independent of their carrying or supporting bar or rail, being attached thereto by a screw bolt capable of sliding in a groove or slot in such bar or rail, and adjusted by means of a horizontal screw and nut at the outer ends, so that, by the slighest turn of which said screws, the racks may operate upon the copping motion, and regulate the lift of the copping rail as is required.

1918. J. WRIGHT, *Bridge-street, Blackfriars, London*, "*Machinery to be used in carding cotton, &c.*"—*A communication.*—*Dated* 2*nd August*, 1861.

This invention cannot be described without reference to the drawings.

1903. H. POTTER, *Manchester*, "*Treating or preparing textile materials and fabrics.*"—*Dated* 31*st July*, 1861.

The object of this invention is to increase the density or substance of cotton and other fibrous materials and fabrics. The inventor effects this object by subjecting the fibrous materials or fabrics to the action of a solution of resin, or the product left after distilling the volatile oil from the different species of turpentine. The resin is precipitated into the fibrous materials or fabrics by sulphuric or other acid, or by acid gases or vapours.—*Not proceeded with.*

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

1898. W. H. ASH, *London, Canada West*, "*Reaping and mowing machines.*"—*A communication.*—*Dated* 30*th July*, 1861.

This invention cannot be described without reference to the drawings.

CLASS 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

1923. E. TOMLINSON *and* G. W. C. WILSON, *Liverpool*, "*Extinguishing of fires in warehouses and other buildings.*"—*Dated* 3*rd August*, 1861.

To apply this invention to, say, a warehouse the inventors connect to an underground high pressure water main, or to an elevated reservoir, a supply pipe which is carried to the side of the warehouse, and, say, about 3ft. or 4ft. above the level of the parapet, where it opens into a recess formed in the side of the warehouse, and which may be fitted with a lock up door. A suitable length of pipe is placed horizontally upon the head of the vertical pipe (forming a T-shaped head), and to which distinct branch pipes leading to each room or floor are connected. These branch pipes are fitted within the lock up box with suitable stop cocks and handles, numbered correspondingly with the rooms above, and which, upon the discovery of fire in any of the rooms, may be turned on by, say, the policeman on duty, who is supplied with a key to the lock-up box. The pipes may be placed in any convenient position within the rooms, say, along the ceiling in rows, or connected together by transverse pipes; these pipes are perforated with a large number of holes in any convenient manner. By these arrangements a large quantity of water may be immediately supplied to any of the rooms either separately or collectively, as required, and these perforated pipes may also be applied to the inside of the roof of the buildings.—*Not proceeded with.*

1961. D. MILES, *Newport, Monmouthshire*, "*Window sashes.*"—*Dated* 7*th August*, 1861.

The patentee claims the combination of parts tied or kept together by metallic tongues, forming, when complete, a rigid and secure window sash, and permitting, on the withdrawal of the said metallic tongues, both the upper and lower sashes partially to revolve, in order that either side of the glass may be cleaned from the interior of the room or chamber at pleasure. Also the combination of parts in using which he dispenses partly with the metallic tongues for the lower sash, or for both upper and lower sashes, and uses a spring catch, or two spring catches, in lieu thereof. Also the combination of parts by which he causes both upper and lower sashes to present singly or together either face of the glass to the interior of the chamber, substituting the use of spring catches in lieu of metallic tongues.

1962. N. A. LESSUEUR, *Paris*, "*Covering for houses, &c.*"—*Dated* 7*th August*, 1861.

This invention consists, principally, in giving to bricks, tiles, &c., by means of grooves, notches, or mortices cut in dovetail, the faculty of being set and and fixed rapidly, solidly, and economically.

1973. W. S. HOGG, *Rotherhithe, London*, "*The construction of doors, gates, and shutters, principally applicable to fireproof buildings.*"—*Dated* 8*th August*, 1861.

This invention consists in forming the above mentioned articles of parallel iron or other metal bars, rebated or grooved to receive bricks or other moulded forms of earthen materials. In many cases ordinary bricks will answer the purpose perfectly well, and may be variously disposed according to the structure required. The parallel iron bars are combined with an external iron framing of the form and size desired.

CLASS 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defences, Gun Carriages, &c.

1825. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Ships' armour plates, &c.*"—*A communication.*—*Dated* 19*th July*, 1861.

According to this invention it is proposed to employ a crane and peculiar gripping holders for the purpose of seizing the pile or faggot in the furnace, and of conveying the same to the rolls. As in large forgings it is necessary to heat the iron several times, and to turn it over or reverse it each heat (an operation which entails in the ordinary system a vast amount of manual labour), it is here proposed to employ a peculiar apparatus for reversing or turning over the pile or faggot. This apparatus consists of a species of horizontal hinged tipping frame, upon which the pile or faggot is laid, and which is then elevated at one end by means of a chain and suitable windlass until the frame assumes a vertical position, when, by slightly continuing the motion of the free end of the frame, the pile or faggot carried by it is turned over into a suitable bed plate or support. The pile or faggot, on being presented to the rolls, is carried by a pointer table provided with anti-friction rollers, upon which the pile or faggot travels up to and through the rolls. By jointing this table facility is afforded for adjusting it in any position horizontally upon the floor, so as to receive the pile or faggot at the most convenient place, and present it at any desired horizontal angle to the rolls. A similar table may be placed on both sides of the rolls, and the pile or faggot passed to and fro through them, for which purpose a reversing motion worked by a small steam cylinder is employed for reversing the rolls as required. In preparing a pile or faggot intended for an armour plate or other similar forging, a rectangular roller or hammered plate is used, upon which are piled a number of trapezoidal shaped bars, in two or more series, one above the roller, but so as to break joint. Upon these bars is laid a second rectangular plate, having a series of strong ribs rolled or formed thereon; or, in lieu of a plate, a series of ribbed bars may be laid side by side over the piled bars, and the faggot being now complete is heated and welded or rolled together, one of the rolls being grooved in order to preserve the grooved or channelled surface of the plate. This grooved face of the armour plate offers the advantages of increased strength and lightness over those made with plane or flat surfaces.

1871. C. ROBERTSON, *Edinburgh*, "*Lights for fire-arms.*"—*Dated* 25*th July*, 1861.

Under one modification of this invention, when applied to a single barrelled piece, a movable sight bar is placed on the top of the barrel itself. This sight bar consists of a bar or rib or strap of steel, or other suitable metal or materials, which, on the upper side, is a level plane, nearly corresponding in appearance with the centre bar or rib at present used in double barrelled rifles on which the sights are placed, with this exception, that there are no raised back sights, as these are, in the present invention, superseded by a movement of the right bar, to be afterwards explained. On the under side this sight bar is formed so as to fit and rest on the upper portions of the barrel; or it may be fixed upon a saddle piece of the same metal, or some other suitable metal or material, formed so as to fit and rest on the barrel. In length this sight bar is made to extend from the muzzle of the piece to the breech or beyond it. It is attached to the barrel at the muzzle, and by means of a hinge at the point of attachment it is capable of being raised up from the barrel, so that the elevation at the breech end, suitable for shooting at long distances, may be obtained by a vertical movement of the whole bar, or of the bar and saddle piece from the hinged point. This movement of the sight bar is effected by means of a screw actuated from the side of the slab or from beneath it.

1873. J. F. BOURNE, *George Town, British Guiana*, "*Batteries, floating or otherwise.*"—*Dated* 26*th July*, 1861.

The patentee claims, First, the use of three or more layers, strata, or thicknesses of plates, or plates and bars, in the construction of the defensive parts of the battery, in the manner described; also the mode of protecting the decks and crew by continuing the sides so built in an arch or vaulting over head. Secondly, the use of india-rubber, commonly so called, or other elastic gum, placed in thin sheets between the surfaces and edges of the plates and timber, or between the plates and timber or other material used in building an iron plate battery; also the use of asphalte, or asphalte mixed with lime and saw-dust, as a waterproof bed in which iron armour plates may be laid. Thirdly, the mode of securing armour plates to the defensive parts of batteries by means of bolts welded to any plates which may be required to be bolted on; and the mode of securing large plates, as described. Fourthly, the gun carriage or traversing platform as described, and the circular concave porthole with the ball pivot on the platform or gun to work therein. Fifthly, the mode of laying guns by means of guide rods with a sight hole in the face of the battery, distinct from the porthole, as described. Sixthly, the application of elastic breechings and other ropes in the working of guns, as described. Seventhly, the mode described of converting a wooden ship into an iron plated battery by the use of a series of diagonal plates or bars of iron between the timbers and the armour plates with india-rubber sheathing or caulking.

1887. G. STURROCK, *Woolwich*, "*Breech-loading fire-arms.*"—*Dated* 29*th July*, 1861.

This invention consists in the construction of breech-loading fire-arms, whereby the chamber which receives the charge is made to open out clear of the barrel by a lever which, when pressed upwards by the hand, raises a slotted wedge plate from between the face of the fore end or false breech and the back end of the chamber, and allows the chamber to slide backwards upon a longitudinal bolt hinge lying parallel with the axis of the gun. This motion clears the fore end of the chamber (which is cylindrical, and slightly coned) from the back end of the barrel (which is recessed and correspondingly coned), and thus admits of the chamber being folded out to receive the charge. The gun can be constructed so as to receive the ammunition at the fore end of the chamber, or to receive the cartridge (known as the Lefaulcheux) at its back end, in which latter case the chamber is hollow throughout, the back end being closed for firing by a plate of metal hinged upon the back end of the chamber. When the chamber is opened out clear of the barrel this plate is folded back to enable the Lefaulcheux cartridge to be introduced at the rear or back end of the chamber. One lever is used for the whole of the movements required in loading, and with the ordinary cartridge the gun may be loaded at the muzzle if desired.

1904. H. J. HOLLAND, *Bond-street, and* W. PAYTON, *Johnson-place, Harrow-road, London*, "*Breech-loading fire-arms.*"—*Dated* 31*st July*, 1861.

The patentees claim the application and use, in breech-loading fire-arms, of a slotted tube and collar screwed externally on the rear end of the barrel, having a plunger provided with a longitudinal rib or projection sliding thereon, in combination with a slot or recess formed in the screwed breech end of the barrel, as described. Also, making the front end of the plunger above referred to loose from the body of the plunger, so as to admit of the plunger being partially rotated, whilst the loose end thereof remains stationary inside the breech of the barrel, as described. Also, the application and use of a vertical cam or lever, situate between the pivot or working centre of the barrels and their breech ends, in combination with front and rear projections fitted to or forged upon the barrels, as described.

1938. C. BURN, *Delahay-street, Westminster*, "*Fastening iron armour-plates to ships' sides.*"—*Dated* 5*th August*, 1861.

These improvements consists in securing or fastening iron armour-plates at the horizontal joints in the following manner:—A bolt hole tapering inwards, that is, smaller at the inside of the plate than at the outside, is made to extend equally from the joint into each plate; an iron plug tapered in like manner is made to fit this bolt hole, and a bolt made of wire or wire rope, endless or otherwise, passes round the same, thence through the side of the ship, and is secured inside by a key or wedge, by which it may also be tightened. In order that the plug may fit the bolt hole, and bear evenly on the plates, a groove is made therein for the reception of the wire bolt or rope.—*Not proceeded with.*

1964. M. A. F. MENNONS, *Paris*, "*Breech-loading fire-arms.*"—*A communication.*—*Dated* 7*th August*, 1861.

The patentee claims the substitution, to the ordinary lock mechanism with external hammer in Lefaucheux and similar breech-loading fire-arms, of a percussion spring, enclosed in the stock settings, and so combined with the trigger as to ignite by an upward stroke the fulminating priming of the cartridge.

CLASS 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

1888. F. TOLHAUSEN, *Paris*, "*Comforters, neck-ties, &c.*"—*A communication.*—*Dated* 29*th July*, 1861.

These improved comforters are made up of a comparatively narrow band of silk, cloth, or other suitable material, which band surrounds the neck or throat, and its two ends, joining at the front part of the throat, widen out into two wide scarf-like flaps or shirts, with which the wearer covers his chest by either crossing the said flaps or laying them parallel (more or less overflapping) on his bosom. At the point where the narrow throat-band merges into the wide flaps the comforter is united by means of a stud or a button, or a breast-pin, or a clasp, or any other suitable locking device. The visible or outer side of this comforter is ornamented in any suitable style or pattern, such as trimmings of artificial or real fur set along the edges.—*Not proceeded with.*

CLASS 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting Glass, Pottery, Cements, Paint, Paper, Manures, &c.

1819. R. LAING *and* G. H. COSSINS, *Ince, near Wigan*, "*Obtaining nitrous acid gas for making sulphuric acid.*"—*Dated* 19*th July*, 1861.

In carrying out this invention the patentees First use arsenious acid, or arsenic acid, to decompose nitrate of soda or nitrate of potash. If nitrate of soda be decomposed they prefer to use the proportions of seven parts nitrate of soda to five parts of arsenious acid, or six parts of arsenic acid. If nitrate of potash be decomposed they prefer to use the proportions of seven parts nitrate of potash to four parts of arsenious acid. In performing the above decompositions they prefer to use a muffle or retort, so placed as to be heated by the furnaces or kilns in which the pyrites are burnt, and to allow the gas to issue from the retort through a small tube bent in the direction of the draught. The object in using a close vessel and a tube is to prevent any sulphurous acid gas from coming in contact with the mixture, as in that case sulphate of soda would be found, which would vitiate the result. Secondly, they use chrome iron ore to decompose nitrate of soda or nitrate of potash. In performing this decomposition the proportions must be regulated by the percentage of chronium contained in the ore employed. For the purpose of effecting this decomposition they prefer to use a small reverberatory furnace separate from the pyrites kilns.

1822. M. HENRY, *Fleet-street, London*, "*Improvements in the production of paper pulp, and in bleaching paper pulp and certain fabrics, also in apparatus for cutting wood.*"—*A communication.*—*Dated* 19*th July*, 1861.

The principal object of this invention is the manufacture of paper pulp, the pulp being obtained from wood divided, cut, torn, crushed, or brought by suitable means into a state of splinter chip, shaving, thread strip, sliver, or shred, or of sawdust or powder, or similar reduced condition. The processes are also applicable to the treatment of pulp from barks and portions of trees, shrubs, and plants. The invention also relates to improved modes of bleaching.

1836. C. N. KOTTULA, *Holborn, London*, "*Compositions to be used in the manufacture of soap.*"—*Dated* 22*nd July*, 1861.

This invention consists in forming new compositions by mixing alum with caustic soda, or with soda ash. When the caustic soda composition is dissolved in water, and the soda ash composition in water, to which lime has been added in the usual manner in making ley, purified leys are produced superior to any hitherto obtained for the manufacture of soap.

1856. W. E. GEDGE, *Wellington-street, Strand, London*, "*Preparation and clarification of the saccharine matters obtained from beet root, sugar cane, Indian millet, &c.*"—*A communication.*—*Dated* 24*th July*, 1861.

This invention consists in the extraction of sugar without the use of bone black or animal charcoal, and the process is based upon the use of two products, the one alumina in jelly or viscous state, the other subacetate of lead. The first from its affinity for the colouring matter, the second to precipitate the gummy matters.—*Not proceeded with.*

1858. A. WOOD, *Lewes*, "*Apparatus employed for fermenting purposes in brewing beer, &c.*"—*Dated* 24*th July*, 1861.

The patentee claims, First, the construction of fermenting tuns, in which covers are employed having attemperating metal vessels, with either plain or corrugated surfaces, not in contact with the fermenting liquor, but which serve to attemperate the yeast, barn, or fob after it has left the fermenting liquor, in combination with other attemperating metal vessels, with either plain or corrugated surfaces, and provided or not with partitions, which vessels are fixed upon the bottom of fermenting tuns, and through which cold or warm water is made to flow, substantially as described. Secondly, the attemperation of the yeast, fob, or barn, after it has left the fermenting liquor, by means of hollow metal covers, either fixed or floating, constructed substantially as described, through which cold water is made to flow, and which covers do not act upon the fermenting liquor in the tun. Thirdly, the employment of fermenting tuns, constructed as described, for the purpose of storing fermenting liquors after the process of fermentation has been completed.

1869. E. HAEFFELY, *Kearsley, Lancashire*, "*Extracting copper from its ores.*"—*Dated* 25*th July*, 1861.

These improvements relate, First, to the extraction of copper from its ores by an inexpensive menstruum, and this part of the invention is applicable chiefly to those ores which have been used in the manufacture of sulphuric acid, such ores containing comparatively but a small quantity of the metal. For this purpose the patentee uses the refuse liquid discharged from chlorine generators. Secondly, the improvements relate to the precipitation or separation of copper from its solution, for which purpose he uses the refuse known in alkali works as "vat waste," which material, being at present of no commercial value, affords the means of effecting a great saving in the required operation.

1892. C. C. J. GUFFROY, *Lille, France*, "*Preparing medicinal substances and compounds from the livers of cod and other salt water fish.*"—*Dated* 29*th July*, 1861.

This invention refers to a previous patent dated 20th July, 1860 (No. 1764), and consists in a method of preparing new medicinal substances and compounds from the watery liquids obtained in or remaining after the extraction of oil from the liver of cod and other salt water fish.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

BIRMINGHAM 'CHANGE YESTERDAY: *Gloomy Meeting: Reports from Ironmasters: Low Rates: Two Works Closed*—EFFORTS IN AMERICA TO INCREASE THE TARIFF: *Counter Efforts: Imports of Hardwares into New York*—PIG IRON TRADE: *No Sales*—COAL TRADE: *Very Low Rates in North Wales*—GENERAL HARDWARE TRADES: *Slight Improvement: Branches Specified: The French Demand*—THE NAIL-MAKERS' STRIKE—COVENTRY SILK TRADE—EAST INDIA SILK EQUAL TO ITALIAN: *Experiments at Coventry*—SCHOOLS OF ART: *Kidderminster, Wolverhampton, and Dudley*—RAILWAY COLLISION ON THE WEST MIDLAND.

YESTERDAY (Thursday) in Birmingham a most gloomy feeling pervaded the iron trade. The orders of the week, as compared with the previous period, were said to have fallen off, and thoughtful men expressed their conviction that business will be worse before it is better. The tone was not improved by the expectation openly expressed by some that by this time the "financial crash" in the Federal States of America has commenced. The extent to which in that event firms in this country may be affected was sufficiently doubtful to occasion somewhat uncomfortable feelings of foreboding, and to prevent any manifestation of increased confidence. At the same time there were masters who, in reference to that contemplated crisis, said "The sooner the better." By this expression they intended to convey their conviction that only a cessation of hostilities in America would produce any improvement in the demand for iron. There have been some inquiries on the market during the week, but purchasers desire that the orders should be taken at so low rates that makers who ask a paying profit do not expect to receive the specifications. The rates that are being now accepted for finished iron are reported to be even lower than they were last week, particularly in the article of sheets. Their unproductive character has resulted in the voluntary closing of two works since our last. In consequence of that closing one maker was to-day quoting his sheets at half-a-crown advance. A considerable improvement in the demand for galvanised sheets is expected at an early date, certain large orders having been referred to as about to be placed upon the market for delivery during the summer months.

The accounts received in this district from New York are not cheering. It is said that a certain trading party are urging upon the Committee of Ways and Means the propriety of increasing the duties on iron, copper, and lead, contending that these are legitimate articles of taxation, and ought to yield a larger revenue than they do. Against this attempt a strong foreign influence is being brought to bear. Indeed, not only is the "foreign influence" opposing these applications, but it is seeking to convince the Ways and Means Committee that by the duties on iron and hardwares being reduced a large addition would accrue to the revenue of the Federal Government. The "foreign influence" referred to here is supposed to be agents representing Birmingham and South Staffordshire and Sheffield firms. Their influence, however, will be but little in comparison with that of those whom they oppose, who are delegates from New England and Pennsylvania, and have votes to give. Further, the chairman of the committee is known to have decided protectionist views, which are shared by a majority of the committee.

The following extract from the New York Custom House Tables for the year 1861, made up to January 18th this year, will show the variation in the quantity of goods imported into New York from this and similar districts in the four years specified:—

	1858. Dols.	1859. Dols.	1860. Dols.	1861. Dols.
Buttons	413,368	464,549	285,831	85,557
Coal	738,696	533,643	619,788	964,527
Earthenware	798,830	1,355,801	1,402,229	587,574
Plate Glass	422,923	592,111	814,003	401,724
Copper	597,497	968,496	909,832	903,966
Iron Bars	1,524,237	3,122,572	3,093,277	1,054,718
" Pig	356,807	607,180	612,752	378,058
" Railroad	370,092	1,642,015	699,535	399,536
" Sheet	293,003	500,688	[illegible]	127,631
Lead	1,492,123	1,551,996	2,012,044	534,584
Spelter	509,149	357,867	359,628	30,079
Steel	1,033,905	1,798,932	1,959,785	1,125,014
Tin and Tin-plates	3,667,099	4,899,905	5,005,743	2,334,766
Zinc	451,507	391,655	435,023	64,403
Watches	1,676,019	[illegible]	2,264,625	576,961

Pig iron remains without movement. Large quantities are still being delivered at the rates of last quarter, and, instead of having to yield to the demands now being made by certain makers, there are buyers who look to make purchases in a short time at under rather than over those figures.

Coal is vended on every hand, and is offered at prices that might seem to be most tempting, but which lead to no transactions. The competition of other districts is felt with much severity. Our readers who are not extensive purchasers will be surprised to learn that large coal is being loaded into the railway trucks at certain collieries in North Wales at two shillings and twopence a ton! Such prices of course refer to sales of considerable magnitude; but

they are so greatly under the lowest figure at which sales are being effected in South Staffordshire that they seriously injure the trade here.

In the general hardware trades there is a slight improvement at Birmingham, but the improvement is scarcely so perceptible at the large works in Wolverhampton. At the same time Wolverhampton has been better off during the depression than a considerable portion of Birmingham. The smaller makers in and about Wolverhampton participate in the improvement that had begun to manifest itself last week. In certain branches of the lock trade, for instance, where only three and a half and four days were worked, there are now five days' employment, and the stock of certain locks on hand is being gradually reduced. There are a few orders on hand for the Federal States of America; but for France large quantities of goods continue to be sent away. We know of one house in Birmingham who, since October last, have sent to one concern in that country general hardware goods, all of a serviceable description, of the value of upwards of £14,000. That same French house is opening up other markets for our wares, for they are sending out travellers throughout Southern and Northern Italy, all carrying Birmingham and Sheffield goods. The East Indian trade has not recovered since it fell off on the arrival in that dependency of the fears that were entertained here of a war with America. In tubes for marine and other engines there is a grand trade being done for both home and foreign markets. Edge-tool makers are better off. Incompleted Government orders continue to supply a little work to hollow-ware houses. Brass-casters are doing very little. The gun trade continues active in all, but the birding branch. The jewellers are seriously overstocked, and are affording very little employment to their work-people. In all departments we hear complaints of the natural result of the competition for orders in this slack period, viz., that prices are scarcely paying, and in some cases ruinously low.

Some of the nail-makers on strike are finding work at 20s. a week, the rate they were receiving before they were served with a notice of a reduction to the extent of 2s. a week.

The collapse of the silk trade is occasioning the severest distress in Coventry, where the jocular vein in which the Premier referred to that distress two or three nights ago, in the Lower House, is felt in a way that may be easily conceived.

The Chamber of Commerce of Coventry report that samples of silk produced in the Umritsur district in India, and forwarded to that city by the Board of Trade, have been "thrown" by the vice-president of the chamber, and afterwards tried by other manufacturers, and it proves to be equal in quality to Italian silk, and of fair average value. The report has been forwarded to the Board of Trade.

The Kidderminster School of Art is to be revived; and Mr. Mückley, the master of the Wolverhampton School, has been selected, by a committee from Manchester, to be the master of the school in that city, in consequence of the drawings of his pupils in Wolverhampton excelling those of the pupils of any other candidates visited. Notwithstanding the efficiency which the pupils in the Wolverhampton School are making, it seems almost absurd to expect that the Wolverhampton School will be long continued, so utter is the indifference manifested in its condition by the manufacturers of that town. The Dudley School held its annual meeting on Tuesday night. It is quite remarkable that, whilst in Wolverhampton and Kidderminster, the manufacturers of which towns depend so much upon the cultivation of the arts in connection with them, such schools should languish, whilst in Dudley—known as the centre of the nail with the heavy chain and anvil trades—they should be thriving. At the Dudley School there are seventy morning and evening students, and the number of young people instructed through the agency of the school is 1,132. Ten medals have been taken by the school during the year. These medals entitle the establishment to £10 worth of new examples. Still, at Dudley, the funds are not in a flourishing condition.

A collision happened between ten and eleven o'clock on Monday night on the West Midland Railway, near the Netherton station. The express train ran into the tail of a goods train. Two of the goods wagons and the guard's brake-van were thrown off the line, and the engine of the passenger train was slightly damaged. Three women have been so far injured as to necessitate surgical aid. The line was cleared by about one o'clock the next morning.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

Northern Matters: *Steam Shipbuilding at Stockton: Proposed Permanent Relief Fund for the Northumberland and Durham Miners: The Cleveland Iron Trade and the Stockton and Darlington Railway: River Tyne Commission*—Border Counties Union Railway: *Progress of the Works*—Mersey Docks and Harbour Board: *Continued Schemes of Extension*—State of Trade at Sheffield: *Some Amelioration*—London and North-Western Railway: *Last Half-Year's Train Service: Railway Prospects*—Trials with a New Steamer, the Reiver—The Derbyshire Iron Trade: *Proposed New Works by Messrs. Brassey*—Cotton Spinning Machinery for India: *The Import Duties Question*—Scottish Shipbuilding—The Scotch Pig Iron Trade.

We commence with the north. Messrs. Richardson and Duch launched, last week, at Stockton an iron screw steamer named the Elena, 760 tons burthen, dead weight. Her length over all is 187ft.; her extreme breadth 27ft. 2in.; and her depth of hold 15ft. 6in. The engines, by Richardson of Hartlepool, are direct-acting inverted; and they are 80 horse-power nominal, 300 effective. The Elena's vacant place in the yard has been taken up by a steamer of larger size; Messrs. Richardson and Duch, who have hitherto had establishments both at Middlesbro' and Stockton, are concentrating both at the latter place. Messrs. Pearce and Co., also of Stockton, have enlarged their previously extensive premises, and are now engaged with five iron vessels, besides having orders on hand for others of large tonnage—it is said 2,000 tons each. The miners of Northumberland and Durham held a meeting on Saturday for the purpose of devising measures for establishing a permanent relief fund. A committee was appointed to prepare and submit to the coalowners an outline of the scheme proposed for approval, and it was resolved to suggest to the Hartley Relief Committee to appropriate any surplds which may remain after requiremen s of that fund have been met towards the nucleus of the permanent fund. Such a resolution the committee have already virtually adopted. Some interesting information was communicated to the shareholders in the Stockton and Darlington Railway at the half-yearly meeting just held. The chairman stated that the locomotives were in such a state of efficiency as to enable the company to work the Eden Valley line, which was to be opened for goods traffic in March, and for passengers in April, without any addition to the rolling stock of the company. They expected that the whole line to Bishop Auckland would be opened this year. Another paragraph in the report referred to increased facilities in the neighbourhood of Tow Law, where the increase in the mineral traffic had been so great, and the representations of the people were so strong in favour of locomotive communication, that the bill had been introduced to obtain that communication. The directors could not avoid referring to the depressed state of trade on the east part of their railway; but he could point with pleasure to the westward. There has been a marked depression in the iron trade, which was the staple of the district; yet the directors had not been disposed to feel any permanent discouragement. If they referred to the state of the iron trade in Scotland they would find the stock of pig iron, at the close of 1860, was 930,000 tons; in 1861, it was 460,000; and the returns made in 1862 566,000 tons. In Cleveland, at the commencement of 1861, the stock of iron was 70,000 tons; but instead of an increase at the close of the last and the commencement of the present year the stock had decreased to 52,253 tons, so that while the stock n the Scotch district was going on augmenting, the stock of iron in this district had considerably decreased. Upon this topic he might state that people should be careful how they read in the newspapers the number of furnaces in blast in that district. Within the last five. if not four, or fewer years, a party having three furnaces at work at a time, and who might have two now only in blast, produced as much as he formerly did in three furnaces, so when they read in the papers they must take into account that the make had not decreased in proportion to the furnaces out of blast. The make might be said to have increased nearly one-third during the last five years, and every furnace burning produced alone 50,000 tons per annum for them to carry. The state of things in America must affect the Scotch trade more than the Cleveland. The company received during the last half-year only about £4,000 from the Consett Ironworks Company, while in 1858 they received from the same source £33,000. As regards the future of the works the chairman added that he could give no definite information. The River Tyne Commissioners held their monthly meeting yesterday week. The Piers Committee reported that the prevalence of bad weather in January had greatly interfered with the progress of the piers. A report by Mr. Walker was ordered to stand over. Mr. Mease protested against the delay in the construction of the Tyne Piers, which he said was injurious to the public interests, and also to the interests of the commissioners. Mr. Messent observed that the north pier was expected to be completed in August, and that the south pier would be finished about the end of the working season in October. Great progress is being made with the important new line of railway in the north, known under the name of the Border Union. The late open weather has greatly aided the contractors in bringing their labours to a close. It was at one time feared by those who regarded the communication with Hexham, Newcastle, and the Plashetts coal districts as the most important feature in the extended railway system, that the Border Counties extension would not be completed as soon as the trunk line, but, instead of that, this branch will be ready before the Border Union is opened all the way to Hawick. On New Year's Day it was opened for passenger traffic to Keilder Castle, five miles from the junction at Riccarton, and on Saturday a locomotive went along the line all the way to the junction. The section between Keilder and Riccarton, however, is not yet ready for the visit of the Government Inspector, but, weather permitting, is expected to be completed in five or six weeks. The Liddesdale Railway, as the combined Border Union and Border Counties systems are familiarly termed, has been a gigantic undertaking; but the construction has been in such able hands that even the difficulties which were not foreseen have been successfully surmounted.

At the last meeting of the Mersey Docks and Harbour Board a discussion took place upon certain improvements at the Woodside landing-stage recommended by the engineer, which he estimated would cost £42,047. After discussion the board divided, when it was decided by 14 to 7 to proceed with the £1,000,000 scheme. It will be quite another thing to raise the money, unless the affairs of America undergo a speedy material change.

An improvement is at last noticeable in Sheffield trade, although there is still abundant room for a further amelioration of the commercial prospects of the district. The large iron houses are well employed in the manufacture of railway springs and other articles required in the construction of railway wagons, the demand for these goods being considerable both on home and foreign account. Most of the principal steel houses have good orders on hand for the continental and country markets; and the re-opening of navigation on the Elbe has caused the receipt of fair orders from Germany for steel, edge-tools, &c. The engineers and machinists' tool trade continues brisk, some houses being even reported to be "very busy."

We have some interesting details at hand with reference to the Reiver, a new paddle steamer built by Messrs. John Laird, Sons, and Co., for Messrs. Jardine, Mathison, and Co., and intended to trade in Chinese waters. The hull and machinery were designed and constructed by Messrs. John Laird, Sons, and Co., and are built for hard seagoing work. The following are the principal dimensions:—Vessel: Length between perpendiculars, 302ft.; extreme length, 315ft. 9in.; width between paddles, 31ft.; extreme width, 60ft.; depth in hold, 17ft. 8in.; builders' measurement, 1,448$\frac{6}{84}$ tons; gross register, 1,189$\frac{33}{100}$ tons. Machinery: Diagonal engines, 412-horse power; diameter of cylinder, 74in.; length of stroke, 6ft. 6in.; diameter of wheel (feathering) to outside of float, 29ft.; diameter to axis of float, 25ft.; number of floats on each wheel, 12. The boilers are fitted with apparatus for superheating the steam and heating the feed water. The cylinders have steam jackets, and they and the exposed parts of the boilers are lagged. There is a complete arrangement of surface condensers, in addition to the ordinary jet condenser, either of which can be worked at pleasure. In December several trials were made with about 100 tons weight on board, or in what may be considered light trim, and a speed of more than 16 knots was obtained, the engines making 24 revolutions per minute. It was found that the same result was obtained with the surface condenser as with the ordinary jet condenser. During last month a series of trials were made to test the consumption of coal at various rates of speed, the vessel being loaded with about 450 tons dead weight. The following results were obtained with the ordinary condensers:—A speed of 12 knots with 28 tons 12 cwt. per day, or 2½ lb. per indicated horse-power per hour; 14 knots, with 51 tons per day, or 2½ lb. per hour; 15 knots, with 70 tons 6 cwt. per day, 3 lb. per hour; and with the surface condenser a speed of 15 knots, with 66 tons, 8 cwt per day, or 2$\frac{8}{10}$ lb. per indicated horse power per hour. The coal used was Powell's Duffryn steam coal, which was taken direct from the bunkers, and not picked. The weather, during all the trials, was unfavourable.

Messrs. Brassey and Co. have purchased a piece of land at Tapton, Derbyshire, for the purpose of establishing large ironworks. They contemplate the construction of a temporary line from the works to the main system of the Midland Railway, so as to secure a ready exit for their products. The home demand for Derbyshire iron is stated to have improved of late, although a good deal of depression prevails with regard to the foreign trade.

The manufacture of railway springs is on the increase, and the inquiry for plates for shipbuilding has nearly doubled in extent.

At a meeting held at Stockport on Monday afternoon, at which a memorial to Lord Palmerston and the Indian minister was adopted, urging the necessity of obtaining an abolition of the duties levied on manufactured yarns and goods imported into India, the Mayor, (Mr. R. McClure) who presided, said a great quantity of machinery was being sent out from this country to Bombay and Calcutta. An agent in Manchester, a short time ago, was engaged to buy boilers, engines, looms, and other machinery, to the extent of 60,000 spindles, and 400 or 500 looms, and how was it possible the manufacturers of this country could compete with the Indian manufacturers, who had cotton at their own doors, coals almost as cheap as we had, and were free from vexatious import duties

The launch took place, a few days ago, on the Leven, of the Rona, an iron paddle steamer, destined to trade on the river Yangtze, opened up for British commerce in accordance with the late treaty with China. The Rona is the property of Messrs. Jardine, Mathison, and Co., of London and Hong Kong, and is now alongside her builders' stone pier, where she will get her machinery put on board by Messrs. Denny and Co. She will be despatched to her future destination in four weeks. The Rona is built on a peculiar model, so as to carry a large cargo with a slight draught. She is 1,217 tons O.M., and her dimensions are—230ft. in length; depth, moulded, to main deck, 14ft., to spar deck 21ft. 6in.; and her breadth of beam, moulded, is 35ft. Her engines will be of 300-horse power nominal, on the diagonal principle. Her builders have on the stocks, in an advanced state of forwardness, a large screw steamer of 100 tons O.M., whose engines will be of 150-horse power nominal. She is to be fitted up as a first-class steamer for cargo and passenger traffic. The firm are building her on their own account, but it is probable that China may be her destination also. Messrs. Denny and Brothers lately purchased the extensive shipbuilding premises which have been for a considerable time shut up, on the north side of the Leven, which they will open shortly. Messrs. Napier and Co. are building for the Woolwich Steam Packet Company a steamer 170ft. long, and 18ft. 6in. beam, intended to run next summer between London and Ipswich. The steamer, which will be named the Queen of the Clyde, will be an ironship, and will be engined also by Messrs. Napier.

Messrs. Shaw, Thomson, and Moore report with reference to the Scotch pig iron trade:—"The only feature of interest in our market continues to be the negociations still pending amongst the makers about blowing out a number of their furnaces. At their meeting last Wednesday there were representatives of 96 furnaces present, and they expressed their willingness to extinguish an eighth of that number, but, owing to the absence of one of the principal makers, it was resolved to postpone any resolution for another week, until he was communicated with. It appears probable that these arrangements will ultimately result in blowing out about a dozen furnaces, as indicated in our circular of 31st January. The speculative demand is unusually dull, but we expect to see it considerably increased if there is a reduction made in the make. Founders are not so busy in this district as they were."

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£	s.	d.	Dis. p. ct.
IRON, English Bar and Bolt:—					
in London	pr tn	5	15	0	3
in Wales	,,	5	0	0	,,
in Liverpool	,,	5	10	0	,,
Deliv. into boats at wrks / Nom. rates last qr. day for favourite brands: Staffordshire Bars	,,	7	0	0	1½
Sheet, Sngl.	,,	8	10	0	,,
Dbl.	,,	10	0	0	,,
Hoop	,,	8	0	0	,,
Rod, round	,,	7	0	0	,,
Nail Rod, sq	,,	7	5	0	,,
SHIPPING IRON, Delivered in Liverpool 10s. per ton less. Staffordsh. Bars	,,	7	0	0	2
Sheet, Single	,,	8	15	0	,,
Double	,,	10	5	0	,,
Hoop	,,	8	5	0	,,
Rod, Round	,,	7	0	6	,,
Nail Rod, Square	,,	7	5	0	,,
IRON, Rails, in Wales, cash	,,	5	7	6	nett
,, ,, 6 months	,,	5	10	0	,,
Old, to cut up	,,	0	0	0	,,
Railway Chairs, in Wales	,,	4	0	0	,,
,, in Clyde	,,	3	15	0	,,
Pig No. 1, in Clyde	,,	2	8	6	,,
3-5ths No. 1 & 2-5ths No. 3.		2	8	9	,,
No. 1, in Wales	,,	3	8	9	,,
No. 1, in Tyne and Tees	,,	2	12	0	,,
Ditto, Forge	,,		9	0	,,
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	,,	3	10	0	,,
Welsh Forge Pig (all Mine), at the Port	,,	3	5	0	,,
Acadian Pig, Charcoal	,,	7	10	0	,,
Scotch Pig, No. 1, in London	,,	3	0	0	,,

		£	s.	d.	Dis. p. ct.
IRON, Swedish, Indian assortments	pr tn	11	5	0	2
Russian C C N D to arrive	,,	16	0	0	,,
STEEL, Swedish Keg, ham.	,,	15	10	0	2½
Ditto, rolled	,,	15	0	0	,,
Fagot		17	0	0	,,
SPELTER, on the spot	,,	18	13	0	nett
To arrive	,,	18	5	0	,,
Hard, remelted	,,	17	0	0	,,
ZINC, in sheets	,,	23	0	0	,,
COPPER, Tile, 14 to 28 lb.	,,	102	10	0	2
Tough Cake	,,	102	10	0	
Sheathing and Bolts	pr lb.	0	0	11½	,,
Sheet	,,	0	0	11	,,
Bottoms	,,	0	1	0	,,
Old	,,	0	0	9½	,,
Yellow Metal	,,	0	0	9½	,,
Burra	,,	100	0	0	,,
Russian do.		101	0	0	,,
LEAD, British Pig	,,	20	15	0	,,
Spanish	,,	19	10	0	,,
W. B.	,,	21		0	,,
Sheet	,,	21	15	0	,,
TIN, English Block, nom.	,,	120	0	0	,,
Bar ,,	,,	121	0	0	,,
Refined ,,	,,	122	0	0	,,
Foreign Banca	,,	123	0	0	,,
Straits	,,	117	0	0	,,
TIN PLATES, Charcoal, IC	pr bx	1	9	0	,,
Ditto IX	,,	1	15	0	,,
Coke, IC	,,	1	3	0	,,
Ditto IX	,,	1	9		,,
Do. at Newport, 1s. pr bx less			—		,,
Do. at L'pool, 6d. ,,			—		
CANADA, Plates	pr tn	12	0	0	2
QUICKSILVER	pr bt		0		

Rails.—The market continues firm at quotations, although but few sale are reported to have taken place this week.

Scotch Pig Iron has been dull throughout the past week, and prices are unchanged, viz., 48s. 9d. buyers cash, and 50s. three months open, at which the market closes somewhat flat for Mixed Nos. Warrants in Glasgow.

Spelter.—But little business done. The nearest price is now £18 on the spot.

Copper dull of sale.

Lead remains in good request.

Tin.—English in fair demand, but Foreign shows signs of weakness, and prices have a downward tendency. Banca may be had for £123, and Straits at £117 per ton.

Tin-plates are improving.

February 20th, 1861. Moate and Co., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £	s.	£	s.	1862. £	s.	£	s.
Teak	15	10	17	0	15	0	16	0
Quebec, red pine	3	10	4	10	3	5	4	0
yellow pine	3	0	4	0	3	0	3	15
St. John, N.B., yel.	5	0	5	10	5	0	5	10
Quebec, oak, white	5	0	5	10	5	0	5	10
birch	3	10	4	0	4	0	0	0
Memel	0	0	0	0	0	0	0	0
elm	3	10	4	15	3	10	4	15
Dantzic, oak	3	10	6	0	3	10	6	0
fir	2	15	3	10	3	0	4	0
Memel, fir	3	10	4	0	3	10	4	0
Riga	3	5	3	10	3	10	3	15
Swedish	2	10	2	15	2	15	3	0
Masts, Queb. rd pine	5	0	6	0	5	0	6	0
yl. pine	5	0	6	0	5	0	6	0
rd pine	0	0	0	0	0	0	0	0
Lathwood, Dantz, fm	6	0	6	10	6	0	7	0
St. Peters.	8	0	8	10	9	0	9	10
Deals, per C., 12 ft. by 3 by 9 in.								
Quebec, wht. spruce	13	0	18	0	15	0	19	0
St. John, wht. spruce	13	0	16	0	15	0	17	10

Per load—	1861. £	s.	£	s.	1862. £	s.	£	s.
Yel. pine, per reduced C.								
Canada, 1st quality	17	0	18	10	17	10	19	0
2nd do	12	0	12	10	12	0	13	0
Archangel, yellow.	13	0	14	0	14	0	15	0
St. Petersbg. yel.	12	0	12	10	12	10	13	10
Finland	9	0	10	0	9	10	10	10
Memel	10	0	15	0	10	0	15	0
Gothenburg, yel.	10	0	11	10	10	0	12	10
white	9	10	10	0	9	10	11	
Gefle, yellow	10	0	11	0	11	0	12	10
Soderhamn	10	0	10	10	11	0	12	10
Christiania, per C 12 ft. by 3 by 9 in. yellow	22	0	25	0	22	0	24	0
Deck plank, Dntz per 40 ft. 3 in.	0	4	1	4	0	14	1	4
Staves, per standard M								
Quebec, pipe	60	0	70	0	50	0	55	0
puncheon	16	0	18	0	16	0	18	0
Baltic, crown pipe	160	0	170	0	170	0	180	

SCOTCH PIG IRON REPORT.

			s.	d.		
No. 1	Gartsherrie	.. ..	55	6	f.o.b	Glasgow.
,, 1	G.M.B.	.. ..	48	9	,,	do.
,, 3	Do.	.. ..	47	9	,,	do.
M. Nos.	Do.	.. ..	43	3	,,	do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths ,, 3 .. G.M.B.	Cash prompt	48	9	per ton.
	1 mo. open	49	1½	do.
	2 mos. ,,	49	4½	do.
	3 ,, ,,	49	7½	do.

MANUFACTURED IRON.

	£	s.	d.	
Bars, Govan	7	0	0	
,, Common	6	17	6	
Drumpellar, Common	6	17	6	
Do. Best	7	17	6	
Plates and Sheets	9	0	0	to £10.
Rails	7	5	0	
Pipes	5	0	0	
Chairs	4	0	0	

Glasgow, 19th February, 1862.

There has been no life in our market during the past week, and speculation has been almost at a stand still. After negociating for a month, the ironmasters have to-day resolved upon no combined blowing out of any of their furnaces. The consequence has been a rather dull market, and a fall of 3d. in the price. Exports last week were 7,961 tons, against 8,2?1 tons in same week last year. Shaw, Thomson, and Moore, Metal Brokers.

New Sugar Refinery.—An extensive sugar refinery is in course of erection near the Victoria Docks.

Gas Works at Chertsey.—The Chertsey Gas Consumers Company offer £10 (!) for the best plans and specifications submitted to them for works to make and distribute 2,000,000 cubic feet of gas per annum. Plans to be in by next Friday.

Road Locomotives.—Mr. Thomas Rickett, of Castle Foundry, Buckingham, is sending road locomotives to Spain. The stipulated work is a load of 28 tons up a slope of 1 in 12, up which the engine works with ease.

Iron Paving.—We understand that the iron cellular paving, as made by Messrs. Ransomes and Sims, of Ipswich, and put down three years ago, in King-street, Westminster, where it is still in good condition, is about to be put down also in the Poultry.

Friction of Railway Carriages.—A railway axle-box in which friction rollers are applied around the journal, is being fitted to some of the carriages and wagons of the Eastern Counties Railway. One of the passenger carriages, weighing, empty, seven tons, was found to move, on a level, with a resistance of 87 lb., or nearly 11 lb. per ton, and, with the rollers, with a resistance of 47 lb., or less than 7 lb. per ton. The friction, empty, is generally more *per ton* than when the carriages are loaded. In some experiments making on the Stockton and Darlington Railway Mr. Dixon has found that the friction of the passenger carriages is greater *per ton* than that of the wagons.

THE ARMSTRONG GUN.

IN October last, Captain E. P. Halsted addressed a letter to the *Times*, specifying a number of very grave faults of the Armstrong gun. Captain Halsted alleged that a number of "breech pieces" (called "vent pieces" at Woolwich) had been blown out of some of the guns, that others had shown defects in the chase, that the rifle grooves became rapidly clogged in firing, that the breech pieces were not gas-tight, and that at least one gunner had been blown over and injured in consequence, that the gun could not be loaded at the muzzle, that it could not be double-shotted, and that it could not be safely fired with under charges of powder. It required no great knowledge of guns and gunnery to perceive that these faults, did they really exist, must sooner or later prove fatal to the success of the Armstrong gun. The question was, did they exist? Captain Halsted was an experienced officer, had taken part in a great number of the trials with the Armstrong gun, and had, we risk little in saying, an untarnished reputation for truthfulness. Six weeks, however, after the appearance of his criticism, Sir William Armstrong sent a letter of great length to the *Times*, in which nearly all that Captain Halsted had written was contradicted. The latter gentleman, it appears, sent a reply to Sir William to the *Times*, about three weeks afterwards, but this reply the editor declined to print. Captain Halsted has, therefore, published his reply in a pamphlet, just issued, and in which he adheres to all his previous charges against the Armstrong gun, and brings foward fresh instances of its failure. The public may hesitate to decide between Sir William and his opponent, preferring, perhaps, to await the results of a still longer probation of the gun, whenever the War Office may allow those results to go forth complete to the world. It will be a pity, however, if a select committee be not appointed during the present Session, to lay open the whole history of the adoption and performance of this weapon in the united service. Captain Halsted's pamphlet, even were there no other foundation for an investigation, contains abundant *data* to enable an independent member to frame a motion covering a broad field of inquiry.

We have, more than once, given our own opinion of the Armstrong gun, which we, as engineers, consider to be defective in principle and faulty and needlessly complicated in construction. We have reason to believe, too, that our opinions are shared by a large number of mechanical engineers who have given their attention to the subject. Whatever their opinions or our own may be worth, based as they are on *à priori* reasoning upon the gun as a mechanical contrivance, we allude to them now only to say that Captain Halsted's statements agree almost exactly with what we should have (and indeed have) predicted concerning the actual performance of the Armstrong gun.

Captain Halsted is not always concise in his "reply," and it is possible that it was on this account that the editor of the *Times* declined to print it. Were his statements more closely connected than they are, and did he indulge less in the habit of stating his propositions hypothetically, leaving his readers to infer his meaning, we should have transcribed his pamphlet entire into our own columns. As it is, we shall confine ourselves, carefully, to the facts, given by him as such, omitting everything in which he attacks the Armstrong gun by implication merely.

He first observes, what we have no doubt is a fact,

"That not only are there no facilities given, but great official difficulties to be encountered, sometimes to the extent of ungracious refusal, where an officer not on 'full pay' seeks opportunity of practically informing himself on those great changes now so rife in every branch of the military services, and in which, therefore, he may be called on to take part. Nevertheless, this species of jealous blockade against the acquirement of knowledge by the unprivileged, which has been so long felt by many to be equally unjust and unwise, is sure to be effectually broken by all who, under a far higher sense of public duty, are impelled to do so."

With regard to the blowing out of vent pieces (breech pieces), Sir William having said that

"The two 12-pounder vent pieces are those reported to have been blown away in China. This number has been doubled in the magination of Captain Halsted."

The latter says:—

"My informant was one who, whether from the Crimea, India, or America, has never been known to inform amiss; neither, as I believe, will he eventually be found to have done so now."

With regard to the "flaws" in the heavy guns on board the "Stork," and which, as affecting their strength, Sir William had denied, Captain Halsted says of one:—

"The 'flaw' of the third, when seen by me, was $\frac{5}{8}$in. deep, and 1$\frac{1}{2}$in. long, and had been gradually increasing since first seen; and so far had these guns been from undergoing any severe representation of real fight, that in no case had thirty rounds been fired before defect appeared; the lower 12 lb. charges with shell had alone been used, and up to the 21st of August last the full charge of 14 lb., with the solid service-shot of 110 lb., had never been fired out of any of them."

Sir William having said that:—

"But there is yet a very important remark to make on these guns. The fact is, that the particular 100-pounders referred to by Captain Halsted are part of a batch of guns not made purely on my principle. I was compelled for a time to make the inner tubes contrary to my principle, from a solid forging instead of from coiled iron, and the result has proved the inferiority of the plan."

The Captain replies:—

"The only 'result' as yet obtained 'of service' from any 100-pounder whatever is that furnished by the Stork, which is thus acknowledged to condemn, as being constructed upon an 'inferior plan,' not her own three particular guns only, but a whole 'batch' besides. And I feel that no statements of mine could bear with half the effect against that public prepossession which has been so industriously propagated on this whole subject as these and other fatuous truths from Sir William Armstrong himself. These guns, made out of 'solid forgings,' are all the produce of Woolwich, none of Elswick, and many months since I became aware, at the place of their birth, that the 'batch' consisted of more than 200; since which I have learned that they constitute the greater portion of all the 100-pounders yet made. If, therefore, it be true, on the manufacturer's own evidence, that the disabling of the guns in the Stork is the 'result' of their inferiority of plan, no reason of greater moment could be urged by me for ascertaining what amount of service sufficed respectively to break those three guns down; and for then subjecting every specimen of the 'batch,' wherever found, to tests which shall fairly and openly show its fitness for actual fight. It is not, I submit, a mere declaration of being 'fit for use,' made under the hand of the manufacturer or his friends, which can be expected to remove those well-grounded apprehensions which he himself thus so strongly confirms."

As to the clogging of the grooves of which Sir William had said that Captain Halsted "was quite wrong" in supposing that in any case the grooves "became choked with lead," the latter observes:—

"On his own showing I am wrong only as to the cause, not as to the effect. My informant was one whose special duty it had been for many months to see cleaned after firing the 100-pounder then before us, and its two predecessors. He explained clearly the various means invented for reducing the long operation of cleaning; but it still took twenty-four hours, as in the case then being examined, for the gun to 'sweat' or loosen the deposit which clogged its grooves. Like its predecessors, that gun had never previously fired so many as the 22 rounds then recently delivered, without its requiring to 'cease fire,' from the grooves then becoming so clogged with something that the shot were all 'stripping,' *i.e.*, they were going out without being rifled, and were therefore being thrown away in almost any direction. I thought, and so did my informant, that this clogging 'something' was lead; Sir William Armstrong claims it to be 'powder deposit.' What does it signify what the deposit is if at the 22nd round or so it be such as to 'strip' the shot and make it useless, and thus to self-disable the gun?"

As to the blowing down of a "rear right hand man" by the escape of gas at the breech, and of which Sir William had accused Captain Halsted of telling more than the "simple truth," the latter says:—

"But to the truth, and nothing but the truth, of my statement, as quoted, I still steadfastly adhere. I was in personal command of the gunboat at the time. The man was in his proper position at the gun where he had been duly stationed to the duty of 'right rearman,' and some time after his accident, to that duty he asked, and was permitted again to return. I saw him fall, and saw him picked up, and directed his being immediately placed in the hands of the surgeon. I witnessed his examination, especially as to the effect upon his sight, and the result of that examination was duly reported to me as his captain, then present. Truly his serge frock—a new one, and through which his side had been scorched, though not severely—'was singed,' for it fell to pieces where exposed to the blast, and I was appealed to for another to replace it. I will trouble no one with further details, nor name any witnesses by whom to establish those I have now again given. But I confess that my October letter did not contain the whole truth of this transaction, which, therefore, I now proceed to narrate. This 'escape of gas' was attributed to 'want of care' in screwing up the breech, and at the next shot the breech was, of course, screwed up most 'carefully;' but in order to test if there would then be any escape, by request of the writer himself and his brother committee-men named by him, a new coal bag (weight 7 lb) was sent for and thrown over the breech. When the shot was fired the bag was blown many yards along the deck, and when 'picked up' again was found to be so rent as to be entirely useless. Again, by directions from the writer and his co-committee-men, orders were thereupon given through me that every one should thenceforth be kept clear of the line of this then lateral breech discharge before each subsequent shot was fired, which orders continued in force throughout the two days of the trials."

Captain Halsted proceeds to show that, although the breech aperture has been removed from the side to the top of the gun, the escape of gas still takes place, the tin "expanding cups," relied upon to maintain a tight joint, having been blown to pieces on board the Stork. He properly asks, "How about this gas when these guns, as at present intended, form the continuous batteries of our ships between decks?" As for exposing the men in lifting in the breech piece at the top, Sir William had stated that a staff might be used for the purpose, but this, Captain Halsted replies, is not used.

To Sir William Armstrong's denial of the "inherent defects" or "incapabilities" of his gun Captain Halsted observes:—

"With regard to the first, that the gun cannot be loaded at the muzzle, the writer, after affecting to make light of it as a vain objection, and so confirming my statement, but denying its point, actually calls attention to a new gun, on a totally different principle of construction and rifling, in which he says he has, 'after two years' study,' succeeded in removing the very objection which he slights. But if the first-born Armstrong is so perfect, why this long labour in producing a second-born to supersede it? Was not the fact of that first-born's being held up as a perfect gun, the very basis of stipulation by its inventor for a strict monopoly of its supply for the service? To the second 'defect,' that the gun cannot be double-shotted, the writer replies that it can; but he explains that it must be with special flat-fronted shot. Now, as guns are double-shotted chiefly in the crisis of close action, the ordinary shot, not special ones, can alone be available for the purpose. The explanation, therefore, does not meet my objection, which is a practical one, and to which I add, that in no instance, as the writer well knows, has his gun been used, or can it be used, as a 'double-shotted' gun with its ordinary shot. The third 'defect,' that the gun cannot use the incendiary 'Martin's shell,' is met by a statement of some successful experimental practice made somewhere. But the writer again knows that the two 100-pounders with which he made his first attempt both had their breeches blown out, though only 6 lb. charges were used; and whenever renewed attempts shall result in the issuing of incendiary shells, with cupolas to melt their iron, to the fitting-sized Armstrong, as well as other guns, this important 'incapability' may be written off, but not before. In a similar manner I deal with the writer's reply to the fourth 'inherent defect,' that reduced cartridges cannot be employed for this gun. His invitation to 'ricochet practice' at Woolwich simply begs the question; but whenever the magazines of our ships are supplied with reduced cartridges for close action, for the Armstrong as for all other guns, I shall then put credit in the writer's own belief that they can be safely used. The grave defect of 'shedding the lead coating,' and thus imperilling the lives of our own people when shot or shell are fired over the heads of boats' crews or advanced parties, is admitted in certain cases, but the responsibility of accepting it is put upon 'the military authorities who have made their choice.' In a leading article of the *Army and Navy Gazette* of the 30th of November, noticing most favourably Sir William Armstrong's then recent letter, the writer avows his full belief in the statements that a man of the 67th Regiment, while lining the ditch at the assault of one of the forts in China, was struck on the back of the head by a fragment of lead peeled from an Armstrong shell and killed. The article adds, 'We further believe that the report from the Excellent on this subject was not favourable to the use of the Armstrong projectiles over the heads of troops.' And it then continues, 'that for choice, and with this knowledge before us, we would rather not be lying down in front of the Armstrong gun in action. Thus, whenever compliance is yielded to the increasing demand for inquiry into the 'whole truth about the Armstrong gun,' it seems not improbable that the remarkable palliation made for it by my China informant may yet prove correct, viz., 'That, after all, the loose metal from the shot and shells of the French "canon rayés" had killed more of their men in China than the Armstrong had killed of ours.'

"There is yet another 'inherent defect,' or 'incapability' (No. 6), which, though it escaped my former letter, is too important to allow of its being now omitted. It is 'that this gun cannot, as all other guns can and do, ignite its time-fuse by the certain means of the fire from its own discharge,' but its inventor is compelled to resort for this purpose to an ingenious combination of physical action and chemical compounds. These, about August, 1860, were discovered to be liable to self-ignition, and urgent orders went forth for Armstrong fuses to be removed from every magazine and store of powder. In China the effects of voyage and climate on these compounds were found to have rendered the time-fuses useless. And more lately still even the 'percussion' fuse then used has been discarded for the new 'pillar fuse,' which in May last was formally introduced as perfection, at a meeting of the Institution of Civil Engineers; but shortly after it signally failed to explode the shells thrown into the 'Hussar' from a range of 2,000 yards; the ship being eventually burnt (in July last) by spherical shells from the ordinary 68-pounder. Has the 'pillar-fuse' since then been more successful in exploding its shells at the above range? If so, when and to what extent? Also, what proof has the new time-fuse composition given of its power to withstand better than its predecessor in China, the effect of great changes in temperature and climate?"

Captain Halsted divides his reply into two portions, and upon the second of these we have not space at present to enter. He concludes the first portion by showing that the Armstrong gun has been considerably surpassed in range and precision of fire by "a rival breech-loading gun," meaning Mr. Whitworth's, and adds:—

"But what is the true disclosure to which the facts of this trial directly point? Not that there is one rival gun which can surpass the Armstrong almost as much as the Armstrong surpasses its smooth-bored predecessor, but that, if there be one rival which can do it, so may there be many more; and among them such as may equally excel the one whose comparative performance has been quoted. This is the first instance, at least brought to light, in which the Armstrong has been trusted to appear in the ring for a fair competition with any rival; and if the result prove anything, it is the grave public injury of that exclusive monopoly on the sole security of which the assumed superiority of this national weapon is thus proved to rest. To whom, then, is England indebted for this now proved inferior selection? What steps were taken at all proportionate to the gravity of the subject to insure the best selection only? What principles and powers of other rifled ordnance were scrutinised and proved before binding England in the terms of that remarkable public contract put forth in the appendix, and by which she deprives herself of that 'fair field and no favour,' for the general talent of her own people, which she assumes specially to accord to the whole world?"

MALLEABLE CAST IRON.

MALLEABLE cast iron is cast iron which has been subjected to a roasting or annealing process without being fused, by which it becomes soft and tough. The improvement in the treatment of cast iron to render it malleable, was made by Samuel Lucas, of Sheffield, who obtained a patent in 1804, and his process is the one which is in general use at the present day. The articles of cast iron to be malleableised are placed in a suitable furnace with a layer of sand between them to prevent them from adhering; they are then covered with a pulverised oxide of iron, and subjected constantly to a high but not fusing heat for about six days and nights; then allowed to cool very slowly. The theory of the process is, that the excess of carbon in the cast iron, which renders it so hard and brittle, unites with the oxygen of the pulverised iron ore in the furnace, and passes off as carbonic acid gas, leaving the iron soft and malleable without changing its form. This was one of the most valuable discoveries ever made in metallurgy. It is now extensively practised as an especial branch of art in every civilised country. Cast iron nails can be rendered so soft and tough by thus treating them that they may be clinched almost as easily as those made of wrought iron. In 1838 Charles Burjot obtained a patent for treating raw pig iron with a mixture of the oxide of manganese and charcoal in powder in a furnace, whereby he obtained malleable iron. The pigs were laid in alternate layers in a furnace with the mixture of manganese and charcoal between them; then they were kept at a red heat for two or three days, and subsequently left to cool in the furnace for three days. The second process is a mere modification of the first. Cast iron articles, without being melted or having their form altered, are thus rendered malleable.

Wrought iron, except when mixed with carbonaceous matter, is incapable of being melted and cast, but by mixing it with three times its weight of pig iron it will fuse under a strong heat, and may be cast and annealed. Castings possessing the same properties as those of malleable iron may thus be obtained, but unless made of cheap scrap iron they would cost more than castings entirely of pig iron malleableised.

ACCIDENTS TO WORKMEN.—The bill which Mr. Ayrton has laid before Parliament is one of considerable importance to employers. The bill gives a right of action against a master for damages to any workman or servant (or to his family if he is killed), in case of his being injured in consequence of his master, "or any other person employed by his master," omitting anything proper, or doing anything improper, in the work that is to be done. The only limitation is that a master is not to be liable for any wilful act or omission of the fellow-servant amounting to a criminal offence.

THE SUEZ CANAL.—The reports current respecting the operations of the Suez Canal Company become more and more unfavourable. The small channel, or *rigole de service*, dug through Lake Menzaleh, is already almost entirely obliterated. Whatever embankments had been raised on either side have been washed away, and the small boats that occasionally attempt the passage find themselves every now and then stuck fast in the open but shallow lake. The approaches to Port Said are in as unpromising a state as ever, and the cutting through the sand-heights of El Gisr it is found must be attempted, in spite of its acknowledged difficulties and disadvantages; and it is now altogether vain for the projectors of the scheme to talk of English jealousy and animosity.

ROBINSON CRUSOE AT THE LONDON EXHIBITION.—Our neighbour in Grainger-street, Mr. Tweedy, the famous wood-carver, will shortly be sending off to the Exhibition an oak sideboard, eclipsing all his former efforts. The subjects of the carvings are taken from Defoe's immortal fiction of "Robinson Crusoe," founded on facts which he is said to have collected on the banks of the Tyne. There is Robinson cast on shore; Robinson bringing his treasures on the raft from the ship; and Robinson musing in his hut on the island. In one panel he is making chronological notches on the post whereon the date of his arrival is recorded; in another he carries a goat over his shoulders; in a third, his "Man Friday" makes his obeisance; and in a fourth, the affrighted savage has thrown himself down at the sound of Robinson's gun. There are also several minor carvings. All are executed in high relief; some of the figures, indeed, are detached; and the whole are executed with great spirit and freedom. —*Newcastle Chronicle.*

SHIPS BUILDING, &c.—The annual account of the outlay on her Majesty's ships building, converting, repairing, and fitting, shows in the financial year 1860-61 an expenditure of £852,774 on the hulls of eighty-one ships and vessels building in the dockyards, and £398,712 on their machinery; £465,644 on forty ships building by contract and purchased, and £141,930 on their machinery; £9,650 on six ships converted to screws while building, and £38,480 on their machinery; and £281,794 on eighteen ships converted after launch, and £214,291 on their machinery; making a total expenditure of £2,403,275 in that year on the 145 ships. The outlay on fitting out, refitting, repairs, and maintenance of ships and vessels brought the expenditure up to £3,574,106, and the incidental expenses, such as moorings, buoys, docking ships, repairs to cranes, &c., reached £311,003, altogether accounting for the use and application in the course of the year of nearly the whole £4,207,742 voted for those purposes, the residue being expended, it is presumed, in the purchase of materials which were not used in that year.

INSTITUTION OF ENGINEERS IN SCOTLAND.

Wednesday, 5th February, 1862.

The President in the Chair.

REMARKS ON SOME EXPERIMENTS MADE BY MESSRS. ISHERWOOD, STIMERS, AND LONG, CHIEF ENGINEERS IN THE U.S. NAVY, ON THE LIQUEFACTION OF STEAM IN THE CYLINDER OF AN ENGINE WORKING EXPANSIVELY.

By Prof. W. J. Macquorn Rankine.*

Through the kindness of Mr. Zerah Colburn I was several months ago furnished with a copy of the accompanying Table No. I., but I have not until now had time to calculate their results as connected with the theory of the expansive working of steam.

The fact which those experiments specially illustrate is that of the condensation of a large quantity of steam immediately on its admission into a cylinder which has been cooled by the previous expansion of steam in it. To show the evidence of that fact more distinctly, the lines of the table which specially relate to it are repeated in Table II., together with some results deduced from them.

In the absence of experimental data as to the actual amount of water carried over from the boiler in the liquid state by "priming," the differences in the last line of Table II. will be treated as wholly caused by condensation in the cylinders. The near agreement of the quantities of water expended per lb. of coal shows that the priming, if sensible at all, must have borne nearly the same proportion to the whole expenditure of water in each experiment; so that in comparing the experiments with each other, no material error is caused by neglecting priming.

There can be no doubt that there is a tendency during the later or expansive part of the stroke to re-evaporate part of the liquid water partly to the working steam as it expands, and partly to the water, which partially re-evaporates during the exhaust.

The quantities of iron in the last line of Table IV. may be expected to bear some relation to the extent of surface of the cylinder and piston exposed to the steam during its admission, and to the time during which that surface is so exposed. The calculations in Table V. are made in order to test that conjecture. The products thus obtained, although not simply proportional to the quantities of iron given in Table IV., have their magnitudes in the same order.

The obvious practical conclusions to be deduced from those experiments and calculations are the following:—

1. That in order to realise the proper economy, or indeed any economy whatsoever, from the expansive working of steam in a single cylinder, it is essential that the temperature of the cylinder should be as far as possible prevented from falling below the boiling-point corresponding to the pressure of the steam at its admission. The requisite supply of heat may be communicated to the cylinder either by means of a steam-jacket, or of a flue, or by superheating the steam which is admitted.

2. That a supply of heat to the expanding steam, sufficient to prevent its liquefaction, is essential to economical working; because the water so liquefied re-evaporates during the return stroke, and so abstracts heat from the metal of the cylinder. That heat is supplied at the beginning of the next stroke by the condensation of part of the steam on its admission; another part of that steam is liquefied during the expansion, so that during the next return stroke there is more water re-evaporated, and more heat abstracted from the cylinder, and this goes on until the quantity of liquid water present in the cylinder during the forward stroke is sufficient to prevent liquefaction during the expansion. The quantity of steam

TABLE I.

Steam Expansion Experiments made on board U.S. steamer Michigan, December, 1860, by order of the Secretary of the United States Navy, and under the direction of Messrs. Isherwood, Stimers, and Long, Chief Engineers.*

"The Michigan is a paddle-steamer, 163½ft. long, 27ft. beam, and 12ft. deep deep. Engines have two 36-in. cylinders, 8ft. stroke. Boilers of the water-tube variety—the fire circulating around the tubes. Paddle-wheels, 21ft. 6in. diameter, 8ft. floats, with a dip of 27in. The vessel was lashed at the dock at Erie, Pennsylvania, during the experiments, the wheels revolving in the water. The experiments were for seventy-hours each."

No. of experiment.	I.	II.	III.	IV.	V.
Point of suppression	1/12 stroke.	·67 strcke.	·4 stroke.	·354 stroke.	·25 stroke.
Number of engines worked	One.	One.	Two.	One.	Two.
Pressure of steam in boiler	20 lb.	20 lb.	20·7 lb.	20·7 lb.	21 lb.
Vacuum in condenser	25·9 in.	25·9 in.	25·5 in.	25·5 in.	24·8 in.
Barometer	29·57 ,,	30·15 ,,	30·09 ,,	29·71 ,,	29·45 ,,
Revolutions per minute	14	14·31	19·3	11·035	15·5
Speed of piston—feet per minute	224	229	309	176	248
Total pressure of steam above zero at point of suppression	34·3 lb.	34 lb.	33 lb.	32·8 lb.	34 lb.
Average pressure throughout stroke	30 ,,	28·4 ,,	20 ,,	20·5 ,,	15·8 ,,
Indicated horses power	207½	200	379	111	210
Space to which dense steam was admitted before suppression, exclusive, however, of ports and clearance, whole cylinder being 56·55 cubic feet	52·51 cubic ft.	37·7	(22·62)†	20·02	(14·14)†
Water equivalent corresponding to these spaces at the pressure employed	4·42 lb.	3·15 lb.	1·84 lb.	1·62 lb.	1·17 lb.
Quantity of water actually used per stroke for each cylinder actually running	5·2 ,,	4·4 ,,	3·4 ,,	3·63 ,,	3·02 ,,
Coal per indicated H.P. per hour	5·666 ,,	4·89 ,,	5·4 ,,	5·855 ,,	5·95 ,,
Water ,, ,,	42·233 ,,	37·9 ,,	41·8 ,,	43·3 ,,	46·75 ,,
Evaporation of water at 100 deg.‡ per lb. of coal	7¼ ,,	7·72 ,,	7·8 ,,	7·77 ,,	7·8 ,,

* The data in this table are given as published by Mr. Isherwood, with the exception of three small corrections in the second place of decimals of the figures in the line of "water equivalent."

† One cylinder. ‡ Centigrade.

TABLE II.

Cut-off, in fractions of stroke	·93	67	·4	·354	·25
Weight of steam continuing in the state of vapour at the instant of cut-off, in lbs.	4·42	3·15	1·84	1·62	1·17
Total weight of steam expended per stroke, in lbs.	5·2	4·4	3·4	3·63	3·02
Difference, in lbs.	·78	1.25	1·56	2·01	1·85

TABLE III.

Cut-off	·93	·67	·4	·354	5·2
Absolute pressure of steam at cut-off	34.3	34	33	32·8	34·0
Mean forward pressure, calculated on the supposition that the re-evaporation has no sensible effect	34·3	31·8	24·9	23·3	19·8
Deduct probable back pressure, say	4·0	4·0	4·0	4·0	4·0
Calculated mean effective pressure	30·3	27·8	20·9	19·3	15·8
Observed mean effective pressure	30·0	28·4	20·0	20·5	15·8
Difference	+ ·3	+ ·6	— ·9	— 1·2	none

TABLE IV.

Cut-off	·93	·67	·4	·354	·25
Weight of steam liquefied per stroke, as before, in lbs.	·78	1·25	1·56	2·01	1·85
Latent heat of that steam, at the rate of 927 British units of heat per lb. of steam	723	1159	1446	1863	1715
Lowering of temp. of working steam, due to the expansion (Fah.)	4°·5	24°·2	52°·2	58°·4	75°·8
Weight of water whose temperature would be raised through the above number of degrees, by receiving the above quantity of heat—lbs.	161	48	28	32	23
Corresponding weight of cast iron (its specific heat being taken as 1-9th of that of water)—lbs.	1449	432	252	288	207

TABLE V.

Surface exposed—square feet	84	65	44	41	33
Time of admission—seconds	1·8	1·3	·69	1·08	·63
Surface × time	151·2	84·5	30·36	44·28	20·79

produced by this condensation. When saturated steam, either dry, or mixed with a certain limited quantity of liquid water, performs work by expansion, and receives no heat from without, theory and experiment concur to show that the cooling is so rapid as to cause the condensation of part of it; but the presence of liquid water at a temperature as high as that of the steam diminishes such condensation. When the weight of hot liquid water present bears to that of the steam a certain proportion depending on the temperature, the condensation of the steam stops; and when the liquid water exceeds that proportion, there is a tendency for a portion of it to evaporate as the space is enlarged.

To determine whether such tendency to re-evaporation had any effect of practical importance in these experiments, the calculations in Table III. are made.

The smallness of the differences in that table, and the irregular manner in which they vary, show that no practically appreciable effect on the work performed by the steam can be ascribed to re-evaporation. If re-evaporation took place to any considerable extent during the forward stroke, it would increase the mean effective pressure, so that the steam at first liquefied would not be entirely wasted. From these calculations it appears that the re-evaporation must take place mainly during the return stroke, so that most of the steam which undergoes temporary liquefaction simply goes to the condenser without performing work, and the heat expended in producing it is wasted; the consequence being, as the last three lines of Mr. Isherwood's table (Table I.) of experiments show, that the economy which would otherwise arise from expansive working is more than neutralised.

The calculations given in Table IV. are made in order to compare the quantity of steam liquefied per stroke, with the cooling due to the expansion of the working steam.

The largest of the quantities of iron given in that table must be considerably less than one-half of the weight of the cylinder and piston. It is not to be supposed, indeed, that the whole cylinder undergoes an alternate rise and fall of temperature equal to that of the steam; but only that the parts of the cylinder and piston which are exposed to the hot steam on its admission receive the before-alculated quantity of heat from that part of the admitted steam which condenses, and give out again the same quantity of heat, liquefied upon admission then becomes constant, and imparts a uniform quantity of heat to the cylinder at each stroke. Part of that heat is communicated to the expanding steam, and so made to disappear, and the re-evaporation during the return stroke becomes just sufficient to carry off the remainder; and thus the waste of heat goes on at a uniform rate per stroke.

3. In a double-cylinder engine the waste of heat incurred by neglecting these principles may be expected to be not so great as in a single-cylinder engine, because of the depression of temperature being divided into two stages, which take place in the high-pressure and low-pressure cylinders respectively; and of the two cylinders, the high-pressure cylinder is that which it is of most importance to keep hot.

These principles, or at all events part of them, have for some time been generally known and acted upon; and I believe that many members of this institution can corroborate them from their practical experience. The first of them, indeed, must have been known to Watt, as his invention of the steam-jacket proves; and the fact of the liquefaction and re-evaporation of steam in the cylinders of locomotive engines was proved experimentally by Mr. D. K. Clark; but the experiments referred to in this paper exemplify the operation of those principles in a remarkably definite and precise manner, and show very clearly how the great waste of heat in unjacketed cylinders is connected with the comparatively small disappearance of heat during the expansive working of the steam.

Appendix—added since the meeting at which the paper was read (5th February, 1862).

In compliance with a suggestion made by Mr. Brownlee, I have computed theoretically the proportionate and absolute weights of steam which would have been liquefied per stroke during the expansion, if the cylinder had consisted of non-conducting material. An approximate formula for such computations was first given in the "Transactions of the Royal Society of Edinburgh" for 1850; and a more exact formula in the "Philosophical Transactions" for 1854; and also in "A Manual of the Steam Engine and other Prime Movers."

The quantities are exceedingly small as compared with the quantities of steam which actually condensed in the cylinder during the experiments; but they show, nevertheless, the small beginning from which the great condensation in a cylinder made of conducting materials at first arises; and they also form a measure of the small quantity of heat which should be supplied to the cylinder at each stroke by means of a steam-jacket, or of superheated steam, or otherwise, in order to prevent a great waste of heat such as the experments show.

* From the Transactions of the Institution.

TABLE VI.

No. of experiment	I.	II.	III.	IV.	V.
Cut-off	·95	·67	·4	·354	·25
Lbs. of steam expanded per stroke	4·42	3·15	1·84	1·62	1·17
Fraction of the whole steam admitted which would have condensed in a non-conducting cylinder	·004	·026	·056	·061	·081
Lbs. of steam per stroke which would have condensed in a non-conducting cylinder	·018	·082	·103	·099	·095

In the discussion which followed:—

The President said he thought Dr. Rankine must have been at great pains in investigating these experiments and bringing out these results.

Mr. J. F. Spencer asked how what seemed to be a discrepancy in the weight of water and the expansion of steam was to be accounted for? For instance, it appeared from Table I. that, under the expansion of ·4, the weight of water expended every stroke was 3·4 lb.; under the next grade of expansion, ·354, it rose to 3·63 lb., and then at grade ·25 it dropped down to 3·02.

Dr. Macquorn Rankine said that would not seem so unaccountable if they went to Table IV., and compared the quantities of iron to which the heat was communicated. In the latter case they would observe that, although the absolute quantity of steam wasted appeared to be out of its proper order, if they took the proportion of steam wasted to that properly used, it would be found that the different results were in regular order. Although the absolute waste was greater, yet the comparative waste was less.

Mr. J. F. Spencer said that, as one who had taken a great deal of interest in the working of steam expansively in jacketted cylinders, he must say that he felt exceedingly thankful to Dr. Rankine for the clear and lucid way in which he had brought this subject before the institution. Although experience had proved to him and to others there was a great advantage in preventing the internal condensation in steam cylinders, there had always existed a difficulty in accounting for the saving thus realised; but the tabular comparisons now given threw great light on the subject, and explained the connection between the condensation, the heat absorbed by the metal, and the final disposal of the latter.

Mr. Brownlee said it appeared rather remarkable that the absolute quantity of steam which condensed per stroke should, up to the fourth experiment, have uniformly been greatest with the shortest admission.

Dr Rankine said that the condensation of the steam was dependent on the surface of the iron, on the time during which the surface was exposed, and on the difference of temperature. Although in the last experiment little more than one-fourth was exposed, yet there was the very great difference of 75·8 deg. to promote the condensation of steam.

Mr. Brownlee said that the general results corresponded with what had often before been observed, and with the views expressed by members while discussing, some three years since, a paper then read upon the same subject by Mr. Carmichael. On that occasion it was mentioned by Mr. J. R. Napier and himself, that in the ordinary engine (without superheating or steam casings) they had never found any advantage in expanding the steam to more than a double volume. The necessity of the steam jacket was observed by Watt at a very early period of his experiments.

Mr. T. Davison asked whether there was not a very important element of time, the omission of which exaggerated the effect of condensation in these experiments? If they could imagine an engine going at an infinite velocity, then there would be no loss whatever from heat being imparted to the cylinder and given back again to the exhausting steam. The effects of condensation would be in proportion to the speed of the piston. The effect of cutting off short was well ascertained. Even without jackets, great economy had been obtained by cutting-off short when the engines ran at a proper velocity. Was not this element of velocity wanting in the tables in order to render them useful in practice?

Dr. Macquorn Rankine said the element of time had been taken into account, and would be found in the tables in the paper. If the time had been less in each case, there is every reason to believe that the waste of heat would have been less.

In answer to questions, Dr. Rankine said the length of the stroke was 8ft., and the diameter of the cylinder 36in. All the calculations had reference to one cylinder; but sometimes they worked with both cylinders, and sometimes with one only, and the differences in the velocity naturally followed from such differences in the power.

On the suggestion of Mr. Gilchrist, the further discussion of the paper was postponed until the 5th of March. He also complimented Dr. Rankine on the intelligible form in which he had placed the tables before the institution.

Dr. Macquorn Rankine said that any merit in the arrangement of the tables was due to the gentlemen by whom the experiments were made. Table I. was theirs entirely, and the rest were his own, but in arranging them he followed their plan.

Mr. Brownlee suggested to Dr. Rankine the propriety of putting another line into his tables, showing the theoretical condensation that would take place from expansion alone, supposing the cylinder was of a non-conducting material.

Dr. Macquorn Rankine said that he should add that information. The condensation that would take place from exhaustion alone, supposing a cylinder of non-conducting material was used, would be exceedingly small compared with that which actually took place; but it could be very easily added.

The President begged to move a vote of thanks to Dr. Rankine for his very interesting paper.

The vote was unanimously awarded.

Dr. Macquorn Rankine said that as the paper had been prepared in consequence of a communication from Mr. Zerah Colburn, of London, he thought it his duty to propose that the thanks of the meeting be given to that gentleman.

The President had very much pleasure in seconding Dr. Rankine's motion, which was cordially adopted.

Boiler Explosion.—An explosion of boilers took place at the Fenton Park Furnaces, North Staffordshire, belonging to Messrs. Lawton and Co., on Friday morning. At these works are two blast furnaces, worked by an engine which is supplied with four boilers. The explosion not only shattered the engine house to pieces, but demolished one of the furnaces, and every building in the vicinity was injured by the shock, as well as by the fragments of iron and the bricks, which were thrown with tremendous force a great distance. Buckley, the engine-tenter, was killed, and two other men were badly burned. Mr. Wynne, the mines inspector of the district, was at the inquest the following day. George Berks, the day engine-tender, said he went to the works a little before six on Friday morning, when Buckley told him the boilers were all right. The engines were going slowly, and deceased was oiling the valves. The extent of pressure on the gauge the day before was 40 lb. He heard the whistles of Nos. 1 and 2 boilers blow the night before. No. 3 boiler was not quite full of water when he left on Thursday night, but it was safe. He thought the explosion was caused by some of the boilers being empty. The coroner said there seemed to been a dereliction of duty on the part of the deceased; an opinion in which Mr. Wynne concurred. Mr. Wynne added that he had examined the boilers, and he could find no flaw in them. The parts which had gone were not the weak parts, but the suddenness and force of the explosion had torn up the plates like paper.—The jury immediately returned a verdict of "Accidental death." The damage is estimated at between £4,000 and £5,000.

SOCIETY OF ARTS.

February 5th, 1862.

Dr. A. W. MILLER, F.R.S., in the Chair.

ON IMPROVEMENTS AND PROGRESS IN DYEING AND CALICO PRINTING SINCE 1851.

By Mr. F. CRACE CALVERT, F.R.S.

(Concluded from page 117.)

Fourthly, *Dung Substitutes.*—During the last few years the various dung substitutes, such as the double phosphate of soda and lime, the arsenites and arseniates of soda, and the silicates of soda have completely taken the place of cow dung in the process of dunging, that is to say, a process which consists in passing the mordaunted and aged cloth into weak and hot solutions of the above-named substances, with the view of fixing thoroughly the mordaunt in the cloth, and removing any excess that may have been used, without allowing it to fix itself on the white, or unmordaunted parts. By the introduction of these dung substitutes, and improved dunging vats, a great saving of time, labour, and expense has been effected. Thousands of pieces are now done in the same vat, where formerly as many hundreds only could be so heated.

Fifthly, *Washing Machines.*—As madder goods have to be thoroughly washed, not only after this operation, but also after dyeing, several improved machines have been introduced in the trade. I shall only here mention those of Messrs. Mather and Platt, Mr. Furnival, Mr. D. Crawford, the last of which is much used for steam work and loose colours, and especially that of Mr. Thomas Whittaker, which I have heard highly praised by madder and garancine printers, and a model of which I have the pleasure to lay before you through the kindness of Messrs. Christopher Whittaker and Co. To give you an idea of the vast capabilities of some of those machines I will cite the following fact mentioned by Messrs. Whittaker:—"Our machine will wash 6,000 yards for all kinds of dyeing purposes, and 12,000 yards for all bleaching purposes, per hour (which only requires the attention of a person of 12 or 14 years of age)."

Sixthly. After the madder goods have undergone the above improved processes they are ready for the dyebeck, where the mordaunts assume the colours for which they are adapted. Here, also, a slight improvement has been effected, the advantage of which is a saving of time; as it now requires for saturating the mordaunts with alizarine only one and a quarter hours for garancine and two hours for madder. After leaving the dyebecks the pieces are thoroughly washed in the improved washing machines, but as the white parts (or those not mordaunted) are still soiled and the colours dim, it is necessary to pass the pieces for half an hour into a rather strong soap solution heated to 180 deg., when the loose dye is not only removed from the white parts, but also from the parts on which colour has been fixed. To finally brighten the colours and completely clean the white portions the pieces are passed into a weak solution of what is called "chimic," or an alkaline hypo-chlorite of soda, with a little sulphate of zinc, until the desired effect is obtained, but latterly this process has been improved by passing the goods rapidly into chimic, and then through a steam chest. As the pieces have not yet, however, a commercial appearance, they further undergo what is called finishing, that is, the pieces are passed through a solution of sour flour (flour which has been fermented for several weeks), starch, farina, &c., and then between rollers, dried, and lastly through calenders, the object of which is to fill up the interstices of the fabrics and to give them a glossy appearance. Much improvement has also taken place in this department of printing by the introduction of new machinery, especially in the methods of adapting the finish to the various markets of the world. I wish to take the opportunity of impressing upon printers the importance of dispensing, as much as possible, with the use of sour flour, and confining themselves to that of starch or farina, with the addition of about one ounce of sulphate of zinc per piece, for the purpose of diminishing the risk of mildew and other stains, to which a low class of printed goods are liable, during their transit in tropical climates, and especially those dyed with common garancine, bark, sumach, and peachwood.

In concluding my remarks upon madder I wish to draw your attention to these beautiful examples of madder styles, for which I am indebted to Messrs. Symonds, Cunliffe, and Co., and of garancine styles to Messrs. Wood and Wright.

Indigo.—Most of the styles obtained with this valuable dye-stuff are due to the mixture of printing and dyeing, and only a few improvements have been effected herein, to my knowledge, during the last ten years.

First, the usual method of dyeing cotton, plain or self blue, is to fill with water large stone vats, and dissolving in them two parts of sulphate of protoxide of iron, adding one part of finely ground indigo, and then three parts of hydrate of lime. After having well stirred the whole for several hours, pieces of calico which have been hooked on a frame and dipped in lime water are then plunged for 15 minutes into the vat, when the blue indigo which has been converted into white indigo by the protoxide of iron, and rendered soluble by the excess of lime, fixes itself on the fibre, and, on the exposure of the latter to the atmosphere, re-absorbs oxygen and becomes blue. When white patterns are required the pieces are printed before dyeing with what is called a "reserve," that is, a composition which prevents the colour from fixing itself on the fibre; the chief ingredient for that purpose is sulphate of copper, which acts by prematurely oxidising the indigo, and thus preventing its fixation. In both these cases the pieces are passed through a weak sulphuric acid bath to perfectly fix the indigo, and formerly the copper thereby liberated from the fabrics was completely lost. Mr. Joseph Leese has recently devised a method of saving this valuable metal. To effect this the diluted solution of sulphate of copper is made to filter through vessels containing wrought-iron turnings, the acid thus dissolving the iron, which may be used as sulphate of protoxide of iron for future operations, whilst the copper deposited on the excess of iron employed may be used, if thought fit, to manufacture again sulphate of copper. To give an idea of the importance of this process, I may state that the sulphate of copper consumed by one firm amounted to £3,000 a-year.

Secondly. A few years ago I was able also to effect an economy in this branch of calico printing, which consisted in extracting from the cold indigo vats which were considered by the printer to be exhausted, a considerable percentage of the indigo originally employed. Having observed that a green insoluble flocculent matter, which remained in the vats, and which was considered by chemists and printers to be simply oxide of iron, was in reality a compound of indigo and iron, I devised the following simple means of extracting the indigo therefrom:—The green pulp alluded to was conveyed from the several exhausted indigo vats into a general receptacle, and there mixed, first with a small quantity of hydrochloric acid, so as to remove the excess of lime, allowing the green pulp to settle, and running off the liquor. The so purified green pulp was then treated with strong hydrochloric acid, when chloride of iron was produced, and the indigo liberated, which required only to be washed to become again fit for use.

Thirdly. Although the printing of indigo offers great difficulty, still several printers have recourse to it from time to time, with greater or less success. The usual method of printing indigo consisted in mixing finely-powdered indigo with orpiment, or protochloride of tin, with a caustic alkali, and this process was further facilitated by printing the pieces in an atmosphere of coal gas, as devised by Mr. Bennett Woodcroft, the present learned officer of the Great Seal Patent Office, and carried out by Messrs. T. Hoyle and Sons, of Manchester. But of late years Mr. Joseph Leese, of Messrs. Kershaw, Leese, and Co., has succeeded in applying the following method, first devised by Mr. Fritzsche. The indigo is finely ground, and reduced to an impalpable powder, and then mixed with glucose, lime, and caustic soda, in such proportions as are needed to produce the shade of colour required. These materials are all mixed cold, and after the cloth is printed with the mixture it is passed through a steam chest, in which it is exposed for the space of from 30 to 60 seconds. In this short period the indigo is completely reduced and rendered soluble, when it enters into the fibre, and on emerging from the steam chest it becomes oxidised and fixed by exposure to the atmosphere, or the pieces may be immersed in a solution of an oxidising agent, such as dilute sulphate of copper, after which they only require to be washed, dried, and finished.

I am not aware of any marked improvement in the style of printing called "spirit colours," but in that of "steam colours" considerable advance has been made since 1851, rather, however, in a mechanical and artistic, than in a chemical point of view. Thus, it was owing to certain mechanical improvements that Mr. Robert Kay, calico printer of Manchester, and his workmen, had the honour of obtaining the gold medal at the Paris Exhibition of 1855. The beautiful furniture patterns which he exhibited there were the result, not only of artistic skill, and of improved machinery, by which twenty colours can be printed at once, but also of an invention patented by Mr. J. Burch, of Macclesfield, of which Mr. Kay availed himself with great tact. Of course you must be aware that, in order to produce light shades of colour, the darker shades are diluted with gum-water, or reducing liquid; this was the work of the colour mixer, and, therefore, to produce four colours and four shades of each colour sixteen rollers would be required. Now the invention of Mr. Burch consists in reducing the colour upon the cloth during the process of printing. The pattern of the paler shades of each colour in a chintz design being engraved on one roller, an impression in gum-water or reducing liquid is given off upon the cloth first, the impression of the other rollers then following in the usual order; where the different colours fall upon the gum-water a lighter shade is produced, owing to the dilution of the colour on those parts, which effect may be still further heightened, by more lightly engraving the corresponding parts of the colouring roller, so that a less quantity of colour shall be given off. The application of this process to furniture styles, first by Mr. Kay, and of late by Messrs. Littlewood and Wilson, and other large calico printers of Manchester, together with the substitution of the large rollers above mentioned for block printing, has produced quite a revolution in furniture styles.

Pigment Printing.—This style remained for many years in a dormant condition, owing, first, to the difficulty of finding a proper fixing agent, and then to the insufficient variety of pigments, for it was necessary to find a substance which would give the pigment the required consistency, and at the same time cause it to adhere to the cloth. Artificial ultramarine was the first pigment attempted to be printed, and in 1843 india-rubber dissolved in naphtha was proposed as a fixing agent for it, but owing to the danger of fire, and for other reasons, this method was abandoned. In 1847 egg albumen was introduced into this country for the same purpose, but owing to the coarseness of the ultramarine, and its high price, which was about £8 per lb. (it is now 1s. 3d.) the progress of this mode of printing was greatly retarded. In 1849 Mr. R. T. Pattison, of Glasgow, patented the use of caseine from milk, which he called lactarine, which promoted the use of ultramarine, buff, and stone pigments in shawl printing. About the same period another fixing agent was introduced, viz., albumen obtained from blood. The style of pigment printing, however, received an extraordinary impetus in the spring of 1859, when the purple aniline of Mr. Perkin was successfully introduced by Messrs. James Black and Co., of Glasgow, and the French purple of Messrs. Guinon, Marnas, and Bonnet, of Lyons, by Messrs. Walter Crum and Co., Dalglish and Co., Boyd and Hamel, Inglis and Wakefield, Heys, &c., and the splendid mauves and purples which astonished the world by their beauty, fastness, and brilliancy, were obtained by printing albumen or lactarine on muslin, and fixing the same by coagulating it by the action of steam. The pieces were then passed into the dyebeck, containing in solution Mr. Perkin's aniline purple, or Messrs. Guinon, Marnas, and Co.'s French purple, first dissolved in oxalic acid, and then added to a slightly ammoniacal bath, when the albumen or lactarine took up the colour and fixed it on the cloth, the pieces being then thoroughly washed, to remove any excess of colour. In the middle of the same year a beautiful green pigment, which had been patented in 1858, by Mr. Guignet, was introduced, and, as it is extensively employed, it may be interesting to know how this green oxide of chrome is produced. Three parts of boracic acid are intimately mixed with one part of bichromate of potash and a sufficient quantity of water to form the whole into a thick paste. It is then introduced into a furnace, and heated to a dull red heat, when a borate of potash and a borate of oxide of chrome are produced. The mass is allowed to cool, and is then thrown into cold water, when the borate of potash dissolves, and the borate of oxide of chrome is decomposed. The hydrate of oxide of chromium, $Cr_2 O_3 + 3HO$, falls to the bottom as a magnificent green powder, which requires only to be well washed and drained to be ready for use. The peculiarity of this green, as well as of one prepared by Mr. Arnaudon, of Turin, from phosphate of ammonia and bichromate of potash, is that, besides being of a brilliant green, they maintain this colour by artificial light. In the month of November, 1859, the magenta colour, or fuchsine, of Messrs. Renard was also introduced to the printing trade, and fixed by the above described method. The beautiful pinks thus obtained were soon followed by the application of roseine, azaléine, and other aniline reds. In May, 1859, a further improvement was made, which reduced the cost of applying these colours to muslins, by Mr. Walter Crum, who made the curious observation that if the gluten of wheaten flour is allowed by exposure to the atmosphere to fall into a semi-fluid condition it dissolves easily in a weak solution of caustic soda, which solution he used as a substitute for albumen or lactarine. About the same time Mr. Scheurer-Kestner also introduced the use of gluten by the aid of weak acids, and Messrs. W. A. Perkin, and Matthew Gray, of the Dalmarnock Printing Company, proposed to fix the coal tar colours on fabrics by means of a lead soap.

Early in 1860 calico printers succeeded in printing the aniline colours directly with the animal mordaunts, instead of dyeing the mordaunts after the latter were printed and fixed, and thus were enabled not only to print a variety of colours on the same piece, but also to effect a great saving and simplicity in the operation. By this means the pigment style was fully developed, and an entirely new class of prints was introduced into this market.

Owing to the great extension of this style, the cost of the animal mordaunts employed became such a serious consideration as to cause anxious search for other means of fixing the colours, and Mr. Charles Lowe and myself having observed in 1856 that tanning matters would precipitate and render insoluble certain coal-tar colours, and having further observed, at the end of 1859, that tannin, when printed on cloth and submitted to the action of steam would become fixed, and serve as a mordaunt for the coal-tar colours, we took out a provisional specification on the 10th of December, 1859, for fixing the insoluble tanning compound formed by adding a solution of gallnuts to a coal-tar colour, on cloth prepared with oxide of tin or alumina, or other metallic oxides. For various reasons this patent was not proceeded with, but in the early part of 1861 Mr. Gratrix, with the intelligent and persevering assistance of Messrs. Butterworth and Brooks, of Manchester, succeeded in fixing aniline purples, which, though faster against soap than those printed with albumen, did not so perfectly resist the action of light. The first process used by Mr. Gratrix was, with very slight modification, the same as that described above, but his second process, which I think he preferred, was the following:—He took cloth prepared with the oxide of tin, such as is generally used for steam colours, and after having printed it with a gallnut solution, submitted it to the action of steam, when the tannin became fixed and insoluble; the pieces were then passed through a dunging liquor, washed, and then into a beck containing analine purple mixed with a little acetic acid. As the bath was gradually carried to the boil the colour fixed itself on the tannin, and thus produced the print, but as the whites were rather soiled the pieces were passed into a weak acid bath, or through a weak solution of printing clearing liquor, such as is used for garancine.

Early in 1860 Mr. John Lightfoot also took out a patent to fix colours, especially those from coal-tar, by various means, the chief of which was tannate of gelatine. In 1861 patents were secured by Messrs. Pattison, Miller, and Nathaniel Lloyd, and J. G. Dale. The last of these patents is, in my opinion one of the best which have been taken out for that purpose, and is successfully worked by Messrs. Littlewood and Wilson, of Accrington. The characteristic feature of this process is the employment of tartar emetics as the agent for fixing the aniline purple on the fabric.

It is to be regretted that the beautiful colours obtained from coal-tar should be exposed to injury in public estimation, owing to certain parties printing them with starch only, by which they are so loosely attached to the fabric that a slight washing in pure water will entirely remove the colour and leave nothing but white cloth. By such means the reputation of this style of printing is being rapidly destroyed, and these colours, which might otherwise become a valuable addition to the printer's repertoire, are likely to lose altogether the favour of the public. This subject is so important that I cannot refrain from making another remark, viz., that if the use of coal-tar colours were properly encouraged they would doubtless gradually decrease in price, and this country, instead of being tributary to others for its dyestuffs, would in time become the purveyor of dyeing materials, or of the substances yielding them, to the whole world.

I cannot conclude this paper without calling your attention to the immense extent to which calico printing is carried out, and the wonderful progress it has made. Thus in 1830 about 2,000,000 pieces were printed. In 1851, according to a lecture delivered before this society by Mr. E. Potter, M.P., the estimated quantity of goods exported was 6,465,000 pieces, and the same authority estimates that in 1857 the export of printed calico amounted to about 27,000,000 of pieces.

THE SPHEROIDAL CONDITION.

WHEN liquids are thrown upon incandescent metallic surfaces they present remarkable phenomena, which were first observed by Leidenfrost a century ago, and have been named after their discoverer. They have since then been studied by other physicists, and more especially by M. Boutigny, to whom our present knowledge of the subject is mainly due.

When a tolerably thick silver or platinum dish is heated to redness and a little water dropped into the dish by means of a pipette, the liquid does not spread itself out on the dish, and does not moisten it, as it would at the ordinary temperature, but assumes the form of a flattened globule, which fact M. Boutigny expresses by saying that it has passed into the spheroidal state. It rotates rapidly round on the bottom of the dish, taking sometimes the form of a star, and not only does it not boil, but its evaporation is only about one-fiftieth as rapid as if it boiled. As the dish cools, a point is reached at which it is not hot enough to keep the water in the spheroidal state; it is accordingly moistened by the liquid, and a violent ebullition suddenly ensues.

All volatile liquids can assume the spheroidal condition; the lowest temperature at which it can be produced varies with each liquid, and is greater the higher the boiling point of the liquid. For water, the dish must have at least a temperature of 200 deg.; for alcohol 134 deg.; and for ether 61 deg.

The temperature of a liquid in the spheroidal state is always below its boiling point. This temperature has been measured by M. Boutigny by means of a very delicate thermometer: but his method is not free from objections, and it is probable that the temperatures he obtained were too high. He found that of water to be 95 deg.; alcohol 75 deg.; ether 34 deg.; and liquid sulphurous acid —11 deg. But the temperature of the vapour which is disengaged appears to be as high as that of the vessel itself.

This property of liquids in the spheroidal state remaining below their boiling point has been applied by M. Boutigny in a remarkable experiment, that of freezing water in a red hot crucible. He heated a platinum dish to bright redness, and placed a small quantity of liquid sulphurous acid in it. It immediately assumed the spheroidal condition, and its evaporation was remarkably slow. Its temperature, as has been stated, was about —11 deg., and when a small quantity of water was added it immediately solidified, and a small piece of ice could be thrown out of the red hot crucible. In a similar manner Faraday, by means of a mixture of solid carbonic acid and ether, has succeeded in freezing mercury in a red hot crucible.

In the spheroidal state the liquid is not in contact with the vessel. M. Boutigny proved this by heating a silver plate placed in a horizontal position, and dropping on it a little black coloured water. The liquid assumed the spheroidal condition, and not by the flame of a candle placed at some distance, could be distinctly seen between th drop and the plate. If a plate perforated by several fine holes be heated, a liquid will assume the spheroidal state when projected upon it. This is also the case with a flat helix of platinum wire pressed into a slightly concave shape. An experiment of another class, due to Mr. A. H. Church, also illustrates the same fact. A polished silver dish is made red hot, and a few drops of a solution of sulphide of sodium are projected on it. The liquid passes into the spheroidal condition, and the silver undergoes no alteration. But if the dish is allowed to cool, the liquid instantly moistens it, producing a dark spot due to the formation of sulphide of silver. In like manner nitric acid assumes the spheroidal state when projected on a heated silver plate and does not attack the metal so long as the plate remains hot.

These phenomena of the spheroidal condition are sometimes explained by assuming that the liquid globule is kept at a distance from the vessel by the tension of the vapour produced at its surface, and as the liquid is heated by radiation, and not by contact, it only evaporates slowly, especially as water is diathermanous for rays from an intensely heated source, the greater part of the radiant heat traversing it without heating it. M. Boutigny thinks, however, that the cause of the phenomenon is a repulsive force between the hot body and the liquid, a repulsion which is greater the greater the difference of temperature. This hypothesis accords with the following observation of Mr. Perkins. A stopcock placed in a steam boiler below the level of the water, having been opened, the liquid did not pass out as long as the sides of the boiler were at a very high temperature, although the internal pressure was considerable; but at a lower temperature the liquid spouted out with great force.

These experiments explain the fact that the hand may be dipped in melted lead or even melted iron without injury. It is necessary that the liquid metal be heated greatly above its solidifying point. Usually the natural moisture of the hand is sufficient, but it is better to wipe it with a damp cloth. In consequence of the great heat the hand becomes covered with a layer of spheroidal fluid, which prevents the contact of the metal with the hand. Radiant heat alone operates, and this is principally expended in forming aqueous vapour on the surface of the hand. If the hand is immersed in boiling water, the water adheres to the flesh, and consequently a scald is produced.

The tales of ordeals by fire during the middle ages, of men who could run bare-footed over red-hot iron without being injured, are probably true, and find a ready explanation in the preceding phenomena.—*Ganot's Physics.*

CARLISLE-STREET BRIDGE, DUBLIN. — A competition has been invited among engineers and architects desirous of proposing plans for rebuilding this bridge. The estimated cost is about £60,000.

STEEL IN THE EXHIBITION.—Sheffield this year must look to itself when it enters the lists against its German rivals. Krupp's steelworks at Eissen, in Rhenish Prussia, have attained a world-wide celebrity for their vast extent, for the almost military discipline which prevails there, and for the extraordinary steel castings they turn out. Only two or three years ago scientific journals contained accounts of the manner in which the almost impossible feat, as it was then considered, of making a piece of cast steel weighing 11 tons was performed. But Krupp will send to the Exhibition this year one piece of cast steel weighing no less than 21 tons. Ten years ago the manufacturer who talked of making such a casting in steel would have been thought little short of insane.

THE INTERNATIONAL EXHIBITION.

The following are the general rules for the admission of persons and the reception of articles during their arrangement:—

"Admission of Persons.

"125. No person whatever will be admitted into the building unless he is the bearer of a pass or day ticket.

"Passes.

"126. Passes, for the period specified thereon, available only at a particular entrance, and for a particular part of the building, will be issued as follows:—

"To Commissioners of Colonies and foreign countries, on application to the Secretary to her Majesty's Commissioners;

"To Custom House officers and their attendants, on application to her Majesty's Commissioners through the superintendent, British side;

"To exhibitors, and others not before specified, obtaining a pass available for more than one day for British side;

"To exhibitors, and others not before specified, obtaining a pass available for more than one day for foreign side.

"127. An exhibitor, British side, desiring a pass, must apply on a form to be obtained at the office for passes at least two days before it is required. The application must be addressed to the superintendent of the class to which the exhibitor belongs, who will forward it to the superintendent of the British side, with his recommendation attached. If granted the name will be entered on the registry, and the pass forwarded to the applicant.

"128. Passes for workmen in the employ of exhibitors, British side, will be issued, at the discretion of their class superintendent, to exhibitors themselves on application to him, and superintendents of classes will state in their daily reports any irregularity or misconduct they may observe.

"129. No application for a pass will be received from a foreign exhibitor except through the Commissioner of his own country.

"130. Lists of foreign exhibitors requiring passes, signed by the Commissioner of the country to which they belong, will be considered as vouchers, on which the number of passes required will be delivered to such Commissioners.

"131. Passes for workmen, foreign side, will be issued on the application of the Commissioner of the foreign country requiring their admission.

"132. Day tickets will be issued on the application by the superintendents of the several classes, and by the superintendent of the foreign side.

"133. An exhibitor, British side, requiring a day ticket, will be furnished with it by the superintendent of the class to which he belongs on application at the building.

"134. Applications for passes or day tickets on account of exhibitors from India or the colonies must be addressed to the superintendents of the Indian and Colonial Departments at the building.

"An exhibitor, foreign side, requiring a day ticket, will be furnished with it on application to the superintendent of the foreign side.

"136. Passes and day tickets must be shown on entering and leaving, and, whenever demanded, within the building.

"137. Passes and day tickets are not transferable; the transfer of a pass or ticket will, on discovery, subject the holder to expulsion from the building, and prevent the person to whom it was originally issued from obtaining another admission.

"138. If the possessor of a pass is found in a part of the building beyond the specified limits of his pass, it will be taken from him.

"139. All persons holding passes will be considered as agreeing to conform to all regulations from time to time issued.

"140. Infringement of rules will be followed by expulsion and forfeiture of pass.

"141. If a pass is lost by the owner, he must pay 10s. before obtaining its renewal.

"142. The door-keepers will be held responsible for any person found in the building without a pass.

"143. The officer in charge of a class space will be held responsible for the presence of any unauthorised person within it.

"144. Every person not properly authorised found in the building, or handling, or conveying or removing, any package or article from one part of the building to another, will be liable to be given into custody.

"145. No person will be allowed to carry any bundle or parcel of any size or kind whatever out of the building before it has been opened and examined.

"146. All persons using tow or cotton waste must provide slate or metal boxes for containing the refuse.

"147. Smoking is strictly forbidden.

"148. The introduction of lucifer matches into the building is strictly forbidden.

"149. Officers and servants of the Commissioners must attend punctually at the appointed hours, and enter their names in the books provided.

"150. Intoxication or disobedience of orders will subject the offender to immediate dismissal.

"151. The receipt of fees or payments of any kind by any officers or servants of her Majesty's Commissioners will subject the receivers to dismissal.

"Mode of Passing Articles of the United Kingdom into the Building.

"152. All articles must be delivered at the building with all charges and dues whatever upon them paid.

"153. The entrances for the reception of goods into the building will be as follows:—No. 1. The entrance to the eastern annexe in Exhibition-road for Classes 1, 2, 3, 4, and 9, and part of 5 and 7, marked Door A, No. 2. The central gates in the Cromwell-road for Fine Arts and General Manufactures, English and Foreign, marked Door B (Fine Arts), Door C (General Manufactures). No. 3. The entrance by Gore-lane for English and Foreign Machinery, marked Door D. No. 4. The entrance by the Horticultural Society's-road in Prince Albert's-road for English Machinery only, marked Door E.

"154. Goods and machinery will be received during such hours only as may from time to time be fixed.

"155. No persons but the carmen will be allowed to enter with a wagon; they will not be permitted to leave the wagon while within the building.

"156. Every article sent separately and every package must be legibly marked with the class number, and the name of the exhibitor or exhibitors, and special labels will be accordingly sent to them.

"157. An officer will be appointed to superintend the unloading and transporting of the articles to their respective places, and the following regulations will be observed in the reception and distribution of goods.

"1st. Every package on its delivery into the building to be entered in a register, with the name and address of the sender, the class to which it belongs, and whether received in good condition or damaged.

"2nd. A rotation number to be marked distinctly on each package; the same number to be entered against the sender's name in the register.

"3rd. All packages to be removed from the landing-stage, and deposited in charge of the class superintendents, or their Deputies, at places appointed for such purposes as soon as possible after their reception into the building.

"4th. Packages accidentally delivered or received at the wrong door, or from which the name of the exhibitor may have become obliterated, to be deposited in a place set apart for such packages.

"5th. In order to facilitate the answering of inquiries the rotation numbers of all packages received during the day will be entered in a book containing the names of the exhibitors alphabetically arranged, to be made up every evening.

"158. Each class will have a superintendent, a deputy superintendent, and the requisite number of attendants attached to it.

"159. The space for each exhibitor will be distinctly marked in the building.

"160. Trucks will be numbered for each class, and wheeled off to their respective classes by the officers of the Exhibition.

"161. All packing cases, &c., must be removed by the exhibitors as soon as they receive orders from the Commissioners to do so. Packing cases not removed within two days after notice will be sold, and the proceeds applied to the funds of the Exhibition.

"Mode of Passing Foreign and Colonial Goods into the Building.

"162. The receipt of all foreign and colonial articles will be subject to the control of the officers of the Customs, and in case any difficulty should arise, application is to be made to the senior Customs' officer at the building.

"163. The officers of the Customs and their servants will be provided with passes, and will be privileged to enter all portions of the building in which they may have business.

"164. All carts and wagons bringing foreign goods will enter the building at Cromwell-road, Door C, excepting machinery, which will enter the machinery department by Grove-lane, Door D.

"165. Goods and machinery will be received during such hours only as may from time to time be fixed.

"166. All articles and packages must be delivered at the building with all charges and dues whatever paid on them.

"167. Every article sent separately, and every package, must be legibly marked with the name of the foreign country or colony of which they are the produce or manufacture, and, as far as practicable, with the name of the exhibitor or exhibitors.

"168. No person but the carmen and the officer of Customs in charge will be allowed to enter the building with a cart or wagon; neither the carman nor the officer of Customs in charge will be permitted to quit the wagon while in the building.

"169. The carts or wagons will be unloaded in rotation by the officers of the Exhibition, when rotation numbers will be affixed to each package by the officers of the Customs.

"170. The packages must be produced on arrival to the officer of Customs at the Exhibition, who will see that the Customs number as well as the name of the foreign country is affixed to each package, which will then be placed on trucks and conveyed to its destination in the building.

"171. The officer in charge of each division will see that the packages belong to that division, that the Customs rotation number is marked thereon, and that the goods are then properly stored within it. When the articles of each country are deposited within the space assigned to them, the commissioner and agents appointed by foreign commissions and colonial committees, or the exhibitors, must themselves unpack, put together, and arrange them. In the case of foreign and colonial productions, as they must be necessarily unpacked for a considerable time before they are finally arranged for exhibition, it is suggested that the consignees or agents should be authorised to provide proper temporary coverings, such as glazed calico, to protect the articles from dust, &c., and in the case of machinery and polished goods, make the requisite arrangements for keeping the articles free from rust.

"172. The officers of the Exhibition in charge of each division will cause all packages properly certified as empty to be ranged in places hereafter to be determined upon.

"173. All packing cases, &c., must be removed by exhibitors or their agents as soon as they receive notice from her Majesty's Commissioners to do so.

"174. All packing cases not removed within two days after notice will be sold, and the proceeds applied to the funds of the Exhibition.

"175. Exhibitors intending to introduce foreign articles upon which duty has been paid with the view of exhibiting them among the goods of the country of which they are the produce or manufacture, must have a ticket attached to each, with the words "duty paid" thereon; and, to prevent difficulty in their delivery at the close of the Exhibition, they should be brought under the notice of the principal officer of Customs at the time they are brought in.

"By order, F. R. Sandford, Secretary,
"Offices of Her Majesty's Commissioners, Exhibition Building,
"South Kensington, London, W."

LAW INTELLIGENCE.

COURT OF CHANCERY, Lincoln's-inn, Feb. 21.

(*Before the* Lords Justices *of* Appeal).

CROSSLEY *v.* DIXON.

This appeal from a judgment of Vice-Chancellor Wood was heard on the 30th of January last. The object of the suit was to obtain relief against the defendant, Mr. Dixon, a carpet manufacturer at Kidderminster, for alleged infringements of the patents of the plaintiffs, Messrs. Crossley, carpet manufacturers at Dean Clough Mills, in Halifax. The facts, complicated and involved, were little aided by a voluminous correspondence. The bill stated that Dixon and Co. applied to Messrs. Crossley, in 1852, for a license to use their patent inventions for the manufacture of Brussels and velvet pile carpets; that no actual license was granted, but, after negotiation, the plaintiffs supplied the defendant with some looms upon the principle of their several patents, on the terms of the defendant paying the price of the looms and a royalty on every yard of carpet made from them; that the defendant had also bought carpet looms from Messrs. Sharpe, Stewart, and Co., of Manchester, alleged by the plaintiffs to be constructed so as to infringe their patent rights; and that the plaintiffs had sued that firm at law, and on reference the plaintiffs were awarded a large sum for damages. The prayer of the bill was either that it might be declared that the looms sold by the Manchester firm were constructed on the principle of the plaintiffs' patent, and that the defendant was bound, by the terms of his constructive license, to account for and pay the royalties, or that, if the license did not extend to those looms, the defendant might be restrained from infringing the patents of the plaintiffs. The Vice-Chancellor held that the defendant was a licensee from the plaintiffs, and was bound to pay the royalties, and the defendant appealed, alleging that there was no license at all, nor any application for one, but only an agreement for a license, and only, in any case, an agreement to pay a royalty for the machines actually sold by the plaintiffs. He also contended that he was at liberty to question at law the validity of the plaintiffs' patent, and that at all events, if there were a license or agreement for a license, the whole affair had terminated in 1854, when Messrs. Sharpe, Stewart, and Co. openly offered their machines for sale, made in conformity with their patent, which they alleged to be free from any objection by the plaintiffs or any other person holding any patents.

The case was argued by Sir Hugh Cairns and Mr. Cracknall for the plaintiff, and by Mr. Rolt and Mr. W. R. Fisher for the defendant.

Their lordships said that it was always with extreme regret that they differed with Vice-Chancellor Wood, but they were of opinion that the plaintiff should be at liberty to bring any action he might be advised. The appeal was ordered to stand over, but their lordships purposely abstained from offering any opinion on the validity or the invalidity of the letters patent mentioned in the pleadings.

A prospectus has been issued of the London India-rubber Company with a nominal capital of £75,000, in £10 shares. The object is to work certain patents known as "improvements in treating waste vulcanised india-rubber," which are stated to have yielded very profitable results in New York. A favourable feature of the undertaking is that the payment to the patentee, which is fixed at £20,000, is to consist of shares, upon which no dividends will be payable until the other shareholders shall have received 7½ per cent.

MISCELLANEA.

The extensive works, erected by Messrs. Kitson and Hewitson, of Leeds, for the manufacture of Fowler's steam plough, are understood to be very fully occupied, 420 men being at present employed.

Mr. James E. McConnell, for many years locomotive superintendent of the London and North-Western Railway at Wolverton, has resigned his appointment The cause of this step has not yet transpired.

The report of the Dublin and Belfast Junction Railway directors, observes that the extensive works which Mr. Hawkshaw recommended for the Boyne Viaduct, to insure the permanent stability of that structure, have been completed in a substantial and durable manner.

The Liverpool, Philadelphia, and New York Steamship Company (Inman line) are about to build another steamer to be equal or superior in speed to their new steamer City of New York, to be called the City of London, and to be ready for sea about Christmas of the present year.

In the attempt, on Sunday week, to place the Great Eastern on the gridiron, in Milford Haven, two men were drowned, and eleven others came very near being lost. The great ship got adrift also, and came in collision with the Blenheim. The attempt was repeated on Monday with better success, the vessel being securely placed on the gridiron.

In addition to the steam fire engines making by Messrs. Shand and Mason, of Blackfriars-road, and Mr. Merryweather, of Long Acre, Mr. Roberts, manager at Messrs. Brown and Lenox's, Millwall, is constructing one with Benson's boiler, and Messrs. Handyside and Co., of Derby, are making two upon the plans of Paul R. Hodge, Esq.

The deaths by street and other railroads in Philadelphia during the year 1861, number forty-two persons, sixteen of them under fifteen years of age. The accidents were mainly the result of carelessness on the part of the killed, and but one life was lost at a time. The population of Philadelphia is upwards of 600,000, and upwards of 150 miles of street railways are laid in the streets.

The London, Chatham, and Dover Railway charter prescribes a headway of 37ft. under the soffits of the new railway bridge at Blackfriars. The company are now seeking to obtain the repeal of this section, and permission to make the headway, under the soffits of the bridge, not more than 27ft. nor less than 20ft. The company seek powers also to lay down four lines of rails at the level of Holland-street, Blackfriars.

The directors of the Great Ship Company have decided on the appointment of Captain Walter Paton, of Liverpool, as the commander of the Great Eastern. Captain Paton, who is well-known in Liverpool, is highly spoken of as an able and experienced seaman and as thoroughly a gentleman. It is understood that his salary will be £1,000 per annum, with contingent advantages. Captain Harrison's salary was £1,500.

So far as we are aware the largest hydraulic presses ever made have been those by Mr. A. McArthur, of the Peockland Engine Works, Johnstone, near Glasgow. He has made presses, for pressing tin pipes, with 30-in. rams, loaded to five tons per square inch. The cast iron cylinder was hooped with 4-in. square wrought iron rings shrunk tightly on. Others of Mr. McArthur's presses, made for Woolwich Arsenal, have 20-in. rams.

The Warrior is ordered to Portsmouth from Gibraltar. Her list of defects, sent home from Lisbon, is somewhat formidable. It is asserted that the statement of the ship's labouring heavily and refusing to answer her helm on her outward voyage to Lisbon was actually less than the truth, although partially contradicted by Lord C. Paget in his answer to the question recently put by Sir John Pakington in the House of Commons.

The following appointments of naval engineers have been made since our last:—Andrew M'Farlane, promoted to chief engineer; Albert Martell, promoted to first-class assistant engineer; William Head, promoted to first-class assistant engineer in the Grasshopper; Den is Driscoll, first-class assistant engineer, appointed to the Asia as supernumerary for hospital treatment; Henry Coller, confirmed as second class assistant engineer in the Cornwallis.

Notice has been given that the *Moniteur* contains an Imperial decree, admitting, free of duty, under specified conditions, the following materials intended for re-exportation after being converted in France into various articles:—Iron, purified, called *mazée;* broken iron, iron crude, in lumps; bar and hoop iron, angle, T, and other iron of irregular shapes, iron in plates, steel in bars, in hoops and brown plates, hot rolled, and copper, rolled, pure or allied with other metals.

A prospectus has been issued of the Indian Tramway Company, with a capital of £1,000,000, in £5 shares. It is proposed to construct tramways at a cost of about £2,800 per mile, as an auxiliary to the railways, and to be worked by animal or steam power, according to the locality or the nature of the traffic. An agent will be sent out to negotiate with the Government of India, and a payment of 2s. per share for that purpose is all that is required in the first instance.

Orders have been recently received at Portsmouth to fit the Black Prince, 40, iron frigate, with Renton's patent hydraulic steering apparatus, at a cost of £1,270, conditionally on its acting efficiently when completed. The apparatus will be enclosed in an iron box, made from 3½ and 4½ inch plate, and will be fixed under the iron beams of the upper deck, abaft the screw well, in the captain's after cabin. The power will be brought to bear upon the rudder-head with a screw of a similar nature to the one fitted to the rudder-head of the American frigate Niagara.

The *Canadian News* understands "that Mr. Chalmers, the author of 'the Channel Railway,' at the request of influential parties in Canada has been considering the feasibility of a railway communication across the St. Lawrence at Quebec by means similar to those which he proposes for crossing the English Channel at Dover. Mr. Chalmers believes that there are no insurmountable, or even very serious, difficulties to be encountered, and that a substantial and durable roadway can be constructed on his plan for about one-fourth the cost of the Victoria Bridge at Montreal."

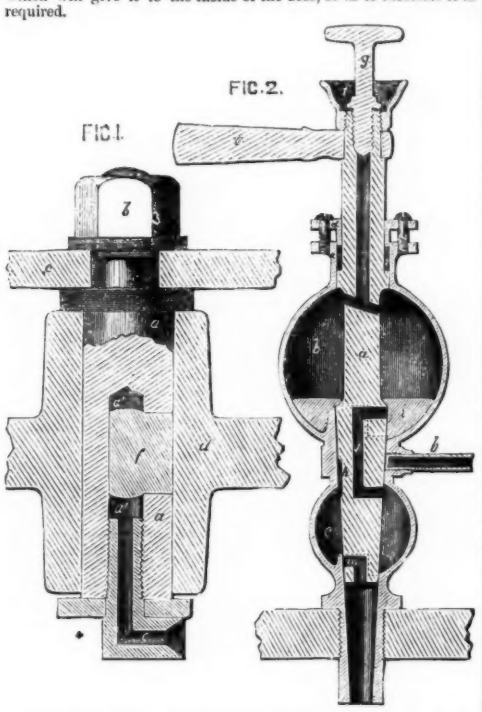
Two rails, weighing about one ton each, were rolled, on Saturday week, at the Codnor Park Ironworks. One was rolled 120ft., and the other 110ft. long. On the previous Saturday a side for an engine beam of wrought-iron was rolled 37ft. long, 7ft. wide in the centre, and 2½in. in thickness. Other works equally surprising are in progress in armoury plates and machinery of the most colossal magnitude. When the new works are completed Codnor Park will be second to none of the ironworks in the kingdom, and the specimens of iron intended for the Exhibition in May will, though executed at the old works, be worthy of the world-wide repute of this powerful company.

A new system of telegraph has been submitted to the Emperor, to which its inventor, M. Caselli, has given the name of "pantegraph." This telegraph has been already worked at Florence and Leghorn. It transmits autograph messages and drawings with all the perfections and defects of the originals. An inhabitant of Leghorn wrote four lines from *Dante*, and they appeared in the same handwriting at Florence. A portrait of the same poet was painted at Leghorn, and it was reproduced at Florence line for line and shade for shade. A bill of exchange was drawn in the same manner, and its authenticity admitted. The Emperor was much pleased at the trial made in his presence, and he proposes to establish it in France.

Herr Friedrich Krupp, of Eissen, Rhenish Prussia, whose steel works are, probably, the most extensive in the world, not long since added to his tools a steam hammer of unprecedented dimensions. The head alone weighs 45 tons, and the whole weight, including frame, anvil-block, &c., is upwards of 500 tons. This hammer has been lately employed for forging masses of cast steel upwards of 2ft. 6in. square and intended for mortars, but even the enormous impact of 45 tons has been found to be "too light," and it is understood to be the intention of Herr Krupp to erect another hammer with a head weighing upwards of 100 tons, the whole "implement" weighing considerably upwards of 1,000 tons.

THATCHER'S LUBRICATORS.

THE first part of this invention, by Robert Thatcher, of Oldham, is shown in Fig. 1, which represents a stud, with the boss of a wheel or pulley, which revolves on it, with sponge or other absorbent material applied. *a* is the stud (shown partly in section) which is fastened by means of the nut *b* to the framing *c*, which is shown in section; *d* is the boss of the wheel or pulley which revolves on the stud *a*; the stud *a* has a hole a^1 bored in it; *e* is an oil cup, which is screwed into the end of the stud *a*; *f* is a piece of sponge or other absorbent material, which is packed into a slot or opening, which is cut through the top side of the stud from the outside to the inside, so that if any oil is poured into the cup *e* it will be conveyed inside the stud, when it will be absorbed by the sponge, which will give it to the inside of the boss, so as to lubricate it as required.



The second part of the invention is shown by Fig. 2, which represents a section of an improved oil or tallow cup. *a* is a vertical plug, which fits into a hole between the spherical cups *b* and *c*, and into a hole below the cup *c*; this plug is kept in its place by means of the cap *d*, which is screwed to the flange of the cup *b*; *e* is a handle, which is fastened to the plug *a*; *f* is a cup, which is screwed on the top of the plug, and *g* is a plug, which is screwed into the hole *h*, which is bored in the plug *a*. Its mode of operation is as follows:—The plug *g* is unscrewed and oil or tallow is poured into the cup *f*, when it runs down the hole *h* into the large cup *b*, which is made so as to contain about ten times as much oil or tallow as the cup *c*. When the large cup is filled the plug *g* is screwed in again. If the handle *e* is in the position shown, the oil or tallow will filter through the sponge *i*, and run down the hole *j*, which communicates with the cup *c*; by this means the cup *c* will be filled with oil or tallow, and by turning the handle *e* half a revolution the communication between the cups *b* and *c* is cut off, and the groove *k* which is in the plug will be brought opposite the steam pipe *l*, which comes from the valve box or from a pipe communicating with the boiler, and the steam blows the oil or tallow that is in the cup *c* through the hole *m* into the inside of the cylinder or valve box as required.

PRICE'S TOOLS FOR CUTTING SHIVES.

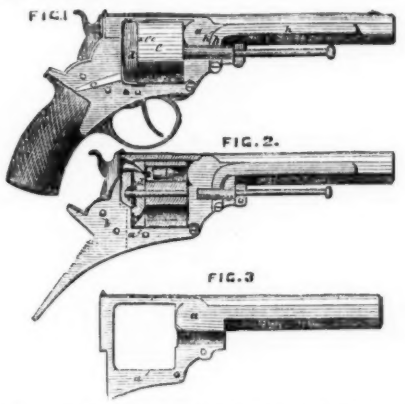
THIS invention consists in fixing upon and around a conical mandril or block a conical band of steel, which is formed with saw teeth for cutting wooden shives and other substances usually cut by saws, and with a knife edge for cutting cork and other substances requiring a knife edge for cutting them.

* The band does not extend round the whole circumference of the mandril, as there is a space left between the ends thereof, and the entering end is formed with a knife edge. The cutter is adjustable on the mandril, and is made to protrude more or less beyond the top or the base thereof, according to the thickness of the shive or other article to be cut, and is retained in its position by a ring driven over it and the mandril. The cutting is effected by rotary motion being imparted to the tool.

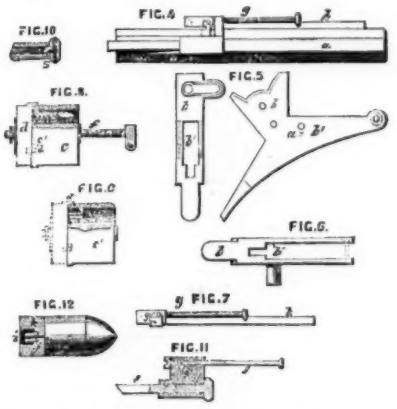
Fig. 1 is a side elevation; Fig. 2, a longitudinal section; and Fig. 3, a perspective view of this tool for cutting shives and other conical blocks. *a* is the conical mandril or block, to which the band of steel *b* is secured by a metal ring *c*. The outer end of the band of steel is formed with saw teeth *g*, as shown, when wooden bungs are to be cut, and with a knife edge for cork and other soft material. The mandril *a* carries a screw-threaded spindle *d*, whereby it is connected to a lathe or other machine for communicating rotary motion. *f* is a knife edge formed on the entering end of the steel band *b*. The wood or other material to be cut is pressed towards and into the tool while made to revolve. The shive or other conical block is pushed out by inserting a rod in the aperture *h*, formed hrough the spindle *d* and mandril *a*.

ADAMS' REVOLVING FIRE-ARMS.

FIG. 1 shows a side view of a revolving fire-arm constructed according to the first part of the invention of John Adams, of King William-street, City; Fig. 2 shows a side view partly in section of the barrel and frame, in which the chambers revolve in combination with the part of the frame which carries the lock and hammer, and to which the stock is attached; Figs. 3, 4, 5, and 6 show separate views of these parts.



a is the barrel and frame in which the series of chambers revolve, formed, as shown, out of one piece of metal, the lower part a^1 of which fits accurately into the slot b^1 formed in the part *b* of the frame which carries the lock and hammer, and to which part the stock of the fire-arm is attached, as is well understood in the construction of revolving fire-arms of this description. The two parts *a*, *b*, are secured together by screws or pins at a^2, a^2, or in any other convenient manner. By thus forming the barrel *a* and frame *b*, to which it is attached, in two parts, the construction of such parts is greatly simplified, and the cost of manufacturing fire-arms of this description is considerably reduced.



The second part of the improvements consists in constructing and arranging the cylinders or series of revolving chambers of revolving fire-arms in combination with a revolving breech-piece or base-plate, so that such chambers may be suitable for receiving and exploding the charges contained in cases or cartridges, somewhat similar to those known as "Lefancheux cartridges." *c*, *c*, show the series of revolving chambers which are open at each end, and suitable for being charged with cartridges at the breech end of each chamber; *d* is the breech-piece or base-plate for closing the back ends of the chamber *c* when the fire-arm is discharged. This breech-piece or disc *d* is carried by and rotates with the chambers *c* on the same central pin or axis *f*, which is capable of being readily withdrawn when it is desired to release the breech-piece to detach or exchange the revolving chambers *c*. The lock of the fire-arm, and the apparatus for giving motion to the combined parts *c* and *d*, is of the ordinary construction, the driver being arranged to act on a ratchet formed on the back of the breech-piece or base-plate *d*, so as to give rotary motion thereto, there being a tooth or projection d^3 on the breech-piece *d*, which, in its rotation, comes against one of a series of projections c^1 formed on the outer circumference of the revolving chambers *c*, by which such chambers are caused to rotate correctly with the breech-piece *d*. Openings are formed in the breech-piece *d* for the hammer *e* to pass through in order to explode the cartridge when the fire-arm is discharged. When it is desired to load the fire-arm the central pin or axis *f* (which is retained by a spring f^1) is withdrawn a short distance to permit the breech-piece *d* to be slid a short distance sideways, so as to uncover the back ends of some of the revolving chambers *c* on one side, in order to admit of the cartridges being introduced into the back end of each chamber as they are brought round in succession for this purpose. The cartridges employed in this arrangement are each furnished with a percussion-cap, which is exploded when struck by a projection on the hammer. A sliding rod *g* is arranged in combination with the central axis *f*, as shown at Fig. 11, to force out the empty cartridge cases when exploded. This rod *g* is also suitable for ramming in the charges when chambers carrying ordinary ammunition are employed; it is also so arranged that when the central sliding axis *f* is forced home, and the parts are in position for being discharged, the rod *g* is fixed by a sliding pin or bolt g^4 actuated by the central axis.

It will be evident from the foregoing description that by withdrawing the central axis the set of revolving chambers *c* may be readily removed and another set of chambers substituted therefor; and part of the invention consists in constructing revolving fire-arms of this description, that a set of rotating chambers c^2, such as is shown at Fig. 9, suitable for being charged at the muzzle with cartridges or with ordinary ammunition, may be substituted for the set of chambers *c*, Fig. 8, before described, which are only suitable for being loaded with cartridges at the breech end. It will be seen on examining Fig. 9 that these chambers c^2 are formed with a nipple suitable for receiving an ordinary percussion cap, which is exploded by a blow from the hammer *e*, which passes through openings formed in the breech piece *d*, which is the same, together with the other parts, as before described.

The improvements in cartridges suitable for being used with revolving fire-arms, such as before described, are shown by the enlarged section of a cartridge, constructed according to this part of the invention, at Fig. 12, which, it will be seen, is arranged with a percussion cap *i*, and an exploding pin *j*, placed in the base or back end of the cartridge. The cap with the small exploding pin is inserted into a hole or recess formed in the solid base *k* of the cartridge, a small hole or passage being formed to connect the recess in which the cap is placed with the interior of the cartridge, so that the fire from the explosion of the cap passes directly into and through the centre of the charge.

TRANSATLANTIC STEAM PASSAGES IN 1861.

In 1861 there were fifty steamers plying between Europe and America, and sailing from, or touching at, ports in the United Kingdom. They conveyed between them 69,307 passengers. The proportions to each line were as follow:—

	Eastward.	Westward.	Total.
Cunard steamers	2,226	2,026	4,252
,, Boston branch ..	1,966	1,744	3,710
Liverpool, New York, and Philadelphia	11,626	12,975	24,601
New York and Havre	1,470	1,957	3,427
Hamburg and New York	3,778	5,910	9,688
Bremen and New York	1,700	3,106	4,806
Liverpool, Quebec, and Portland ..	3,875	8,404	12,279
Galway and New York	1,213	2,467	3,680
Glasgow, Quebec, New York, and Portland	449	983	1,432
Miscellaneous steamers	563	779	1,342
Total in 1861	28,976	40,351	69,307
Total in 1860	24,644	49,796	74,440
Decrease in 1861 from 1860	.. ..	..	5,133

Considering the civil strife raging in the United States, the falling-off in numbers is much less than might have been expected. It must also be taken into consideration that the packets of the Galway line, which usually carry the largest number of emigrants, were withdrawn from the trade, and that the Fulton and Arago were taken off the Southampton line early in December. Had the same number of voyages been made in 1861 as in 1860, it is probable that the totals of the past year would have compared favourably with the preceding one, in spite of the disturbance of trade by the Federal and Confederate war. That the diminution was only 5,133 is a subject for congratulation, and is proof that when the normal state of relations between this country and America regain their sway there will be a resumption of passenger traffic by steam in excess of any former period. Three losses were incurred in 1861:—First, the United States, of the Anchor Line, from Glasgow for Quebec, which struck on the Bird Rock, in the St. Lawrence, in April; next, the Montreal steamer Canadian, lost by contact with ice; and, lastly, the North Briton, off Paraquet Island, on the 5th November. The Cunard steamer Australasian put back, with her fans of screw broken, on the 3rd of March. The Etna, of Inman's Line, returned to Cork on the 7th August, from derangement in machinery; and the Great Eastern having encountered a hurricane, which broke her rudder-post and damaged her paddle-wheels, steamed back to Queenstown. The Hibernian put back to Donaghadee in May, with one engine broken; and the Norwegian struck on a reef in the St. Lawrence on the 27th July, but floated again on the 2nd August. These are all the Transatlantic casualties to steamships during the year expired. The Liverpool, New York, and Philadelphia Company's steamers made 51 outward passages, on an average of 14 days and 57 minutes each; and 49 homeward passages, at an average of 12 days 14 hours 8 minutes. The shortest passage outwards by this line was performed by the City of New York in 10 days 17 hours. The quickest homeward passage was made by the Etna in 10 days 15 hours. Deducting the voyages of their spare steamer Vigo, the average passages of Inman's steamers are under those of the Cunard line. The steamers of the British and American Royal Mail Company made 26 passages from Liverpool to New York in 12 days 17 hours 34 minutes average, and from New York to Liverpool in 11 days 3 hours 55 minutes. The same company's steamers made 26 passages to Boston, *viâ* Halifax, on an average of 13 days 14 hours 18 minutes, and homewards to Liverpool in 11 days 12 hours 11 minutes.

The Montreal mail steamers made 20 passages from Liverpool to Portland, in Maine, on an average of 14 days 2 hours 9 minutes, and homewards in 11 days 13 hours 18 minutes. On 30 passages from Liverpool to Quebec the average time of performance was 12 days 17 hours 34 minutes, and on 27 passages to Liverpool 11 days 7 hours 51 minutes.

Eighteen hundred and sixty-one was not particularised by any very remarkably fast passages. The Persia made two passages in 9 days 18 hours and 9 days 19 hours respectively; the Australasian, one in 9 days 19 hours; the Anglo Saxon, two to Quebec in 9.22 and 9.23; the Hibernian, one in 9 days 18 hours; and the North American, one in 9 days 21 hours. The Adriatic ran out from Galway to New York, *viâ* St. John's, in 8 days 22 hours, and next to the Great Eastern she performs her passages, on an average, in the shortest time of any vessel plying between England or Ireland and America. Had the Great Eastern not been crippled by the accident which befel her, she would have proved to be the most exact-timed vessel that ever crossed the Atlantic. The passages she performed in 1861 were as follows from and to Liverpool:—

		dys.	h.	m.
Great Eastern outwards, in May, New York		9	19	40
,, ,, July, Quebec		9	8	45
,, homewards, May, New York		9	8	11
,, ,, July, Quebec		9	8	45

Instead of averaging from nine to sixteen days, like the ordinary steamers, the Great Eastern would run across and return the whole year round with a variation in time of a few hours only. This was proved by the speed she made in the gale before breaking down. Her ponderous weight and size gives her a great momentum, and when her steering gear is in effective order, and her paddle engines made to disconnect on an emergency to bring her head to the wind, she will redeem her character, and, we hope, pioneer the way for a class of ships that will reduce the at present shortest passage, as professed, by two days, and develope a stream of passenger traffic between Europe and America by robbing the ocean of some of its terrors. The average passage of the subsidised mail steamers increases despite the improvements in steam navigation. The run home of the Persia recently from Halifax to Liverpool shows what could be done by faster steamers on that line; and the requirements of the age demand that the passages between England, Halifax, Boston, and New York should be reduced fully one-third in time, and this is practicable with suitable ships.—*Mitchell's Steam Shipping Journal.*

THE NAVY.—Our ships and vessels in commission on the 1st of December last were 337, being 24 less than the number a twelve-month previously. Among the sea-going vessels, 160 in all, we have at the later date the line-of-battle ships reduced from 27 in number to 22, but then we have to make the important addition of an iron-cased ship to the list; the frigates and corvettes are reduced from 50 to 41, and the sloops, small vessels, and gunboats from 106 to 96. The harbour guard-ships and stationary ships, 32 in all, are four less than in the previous year, and the surveying, troop, and store-ships 20 instead of 21; but the tenders are increased from 48 to 51. The guard ships of the Coastguard are 11, as before; the tenders, including cruisers, are increased from 62 to 63. The number of cadets admitted in the year was 174. To man this fleet the estimates propose, for the financial year which will commence at the end of next month, a force of 40,000 officers and men, instead of 49,000 voted last year, but the boys are to be 9,000 in place of 2,000; the Coastguard service will be reduced from 8,000 to 7,850, with 1,150 not borne on ship's books; the marines are 18,000, as before. Thus the whole force in the fleet and Coastguard service is fixed at 76,000, instead of 78,200, the number voted last year. The Navy Estimates are reduced from £12,640,588, the amount voted last year and on supplemental estimate of this year, to £11,794,305 but this also will, of course, be subject to supplemental additions.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

THE ENGINE AT HARTLEY NEW PIT.

Sir,—I beg you will excuse my sending you a few remarks relative to the accident at the Hartley Colliery. With all due respect to the makers, I beg to say that if the engine was erected on the Cornish principle, and the beam broke in the centre, the outside half could not fall into the shaft and cause such a calamity. The Cornish engineers always place the condensing cistern outside, between the engine-house and shaft, and the end of the beam only to plumb the shaft or pumps, and on the edge of the shaft next to the condensing cistern place several large, whole, pieces of timber, one upon the other, well secured and sufficiently strong to bear all the weight of the rods in the shaft, called catch-pieces, should the beam piston rod or any of the connections give way.

I would also advise all owners of coal mines to discontinue the use of buckets or drawing lifts if possible, and convert them into plunger lifts, and I am certain that this alteration would soon pay them the outlay in saving of the fuel which I will endeavour to show. All scientific engineers are aware of the extra power required to force water through pipes of a less diameter than the bore of the pump with the same velocity as a piston should travel with the steam acting on it. In the bucket pump we have the spears in the centre of the column, filling the space where the water would pass with the least friction, consequently producing more on the sides, the whole length of the lift. The plunger lift has not this obstruction, and being attached to a single acting steam engine (condensing the steam only at the bottom of the piston), delivers the water through the column by the weight of the rods on the down stroke of the pump with half the velocity as the bucket which delivers the water by the steam on the piston. The rods being on the out-side of the pumps a defect may be seen in time to prevent an accident.

I would also remark that the engines in Cornwall are not put on trial until the plunger lifts are all fixed; if they were they would not show such favourable results.

Should a similar accident occur as at Hartley, and having plunger lifts instead of buckets, I think it is very likely some of the men would think of getting at the door-piece of the column to ease the nuts and bolts of the door to let down the water to have a communication with the surface, and an up-take for the foul air; and if a stream of water could be turned into the pumps at intervals from the surface, it would force down a sufficient quantity of air to save the men's lives, and other necessaries could be passed through the pumps until the men were rescued. There could also be erected in a short time a blowing machine, to force air to them. Perhaps a locomotive engine could be made to answer the purpose with a little alteration, or the stationary winding engine might be made to serve.

Had the men at Hartley Pit taken off the door of the lift in the shaft it would be of no service to them while the bucket and spears remained in the pump. Thomas Sampson.

Campden-hill Waterworks, Kensington, February 20th, 1862.

Sir,—Being of opinion that the result of "P. J.'s" calculation of the Hartley beam is erroneous, I beg to submit the following:—

Let B = 8in., D = 98in., $b = 3\frac{1}{4}$in., d = 86in., and L = 18ft.

Then, according to Fairbairn, the breaking weight of a rectangular cast-iron bar, 1in. square and 4ft. 6in. between the supports, and loaded in the middle, is about 444 lb. for common cast iron (S); but this beam being an open sand casting, the value of S will be required to be reduced to 296 lb.

For a bar loaded at one end and fixed at the other, the formula will be thus, referring to "P. J.'s" sketch—

$$\frac{(B D^2 - b d^2) \frac{1}{4} S \times 4{,}5}{L} = \text{breaking weight};$$

or,

$$\frac{(76832 - 24037) \times 74 \times 4{,}5}{18} = 976707{,}5 \text{ lb.}$$

The pressure in the boiler being 10 lb. per square inch, and the vacuum 12 lb., we have for the entire load on the piston 5876,5 × 22 = 129243 lb., which gives 64641,5 for each beam. $\frac{976707{,}5}{64641{,}5}$ is nearly 15. One side of the beam being flat, and on the other side a boss, &c., the loss of strength, through unequal contraction, might be 10 per cent; leaving the result to be that the beam was loaded with $\frac{1}{13{,}5}$ of the breaking weight. S.

Bermondsey, February 25th, 1862.

AGRICULTURAL LOCOMOTIVES.

Sir,—In Mr. Aveling's reply to Mr. Butlin with respect to traction engines priming in ascending or descending inclines, he says he endeavoured to prevent it in an engine built by Clayton and Shuttleworth in 1859, by placing a screw under the smoke-box of the boiler in order to raise and lower it, and that by his present arrangement the complication of the screw can be got rid of. Mr. Aveling may get rid of priming in the way he says, but the use of the screw has another and a far more important duty to perform, viz., preventing the crown plate of the internal fire-box from becoming bare of water when descending inclines.

I have had nine or ten years' experience in the working of traction and common portable engines, and have no hesitation in saying, without fear of contradiction, that it is very dangerous for such engines to travel about on town or country roads without first having some mechanical means of adjusting the boiler when made of horizoatal tubes; in fact I have had several fusible plugs melted out of the crown plates, to our great annoyance, in the middle of our journeys, whenever we happened to neglect the use of the screw, and the same thing occurred in Ireland to an engine of the late Mr. Boydell. I patented, in 1856, the use of the screw in levelling the boiler, and my last six digging machines were provided with them. Boydell's and Smith's, of Coven, have, since that time, been also, in like manner, provided with the screw, so important do they consider it; and even lately Messrs. Taplin and Lee, of Lincoln, have re-patented the same invention for the same purpose, as illustrated in The Engineer of the 10th of last month.

With regard to the difficulty of priming, I have found, by experience, to have got over it by an arrangement in one of my patents, whereby the steam domb is placed as near as possible over the main axle or point of suspension, and divided into two compartments by a partition, in order to supply two separate induction pipes alternately with steam, breaking the continuous flow to the single or double set of cylinders. Robert Romaine.

Devizes, Wilts, February 22nd, 1862.

A STEAM REGENERATOR.

Sir,—It may interest some of your readers to know that the "steam regenerator," of which you gave us such a full and amusing account last week, and which has been produced by the united genius of three nations—English, Italian, and French—which caused such a sensation at the axle-works of Mr. Collinge, has been patented, and for the manufacture of which it appears a company is to be got up—I say it may interest your readers to know that this apparatus has been tried years ago. The placing a feed-water heater in the boiler flues is a very old idea, which, no doubt, most of us remember to have seen carried out as far back as our apprenticeships. I may also add that about seven years ago this very same condensing apparatus, including the force-pump, was applied, by the resident engineer, to a 12-horse high-pressure engine erected by the writer at Ely for supplying the town with water; and that, at a subsequent date, when it was decided to put down a second engine, Mr. Joseph Glynn, who was consulted by the Board of Health, designed and specified "what is termed a regenerator" for heating the feed-water. I have a tracing of this by me, and it is just what is described in the "extracts" you gave us last week. So much, then, for the patent "invention which comes from Italy."

Surely, sir, journals which profess to teach the public ought to be more careful how they are led into circulating such stuff as your contemporaries have done. No Gammon.

Leeds, 25th February, 1862.

THE LENGTH OF CONNECTING RODS.

Sir,—I observe in your impression of the 21st inst., under your notices "to Correspondents," the following words: "A connecting rod should, if possible, be from three and a-half to four times the length of the stroke, and, if the engineer is cramped for room, a length of twice or even one and three-quarter times the length of the stroke has often to be adopted."

Now, sir, I have been taught to believe that a long connecting rod is of immense importance, and, looking at the plans adopted by some of our engineers to obtain a long connecting rod in marine engines, I cannot but believe that it possesses some advantages which I have never been able to define; and I shall, in common with many of your readers, be glad if you will give us a clear mathematical demonstration of the advantages possessed by a connecting rod four times the length of the stroke over one of twice the length of the stroke. An Engineer's Pupil.

London, 24th Feb., 1862.

[We will leave to some of our correspondents the task of demonstrating, *mathematically*, the advantages of a long over a short connecting rod. If, however, our correspondent will prepare a diagram showing two connecting rods whose respective lengths are equal to once the length of the stroke and to four times its length, he will perceive the very great difference in the pressure upon the slides and corresponding unproductive strain upon the crank pin and main journal. This pressure and strain represent a great amount of friction. With a short connecting rod, too, it is difficult to adjust the valves to cut off at equal portions of the top and bottom stroke.—Ed. E.]

SURFACE CONDENSERS.

At a meeting last April of the Institution of Engineers in Scotland the following communication by Mr. David Napier was read: "I have not the slightest doubt of the day not being far distant when surface condensation will be generally used both on land and water. I have had nothing to do with a steam engine of any kind for upwards of thirty years, without a surface condenser. The engine I had for driving my lathes at Millwall, London, had one. It is true that I have sold steamers having surface condensers, which the purchasers immediately turned out. I may state an instance of that in the Falcon about twenty-six years ago, on hearing which I wrote the proprietors, offering to buy the condenser, if they had no other use for it. It consisted of a number of thin flat iron tubes, made of sheet iron, contained in an iron box or case about 4ft. square. I ultimately did buy it back, and put it just as it was into a steamer called the Chieftain, which steamer I purchased from the same parties who bought the Falcon from me. After constructing the engines of the Chieftain so that they would consume ever particle of steam the boilers could produce, and not allow any to blow off, I had the boilers filled with pure water from the hills of Kilmun, from which place I started and went by the Pentland Firth to London, from thence to Rotterdam and back, when I sold the Chieftain. But, before parting with it, I had some water drawn from the boilers, which were still hot, for the purpose of making toddy, when I found the water nearly as pure as when we left Kilmun."

The next communication was one by Dr. Joule, of Manchester, on the same subject:—"The numerous experiments I have made with a surface condenser, fitted to a two-horse engine, have led me to form a decided preference for it over the method by injection. In addition to these, I have made between one and two hundred experiments with a condensing apparatus not in connection with a steam engine, the results of which I have communicated to the Royal Society, and they will, I trust, be of some use in furnishing data for the guidance of practical men. Probably the best arrangement of a large condenser is that in which the refrigerating water is forced through pipes surrounded by the steam to be condensed, for then a small leakage contributes to supply the loss of steam perpetually going on from a variety of causes. Pipes from $\frac{1}{8}$ths of an inch to 1in. diameter appear to be the most suitable. A considerable advantage is obtained by causing the water to circulate in the pipes with a spiral motion, which is easily effected by placing a loose spiral wire in each pipe, as patented by me some time ago. The conduction of heat through the pipes is principally retarded by a film of adhering water, and is not as much affected as might have been anticipated by the greasiness of the surfaces. The grease which passed from the cylinder of my engine did not seriously impair the working of the condenser, and I did not find that the presence of grease in the boiler occasioned corrosion or a tendency to prime. It appears to be almost immaterial in which direction the refrigerating water is transmitted, that is, whether or not the coldest water comes in contact with the steam which has been longest in the condenser, the reason evidently being that the temperature of the vacuum is nearly equal in every part. There is a limit to the advantageous diminution of the diameter of the pipes, which is soon reached on account of the increased force required to propel the water. The experiments I have made show that the pressure of the water entering the condenser ought in no case to exceed 10 lb. on the inch. I believe that a head of 10ft., or 5 lb. pressure on the square inch, is amply sufficient. The difficulties at first experienced in the application of surface condensers to steam engines are evidently fast disappearing before the intelligence and practical experience of the present day; and I think few engineers will doubt that, in marine engines, at any rate, they will soon be universally employed."

The next communication was by Mr. J. G. Lawrie, on the same subject:—"The contentions of the advocates of rival plans, exhibited on the last occasion when this subject was before the Institution, carried the discussion into matter somewhat irrelevant, and led to questions of less importance in surface condensation than to the competing interests of these several gentlemen themselves. It may, therefore, not be without advantage to review our position, and to see where we really are. With the intention of doing this, the following remarks will be of two kinds, one being addressed to the opinions of the rival advocates in the order in which they were expressed, and the other tracing a general outline of surface condensation.

"Mr. Davison in his paper stated the minimum economy derived from the use of fresh water in boilers to be 13·7 per cent., and explained his mode of making the calculation; but Mr. Spencer objected to receive that calculation as any estimate of the resulting economy, on the ground that, when salt water was used, and, of course, blowing off resorted to, a quantity of steam was blown off together with the water. It is true that the actual economy derived from the use of fresh water in boilers must be, and is, greater than the minimum stated by Mr. Davison; but the explanation given by Mr. Spencer certainly does not account for the difference, which arises chiefly in the following way:—The water being blown off from one particular part of the boiler causes a current of all the water, including the feed-water, to that place; and, therefore, to maintain the salinometer, placed at another part of the boiler, uniformly at the same degree, a larger quantity obviously must be blown off than the minimum quantity, which, to have the effect assumed by Mr. Davison, must be withdrawn equally from every part of the boiler, a desideratum that cannot in practice be accomplished. The economy is thus greater than the minimum of 13·7 per cent., stated by Mr. Davison, to an extent different in different boilers. Mr. J. M. Rowan argued that for surface condensation the lubrication of the machinery must be effected by water, apparently for the double reason that the use of other lubricating material was incompatible with keeping the condenser clean, and because when tallow or oil was used it was decomposed at 250 deg., releasing glycerine in the case of tallow, and they were therefore, when steam was superheated, unfit for lubrication. Tallow suffers some decomposition at about 300 deg., and fish-oil at about 500 deg.; but whether they then become unfit for lubrication is really of little moment, because no one supposes that, even in those cases in which a cupful of tallow is occasionally injected into the cylinder, the rubbing surface is thereby kept coated with tallow. Mr. Rowan appears to imagine that the practicability of superheating depends solely on the applicability of tallow in lubrication to prevent the rubbing surfaces from being torn up, but in no case has a quantity of tallow been used to keep the rubbing surface of the piston coated with it, and there are other methods by which injurious effects arising from superheated steam can be palliated, and perhaps avoided. Until these other methods are exhausted the use of superheated steam cannot be set aside as impracticable. The amount of economy to be derived from an extended expansion of the saturated and wet steam which all marine boilers produce is by no means so apparent as that derived from the expansion of superheated steam, and no course of procedure inconsistent with its use can be received as satisfactory. Each of the advocates claim a superiority in the mode of securing the tubes, and also a superiority in the arrangement of the condenser for effecting condensation. In the writer's opinion the time stated by Mr. Davison as necessary to withdraw and replace the tubes when secured with india-rubber washers and nuts, at two and a half minutes for each end, is correct, or, at all events, not overstated. It is not, however, so simple a matter to decide which of the arrangements of condensers recommended is most effective for condensation. The advocates for the condenser of Mr. Rowan contend that the effective vacuum obtained by it arises from a perfect circulation of the water due to the central fan, that each tube is equally effective, and that the temperature of the condensing water must be uniform; but an examination of the arrangement leads to the conclusion that the condenser is by no means entitled to all that is claimed for it. The cooling water enters the condenser at the centre, and is intended to be thrown out radially by the fan; but, if it be so thrown, it follows, as a necessary consequence, that, while all the water is brought into contact with the tubes nearest the centre, those nearer the circumference receive less and less, in proportion to their distance from the centre. Besides, the passage from the condenser for the heated water being tortuous, and the outlet confined to one part of the condenser, the current which is stated to exist is inherently impossible. When it was urged that the use of this condenser on board the Thetis, through 17,000 miles in twelve months, proved its superiority, it was omitted to be stated that the greater part of that work, indeed all the successful part of it, was performed while the vessel was employed on a short station, on which at short intervals the condenser was scoured out with fresh water.

"To obtain a good vacuum does not appear difficult with various forms of surface condenser. In a ship called the India, with which the writer was somewhat connected many years ago, and which latterly became the property of the Peninsular and Oriental Steam Navigation Company, Hall's condensers were fitted. The engines of this ship had steam cylinders of 63in. diameter, with 5ft. 6in. stroke, and each of the condensers contained five miles of half-inch brass tubes. The engines were completely finished before Hall's condensers were attached, and in consequence the arrangements were such that the common condensers, or Hall's, could be used either alternately or in different engines at the same time. The experiment was repeatedly tried of working alternately with the different condensers, and invariably the vacuum in Hall's was from a pound to a pound and a quarter better than with the common condensers. The vacuum with Hall's was about 28in.

"Proceeding with the second object of these remarks, the writer would observe that the use of surface condensation is of old date. In 1699 Savery used surface condensation in the first steam engine ever constructed. James Watt, during his early progress, generally used the same plan of condensation, arranging his condensers in the formo large tubes or flues, and also in the form of flat boxes like books or chambers. Watt, in writing to Smeaton in 1788, thus explains his reasons for discontinuing the use of surface condensation:—'The idea of condensing the steam by injecting into the eduction pipe was as early as the other kinds of condensers, and was tried at large by me at Kinneal; but the other imperfections of that engine made me attribute a bad vacuum to the air which entered with the injection, and consequently I disused the injection until the size and expense of the tabulated condensers for large engines made me resolve to sacrifice part of the power to convenience and to employ large air-pumps.' The first authentic record with which the writer is acquainted of a tubular condenser made with small tubes, is contained in a patent granted to the elder Brunel in 1822. Since that time tubular condensers have been twisted into various forms, but without any remarkable change until 1840, when Craddock contrived and patented the plan of constructing the condenser in the form of a revolving frame, consisting of small tubes, with the intention of giving that frame rotation in air or in water, as expressed in the patent. There is no question that Craddock's plan effects a most thorough circulation of the condensing water; but his condenser has been little used, arising probably from inconvenience in the structure of the rotating frame. Next in order of novelty is the plan of Messrs. Rowan and Horton, and which has already been commented on in these remarks.

"To condense steam by surface condensation involves no recondite principle. The object will be most effectively accomplished by the plan which passes the largest quantity of condensing water with the greatest uniformity over the condensing surface, and with the smallest expenditure of power. A considerable amount of surface is desirable; but the power or effectiveness of the condenser is measured quite as much, or perhaps more, by the quantity of water brought into contact with each square foot of surface, than by the number of square feet."

DURABILITY OF CAST IRON IN SEA WATER.

E. B. Webb, Esq., C.E., has lately published a work on Iron Breakwaters and Piers, from which we extract the following:—

Cast iron in sea water is liable to two descriptions of deterioration—generally, by the absorption of oxygen, and occasionally, with certain qualities of metal, by a softening of the outer surface.

The oxydation of cast iron in sea water does not proceed rapidly, even when its surface is unprotected and its quality that most favourable for a union with oxygen. An idea of the rate of oxydation may be formed from the following statement by Mr. R. Mallet (as the result of numerous experiments), that "cast iron freely exposed to the weather at Dublin, and to all its atmospheric precipitations, was corroded nearly as fast as if in clear sea water, when the specimens in both cases were wholly unprotected."*

In iron breakwaters, the question as to durability will refer chiefly to the parts below low water; for the protection of the superstructure against slow and unimportant oxydation may be readily insured. It has been stated† that the oxydation of iron surfaces continually covered with water, goes on more slowly than when the metal is exposed alternately to air and water. In addition to this circumstance, favourable to the easy protection of ironwork standing in the sea, it will be found that, in the majority of localities, the sea itself provides, in the shape of mollusks, an excellent protection to the submerged portions.

The necessity of substituting iron for wood in sea piers and other similar works, is obviously due to the perishable nature of timber. When timber and cast iron are immersed side by side in sea water,

* Minutes of Proceedings, Institution of Civil Engineers, vol. ii., p. 175. Session, 1842.

† Minutes of Proceedings, Institution of Civil Engineers, vol. iv., p. 329.

we find that the timber is, sooner or later, destroyed by the very class of animals which forms an excellent protection to stationary iron structures. Cast as well as wrought iron is frequently preserved from decomposition in sea water by the accumulation of shell-fish on the surface. In tropical countries this process is often very rapid. The pipe piles, for instance, of the Itapagipe Viaduct (Bahia) were completely incrusted, in a very short time, below high-water mark, by shell-fish; and by this incrustation the iron is thoroughly protected. When some portions of shell-fish had been removed from the cast iron piles at Southend and Margate, the exposed surface of the iron was found to be smooth, and quite free from any deterioration by the action of the sea water.

The softening of cast iron is a process not clearly understood. Cast iron will soften in the cylinders and pipes used in mines, as well as in piles standing in sea water. After softening under sea water it will, at times, become hard again on exposure to the air. Cast iron, however, is very far from being generally liable to the process of softening.

In consequence of the great variety in the quality of cast iron, instances are not wanting which apparently support directly opposite opinions. Cast iron has been taken up after immersion in sea water, utterly decomposed. In many such cases, it is known that the iron has been purposely cast of the softest metal, and in others it may fairly be presumed that soft metal has been employed. On the other hand, there are numerous instances of cast iron having remained perfectly sound and uninjured after an immersion for many years in sea water. From very numerous examples of long immersion without injury, the writer will select a few which he has personally examined.

DOCK GATES, SHEERNESS.

There are several pairs of cast iron dock gates at her Majesty's dockyard, Sheerness. They were designed by the late Mr. Rennie.* The heel posts, mitre posts, and ribs, are of cast iron. The gates are sheeted from top to bottom with cast iron plates, perfectly water-tight. Three pairs of gates have been exposed to the action of sea water since 1821, and a fourth pair since 1827.

The writer examined these gates in January of this year, 1862, and he found that the framing and plates were in perfect condition. From the dockyard officials he learnt that no portion of the cast iron had ever been replaced, in consequence of deterioration of the metal, and that no plate had given way, although there is a head of water equal to 26ft. at spring tides. Three pairs of these gates have, therefore, resisted the action of sea water, uninjured, for fully forty years, and a fourth pair for thirty-five years.

The writer observed, however, that the cast iron sector plates, against which the gates shut, are softened in places to some little extent, but only where the iron is in contact with a mass of lead, which has been used to form a water-tight joint; the galvanic action created by the contact of the two metals having, doubtless, caused the softening of the iron.

At Chatham, the writer saw a number of iron castings which had been removed thither from a dock at Pembroke, where a caisson has replaced the gates. After an immersion in sea water at Pembroke for many years, these castings are found to be in so perfect a state, that they will shortly be put in use at the new entrance to No. 1 dock at Chatham, there again to be exposed to the action of sea water.

LOWESTOFT HARBOUR (BASIN ENTRANCE).

The late Sir W. Cubitt having witnessed the rapid destruction of timber in the sea at Lowestoft, and being satisfied as to the durability of cast iron in sea water, determined upon casing the entrance of the Lowestoft basin with cast iron piles. The work was commenced in 1832, under Mr. George Edwards. The writer examined these piles last year, and he found them uninjured. They are, for all practical purposes, as sound and as perfect as when they were driven—upwards of twenty-eight years ago.

SOUTHEND PIER (EXTENSION).

Mr. James Simpson (Past-President of the Institution of Civil Engineers), in designing the extension of this pier, after careful consideration of the durability of cast iron in sea water, selected that metal for his piles. The extension was executed in 1841. In February, last year, the writer examined these piles: he found them in a most perfect state. They are square, and the angles are as sharp as when they left the foundry. Mr. Simpson specified the quality of the iron from which these piles were to be cast, because he found, from examination of specimens of cast iron which had been exposed to the action of sea water, that the durability depended upon the quality. These piles, after having been exposed to sea water during seventeen years, are perfectly uninjured.

* Described in Sir J. Rennie's treatise on Harbours, p. 35.

AMERICAN STEAM FIRE ENGINES.

MR. FREDERICK HODGES, the well-known distiller, of Lambeth, has this week added an American steam fire-engine to his "fire brigade." Mr. Hodges, we need hardly say, already had the most complete fire engine establishment in the metropolis, excepting only the Brigade of which Captain Shaw is superintendent. His hand engines, it is true, are but two in number, but they are of superior power, one in particular having two pairs of pumps, viz., one pair of 7in. and one of 8in., so arranged that either pair may be worked by themselves, or in connection with the other pair. This engine, too, has an air vessel on the suction side of the pumps, in addition to that on the forcing side, the lower air vessel considerably improving the action of the lower clacks, by preventing the irregularities to which the flow of water is subject when going on in contracted pipes.

The steam fire-engine just added was built at the Novelty Iron-works, New York, upon the plans of Messrs. W. Lee and J. G. Larned, Mr. Lee having brought the engine to this country. It has an upright boiler with annular water tubes, a 1¼in. tube being placed within a 2½in. tube, with water in the annular space, and fire or hot air on both sides. The boiler is covered with a beautiful planished Russia sheet iron, so much used in the States and so neglected here. There is but one steam cylinder, placed horizontally, and having the slide valve on one side. The length of the ports is equal to the diameter of the cylinder, and the adjustment of the valve gear is such as to favour a high speed. A cross head projecting on each side carries two connecting rods working just clear of the sides of the cylinder and turning a shaft close behind it. This shaft serves, also, as that of a rotatory pump, made of brass throughout. The framing of the engine is of light wrought iron bars, the springs are of a novel construction, and hung upon a plan unlike anything seen on English carriages, and every part of the work is brightly finished. The wheels are of large diameter, and altogether the engine is of a singularly light appearance. Its weight, in working order, is 3,800 lb., or 1 ton 14 cwt. The working pressure of steam is from 140 lb. to 160 lb. per square inch, and steam of a pressure sufficient to commence working is raised in six minutes. At some trials in the yard of Mr. Hodges' distillery the engine threw a 1-in. jet more than 20ft. above the cap of the chimney, 140ft. high, making a total height of at least 160ft. It is understood that the engine will be placed in the forthcoming Exhibition, before the opening of which some public trials are to be made.

AUSTRALIAN GOLD.—Among other curiosities coming to the Exhibition from Australia is a wooden obelisk, dead gilt on the outside. This column is nearly 70ft. high and some 10ft. square at the base. It represents exactly the bulk of gold which Australia has sent to this country since 1851, and which in all amounts to nearly 800 tons. The base of this column will be surrounded by various specimens of gold quartz from the different reefs, nuggets, alluvial gold, washing-cradles, &c.

CANAL LOCKS.

SOME time since Mr. George Simpson read the following paper on this subject before the Institution of Engineers in Scotland:—"The first introduction of canal locks seems merged in oblivion; the rise and fall of the tide may have suggested the idea; at all events, any floating body on the sea, when elevated by the rise of the tide, or lowered by the fall thereof, would show clearly enough the power obtainable by water in this respect. The necessary chamber, gates, and sluices forming a canal lock for the raising or lowering of boats, or other floating bodies, are too familiar to every one to require description. Of course canal locks are only called into requisition where uniformity of water level, practically speaking, is not to be had. The supply of water for a canal through a country requiring canal locks is of first importance. And the storage of water being attended with such great expense, the reservoirs in a mineral district being by nature so precarious, it is singular that such a wasteful mode of raising and lowering boats as that of canal locks should have been persevered in in modern times. The Chinese appear to have adhered to inclined planes on canals for upwards of two thousand years, evidently steering clear of the expense of reservoirs and the waste of water. The merit of a canal lock consists in the simplicity of the arrangements for deriving mechanical power from the water, but certainly not in the economical use of that power, as in any application of a canal lock which has come under the writer's observation, whether by the adoption of side ponds or low lifts, a very great waste of power follows. By way of example, the writer may refer to the Blackhill locks on the Monkland Canal, where there are eight locks in operation (four double locks) to accomplish a lift of 96ft., the dimensions of each being—length, 75ft.; width, 14ft.; depth, 12ft.; and they are each capable of containing 350 tons of water, whilst the largest boat and cargo that can be passed through is one of 80 tons; so that, for the elevation or lowering of a boat and cargo, 350 tons of water, less the displacement of the boat, are expended; or, irrespective of leakage, fully three-quarters of the power is unavailable, and even fully this loss follows in the raising or lowering of an empty boat. In other words, an empty boat in being raised or lowered requires more water than a full one. Besides the great waste of water, canal locks are very objectionable on account of the time occupied in passing a boat through them, and are most expensive to work and keep in repair. They limit the size of the boat and cargo to the working capacity of the lock chamber, whilst, not to speak of the large outlay involved in their construction, the cost of their maintenance and working is an important item in canal expenditure. The cost and maintenance of the reservoirs are directly chargeable against the lock; hence, the rate per ton per mile of transit in passing locks is four times the amount on any other parts of the canal.

In order to overcome some of the defects arising from the use of the locks, and which invariably accompany all canal locks, there was constructed at Blackhill, eleven years ago, at a cost of little under £20,000, a double inclined plane. Two caissons of the form of the boat are used here, each placed on a carriage on rails, arranged so that one so far balances the other. The friction, and also the loss of weight on the descending caisson entering the water in the lower reach, is overcome by a stationary steam engine. A very complete description of this inclined plane is given in the "Transactions of the Royal Scottish Society of Arts for 1852. Although this inclined plane is a decided improvement over canal locks, and would have been still more so had it been generally used, and not merely for the raising of empty boats; yet the raising of an empty boat thereby occupies fully ten minutes, compared with half an hour by the locks; and without taking into view the great first cost, tear and wear, and working expenses, the time of transit of a boat by it seems not quite to obviate the objection of the lock. It is a fact worthy of note that, in the face of existing and competing railways and stoppage by frost, the traffic on this canal, which at one time was so little as to induce the parties interested to shut it, is still increasing, and there is little doubt, could the locks referred to be conveniently and economically superseded, the capacity of the boats considerably enlarged, and horse haulage generally supplanted by steam power, a greater traffic would follow. From 4,000 to 5,000 tons of material are passed daily at Blackhill. A much greater quantity might be passed were the boats to arrive at the locks at regular times; but this cannot be so arranged, so that a part of the present traffic is already diverted from the legitimate portion of the working day, pointing to a more expeditious mode of transit as likely soon to be required.

Many schemes besides the modern application of steam to inclined planes have been projected as substitutes for canal locks, such as vertical balance lifts, some of which have been put in practice. The object of course aimed at in all such lifts is to store the power generated by the descent of the material, to be afterwards utilised; but in any of the lifts of this description which the writer has noticed, the storing of the power is accompanied by unnecessary friction, arising from the use of intermediate machinery and unnecessary weight thrown on the supporting parts of the lift, especially where two cradles or caissons, or one cradle and counterweight, are suspended over pulleys. The writer some time ago proposed as a substitute for canal locks what he calls a hydro-pneumatic lift, in which a buoyant vessel is made subservient to this end, and which he considers the best means for storing the power with the least friction. One application is shown by the model (exhibited at the meeting). In the model the buoyant vessel is placed under the cradle, and in another arrangement two buoyant vessels are placed, one on each side of the cradle, keeping the working parts entirely above ground. The model shows the mode of raising and lowering a boat by the lift. The buoyant air vessels are made of malleable iron, and are capable of supporting the tubes and cradle with its contents. The tubes act as regulators for the ascent or descent of the buoyant vessels, by means of the outlet of water at the bottom and the inlet of air at the top. The junction with the upper and lower reaches of the canal is effected and cut off by means of sliding doors, such as are used at Blackhill. In ascending the buoyant power is in excess, but at the top the weight of the cradle is rendered in excess by a small extra quantity of water received from the upper reach. The descent is regulated by adjusting the air outlets, and the consequent entrance of the water below. At the bottom the small extra quantity of water received at the top flows into the lower reach, which renders the buoyant power in excess, and causes the cradle to rise. The cradle is retained at either top or bottom by catches or stops. The cradle is guided in its ascent and descent by pillars, which the writer prefers to construct according to a plan proposed by him for chimney shafts. Each pillar consists of a central cylindrical shaft of the same diameter throughout, such shaft being formed with four external wings or abutments, such abutments in the case of chimneys, all tapering from a wide base to the diameter of the shaft at the top. In the present case one abutment of each shaft is built with an outer vertical edge, in which is formed the groove for guiding the cradle. To insure the cradle being kept horizontal, racks may be fixed in the guiding grooves, the cradle being fitted with pinions gearing into the racks, and connected to each other by shafting and bevel gearing, so as to act simultaneously. For a lift of this kind, applicable at Blackhill, and calculated to raise and lower boats containing 100 tons cargo, the cost would be about £7,000, exclusive of excavations and building, to bring the eastern extremity of the lower reach vertically under the western extremity of the upper reach. Two lifts placed alongside would not range so high in cost. As at Blackhill the heavy traffic is entirely in a downward direction, the improved lift will be the means of actually transferring water from the lower to the upper reach, as the loaded boats would displace more water out of the cradle into the upper reach than the empty boats would displace out of the cradle into the lower reach. In conclusion, it may be mentioned, that if it is inconvenient to apply a directly vertical lift, the hydro-pneumatic lift can be modified to carry the cradle up and down an inclined plane, and its application in this way would probably be the least expensive at Blackhill or similar localities.

SHAW'S HOT AIR ENGINES.

IN this invention, by Philander Shaw, of Boston, U.S., two single-acting cylinders, having their pistons coupled to a shaft, with its cranks at right angles with each other, are arranged with a furnace and its accessories centrally placed between the cylinders and within an air-tight casing, which forms a reservoir for compressed and heated air, and is so divided by partitions and diaphragm plates as to receive the cool supply air at or near the exterior of the reservoir, and to guide it inward toward the furnace in such a direction that it shall absorb the heat radiated from such parts of the engine as receive the products of combustion, those parts of the cylinders in which the pistons fill the bore being located without, and upon the casing, and exposed to the atmosphere, and the other parts of the cylinder being located within the casing, so as to impart the heat radiated from them to the compressed air on its passage to the furnace.

The invention consists, secondly, in a peculiar construction and arrangement of the hot air cylinder, the packed part of its piston, and a piston trunk which, with the necessary packing valves and other adjuncts, form a pump, by which cold air is compressed and supplied to be expanded by heat, the pump being annular and exposed to the cooling influence of the atmosphere, and being operated by the direct pressure of the expanded air on the engine piston (when compressing the supply air), the force necessary for that purpose is not passed through the rotative parts of the mechanism, and facility is obtained for connecting the pitman which vibrates within the trunk direct to the piston, and for keeping the connecting joint cool by free atmospheric exposure, with good facilities for lubrication.

Thirdly, in a construction of the cylinder, which consists in a groove formed around the inner side of the cylinder at that part where the lower edge of the closely-fitting portion of the piston comes at the lowest point in its downward stroke, which groove serves to receive the lubricating fluid which escapes past the packed portion of the piston, and also such as may be directly introduced into it by means of "oil pumps," &c. The lower edge of the piston may be made to dip in the fluid in the groove, and so lubricate the inner surface of the cylinder at each upward stroke of the piston.

Fourthly, in the construction of an inwardly projecting flange, which flange may form part of the boundary of the circular groove above referred to, and comes nearly but not quite into contact with the contracted and extended part of the piston, for the purpose of deflecting such solid products of combustion as may find their way with the gaseous products into the space within the cylinder, and thus prevent them from abrading the finished upper part of the cylinder.

Fifthly, in the employment of an auxiliary valve operating to admit from the supply pump or receiver comparatively cool pure compressed air into the clearance spaces within, and connected with the cylinder for the double purpose of balancing the pressure on the inlet valve into the cylinder, and to maintain the frictional surfaces of the piston and cylinder cool enough to be kept lubricated. When the isolated oil trough is employed the cool air passing round it from this auxiliary valve cuts off from the oil the conducted heat which might otherwise evaporate it.

Sixthly, in regulating the speed of hot-air engines by controlling the flow of the air, under pressure, to the engine pistons, by means of a regulator operating to work a valve for this purpose, instead of permitting the regulator to open a valve for the escape and consequent loss of the generated pressure, as formerly practised in regulating the speed of hot-air engines.

Seventhly, in the employment of a close receiver for the "exhaust," with a large radiating surface within the air-tight reservoir into which air is forced, and then expanded by heat for the purpose of imparting from its outer surface a portion of the caloric contained in the "exhaust" to the surrounding currents of incoming compressed air.

Eighthly, in the utilisation of the caloric escaping with the "exhaust," by employing it to generate steam, substantially as described, which, when generated, may be made to operate through any well-known steam engine and air pump to aid in the compression and supply of air to the caloric engine, or the steam thus generated may be employed in any well-known way.

Fig. 1 illustrates, in half-side elevation, and in half-sectional elevation, a hot air or caloric engine embodying the invention, the section being taken in the lines y, y, Fig. 2, and z, z, Fig. 3.

Fig. 2 is a half plan and half horizontal section taken in the lines z^1, z^1, Fig. 1, and z^2, z^2, Fig. 2.

Fig. 3 is a sectional elevation of a boiler designed to be connected with the exhaust of the hot-air engine to utilise the escaping heat. Fig. 4 is a sectional elevation taken in the line y^2, y^2, Fig. 2, of so much of the cylinder and parts connected therewith as to illustrate how the exhaust escapes into the radiator or heater; Fig. 5 shows in section the groove in the cylinder, the isolated oil trough therein, and the inwardly projecting flange. E is the casing, which, as it forms the reservoir for the compressed heated air, the foundation or bed-plate for the mechanism should be so made as to be air-tight under the heat strains and pressure to which it is subject, and wherever moving parts pass through it they should be carefully packed. Centrally placed in E is the furnace lined with the fire-brick J, provided with grates c, and an ash-pit, which has an air-tight door I, and fuel holder H, from which fuel is fed to the fire through the top of the furnace. The fuel box H is provided with an air-tight receiving door d, having suitable fastenings, and a valve e, opened and closed by a link f and valve rod, which passes through a packing box. A piston g, with its rod h, passing packed through H serves to thrust the fuel forward, so that it will fall through the aperture which the valve e serves to close. By this arrangement and its proper manipulation, which needs no explanation, it is obvious the fire may be replenished with fresh fuel while there is the requisite pressure of hot air within the furnace needed to operate the engine, and without impeding the movement thereof. The furnace is provided with openings a^1 below the grates, and others a^2 above the top of the fuel, through which air under pressure is supplied by means hereinafter to be described, which air is introduced into the space contained between the outside casing b of the furnace, and the casing t which next surrounds it. The working cylinders, of which there are two, are located within and upon E, and on opposite sides of the furnace. These cylinders are single acting, that is, the piston of each is forced upward by the action of heated air, and both being connected to the same shaft R by cranks at right angles with each other, the downward movement of each piston is produced by the upward movement of the other, acting through the shaft in connection with the fly wheel.

Each cylinder may be described as in two sections, the upper section A standing above the bed plate, and being bored out so that a packed piston D may move freely therein after the manner of steam engine pistons within their cylinders. The lower section B is within the bed-plate, for the reception of the extension F of the piston, and need not be bored or finished, as the extension of the piston is not intended to fill the cylinder, but leaves (when the piston is at the extreme of its downward stroke) an end clearance as well as an annular space around it. That part of the piston which is marked D is constructed nearly like steam engine pistons so far as packing is concerned. The follower c^1 is the flange of the pipe or trunk C, which is open at the top, and in which the connecting rod P plays. The trunk passes through the upper head i of the cylinder, where it is packed with leather, and guided by the gland x. The head i is furnished with valves n to admit air into the annular space between A and C, and with an outlet valve o, which permits, when open, the air within the space to pass into the casing through the valve box K and pipe L. Supposing the engine to be in motion, the air which is taken in by the pumps at each downward stroke of the pistons, is compressed and thrown out by the upward strokes thereof, and passes, as is indicated by the arrows, along the division plate j, which extends entirely across the space enclosed within E, to an opening in the centre of j, then between

SHAW'S HOT-AIR ENGINES.

FIG. 1.

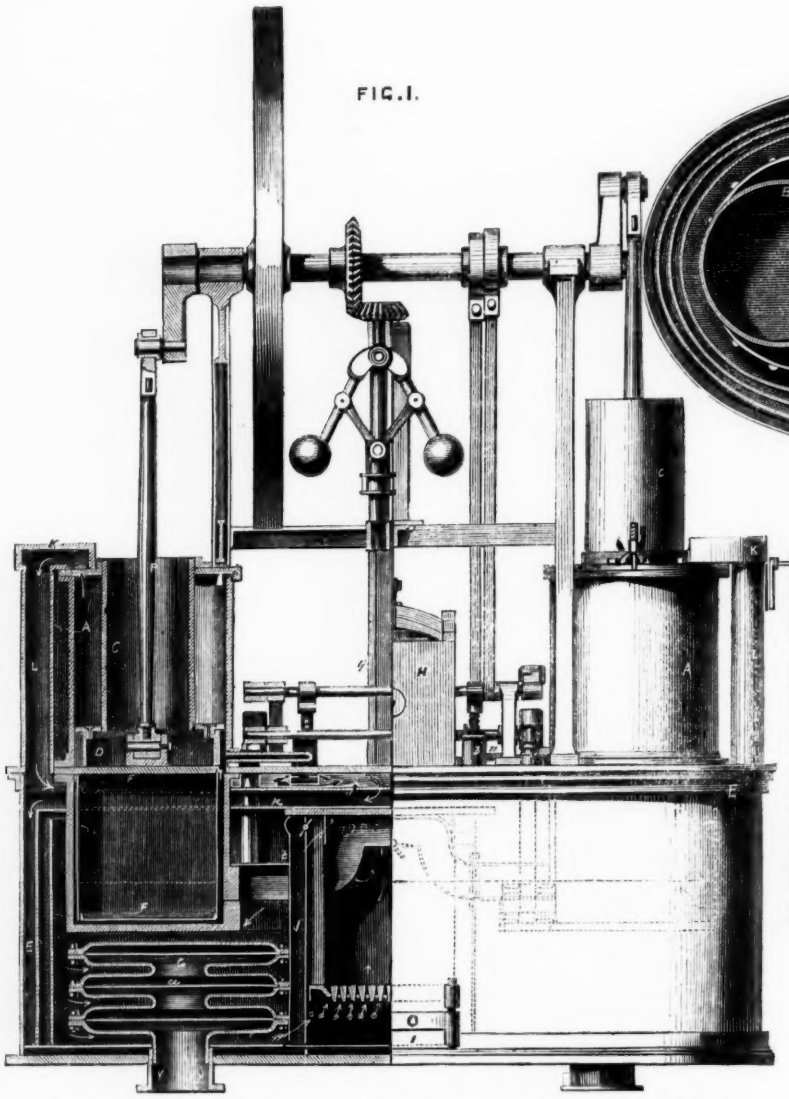


FIG. 2

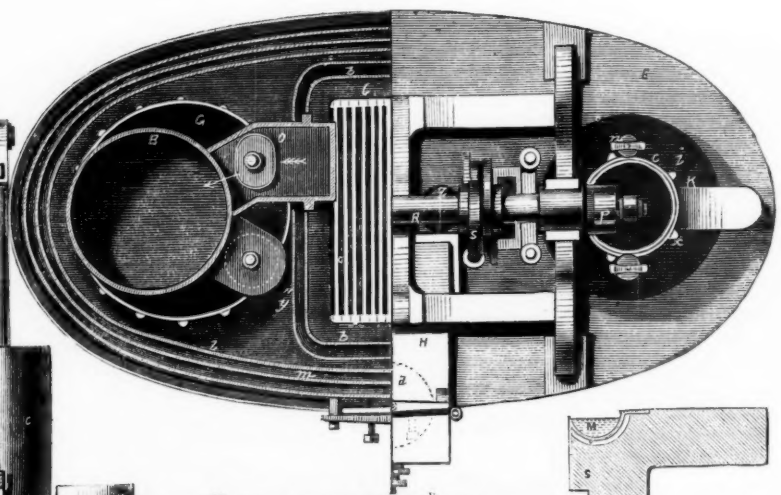
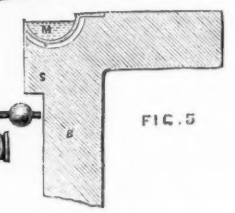


FIG. 5



C. STEVENS

FIG. 3

FIG. 4

plates *j* and *k*, then downward between the outer wall of E and an internal vertical partition *m* parallel with E, which extends entirely around within E, and parallel to its vertical wall, then vertically between partitions *m* and *l*, into a space contained between *l* and *t*, whence the air passes to the furnace through openings in *t*, and the openings a^1 and a^2 before described, the position of the damper *r* determining the proportion of air admitted above and below the fuel.

Having described how air is compressed and forced into the furnace, it may now be shown how, when expanded by heat, it passes into the cylinders and is exhausted therefrom, thereby producing reciprocation of the pistons within them, and developing the power generated by heating the air. In the top of the furnace, and passing through it to the inlet valve boxes O, is a suitably shaped pipe with an opening into it, which a throttle valve *p* operates to open and close in the usual way by a governor Q, dependant on the speed of the engine, and acting through the connection *q*. The heated air and gaseous products of combustion mingled pass into this pipe, and when the inlet valve is opened pass into the cylinder, and force the piston upward.

The inlet valve closes when or before the piston has completed its stroke, and the exhaust valve opens and permits the contents of the cylinder to escape into the open air through the passage N, and radiator or heater G, placed in the space through which air passes on its way to be heated in the furnace. The valves are of the poppet form, and are worked at proper times by lifter toes on the valve rods, and on rocker shafts worked from eccentrics S, on the shaft. There is nothing peculiar about the valves or valve gear, and any other which is adapted to the ingress and egress of the heated air, and known to engineers in the practice of their profession, may be used for these shown. The form of the heater is immaterial; that shown presents a large surface for radiation, and the diaphragm plates *a* compel a tortuous passage of the "exhaust."

It will be seen that the disposition of division plates and partitions, before mentioned, is such as to cause the gradual heating of the cold air on its way from the pump to the furnace, by absorption of the heat, which radiates from the part of the cylinder filled with hot air, from the conveying pipes, heater, and boundaries of the furnace, so that the radiated heat is nearly all utilised, and the convenience is attained of having a comparatively cool surface to the outer or exposed parts of the machine. A dead air space is formed in E between its base plate and the reservoir of compressed and heated air to prevent radiation from the lower surface. At the junction of the upper and lower sections A and B, of the cylinder, and at the lower edge of the close-fitting part D of the piston, a groove or channel *v* is formed entirely around the cylinder, as shown in Fig. 1. At the upper edge of B there is an inward projecting belt or flange *s*, which forms the bottom of the groove and extends inward from the general surface of B, so as almost to touch the lower or extended part F of the piston. The groove or channel round the cylinder communicates with the compressed air in the upper part of E, by means of the pipe W, which terminates in the valve box b^1, in which the poppet valve *u* operates by any suitable mechanism, that shown being a wiper or arm on a rocker shaft acting on the valve stem, to open the valve against a spring, the reaction of which closes it. It will be seen that when the valve *u* is opened air will flow from the space in E, above *j*, into the cylinder, and if this valve is opened, as it should be, after the exhaust valve closes, and before the main inlet valve opens, that all clearance or unoccupied space in the cylinder and valve passages will be filled with air having a pressure equal to that within the air reservoir. The air taken into the cylinder through the valve *u* will be that directly from the pump, and free from gaseous and solid products of combustion, and moreover it will be comparatively cool.

The object of introducing air through *w*, from and at the places and at the time mentioned, is threefold. First, by rendering the pressure alike on both sides of the inlet valve, the force required to be exerted is reduced to the minimum. Second, by having the spaces in the cylinder filled with pure air, that which rushes into the cylinder from the combustion chamber, to displace the piston, will not carry the products of combustion into the spaces so occupied, and as the valve *u* and the main inlet valve are designed to be closed together, it will be evident that the annular space between the extension part F, and the upper or finished part A of the cylinder, formed as the piston rises in the cylinder, will be kept filled with pure air, to the exclusion of the impure air, which will fill the body of the cylinder. Third, the packing of the piston will thus be exposed at its upper and lower edges to cool air, while the sliding surface of the packing will act upon that part of the cylinder which is exposed both upon its interior and exterior to air of the ordinary temperature. By the described arrangement and devices, the patentee is enabled to pack the piston as closely, and to keep it as well lubricated as any steam engine or air pump piston. The inwardly projecting flange *s* serves to deflect or render difficult the passage of any particle of solid matter coming into the cylinder with the heated air and gaseous products of combustion, and the lower edge of the packed portion of the piston is of the form shown in Fig. 1, to aid in deflecting solid particles to keep the sliding surface of the piston from abrasion by them. The groove *v* around the cylinder serves to catch the oil which passes the packed piston, or oil may be forced into it by a syringe, and a pipe provided with a stop-cock will afford means for drawing off any accumulation of lubricating material which may gather there, while the lower edge of the packed part of the piston, by dipping into the oil at each downward stroke, will aid in keeping the working surfaces well lubricated. To prevent burning the oil by the heat absorbed and conducted by the material of the cylinder, there is placed within the groove a circular oil trough M, Fig 5, which is maintained at a little distance from the metal of the cylinder by ears placed at intervals around the trough; the current of cool air from the auxiliary valve will pass through this space and around the trough M, keeping the oil at or about the temperature of the air in the casing E, above the division plate J. One of the many forms of boiler which may be employed to utilise the caloric in the exhaust is illustrated in Fig. 3, where a plain vertical tubular boiler U is shown set in brickwork with a furnace beneath it, for a purpose to be explained hereafter. The "exhausts" pass into a smoke-box at the top of the boiler through the passages Y, Y, which can be closed by the dampers therein shown, and, after passing through the tubes, escape through the outlet *w*, which is provided with a damper, the direction of the currents of the exhausts being indicated by the arrows. As this boiler may be made available in starting the caloric engine, a fire to generate steam may be kindled on the grates shown, and the dampers in Y and W closed, when the draft will be in the direction indicated by the dotted arrows, escaping past the damper *v* in the smoke outlet. The steam thus generated may be employed in an engine to work an air pump to compress air into the reservoir E, and to support combustion on the grates *c* of the furnace within the casing, or the engine which uses the steam may be coupled direct to the shaft R, to rotate it, and thus compress air into E, and support combustion on grates *c*, by the action of the before-described annular air pumps. After the fire is well agoing on the grates *c*, and air compressed within E, the expansion by heat of the compressed air will work the caloric engine without any external aid, and the fire kindled on the grates beneath U, may be permitted to die out. The dampers in Y, when any are used, should be opened before the shaft R is rotated, and the door of the furnace under the boiler and the damper V, should at the same time be closed, while the damper in W should be opened. In small caloric engines constructed in accordance with this invention, and where the shaft R can be rotated by hand or otherwise sufficiently to compress the air within E, it may not be worth while to attempt to utilise the heat escaping in the exhaust, by applying it to generate steam, but much may be utilised by increasing the area of the radiator G, which may be entirely dispensed with when the boiler U is employed, substantially as described.

In starting a fire on the grate *c*, the main inlet exhaust, and throttle valves, and ash-pit door should be opened, and also the dampers in the exhaust exits Y, so that the products of combustion may be carried off through the engine. If the draft by this passage should be insufficient to make the fire burn freely, then the valve *e* should be opened, and the door *d* taken off, thus establishing a direct upward draft, which may be conducted by a temporary funnel. When the fuel is well ignited, the doors J and *d*, the exhaust and main inlet valves, should be closed, and if the steam boiler is connected, the dampers should be manipulated as before described. Air should then be supplied to the fire on grates *c*, and compressed and expanded within E, by any of the means mentioned, and by the fire on the grates, when sufficient pressure will be generated to move and maintain in movement the pistons before referred to, while the fire can be kept supplied with fuel by the described means. It should be observed that the valve chest covers are provided with pipes T, as shown in Fig 5, which extend up through the top of E, where the pipes and the valve stems can be packed, without having the packing exposed to heat that would be destructive to it.

Exports of Coal.—By the monthly circular of Messrs. Laird, we learn that the quantities of coal exported during January was 453,255 tons, against 385,010 tons in the corresponding month of 1861, showing an increase of 68,245 tons. The particulars are—from the Northern ports, 196,298 tons; Yorkshire, 15,007 tons; Liverpool, 38,287; Severn ports, 170,053 tons; and Scotch, 33,610 tons. There was an increase at all the ports.

Steam on the Rivers of India.—Advices from Bombay state that the Burmah Steam Company has obtained the contract for carrying the mail between that place and Kurrachee, but that in the meantime the service is performed by the steamer Rifle, belonging to the Oriental Inland Steam Company. The new steamer Indus, belonging to the same company, had performed her first voyage to Mooltan most successfully in twenty-three days, with two fully laden barges, and the steamer Sutlej, belonging to the same company, had made her last voyage with two laden barges in twenty-four days, which was a great improvement on previous performances. The Indus was on her second voyage when the mail left, and the quantity of goods offering is said to have much increased. The Calcutta papers speak favourably of the energy with which the business of the company was being pressed forward at that place, the Soane steamer having been put together and launched in two months with her machinery on board, and it was expected that she would be running in February.—*Mitchell's Steam-shipping Journal.*

Steam Engines for the Navy.—In Lord Clarence Paget's speech, on Monday night, he observed, "It will be seen that the vote for engines already ordered is £415,880. That is what we propose to take in this year and next year, deducting £108,900 to be voted in future years. We require for engines already sanctioned by the House £306,980. I am going to ask the committee to agree to purchase a certain number of new engines, and they will cost £276,000, of which we propose to take during the present year £130,440. As to that branch of the vote it is entirely within the power of the committee to give the whole or a part of it. None of those engines are ordered. That is what we ask you to allow us with regard to steam engines. When we come to the vote I can show the number of engines, the horse-power, and all the details connected with them."

TO CORRESPONDENTS.

**** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

V. P.—*Once more, next week.*

SYMPATHISER.—*Thanks for the circulars.*

J. B.—*We are not aware that Brunton's press is patented in his own name.*

G. C. P.—*A. T. wished for a "rule" for calculating the length of governor arms for any given speed.*

C. D. (West Bromwich)—*The North Moor Foundry Company, at Oldham, make Schiele's noiseless fan.*

W. T. E.—*You will find the advertisements of makers of steam engine indicators in our advertising columns.*

J. T M.—*We have paid but little attention to gold mining. The editor of the* Mining Journal *could, we have no doubt, recommend some good work on the subject.*

SPERO.—*The Secretary of the Institution of Civil Engineers, Mr. James Forrest, 25, Great George-street, S. W., will, on receiving a note from you, give you all the information you require.*

J. W. (Leeds).—*The Transactions of the Institution of Civil Engineers are not for sale. Professor Willis' paper has been separately published, we believe, and we think you can obtain it from Mr. Weale, of Holborn.*

G. W. (Durham).—*We know of no such work as "Tomlinson's Workshop Companion." You can order "Templeton's Workshop Companion" through any bookseller. The price is, we believe, about 6s.*

R. L (March).—*It would occupy too much space here to describe Normandy's distilling apparatus. A description was given in* THE ENGINEER, *in November, 1858. It might be best for you to obtain the patent, which issued in April, 1858.*

INQUIRER.—*We have published numerous articles, from time to time, on aluminium, one in particular in February, 1859. Messrs. Bell Brothers, of Newcastle-upon-Tyne, manufacture aluminium and aluminium bronzes, and are doing much to introduce them into general use.*

T. H. J.—*The square portion of the axle ought, if of good iron, to be strong enough. A collar should be shrunk on at the neck, and a diameter of 2¼in. preserved there, tapering down to 1¾in. or 2in. It may be strong enough as it is for a load of three tons, but it is badly proportioned.*

AN OLD SUBSCRIBER.—*Mr. Britten is among the principal advocates of rifling cast iron guns, from which he fires hollow shot, having a ring of lead around the rear end, with a sort of sabot of wood to confine the lead and receive the shock of the explosion. Mr. Lynall Thomas employs wrought iron forged guns, rifled with numerous shallow, rectangular grooves, with a rapid twist. Sir William Armstrong's muzzle-loading gun, which he chooses to call a "shunt," has an iron shot with three ribs of zinc corresponding to the three principal grooves. There is a slight windage in these grooves when the shot turns into the shallower grooves adjoining them.*

GAS.—*Hughes' treatise on gas-making, in "Weale's Rudimentary Series," contains information upon the manufacture of "water-gas,"—obtained by decomposing steam in contact with hot bricks, and afterwards carburetting it by means of cannel coal or oil. Water-gas has been said to be very cheap, but it has never come into extensive use. Your 3-horse engine, if burning 5lb. coal per hour, would require the combustion of about 450ft. of gas per hour to accomplish the same work. This is presuming that both the coal and gas are completely burnt. 9 cubic feet of gas are about equal in heating value to 1lb. of coal. In an apartment, however, the products of combustion and the heat of burning gas are diffused on all sides, while in an ordinary grate much of the heat goes up the chimney.*

FANS AND BLOWING MACHINES.

(To the Editor of The Engineer.)

SIR,—Can you or any of your intelligent readers inform me whether a fan of 9in. diameter or one of 9ft. is the most economical and effective for producing a blast of air, the velocities of the peripheries being the same; also whether a fan, or the cylinder and piston blower, is most economical and practical.

A SUBSCRIBER.

February 19th, 1862.

MEETINGS NEXT WEEK.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, 4th March, at 8 p.m., 1st, "Description of the Loch Ken Viaduct, Portpatrick Railway." By Mr. E. L. Blyth, M.I.C.E. 2nd, "Description of the Centre Pier of the Bridge across the river Tamar, at Saltash, and of the means employed in its construction" By Mr. R. P. Brereton, M.I.C.E.

SOCIETY OF ARTS.—Wednesday, at 8 p.m., "On the Progress of British Commerce during the last Ten Years." By Thomas Ellison.

SOCIETY OF ENGINEERS.—Monday evening, 3rd March, at seven o'clock. A paper will be read by W. Parsey on Trussed Beams.

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THE ENGINEER.

FRIDAY, FEBRUARY 28, 1862.

THE STEAM ENGINES OF OUR SHIPS OF WAR.

THOSE who have been on board our great modern frigates and ships of war must be willing to admit that their engines leave little to be desired in respect of construction and workmanship, however imperfect they may be in their adaptation to the principles governing the most economical use of steam. In the latter respect, indeed, the majority of all steam engines are very imperfect. Any one who has given much attention to the principles, as distinguished from the practice, of steam engineering and general mechanism, can hardly feel satisfied with engines in which steam of 20lb. pressure is worked at an expansion of less than twofold, the cylinders being unjacketted and the steam not superheated. Nor can the proportions of 9ft. 4in. diameter of cylinder to a stroke of 4ft. be regarded as favourable to economy. Yet, if we admit that modern practice has not, on the whole, altogether justified the attempt to depart widely from these conventional limits of pressure, expansion, and proportions, we must own that our present class of naval engines is admirably made. Only "trunks" are now ordered by the Admiralty, from Greenwich. Much may be said against the plan of the trunk engine, and but little, we believe, in its favour, but, as a sample of engine-craft, the workmanship is exquisite. The Messrs. Penn's castings are superb, being made, as they are, from choice qualities of pig iron, and, to an unusual extent, moulded in loam, and by moulders whose command of the trowel and sleeker, and whose judgment in the management of facing sand are admirable. The tools, too, at Messrs. Penn's are, probably, as near perfection as anything in the same line yet made. They are, for the most part, among the best examples of Mr. Whitworth's skill, and as such can hardly be excelled. With highly-trained workmen, under excellent discipline, the great Greenwich establishment is thus enabled to turn out what a puffing tradesman might describe as the "perfection of mechanism." Good workmanship is a matter admitting of very little diversity of opinion. So far as the machinist's labour goes (apart from the smith's, founder's, &c.), good work consists in accurately fitted plane, cylindrical, and conoidal surfaces, and in combining them with the accuracy of geometrical construction. The proportions of the work are matters of design, and not of execution, but here, too, the engines in question are hardly less worthy of praise. It is some satisfaction to know that, if but little competition is permitted in the matter of the Admiralty contracts, the exclusive system has not lowered the quality of the workmanship of the engines in our vessels of war.

In addition to a large number of smaller engines, Messrs. Penn are now engaged upon the 1,250 horse engines of the Achilles, to be the same as the Warrior's, and upon 1,350 horse engines for the Minotaur and Northumberland. The latter have cylinders of the same diameter as the Warrior's, viz., 112in. inclusive of trunk, but the stroke is 4in. longer, or 4ft. 4in. Instead of one steam port to each end of the cylinder, double induction ports are employed, as in the paddle engines of the Great Eastern, so as, with a long valve, to take steam simultaneously through two openings. This plan requires a large valve, the friction of which is partly taken off by a balance piston on its back. It is to be regretted, we think, that Mr. Spencer's or Mr. Davison's surface condenser, the success of which in other large steamers has been established beyond dispute, has not been adopted in the new frigates. It is a satisfaction, however, to know that Mr. Spencer's plan has already been carried out by the Messrs. Penn on board the Arethusa. Except in respect of the increased length of stroke (which represents an increased cost to the Government of about £6,000 on each pair of engines), and the double induction ports, the large engines now in hand are hardly different from those fitted on board the Warrior and Black Prince, and scarcely different in plan and construction from the other trunk engines of which so many have been already supplied by the same makers to Government.

We are at a loss to know why brass stern pipes and brass propellers have been adopted for the new iron frigates. With wooden ships, copper sheathed, it has been for some time understood that a galvanic action takes place between the sheathing and an iron screw, but the very reason upon which a brass propeller should be fitted to a copper-sheathed ship stands opposed to its adoption with an iron hull. How far the action set up between the brass screw and iron plates of the Warrior may tell upon the latter we will not predict, but we shall not be surprised to hear, after a few years at most, that extensive corrosion has taken place. Even if galvanic action were out of the question, we know of no reason for adopting a brass screw in preference to one of iron for an iron ship. With the large central boss of the Griffiths screw, especially, a cast-iron propeller of ordinary proportions is not at all likely to break, and we do not believe that any commercial company would use any other than an iron screw for an iron ship, even if there were no risk of corrosion with a brass screw. The Griffiths screw for the Doris weighed 25,502 lb. and cost 2s. 1d. per pound, or £2,656 9s. 2d. in all. We have heard that the Warrior's screw weighs 26 tons, in which case, at the same price per pound, it would cost upwards of £6,000, while the royalty alone, at 5s. per horse power, is £312 10s. The latter sum alone is twice what an iron screw, of 26 tons' weight, ought to cost. We believe, therefore, that nearly £50,000 is being needlessly sunk in brass screws for our new iron frigates, and that, furthermore, the effect of these screws in connection with iron hulls will prove very destructive in the end. All this, it is true, may have little to do with the engines, nor are the builders of the engines in any way accountable for it, since the Admiralty are certain to settle all such details for themselves. The subject is, nevertheless, of great importance.

Messrs. Maudslay, Sons, and Field are also progressing with a pair of 1,350 horse engines for the Agincourt, besides three pairs of 1,000 horse each for three of the timber-built iron-plated frigates. In respect of quality of workmanship little distinction, probably, can be drawn between these builders and the great firm at Greenwich.

THE ADMIRALTY PROGRAMME FOR 1862-3.

THE reception given to Lord Clarence Paget's speech of Monday last, both in the House of Commons and in the daily newspapers, shows how easy it is for a plausible person to secure immunity from criticism, even when asking for authority to spend the public money by millions. We do not say this from any desire to depreciate the present Board of Admiralty in public estimation. It is probably the very best board that has existed for many years past, comprising, as it does, several noblemen and gentlemen who have distinguished themselves by their readiness to carry improvement into every branch of our naval affairs. Nor are we even going to complain of the general proposals brought forward by Lord Paget on the occasion in question. With a single exception only, they seem to us to be very reasonable and discreet, all things considered. Our object is rather to show how fearfully short of everything like a wise discrimination the House of Commons and the editors of the daily press fall, when naval affairs come before them for discussion. This we shall do by referring to two, and only two, important subjects.

The first of these constitutes that exceptionable feature in the Admiralty proposals to which we have referred, viz., the substitution of Armstrong guns for the existing service guns in most, if not all, of our ships—not, indeed, to the exclusion of the service guns, but to the removal of so many of them that we feel great anxiety as to the consequences. In a ship of the Revenge class, for instance, the Admiralty will replace 91 ordinary guns with only 71 guns, 7 of which are to be Armstrongs. Hitherto such a ship has carried

34 8-in. guns of 65 cwt.
36 32-pounders of 56 cwt.
20 32-pounders of 45 cwt.
1 68-pounder (pivot) of 95 cwt.

Now her armament is to be,

30 8-in. guns of 65 cwt.
32 32-pounders of 56 cwt.
2 32-pounders of 45 cwt.
6 40-pounder Armstrongs.
1 100-pounder (pivot) ditto.

Now, therefore, she will go into action with four 8-in. shell guns, four 32-pounders of 56 cwt., eighteen 32-pounders of 45 cwt., and one 68-pounder pivot gun of 95 cwt. less than she has hitherto carried; and the places of these twenty-seven useful and reliable guns will be supplied by—what?—one 100-pounder and six 40-pounder Armstrongs! If the Armstrong gun were a thoroughly efficient and well-proved weapon, this change would be a most questionable one, for it absolutely takes the entire armament of a large corvette—of a ship of 1,600 or 1,700 tons—out of a single line-of-battle ship! But with the Armstrong gun what it is—a purely experimental, and not by any means promising weapon—such a change seems to us a most serious and presumptuous fault. And yet it has nowhere been questioned, we believe, on the ground of the imperfect nature of the Armstrong gun. It has been viewed unfavourably, both in and out of the House of Commons, on the general ground of the undesirability of reducing the armament so greatly; but no one has commented upon the doubtful, and even dangerous, character of the guns which are to replace a portion of those removed.

It may be thought by some readers that the cause of this silence is the assured success of the Armstrong cannon. But to believe this would only be to deceive ourselves. The cause is, in our judgment, the ignorance of the Admiralty concerning the real character of that instrument. They have no personal cognisance of the failures that occur with it, and there are too many persons interested in keeping the matter dark for the truth to reach them through legitimate channels. Meanwhile the facts and arguments adduced by honest and fearless men like Captain Halsted are slurred over as exaggerations; and the guns are issued to his brother officers for them to handle as tenderly, and report upon as flatteringly, as may be consistent with their sense of duty.

The second consideration to which we wish to call attention is the perfect coolness and apparent satisfaction with which the House and the Press view the continued construction of wooden ships of the smaller classes. One would suppose that it did not require any very extraordinary mental power to observe that if an explosive shell, or a molten metal carcass, will burn and destroy a big wooden ship, it will do the same to a small one. Yet, so far as Parliament, or even the daily papers, seem to care, the Admiralty may go on building combustible corvettes, sloops, and gunboats without a remonstrance, or even a complaint. In this matter, happily, the Admiralty are not so thoughtless as those whose duty it is to stimulate them, for they have made up their minds to build their small fleets, as well as their large, of iron. But the bare idea of this does not seem to have entered the heads of our members of Parliament, or of our "able editors." The *Times* of Wednesday takes it for granted that small ships must be wooden ships. After quoting Lord Paget's declaration to the effect that "where the navy requires the greatest amount of energy at the present moment is in sloops and a superior class of gunboats," it goes on to say, "So far as *wooden* ships are to be built at all, these are the ships we shall build." Now Lord Paget said nothing to that effect. It is a mere thoughtless inference from our previous practice. But is it right that such a practice should continue in these days of molten iron and liquid fire? Most certainly not. Every vessel built henceforth ought to be either wholly built of iron, or, to say the least, plated with iron. And so most of our future vessels will be—not every one, probably—but we are in a position to state with confidence that the Admiralty have made up their minds, not only to devote their energies to the development of sloops and gunboats, but also to the production of such vessels in an incombustible form. Knowing this, we can only deplore the ignorance which could complacently assume that no such effort either was to be made, or ought to be made.

The two considerations to which we have here drawn attention are not unrelated. On the contrary, the reduction of the armaments of our ships has, doubtless, been made with a view to the reduction which will be inevitable directly we begin to build small iron-protected vessels. This the Admiralty foresee clearly enough. We cannot have armour and armament too on a large scale in vessels of moderate size; therefore the board desire to familiarise their officers and the public with reduced armaments. This is not, we know perfectly well, the cause assigned for the reduction by the Secretary. It suits his purpose better to put other advantages forward prominently—the preservation of the ship from excessive straining in a sea-way, and so forth. But the Secretary knows what he is about, and with whom he has to deal; and the Parliament and public who contentedly allow him to put Armstrong guns into our navy, and who would permit him to go on building combustible ships for ever, must not be surprised if he treats them with some innocent reserve, or even indulges occasionally in a little harmless mystification, provided he can thus make his own path more easy.

THE PATENT LAWS.

IT may be some time before we shall know the final result of the motion, about to be made in the House of Commons, for a select committee to inquire into the policy and operation of the patent laws. We have already had sufficient proof of the determination of a more or less numerous class to obtain, if possible, the total abolition of patents. Great numbers, however, of those most interested in the preservation and improvement of these laws profess to believe that anything like an abolition of patents is altogether out of the question. This kind of faith must proceed from a notion that public opinion is clearly on the side of the inventor. Now, we do not believe that the preponderating share of public opinion has ever occupied itself with the question of patents at all. The grant of letters patent is one of the prerogatives of the Crown, and

the earlier patents were of such a kind and were issued in such a manner as to be beyond the reach of general discussion. If the King chose to grant exclusive privileges, his subjects could not complain, at least until some visible and tangible injury fell upon them in consequence. In the case of a limited monopoly of an invention there could be no resulting injury which was not greatly overbalanced by a coincident public good. For all were left as free as before to practise the processes previously known, and upon which the invention was an improvement. Thus none were directly deprived of anything which they had previously enjoyed. If, however, the new invention was such as to supersede former modes of production, and thus to lead to the stoppage of the employment and profits of manufacturers and artisans practising those modes, this very fact was but a proof that the community at large were better supplied than before, and the public gain by the invention, for example, of the power loom, was many hundred-fold greater than the utmost loss sustained by the hand loom weavers. Indeed, no inventor can benefit himself without at the same time conferring a far greater benefit upon the general public. And, conversely, the public can suffer no injury from a patent for an alleged invention which has failed to benefit the patentee. It is with this assurance that all classes have been heretofore content with the rapid multiplication of patents. They might, as has often been the case, be productive of great public good, and, at all events, they could do no harm. Some persons there have been, and doubtless still are, who have held that the patent was the *right* of the inventor. This, however, is not so, while, if it were, the patent should be in perpetuity and not for fourteen years only. An inventor has a natural right to discover for himself, and to conceal and if possible, profit by his discoveries, but it is altogether a question of public policy whether, on the declaration of his invention, others shall be debarred for a term from practising it without his consent. On the other hand some persons speak of patents for inventions as of monopolies for which there is neither occasion nor propriety. Now, so far from this, an inventor has a natural monopoly in respect of any invention which he can succeed in concealing from others. With a fair amount of secretiveness an inventor may retain a monopoly, for life, of some inventions, bequeathing them to his children afterwards. A patent, therefore, so far from being in itself a monopoly, is but an instrument for limiting what might otherwise be an interminable monopoly.

Within the last few years such wonderful results have been accomplished by means of such combinations as, once explained, were exceedingly simple, that many have come to look upon inventions as matters of course. In other words, it has not only begun to be believed that inventions are sure to be brought forward without the need of any stimulus or protection, but, in fact, that almost anybody can invent anything. That this is not the case is readily capable of proof, but it is always so easy to make the egg stand upright after some Columbus has shown us how to do it, that great numbers of public men and legislators are likely to deceive themselves in the question at issue. But let any one, however intelligent, and however well acquainted with the general principles of science and mechanism, *try* to make an invention, and he will soon discover that he might as well try to say a witty thing. Let any one entirely unacquainted with the construction of a steam engine, but otherwise possessed of a fair allowance of scientific and mechanical knowledge, set about "inventing" a steam engine, and see what he would bring forth. There are, here and there, men of genius who would hit upon what, unknown to them, had been done before, but generally the effort would be unproductive. True invention—the original embodiment of a mechanical principle for the advantage of mankind—is not common. There may be "combinations," it is true, of well known devices, which, combined, produce a better result than before, and it is these "combinations," which after all require little of that mental generation known as invention, that overload the patent office, and render blue books interminable. If discredit has been, at last, brought upon the patent laws, it has been, we fear, in consequence of the readiness with which barren minds have multiplied mere combinations of well known devices, thereby modifying the action of mechanism upon well known principles, just as a child may arrange and rearrange a dozen blocks or a hundred bits of coloured paper, without producing any other than a predictable result.

Whatever may be done in Parliament in connection with the patent laws, the great difficulty will be to distinguish correctly between real inventions and obvious combinations. Indeed it is difficult to distinguish between combinations which are and those which are not obvious. Watt's steam engine was hardly more than a slightly different modification of the existing parts of steam engines, yet he was the first, so far as is known, to whom the possibility and utility of such a combination was apparent. Among our legislators there are able minds, competent, we trust, to deal successfully with the question involved in such cases. We cannot but fear that there is already a large number of our public men prepared for the total abolition of patents, and it will be the fault of those interested in the thrift of invention if these men are not besought upon every point upon which patents are to be defended. The "railway members," and there are already many in the Commons, bear no love for patentees. Yet, when the struggle does come, as come it must, by and by if not upon Mr. Ricardo's motion, let them be appealed to fairly. Let no false issues be raised. Let us have no unfounded declarations of the "rights" of inventors—no empty outcry about the "monopolies of patentees." Let it be shown simply that, without encouragement, inventions are of less likely occurrence; that, without protection, every inventor will be forced upon his natural right of concealment, while *quasi* inventors will resort to a charlatanry against which Parliament is powerless to legislate. Let it be shewn that the public at large will be, to a great extent, deprived of the use which they can now make of the results of invention and discovery, and that written science will be henceforth stripped of its best illustrations. We do not live in revolutionary times, and we do not much fear that the case against patents will be decided upon slight and hasty testimony. It is time that inventors should know upon what ground they really stand, and those whose inventions are worth the care of the nation need hardly fear a searching examination of the whole question.

THE BESSEMER METAL.

The rapidity with which the Bessemer process is being at last adopted is extraordinary. Whatever may be said of the earlier failures in the attempt to produce good malleable iron or steel by blowing a blast of air through a quantity of melted cast iron, it is now certain that ingots of the best quality may thus be produced in from a quarter to half an hour, and, if the iron is taken as it comes from the blast furnace, without any expenditure of fuel whatever. Mr. Bessemer's memorable experiments, made six years ago in Baxter House, were with a good quality of Welsh iron—Blaenavon we believe—which happened to have but little sulphur or phosphorus, and a good quality of metal was certainly made, as many who secured samples at the time can testify. But when the pneumatic process came to be applied to other irons, it proved, in several cases, unsuccessful. No particular attention was directed to the impurities of the iron, since there was no *prima facie* reason for supposing that their presence, so long as it did not prevent the production of merchantable iron by the ordinary process, would cause special difficulties in the new. But difficulties there were, and at one time it was believed by most of those who had paid much attention to the new process, that it had failed completely, which was, of course, tantamount to believing either that the first successes were achieved by juggling, or that what had once been done could not be repeated. Mr. Bessemer persevered, however, and was able to give a good account of himself and his process, three years ago, at a meeting of the Institution of Civil Engineers. From his explanation it then appeared, for the first time, that only the presence of sulphur or phosphorus, in notable quantities, in the iron, affected the conversion of pig metal into good malleable ingots, in less than half an hour, and without either fuel or manipulation. Great difficulty, it was true, had been experienced in finding a lining material, capable of withstanding the heat of the converting vessels, but it was at last found that the "ganister", which occurs in abundance in the neighbourhood of Sheffield, was perfectly adapted for the purpose, and already have nearly one hundred charges, averaging nearly a ton each, been converted in one vessel at Mr. Bessemer's works, with one lining only. Hematite iron having been adopted, and the refractory properties of ganister sufficiently tested, almost the only difficulties in the way of the new manufacture had been overcome before the meeting, last summer, of the Mechanical Engineers at Sheffield. It was then that Mr. Bessemer was first enabled to bring the action and results of the pneumatic process visibly before a great body of practical men, all of whom had every opportunity afforded them for examining into all its details, which, however, are very few and exceedingly simple. A ton of iron worth under £3 was converted, with a loss of less than 17 per cent., into a material intrinsically worth, in comparison with other steel, £40 or £50. The fuel was that, only, say, 3 cwt., employed for melting in the cupola, and the actual cost for labour could not have amounted to as much as one shilling. The product could be graduated to any required hardness or toughness, the blast being first kept on until nearly all the silicon and carbon were burnt out of the iron, immediately after which, the blast being stopped, a measured quantity of melted cast iron, containing an ascertained proportion of carbon, was added. If enough carbon was restored in this way, the ingot would be one of highly carbonized, hard, and unweldable steel, having great cohesive strength. If very little carbon were restored, at the conclusion of the process, the ingot would be soft, nearly as ductile as copper, and capable of being readily welded, while its strength would be from one-third to one-half greater than that of the best Yorkshire malleable iron. The converting process being completely under control, hundreds of tons of metal could be produced of any desired working quality.

Already (at the meeting of the Mechanical Engineers) the Bessemer process had been adopted at the Atlas Steel and Spring Works, now the largest, we believe, in the kingdom, and the proprietors, Messrs. John Brown and Co., were supplying Bessemer steel rails to a number of the continental railways. Messrs. Cammell and Co., of the Cyclops Works, were also about adding the new converting vessels to their great works. The Weardale Iron Company had already erected others at Tudhoe, and more have since been put at work at Tow Law, Durham. Mr. Adamson, the eminent boiler maker of Hyde, who has already employed Bessemer metal extensively, is arranging, we hear, to convert his iron, in future, directly from the pig, and the great house of Platt and Sons, at Oldham, are we learn doing the same. The Messrs. Platt already have twenty boilers on their works made, by Mr. Adamson, from Bessemer plates only $\frac{5}{16}$ in. thick, several of the boilers being 5ft. 6in. in diameter, and carrying, regularly, a pressure of 100 lb. per square inch. Messrs. J. M. Rowan and Co., of Glasgow, have commenced the manufacture of railway wheels and axles from Bessemer metal. The London and North Western Railway Company, pending the erection of converting vessels at the Crewe workships, have already rolled several hundred tons of rails at their own works from Bessemer ingots, and the probability is that rails of this material will ultimately supersede all others in the line. The same company are running Bessemer steel engine tyres and axles, and Mr. Ramsbottom is understood to be arranging for the gradual application of the same material for carriage and wagon tyres and axles. The Great North of Scotland Railway Company have adopted the same material, Mr. Cowan, the company's locomotive superintendent, having lately specified Bessemer steel tyres and axles for 60 wagons and 4 goods brake vans. The tyres not being procurable in season, Mr. Cowan was forced to fall back upon Bowling, but the axles are being made by the Weardale Iron Company, at Tudhoe. At present, we are told, there is but one machine in the kingdom capable of rolling steel tyres in the hoop, this machine being at Messrs. Brown's, at Rotherham. If this be the fact, it is time that steel makers, contemplating an extensive trade in tyres, should put up circular rolling mills of their own. The Weardale Company have been able to deliver ten sets of steel tyres to the Great North of Scotland Company, these being in course of application to carriage wheels. Messrs. Robert Stephenson and Co., who are building six locomotives for the same company, are fitting them with steel tyres and axles made by the Bessemer process. Mr. Cowan, we understand, would have specified the same material for boiler plates (his locomotives work regularly at 140 lb. pressure per square inch), but was deterred by a natural disinclination to risk so much upon a material which, until lately, has been so little known. There has, certainly, been a fear of employing "steel" for boiler plates, particularly for plates which required to be heated in order to be flanged, it being apprehended that steel would be burnt in flanging. With a highly carbonised, brittle steel, this would undoubtedly be the case, but the material which Messrs. Bessemer and Co. supply for boilers is unlike any steel made by the ordinary process of cementation. Their boiler metal will not harden, we believe—at any rate, but slightly, and it can hardly be called steel. Indeed, it has but a very small proportion of carbon, to which ingredient steel appears to owe its hardness, brittleness, and its property of hardening by heating and immersion in a liquid. The experience of Mr. Adamson appears to be almost enough to determine the complete applicability of the new material to all parts of steam boilers, and it will not be long, we conclude, before it will come into general use among boiler makers.

On the Continent, Bessemer steel has been for some time made by James Jackson and Co., of Bordeaux, and more recently, MM. Petin, Gaudet, and Co., the most extensive steel converters in France, have adopted the same process. It is about being taken up, we also learn, at the great works at Seraing, Belgium, originally established by John Cockerill. In Sweden, Bessemer steel has been regularly and extensively made for upwards of four years, the iron being converted immediately on leaving the blast furnace. Mr. Göransson, an iron master at Gefle, Sweden, gave an account of his experience in The Engineer of October 22nd, 1858, and we have since learned that his success has been uniformly maintained. Indeed, there is abundant reason for iron masters and steel makers preparing themselves for an extensive change in the present mode of producing the better marks of iron and steel, and we shall not be surprised if, eventually, with some mode of purifying our impure ores, all iron and steel is made by the atmospheric process.

ENAMELLING IRON.

Enamelling iron is almost a new art. No metal is capable of receiving a coating of vitrified porcelain or enamel unless it is capable of withstanding a red heat in a furnace. Articles of cast iron, as a preparation for enamelling, are first heated to a low red heat in a furnace, with sand placed between them, and they are kept at this temperature for half an hour, after which they must be allowed to cool very slowly, so as to anneal them. They are then subjected to a scouring operation with sand in warm dilute sulphuric or muriatic acid, then washed and dried, when they are ready for the first coat of enamel. This is made with six parts, by weight, of flint glass broken in small pieces, three parts of borax, one of red lead, and one of the oxide of tin. These substances are first reduced to powder in a mortar, then subjected to a deep red heat for four hours in a crucible placed in a furnace, during which period they are frequently stirred, to mix them thoroughly; then toward the end of the heating operation the temperature is raised, so as to fuse them partially when they are removed in a pasty condition and plunged into cold water. The sudden cooling renders the mixture very brittle and easily reduced to powder, in which condition it is called frit. One part of this frit, by weight, is mixed with two parts of calcined bone dust, and ground together with water until it becomes so comminuted that no grit will be sensible to the touch when rubbed between the thumb and finger. It is then strained through a fine cloth, and should be about the consistency of cream. A suitable quantity of this semi-liquid is then poured with a spoon over the iron article, which should be warmed to be enamelled, or if there is a sufficient quantity the iron may be dipped into it and slightly stirred, to remove all air bubbles and permit the composition to adhere smoothly to the entire surface. The iron article thus treated is then allowed to stand until its coating is so dry that it will not drip off, when it is placed in a suitable oven, to be heated to 180 deg. Fah., where it is kept until all the moisture is driven off. This is the first coat; it must be carefully put on, and no bare spots must be left on it. When perfectly dry the articles so coated are placed on a tray separate from one another, and when the muffle in the furnace is raised to a red heat they are placed within it and subjected to a vitrifying temperature. The furnace used is similar to that used for baking porcelain. This furnace is open for inspection, and when the enamel coat is partially fused the articles are withdrawn and laid down upon a flat iron plate to cool, and thus they have obtained their first coat of dull, white enamel, called biscuit. When perfectly cool they are wet with clean soft water, and a second coat applied like the first, but the composition is different, as it consists of thirty-two parts by weight of calcined bone, sixteen parts of China clay, and fourteen parts of feldspar. These are ground together, then made into a paste, with eight parts of carbonate of potash dissolved in water, and the whole fired together for three hours in a reverberating furnace; after which the compound thus obtained is reduced to frit, and mixed with sixteen parts flint glass, five and a half of calcined bone, and three of calcined flint, and all ground to a creamy consistency, with water like the preparation for the first coat. The articles are treated and fired again, as has been described in the preparation coat, and after they come out of the furnace they resemble white earthenware. Having been twice coated, they now receive another coat and firing, to make them resemble porcelain. The composition for this purpose consists of four parts by weight of feldspar, four of clear sand, four of carbonate of potash, six of borax, and one each of oxide of tin, nitre, arsenic, and fine chalk. These are roasted and fritted as before described, and then sixteen parts of it are mixed, with the second enamel composition described, excepting the sixteen parts of flint glass which is left out. The application and firing are performed as in the other two operations, but the heat of vitrification is elevated so as to fuse the third and second coats into one, which leaves a glazed surface, forming a beautiful white enamel. A fourth coat, similar to the third, may be put on if the enamel is not sufficiently thick. The articles may be ornamented like china ware, by painting coloured enamels on the last of the coats, and fusing them on in the furnace. A blue is formed by mixing the oxide of cobalt with the last-named composition; the oxide of chromium forms a green, the peroxide of manganese makes a violet, a mixture of the protoxide of copper and red oxide of lead a red, the chloride of silver forms a yellow, and equal parts of the oxide of cobalt, manganese, and copper form a black enamel when fused. The oxide of copper for red enamel is prepared by boiling equal weights of sugar and acetate of copper in four parts of water. The precipitate which is formed after two hours moderate boiling is a brilliant red. The addition of calcined borax renders all enamels more fusible.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

2786. HERMAN D. BRADY, Boston, Massachusetts, U.S., "Certain new and useful improvements in machinery for lasting and pegging shoes."—A communication from John Taggart, Roxbury.—*Petition recorded 6th November*, 1861.

134. WILLIAM TICE, Downham-road, Islington, London, "Improvements in gas regulators and meters, part of which invention is also applicable for covering various descriptions of metal spindles."—*Petition recorded 18th January*, 1862.

194. CHARLES WEST, Derby-street, Westminster, Middlesex, "Improvements in the insulation and covering of wire, and in the preparation of the materials for insulating the same."—*Petition recorded 25th January*, 1862.

236. JAMES BENJAMIN HARBY, Leytonstone, Essex, "An improved method of preserving electric telegraph cables and wires."—*Petition recorded 29th January*, 1862.

262. PIERRE SCHEURWEGHS and ALEXANDRE JOSEPH AURELE HENRY DE BOISSEROLLE, Paris, "Certain improvements in treating fatty and oily matters for obtaining their acidification, and in the apparatus employed therein."—*Petition recorded 31st January*, 1862.

272. JONATHAN PENDLEBURY, Dukinfield, Cheshire, "Improvements in the method of, and apparatus for, lubricating steam engine cylinders, slides, and other surfaces."

274. JOSEPH DEFREZ, Anzin, Nord, France, "Improvements in machinery or apparatus for extracting coal, ores, and other mineral substances from mines."—*Petitions recorded 1st February*, 1862.

288. WILLIAM CLARK, Chancery-lane, London, "Improvements in processes for preserving and colouring wood, denominated xylochromic and xyloplastic processes."—A communication from Messrs. Heinrich Sperl, Richard Hogen, and Wolfgang Springer, Nuremberg, Bavaria.—*Petition recorded 3rd February*, 1862.

292. PAUL GARDILANNE, Dax, Landes, France, "Improvements in the manufacture of metallic wire fencing."

294. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in the manufacture of hard and soft soaps, and in the preparation of liquids for washing linen and other textile fabrics."—A communication from Léo Bachellerie, Paris.

296. WELBURN WILKS WILLIAMSON, High Holborn, London, "Improvements in apparatus for drying clothes and fabrics."—*Petitions recorded 4th February*, 1862.

306. WILLIAM CAMPION and HENRY JOHNSON, Nottingham, "Improvements in machinery or apparatus for making the welts of hose or other articles made of looped or knitted fabrics, applicable also for other purposes."—*Petition recorded 5th February*, 1862.

322. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in stereoscopic albums, books, and cases"—A communication from Louis François Saugrin, Paris.

324. PETER SHAW, Edinburgh, N.B., "Improvements in lamps."

326. WILLIAM EDWARD GEDGE, Wellington-street, Strand, London, "An improved portable thrashing and winnowing machine and apparatus for working same by horse power."—A communication from Alexandre François Serrin, Passage des Petites Ecuries, Paris.

328. WILLIAM CLARK, Chancery-lane, London, "Improvements in preserving timber, which are particularly applicable to the timbers of ships or other maritime structures."—A communication from Mr. Henri de Lapparent, Boulevart St. Martin, Paris.

330. WILLIAM HAMOND BARTHOLOMEW, Warwick-villas, Leeds, Yorkshire, "Improvements in barges or vessels suitable for the navigation of canals and rivers."—*Petitions recorded 7th February*, 1862.

332. JOHN SENIOR WOODHOUSE, Cheapside, London, "Improvements in hooped skirts."

336. JAMES WEBSTER, Birmingham, "An improvement or improvements in the manufacture of certain descriptions of nails, bolts, spikes, and pins."—*Petitions recorded 8th February*, 1862.

338. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improvements in the treatment of coprolites and other fossil phosphates of lime."—A communication from Guillaume Louis Edouard Buran and Louis Goupy, Rue du Grand c t. Michel, Paris.

340. JAMES DICKSON, Tollington-road, Holloway, London, "Improvements in voltaic apparatus and in the production of voltaic electricity."

342. JOHN BUSFIELD and JONATHAN EASTWOOD, Bradford, Yorkshire, "Improvements in machinery or apparatus for preparing wool for dyeing and spinning."

344. LOUIS RUDOLPH BODMER, Thavies-inn, London, "Improvements in hydraulic oil presses."

346. JOSHUA DANKS, Webber-row, Waterloo-road, Surrey, "Improvements in the manufacture of door-mats and hearth-rugs."

348. ANTHONY MUNCK and HELGE AUGUST MYHRE, Berners-street, Oxford-street, London, "Improvements in ships' logs."—*Petitions recorded 10th February*, 1862.

352. CORNELIUS BONELL and WILLIAM MORTIMER SPRING, Wednesbury, Staffordshire, "A new or improved rotary engine."

354. WILLIAM MACNAB, Greenock, Renfrewshire, N.B., "Improvements in steam engines."

362. FRANCIS JOHN BOLTON, Bolton-row, Mayfair, London, "Improvements in rifle and gun stoppers and oil bottles."—*Petitions recorded 11th February*, 1862.

368. THOMAS COLTMAN, Leicester, "Improvements in sewing machines."

372. THOMAS SPENCER, Liverpool, "Improvements in propellers for navigable vessels, and engines for actuating the same, parts of which are applicable to other purposes."

374. THOMAS HORSLEY, jun., Coney-street, Yorkshire, "Improvements in breech-loading fire-arms."—*Petition recorded 12th February*, 1862.

380. WILLIAM HEWITT, Birmingham, "Improvements in rein-holders."

382. WILLIAM HENRY BROWN, Camberwell, Surrey, "An improvement in yards, fore and aft booms, and gaffs."

386. JOSEPH FEARNS LAWTON and JOHN LAWTON, Vale Mill, Micklehurst, near Stalybridge, Cheshire, "Improvements in the manufacture of flannel for shirtings and other articles of apparel."

388. WILLIAM DANIEL ALLEN, Laithfield-house, Norfolk-road, Sheffield, Yorkshire, "Improvements in the manufacture of stamp heads and beds employed in crushing ores and other mineral substances."

390. EDWARD ELLIS ALLEN, Parliament street, and JOHN STEWART, Blackwall, Middlesex, "Improvements in the construction of steam engines."

392. EDWIN GREEN and JAMES NEWMAN, Birmingham, "Certain improvements in buttons for fastening and ornamenting articles of dress."

394. ADOLPHUS JANSEN, Brussels, Belgium, "A new ball for fire-arms."—*Petitions recorded 13th February*, 1862.

Invention Protected for Six Months by the Deposit of a Complete Specification.

378. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improvements in the disinfection of animal excretions, and in the extraction therefrom of fertilising elements for agricultural purposes."—A communication.—*Deposited and recorded 13th February*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

497. GEORGE TURNBULL, Calcutta, Bengal.—Dated 23rd February, 1859.

490. SAMUEL RIDGE, Hyde, Cheshire.—Dated 23rd February, 1859.

512. CHARLES WILLIAM SIEMENS, John-street, Adelphi, London.—Partly a communication.—Dated 25th February, 1859.

491. WILLIAM ASHTON, Heaton Norris, Lancashire.—Dated 23rd February, 1859.

503. JOSEPH CROSLAND, Crosland Moor, Huddersfield, Yorkshire.—Dated 24th February, 1859.

485. EDWARD LUND, Manchester.—Dated 22nd February, 1859.

498. HENRY BERNOULLI BARLOW, Manchester.—A communication.—Dated 24th February, 1859.

506. JOHN DALE, Cornbrook, Manchester.—Dated 24th February, 1859.

Patents on which the Stamp Duty of £100 has been paid.

431. ALEXANDER THEOPHILUS BLAKELY, Little Ryder-street, St. James's, London.—Dated 27th February, 1854.

386. FREDERIC PRINCE, South Parade, Chelsea, Middlesex.—Dated 21st February, 1855.

382. PAUL PRINCE, Derby.—Dated 21st February, 1855.

409. BARNABY ANGELO MURRAY, Dublin.—Dated 24th February, 1855.

Notices to Proceed.

2549. JOHN CARTER RAMSDEN, Bradford, Yorkshire, "Improvements in healds or heddles for weaving, and in the machinery or apparatus for making the same."—*Petition recorded 12th October*, 1861.

2563. MOWBRAY WALKER, St. Benet's-place, Gracechurch-street, London, "Improvements in breech-loading rifles."—*Petition recorded 14th October*, 1861.

2564. JOHN FLINN, sen., Coventry, Warwickshire, "An improvement in watches."

2568. JOHN GILBERT, Church-street, Old Kent-road, Kent, "Improvements in endless railways."—*Petitions recorded 15th October*, 1861.

2577. WILLIAM BIDDELL, Birmingham, "Improvements in the manufacture of shot."—*Petition recorded 16th October*, 1861.

2584. WILLIAM SMITH, Salisbury-street, Adelphi, London, "Improvements in the apparatus for and method of increasing the illuminating power of gas."—A communication from Hugo Carstanjen, Cologne, Germany.

2585. ROBERT SMITH, Higher Chatham street, Chorlton-upon-Medlock, Lancashire, and JOHN BARNOUIN ROWCLIFFE, Ducie Works, Manchester, "Improvements in apparatus for winding yarn or threads on the pin-bobbins or spools used in smallware and ribbon looms."

2586. CHARLES DE GROOTE, Brussels, Belgium, "An improved instrument for corking bottles and other vessels."—*Petitions recorded 17th October*, 1861.

2591. WILLIAM CROOME, Kilmersdon Radstock, near Bath, Somersetshire, "Improvements in lamps."

2593. JOHN CROSTHWAITE and THOMAS EDWARD ARMAN, Liverpool, "Improvements in the construction of targets, and in signal apparatus to be used therewith."

2594. JOHN GOUCHER, Worksop, Nottinghamshire, "Improvements in the beaters and drums used in thrashing machines."

2595. EDWARD PEYTON, Birmingham, "Improvements in the frames of metal bedsteads."

2598. CHARLES HERBERT HOLT, Huddersfield, Yorkshire, "Improvements in steam engines and boilers, and in apparatus connected therewith, part of which improvements is also applicable to raising and measuring fluids generally."

2599. WILLIAM STREATHER, Raunds, Northamptonshire, "Improvements in the construction of wind engines, and in the structure containing the same, parts of which are applicable in the construction of windmills."

2601. PATRICK ROBERTSON, Sun-court, Cornhill, London, "Improvements in the manufacture of cartridges."—A communication from Algernon Johnston, Connecticut, U.S.

2604. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in brading machines."—A communication from Thomas James Sloan, Paris.

2605. HUGH MACMEKAN, Stratford, Essex, "Improvements in smelting copper, gold, and other ores."—A communication from Rowland Vounder Rodder, Alberton, near Adelaide, South Australia.

2606. CHARLES CHEYNE, Great George-street, Westminster, Middlesex, and THOMAS BEEBY MOSELEY, Lewisham, Kent, "Improvements in the construction of apparatus for signalling on railways, by which improvements the signalling apparatus is rendered self-registering or recording, and also applicable for measuring and recording the speed of passing trains and the time of their passage, part of which improvements is applicable for recording the speed of trains where signalling is not required."—*Petitions recorded 18th October*, 1861.

2609. ROBERT MUSHET, Coleford, Gloucestershire, "A new or improved manufacture of titanic pig metal or alloy of titanium and iron."

2614. JAMES BOURNE, Oakamoor, Staffordshire, and EDWARD KIDD, Birmingham, "Improved machinery for the manufacture of metal tubes and cylinders, which is also applicable to other useful purposes."

2615. CHARLES DE BERGUE, Dowgate-hill, London, "Improvements in sleeper chairs for the permanent way of railways."—*Petitions recorded 19th October*, 1861.

2623. JOSIAH TIMMIS SMITH, Barrow, Furness, Lancashire, "An improvement or improvements in collecting the inflammable gases evolved from blast furnaces."

2633. JOHN TOWARD, Glasshouse Bridge Ironworks, Newcastle-on-Tyne, "Improvements in armour-plates for ships, and in securing the same to the sides of a vessel."—*Petitions recorded 21st October*, 1861.

2636. GEORGE ENGLAND Hatcham Ironworks, New Cross, Surrey, "Improvements in planing machines."

2637. ROBERT MUSHET, Coleford, Gloucestershire, "An improvement or improvements in the manufacture of a certain metallic alloy."

2639. HENRY MAY, Eagle Factory, Tewkesbury, Gloucestershire, "Improvements in goloshes."—*Petitions recorded 22nd October*, 1861.

2643. GEORGE HENRY BIRKBECK, Southampton-buildings, Chancery-lane, London, "Improvements in processes or means employed for separating or extracting silver from lead."—A communication from Jules Frederic de la Batie, Paris

2650. AUGUSTIN MOREL, Roubaix, Nord, France, "A new machine for combing all filamentous materials."

2656. ISAAC LOUIS PULVERMACHER, Oxford-street, London, "Improvements in apparatuses for the production of galvanic and magneto-electric currents, and in machinery employed in making some of the apparatuses."

2657. WILLIAM BARRY LOLD, Plymouth, "An improved plug and socket, or apparatus for closing and opening passages for the flow of liquids and fluids."—*Petitions recorded 23rd October*, 1861.

2660. ALEXANDER FRANCIS CAMPBELL, Great Plumstead, Norfolk, "Improvements in railways."—*Petition recorded 24th October*, 1861.

2678. HENRY GILSON, Maen-Offeren Slate Quarries, Festiniog, North Wales, "Improvements in slate-dressing machines for cutting and trimming the edges of slates."—*Petition recorded 25th October*, 1861.

2684. WILLIAM ROBERTSON, Manchester, and JOHN MUIR HETHERINGTON, Vulcan Works, Manchester, "Certain improvements in mules for spinning and doubling."

2685. JOHN SIDEBOTTOM, Harewood, near Mottram, Cheshire, "Certain improvements in machinery for making partial tubes for the spindles of spinning and other machines."—*Petition recorded 26th October*, 1861.

2720. EVAN LEIGH, Manchester, "Improvements in the construction of sailing ships and other vessels."—*Petition recorded 30th October*, 1861.

2732. JOHN AMERICUS FANSHAWE and JAMES ARCHIBALD JAQUES, Tottenham, Middlesex, "Improvements in the construction of steam generators."—*Petition recorded 31st October*, 1861.

2784. GEORGE TOMLINSON BOUSFIELD, Loughborough Park, Brixton, Surrey, "Improvements in electroplating or depositing metals."—A communication from Jabez Ellis Walcott, Boston, Massachusetts, U.S.—*Petition recorded 5th November*, 1861.

2786. HERMAN D. BRADT, Boston, Massachusetts, U.S., "Certain new and useful improvements in machinery for lasting and pegging shoes."—A communication from John Taggart, Roxbury, U.S.—*Petition recorded 6th November*, 1861.

2797. THEODORE SCHWARTZ, New York, U.S., "Improvements in the construction of air engines or air motors."—*Petition recorded 7th November*, 1861.

2822. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improved apparatus for manufacturing and containing gaseous liquids."—A communication from Pierre Prudence Henri Couillard, Rue St. Sebastien, Paris.—*Petition recorded 9th November*, 1861.

2833. CHAUNCY ORRIN CROSBY, Bridge-street, Blackfriars, London, "Improvements in the manufacture of pointed trimming, and in the machinery for manufacturing pointed trimming."—*Petition recorded 11th November*, 1861.

2924. GEORGE HENRY POLYBLANK, Gracechurch-street, London, "A new or improved method of protecting and preserving photographic and other prints, water-colour drawings, and other works of art from injury and decay."—*Petition recorded 21st November*, 1861.

3009. THOMAS ELLIS, Swindon, Wiltshire, "Certain improvements in rails for permanent ways."—*Petition recorded 29th November*, 1861.

3150. EMILE CAJOT, St. Servais, Belgium, "Improvements in the treatment of pyrites for the manufacture of iron."—*Petition recorded 14th December*, 1861.

3182. WILLIAM TATE, Horsley-hill, near South Shields, Durham, "Improvements in armour, and in making and applying the same for protecting wood and iron ships of war and batteries."—*Petition recorded 19th December*, 1861.

23. HERMANN ESCHWEGE, Mincing-lane, London, "Improvements in treating wood and other vegetable spirit."—*Petition recorded 2nd January*, 1862.

81. THOMAS RAMSAY, Newcastle-on-Tyne, "Improvements in the manufacture of coke."—*Petition recorded 11th January*, 1862.

306. WILLIAM CAMPION and HENRY JOHNSON, Nottingham, "Improvements in machinery or apparatus for making the welts of hose or other articles made of looped or knitted fabrics."—*Petition recorded 5th February*, 1862.

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 22nd February, 1862.

1760, 10d.; 1770, 3d.; 1771, 3d.; 1772, 3d.; 1773, 3d.; 1774, 3d.; 1775, 3d.; 1776, 3d.; 1777, 10d.; 1778, 4d.; 1779, 5d.; 1780, 3d.; 1781, 3d.; 1782, 3d.; 1783, 5d.; 1784, 7d.; 1785, 3d.; 1786, 3d.; 1787, 3d.; 1788, 10d.; 1789, 9d.; 1790, 3d.; 1791, 5d.; 1792, 5d.; 1793, 3d.; 1794, 3d.; 1795, 4d.; 1796, 9d.; 1797, 3d.; 1798, 5d.; 1799, 3d.; 1800, 9d.; 1801, 3d.; 1802, 7d.; 1803, 3d.; 1804, 3d.; 1805, 10d.; 1806, 3d.; 1807, 1s. 4d.; 1808, 3d.; 1809, 3d.; 1810, 6d.; 1811, 9d.; 1812, 9d.; 1813, 7d.; 1814, 10d.; 1815, 6d.; 1816, 7d.; 1817, 10d.; 1818, 1s. 2d.; 1819, 5d.; 1820, 5d.; 1821, 10d.; 1822, 7d.; 1823, 6d.; 1824, 1s.; 1825, 10d.; 1826, 7d.; 1827, 2d.; 1828, 3d.; 1829, 6d.; 1830, 10d.; 1831, 3d.; 1832, 10d.; 1833, 7d.; 1834, 7d.; 1835, 3d.; 1836, 3d.

*** Specifications will be forwarded by Mr. Bennett Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

TAPER OF COCKS.—At some of our locomotive workshops under pressures of 130 lb. per inch, the taper of cocks is one in six, a cock 6in. long being 1in. larger at one end than the other. At one of the principal marine engine factories the taper is one in five (with low pressure). Mr. Bourne recommends one in three.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

(Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.)

1932. P. O'HANLON, *Kingston-upon-Hull*, "*Steam boilers.*"—*Dated 3rd August*, 1861.

The objects of this invention the patentee proposes to effect by two means, namely, on the one part, by causing, through mechanical and artificial contrivances, a more perfect combustion, and, on the other part, by conducting the water for feeding the boiler in such a manner through the flues as to become thoroughly heated, but without obstructing by such process any heat which would otherwise have contributed to the heating of the boiler. In order to effect the first part of these improvements, namely, a saving of fuel by a more complete and regular combustion, he introduces into the mouth of each of the intermediary large flues or tubes (situated above the respective fire-boxes, and connected by these with a series of smaller tubes as described in the specification of the patent hereinbefore mentioned) a kind of fan or exhauster, which by virtue of the air or gases becoming more rarified on the one side than on the other by the heat, will rotate, and by so doing transmit the smoke in a regular manner into the smoke-box of the boiler. With respect to the second part of this invention he proposes to omit the fans above described in the two intermediary tubes or flues, which are respectively situated the nearest to the sides of the boiler, and introduces in lieu of them the feed pipe, which, being of a smaller diameter, would have space enough for the smoke and gases to pass into the smoke chamber. The course the feed pipe takes is, therefore, the following:—First, it enters the boiler at the front, passes through the wing tube before mentioned at one side, traverses the smoke chamber at the back, and repasses finally through the other wing tube at the opposite side again to the front of the boiler, where, with a bend and a valve or cock, it is in communication with the water space.

1939. H. C. MEYER, *Hoxton, London*, "*Slide valves to regulate or stop the flow of water, steam, &c.*"—*Dated 5th August*, 1861.

The patentee claims, First, the use of eccentric axles or eccentric bearings with wheels and rails. Secondly, the adoption of stationary axles of ordinary character with wheels and rods forming a double joint on the slide and on the frame of the valve. Thirdly, elastic packing face double joint. Fourthly, metallic double joint face.

1948. W. *and* J. GALLOWAY, *Manchester, and* J. W. WILSON, *Barnsley*, "*Steam boilers.*"—*Dated 6th August*, 1861.

This invention consists, first, in an improved combination and arrangement of parts forming a vertical steam boiler, wherein two or more sets or stones of tubes connected by water chambers are employed, or can be introduced. Secondly, in applying two water chambers to the flues of horizontal boilers, with two furnaces, such water chambers being placed beyond and near the bridge. Thirdly, in connecting a water bridge by vertical tubes to the upper part of the flue. Fourthly, in applying glasses to the shell of the boiler, through one of which light is reflected, and through the other the interior of the boiler can be examined. Fifthly, in applying a glass plate to the end of the boiler through which the level of the water can be seen; and, lastly, in various improvements relating to safety valves. The invention cannot be described in detail without reference to the drawings.

1952. F. TOLHAUSEN, *Paris*, "*Mechanical contrivances increasing the effect of motive power.*"—*A communication.—Dated 6th August*, 1861.

For the purposes of this invention the patentee has contrived an apparatus in which the crank with its dead points is entirely dispensed with. This apparatus consists of a toothed wheel which, whilst rotating, receives its impulsion at any point of its circumference or rotation except that portion which is termed the dead points. The said wheel has inclined or ratchet teeth into which a pair of racks with trundle or round teeth are made to gear, the racks being set together in a frame, one on each side of the wheel, and parallel to the reciprocating motor from which the rotation is derived. Thus, supposing the two racks to have a simultaneous and identical reciprocating motion given to them, *e.g.*, by means of the piston rod of a steam engine, one of the racks will gear into the wheel teeth, and set the wheel to rotate, whereas the other rack will escape in the manner of a click and ratchet, and on the return stroke the rack first mentioned will escape, the second rack will continue the impulsive motion, both of the racks being set movable in their frames, and kept in gear with the wheel by springs or any other equivalent yielding device.

1969. M. D. P. MAILLARD, *Dublin*, "*Self-acting and inexhaustible hydraulic and atmospheric motive power engines.*"—*Dated 8th August*, 1861.

This invention consists in obtaining from or by the use of cold water, or any other suitable fluid at its natural temperature, or from common atmospheric air, motive power engines, which are applicable to all the purposes for which steam engines are now employed. The first part of the invention consists of two or more metal or other cylinders or receivers in which pistons are placed. These cylinders or receivers are then filled or charged with water or other suitable fluid or air, and these pistons which are worked by long levers resting on suitable bearings are loaded with metal or other weights to give or produce the actual mechanical pressure required to the square or circular inch of the working or driving piston; one only of the receivers is charged with water or other fluid or air, for which purpose its loaded piston is raised to its full height by manual or other power, and the piston in the opposite receiver is let down to its lowest point or level, so that, when the water or other fluid or air in the charged receiver is allowed to pass down the charged receiver, and the falling piston is made by the aid of the lever of the rising piston to raise the piston in the opposite receivers, one of these receivers is caused to act as a force pump and the other as a suction pump, which they do alternately when the charge is forced from one receiver or cylinder into the other by means or through suitable inlet and outlet pipes or tubes. In these pipes or tubes which connect the receivers with the working cylinder suitable valves, tap-cocks, or sluice-cocks are placed, to control the force exerted by the working piston or pistons, and to reverse the movements of the engine. Through these tubes or pipes motion is given to the working piston which moves the crank or working shafts. Secondly, to prevent the loaded pistons balancing themselves the patentee uses two or more auxiliary or monkey cylinders and pistons, which act as lifts and are worked by the pressure from the charged receivers,

1979. H. KINSEY, *Nottingham*, "*Steam engines and boilers.*"—*Dated 8th August*, 1861.

In constructing oscillating steam engines according to this invention the patentee arranges the slide valve to work in a plane at right angles to the length of the cylinder, in place of in the direction of the length, as is usual, and the valve face he forms by preference at one end of the cylinder. The trunnions he then places at the same end of the cylinder, their centre line being in the plane of the valve face. The valve rod projecting from the valve box at one or both ends will then, as the cylinder rocks, move with it, its outer end or ends (supposing the valve to be stationary on its face) describing an arc of a circle. The valve rod, as its end is carried to and fro with the cylinder, is governed by a curved course which pushes the valve to and fro over its seat as required to drive the engine. The curved course is stationary when the engine is at work, but it is capable of pivoting about a point in the centre line of the trunnions; this motion brings up another portion of the curved course, which is of such a form as to cause the engine to work backwards in place of forwards. In constructing steam boilers according to this invention he forms them of two cylinders of different sizes, placed vertically and concentrically with a water space between them; the interior of the inner cylinder forms the fire box, the fire being supported on a circular grating. The fire is fed by a passage formed through the side of the boiler through the two cylinders and the water space, and this passage is fitted with a fire door. The two cylinders are closed at their upper ends, the ends of the outer cylinder being at a distance above that of the inner cylinder, with a water space between the two. The chimney or flue passes out through this water space, it being placed in the centre of the top of the boiler. Within the fire box there is an inverted cone suspended by pipes from the top water space, and these pipes keep the cone constantly supplied with water, and allow the steam generated in it to escape to the top of the boiler. The bottom of the cone is connected by a pipe or pipes with the water space at the side of the boiler, so as to permit a free circulation of water through the cone.

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

1929. G. L. M. V. DE P. DE'AMECOURT, *Paris*, "*Apparatus connected with aerostation.*"—*Dated 3rd August*, 1861.

The patentee claims the imparting to aeronautical apparatus of a specific gravity exceeding that of the air, and by means solely of any suitably prime mover, such as a steam engine or others, the ascending power required for causing the said apparatus to rise in the air by the effect exerted on this latter by suitable revolving helices, propelling blades, or vanes, or other suitable mechanical arrangements, acting in so far in a contrary direction to each other as to cause the vertical components of their forces to unite their efforts for raising the apparatus, whereas the horizontal components keep each other in proper equilibrium, and thus prevent the apparatus from taking a giratory motion, whilst one or more revolving helices, propeller blades, or vanes, or other suitable mechanical arrangements, are made use of for propelling, and one or more rudders, wings, or other suitable devices for directing the apparatus.

1944. F. Seiler, *Paris*, "*An improved mode of overlapping differential levels, applicable to canals, &c.*"—*Dated 6th August*, 1861.

This invention consists, primarily, in the employment of compressed air, gas, or other like agent, for raising and lowering boxes or chambers containing water for receiving boats, barges, and other vessels to different water levels, and it is particularly applicable to canals and rivers. The manner in which the patentee attains the desired object is as follows:—He forms, say, two reservoirs at different levels, and places in each a double box or chamber, open at bottom and formed at top with a case for containing sufficient water to float whatever vessel may be required to be raised or lowered; they are also provided with swing gates, and are in communication with one another by means of a pipe provided with stop-cocks. To raise a vessel from the lower to the upper level the chamber is caused to descend in the reservoir nearest the low level, so that the water therein may be on a level with it, and the vessel enters the chamber, the gates of which are then closed. Compressed air is forced into the chamber, which rises until it reaches the intermediate water level; the vessel is then placed in the other chamber, and the compressed air allowed to return from the first to the second chamber, which raises the latter, and with it the vessel to the upper level. To descend from the higher to the lower level the reverse action takes place. Vessels can by this means be raised and lowered in reverse directions at one and the same time, and without any loss of water. When once the compressed air is forced in, it may be used over again.

1957. A. V. Newton, *Chancery-lane, London*, "*Reversible seats.*"—*A communication.*—*Dated 6th August*, 1861.

This invention relates to a mode of constructing seats suitable for carriages, steam vessels, and other uses, so that the inclination of the back may be reversed at pleasure, and with it the inclination of the seat. The improvements consist, First, in connecting the seat back to the seat in such a manner that the position or inclination of the seat will be shifted by reversing the back, the whole forming an exceedingly simple and efficient device. A further improvement consists in the application of a supplemental back to the seat in the manner described. The invention cannot be described without reference to the drawings.

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

1930. P. Harbet, *Bar-le-Duc, France*, "*An improved circular loom.*"—*Dated 3rd August*, 1861.

This circular loom is composed of a cast iron drum, fitted on a vertical shaft; on a flange of the lower part of the drum rollers are fitted, over which runs a bevel-toothed crown, actuated by a bevel pinion, which pinion, keyed in a horizontal shaft, is caused to rotate by a hand crank. The warp need not be previously dressed for weaving, as in common looms. The threads forming this warp are wound on cops or spools turning freely on spindles properly disposed in any required number outside around a lower cylinder. The warp ascends from the cops up in the cast iron drum; they are guided between small rollers, and each thread thereof passes into a little hole pierced through a small blade placed betwixt the teeth of two concentric circular combs; there are of course as many blades as threads in the warp. The revolving toothed crown carries a set of pinions which gear together, and one of them gears with a fixed toothed crown fitted at the top of the drum; this combined movement will impel the shuttle which runs round between the combs and over the thread-guiding blades. The revolving toothed crown carries also properly shaped pieces, which, in their passage before and after the shuttle, drive the thread-guiding blades inwards or outwards, causing thus the warp to be open or closed for the passage and setting of the weft thread.—*Not proceeded with.*

1931. J. Henderson *and* J. Broadley, *Soltaire, near Bradford*, "*Means or apparatus employed in weaving.*"—*Dated 3rd August*, 1861.

An extension of time for filing the final specification of this invention having been petitioned for, the documents relating to this invention cannot at present be seen.

1950. R. Wappenstein, *Manchester*, "*An improved cop-tube and cover for rollers used in spinning, and an apparatus for putting the tubes on the spindles.*"—*Dated 6th August*, 1861.

In carrying out this invention the patentee makes the cop-tubes of any suitable fabric, woven tubular, which is first cut into lengths, then stretched on conical spindles of the required size, and afterwards coated with cement, gum, varnish, or other binding and strengthening material. He also covers the rollers used in spinning machinery with similar fabric, woven tubular, of the required diameter, and coats it with cement, gum, varnish, or other similar material. For putting the tubes on the spindles of a mule or other spinning machine he employs a frame having in it holes or perforations for holding the tubes, the said holes being encircled with elastic material when desired. In order to keep the tubes firmly in their holes he places in the interior of the frame a movable clipper, having holes or perforations corresponding with the holes in the frame. The tubes are passed through the holes both of the frame and clipper, and then, if the clipper is slightly moved, it will catch each tube, and hold it firmly whilst the frame is being carried about. The clipper is shifted to and fro for tightening and loosening the tubes by means of an eccentric cam-crank lever or other mechanical contrivance. This improved tube frame is made of wood or metal, and may be of any desired length, and adapted for any number of tubes, and used either entirely by hand or attached to other frames employed for putting on any number of tubes by mechanical means. The tube frame cannot be described in detail without reference to the drawings.

1967. L. W. Viollier, *U.S. Consul at Lyons*, "*Machinery for doubling and twisting yarns and threads.*"—*A communication.*—*Dated 7th August*, 1861.

This machine is composed of a horizontal shaft which has on it at intervals bevelled toothed wheels; these wheels gear with other bevelled toothed wheels on horizontal shafts at right angles to the first shaft, and on each of these second mentioned shafts are fixed two discs at a short distance from each other. Between these discs are three or other number of toothed wheels, and these wheels are placed at equal distances apart around the circumference of the discs, and their shafts are supported by the discs. Concentric with the two discs is a ring fixed to the framing of the machine; this ring is formed with internal teeth, into which the toothed wheels between the discs gear; on the end of each of the axes of the toothed wheels which gear into the toothed ring is a frame, suitable for carrying a bobbin, and on the bobbins carried by these frames is wound the yarn or thread or wire to be twisted and doubled. The bobbins are prevented from turning too freely by means of a spring pressing against them; the tension on the yarn is also regulated by the yarn passing over or against three rods carried by each bobbin holder. On the end of the shaft carrying the two discs above mentioned is a head having three or other number of holes through it, according to the number of bobbins carried by the discs; these holes all meet together at the point of the head, the yarn from each bobbin passes through a hole in the top of its holder, and then passes through one of the holes in the head. When the shaft carrying the discs is caused to rotate by means of the first mentioned shaft, the shafts of the bobbin holders are caused to rotate by reason of the toothed wheels upon the shafts gearing into the stationary toothed ring, and the yarns coming from the bobbins are thereby twisted, and as each of the yarns passes through the head of the shaft which has the discs fixed to it, the yarns are twisted by the revolution of the shaft; the cord thus formed then passes between rollers pressed together by springs, and these rollers press the cord and render it smooth. The cord is then wound on a bobbin, or, in the case of heavy cables, is laid into coils. Each of the shafts at right angles to the shaft first mentioned being combined with apparatus similar to that above described, as before mentioned, cords are produced by each of the shafts at the same time, and, if desired, a set of shafts may be placed on each side of the first or driving shaft.

1968. J. *and* T. C. Eastwood, *Bradford*, "*A new kind of yarn, being a combination of refuse and waste matters of fibrous materials.*"—*Dated 8th August*, 1861.

This invention consists in mixing knotted or lumped silk noils or knots, or lumps of silk of various colours, with fibrous substances, and spinning the same into a yarn having knots or lumps of silk fixed therein, and weaving the said yarn into a cloth or fabric.

1988. C. Lee *and* T. K. Mack, *Birmingham*, "*Backing or covering the back or foundations of raised and cut pile fabrics.*"—*Dated 9th August*, 1861.

This invention consists in enamelling or japanning the backs of raised pile or cut pile fabrics, such, for instance, as plush, velvet, coach lace or carpets, or mohair; these materials thus coated have the resemblance and waterproof nature of leather on the one side whilst retaining their natural appearance on the other.

1989. J. Gray, T. Kershaw, B. Crowther, *and* A. Dean, *Manchester*, "*Mules for spinning.*"—*Dated 7th August*, 1861.

This invention cannot be described without reference to the drawings.

2008. J. C. Horner, *Avenue-road, Hammersmith*, "*Looms.*"—*A communication.*—*Dated 13th August*, 1861.

The First part of this invention consists in applying a partially rotating motion to a double or compound shuttle box, the position of the shuttle box being governed by a pattern wheel furnished with two or more rows of holes or pegs; the pattern wheel is put in motion by a ratchet wheel or other equivalent, actuated by any convenient moving part of the loom. The Second part of this invention is applicable to looms in which a drop shuttle box with six or other convenient number of compartments is employed; the position of this shuttle box is governed by means of a pattern drum, which is moved round or to and fro by ratchet wheels and catches or other equivalents. The fingers acting in combination with the pattern drum traverse from one side of the loom to the other on a slide. To the drop box is connected a rack, in which a pinion gears; this pinion is worked by ratchet wheels, the catches of which are put in motion, when required, by pegs on the pattern drum; this improved arrangement and combination of parts is particularly applicable in producing patterns of very great extent. The Third part of this invention is very similar to the second, and is chiefly adapted to looms in which a drop shuttle box with four compartments is employed.

2011. S. Andrew *and* S. Hornby, *Stalybridge, Lancashire*, "*Apparatus for opening, cleaning, and preparing cotton and other fibrous materials.*"—*Dated 13th August*, 1861.

This invention is carried into effect as follows:—First, the patentees employ one or more large cylinders from 18in. and upwards in diameter, as may be required, and adapt them for up and down draughts by giving them a reverse motion to that hitherto used, so that they strike downwards instead of upwards, by which means they obtain a larger and improved surface of grate bars, in connection with a perforated plate or sieve in a diagonal position, for extracting the dirt and refuse matter. Secondly, they employ two or more wire or perforated metal cylinders or cages for extracting dust or light leafy substances. Thirdly, they adapt a side shaft for driving the feeder and delivery rollers by means of bands or gearing, and cause the machine to deliver the opened and cleaned material at the opposite end to the feeder, instead of delivering underneath it as heretofore. Fourthly, they apply the aforesaid large cylinders to lap machines having one or more beaters.

2015. B. Cooper, *Frome*, "*Machinery for spinning and doubling fibrous materials.*"—*Dated 13th August*, 1861.

This invention cannot be described without reference to the drawings.

2017. W. Robertson, *Manchester*, "*Machines for preparing to be spun cotton and other fibrous materials.*"—*Dated 14th August*, 1861.

In carding engines a comb having a reciprocating motion is usually employed for stripping the fleece or sliver from the doffer. Instead of this reciprocating comb, the inventor places a central shaft parallel with the doffer, and at each end of it beyond the ends of the doffer he places a plate made susceptible of receiving a series of shafts, solid or hollow, capable of receiving a small amount of motion. On each of these shafts is placed a doffing comb to correspond in position with, and adjusted to take the sliver or fleece from, the surface of the doffer. To effect the regulation of these combs, on the end of each comb-shaft is placed a small arm, having a projecting stud working in a groove of irregular form fastened on the bracket in which the central shaft is made to revolve. The groove is adjusted so as to bring the combs into position for stripping the doffer, and instantaneously to withdraw them from contact with the fleece whilst it remains in partial contact with the doffer.—*Not proceeded with.*

2019. W. E. Gedge, *Wellington-street, Strand, London*, "*Pressing-boards for pressing cloth, &c.*"—*A communication.*—*Dated 14th August*, 1861.

If thereto lustre has been given to cloth and other stuffs of any texture by placing card or millboard between each fold of the stuff, and submitting it in this state to pressure under the influence of heat. And the object of this invention is to accelerate this operation, and give it more regularity, by making the pressing boards good conductors of heat, and it is proposed to effect this by metallising them in any manner, either by mixing metallic particles with the pulp or paste of which the pressing board is made, by glueing or otherwise fixing a metallic sheet between two boards, or by fixing such sheet of metal on one or both surfaces of the pressing board.—*Not proceeded with.*

2022. G. J. Wainwright, *Dukinfield, Cheshire*, "*Certain parts of machinery or apparatus used in preparing and spinning cotton, &c.*"—*Dated 14th August*, 1861.

This invention relates to the spindles used in mules for spinning, and in steps used for both preparing and spinning. On the spindles of mules and other machines, and such spindles as are not connected with a flit, the inventor places a brush, either fast or loose, made of cast iron or other suitable material, but of the former in preference. The spindles themselves may be enlarged in the part working in the bolster, or the bolsters may be grooved or hollowed, the objects to be gained being mainly a saving in oil and protection to the spindle. To the steps used in mules, frames, or other machines used for preparing the fibrous material, he places a cover or lid of any convenient shape, so as to be free from the spindle, in order to keep out dirt, confine the oil or lubricating matter, and prevent it flying out of the step and being wasted.—*Not proceeded with.*

Class 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

1970. J. Gedge, *Wellington-street, Strand, London*, "*Apparatus for beating or threshing grain.*"—*A communication.*—*Dated 8th August*, 1861.

This apparatus is constructed as follows:—On two uprights of a framing the inventor places a cross piece or yoke, and under the yoke is a board, the face of which is covered with plane tables or small shelves forming rods in position of inclined planes to suit the inclination of the apron on which they act. This assemblage of rods he terms a beating or threshing hammer. Two grooves are made in or on the uprights in which slide the ends of the hammer. An apron on an incline is sustained in position by cross pieces, so that it may receive the stroke of the hammer. This apron is so arranged as to hold the grain for beating, and afterwards to pass it off. The hammer is raised by the action of four (more or less) wings which are brought into action by turning a handle, each end of each wing lifting the hammer as the wing rotates.—*Not proceeded with.*

2007. J. Humpage, *King's Norton, Worcester*, "*Reaping and mowing machine.*"—*Dated 13th August*, 1861.

The platform or base of this machine is supported upon two wheels, upon which said wheels the machine is moved when in work, and from the axis of one of the said wheels the motions of the several moving parts of the machine are taken. On the axis of one of the said wheels are two cams, one of the said cams being in the form of a wheel, on the periphery of which a zigzag depression is made. The toothed knife or sickle which cuts the wheat or grass to be reaped or mowed is situated horizontally at a short distance above the ground, and has a reciprocating horizontal motion given to it by a stud on the end of a horizontal lever, engaging in the zigzag depression in the cam, the knife or sickle being jointed to the said lever. When used as a mowing machine the cut grass falls over a bar connecting the two wheels, the platform, which is movable, being taken away. When used as a reaping machine the cut wheat is received upon the platform, and two vertical gathering forks approach one on either side, and, closing upon the cut wheat, take hold of it, and, by retiring, carry the said wheat from off the platform; the said forks open and deposit the wheat in a sheaf for binding.—*Not proceeded with.*

Class 5.—BUILDING.—None.

Class 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defences, Gun Carriages, &c.

1954. E. A. Cowper, *George-street, Westminster*, "*Protecting ships of war and land batteries from the effects of projectiles.*"—*Dated 6th August*, 1861.

Portions of these improvements relate to a means of causing shot and shell, or other projectiles thrown by an enemy, to glance off from the surface of iron or steel plates in a more certain and complete manner than is commonly the case by fixing a certain thickness of a softer metal on the face of such iron or steel plates. Other portions of the improvements relate to certain means of causing a number of armour plates to assist each other in their resistance when a projectile strikes any one of them, by so connecting the edges of the plates that no plate can be forced in below its neighbours until a large amount of metal has first been destroyed altogether in its form, or sheared in two. This result the inventor attains without any "grooving and tongueing," or rabetting of the edges of the plates, by boring holes of large diameter through the plates exactly in the joints of the same when fixed in their place, so that half the hole is in one plate and half in the other, and in which holes he cuts a coarse strong threaded female screw, and then screws into the same strong iron screw plugs, so as to entirely fill the holes. Other portions of the improvements relate to the forming of such before-mentioned or other armour plates of malleable cast iron of great thickness, and the same may be coated with soft metal.—*Not proceeded with.*

1975. G. H. Bovill, *Wimbledon, Surrey*, "*Improvements in ships of war and other vessels, and in the manufacture of armour and other plates of wrought iron.*"—*Dated 8th August*, 1861.

This invention consists, Firstly, in the application of vulcanised india-rubber that shall be permanently elastic to the seams of the planks and decks of ships. Secondly, in order to prevent adhesion to the bottoms of ships the patentee applies magnetic or galvanic electricity, in such manner as to produce electric currents through the metal plates forming or sheathing a ships' bottom. Heretofore ships and vessels have, in some cases, been propelled and manœuvred by forcing out water. According to the third part of this invention the pipes or apertures used for this purpose are to be formed or placed as far below the surface of the water as practicable; the area of these apertures is not to be less than 1·3 superficial inches for every horse power employed, and where practicable the apertures and conduit pipes leading thereto from the propelling pumps should be so large that the velocity of the current of water passing through them should be about 20 per cent. greater than the speed of the vessel. With the before-mentioned conduit pipes and apertures are combined centrifugal pumps, so as to cause a continuous stream of water to be kept up, and discharged against the water opposed to it at the stern of ship or vessel. Fourthly, in arming ships of war, what may be called telescopic martello towers are used, which are constructed by preference of cylindrical form, and of wrought iron plates of sufficient thickness to be shot proof. These shot proof cylinders should be from 6ft. to 9ft. in diameter or more; on the top is placed a turntable carrying an Armstrong or other powerful gun, and this turntable and gun are housed in and suitably protected by angular shot proof plates, an opening being left in the top to relieve the concussion of the air, and to clear the smoke produced when firing the gun. Fifthly, in order when applying armour or thick plates to the sides of a ship or vessel to utilise the strength of the iron thus added, and to give strength to the ship, instead of the armour plates being fixed or hung to the outer skin of the vessel, as heretofore practised, he uses armour plates with flanges formed or rolled at two opposite edges, leaving the two ends or other opposite edges without flanges; these flanges are put together and connected, when bolts or rivets are used in a similar manner to that in which the flanges of cast iron tank plates are connected, but he prefers to weld the flanges of the plates when set up in position in a similar way to that in which large deck beams are welded by means of a portable forge or furnace. In order to roll plates of iron or steel with suitable flanges or right angle bends along two opposite sides of each plate, he employs rolls of a suitable form to produce a section somewhat resembling the letter **W**, and when such section of iron or steel has been formed, the plate is passed between flattening rolls to flatten the middle bend or curve, and this flattening of the middle of the plate brings the edges or flanges up to the required angle. By these means plates flanged on two sides may be made with facility, either of moderate thickness or sufficiently thick to be suitable for armour plates.

1933. J. Vavasseur, *Gravel-lane, Southwark*, "*Transportable machine or apparatus for rifling cannon.*"—*Dated 2rd August*, 1861.

This invention cannot be described without reference to the drawings.

1980. G. Haycraft, *Lombard-street, London*, "*Powder flasks.*"—*Dated 9th August*, 1861.

In constructing powder flasks according to one part of this invention the neck of the flask is formed by a tube which projects up from the flask; this tube projects down a short distance into the flask, both ends of the tube are open, and the end of the tube exterior of the flask is closed by a lid or cover similar to an ordinary canister cover. Within the tube, and fitted closely to it, is a second tube; this second tube is closed at the bottom and open at the top, extending a short distance above the first tube; in the top of the inner tube are two notches, into which a rib or projection on the interior of the top of the cover enters, so that the inner tube may be turned round by turning round the cover. Apertures are formed through the sides of the lower part of each of the tubes, and when the inner tube is turned so that the apertures in the two tubes coincide, and the flask is inverted, the powder in the flask passes through the aperture and fills the inner tube; if the inner tube is then turned so that the apertures shall not coincide, the powder in the inner tube will be prevented from passing back into the flask, and the charge contained in it may be withdrawn by taking off the lid. The inner tube is prevented from dropping through the outer tube by a pin on the inner tube passing through one of the apertures in the outer tube, or otherwise.

Class 7.—FURNITURE AND CLOTHING.—None.

Class 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

1963. W. Longmaid, *Iaver, Galway, Ireland*, "*Manufacture of iron.*"—*Dated 24th July*, 1861.

For the purposes of this invention either silver, copper, tin, or nickel, or compounds of some of these metals in comparatively minute quantities, are used in the manufacture of iron, and they are applied when the iron is in a state of fusion when refining or puddling iron.

1983. W. L. Scott, *Bayswater, London*, "*Preparing red, purple, and certain other dyes.*"—*Dated 29th July*, 1861.

The main feature of this invention consists in the employment of binitronaphthaline as a basis for red and certain other dyes.

1928. C. Schinz, *Offenberg*, "*Glass furnaces.*"—*Dated 3rd August*, 1861.

According to this invention the fire-grate forms part of a separate furnace, which the patentee calls the "gas regenerator," and this grate, which has an inclined position if intended for burning coal, is fed through a hopper. For the better production of the gases, as well as for this subsequent combustion, he injects atmospheric air, by means of a fan, into the gas regenerator from beneath, and heated air into the flue leading from the fire-grate or generator to that part of the furnace holding the pot or pots, and the supply of air is so regulated as to furnish the exact quantity necessary to insure the perfect combustion of the gases. From the regenerator the gases pass to the furnace holding the pot or pots or crucibles. The pots are of an oblong form, flat on three sides, and rounded at one, and at the corners. The furnace corresponds in shape with that of the pot or pots; and, as only a limited space is left between the side of the pot and the walls or sides of the furnace, the flames are forced to strike or impinge upon the sides of the pots, and, lastly, to pass over them, and from thence, through flues or pipes, to the shaft. These pipes pass through one or more air chambers, where they heat the air supplied for combustion by the fan. The surplus heat from the furnace may also be used for heating annealing furnaces and the like. The furnaces are built of a material which, in the process of its manufacture, is rendered porous, and into a bad conductor of heat.

2035. W. E. Newton, *Chancery-lane, London*, "*Process for producing colouring matters or pigments from manganese.*"—*A communication.*—*Dated 3rd August*, 1861.

This invention consists in the production of a green colour or pigment by the treatment of oxide of manganese; protoxide of manganese is transformed into a crystalline transparent substance, and takes a very rich green colour and diamond-like brilliancy when treated by the process described.—*Not proceeded with.*

1955. A. A. R. Damoiseau, *Paris*, "*Apparatus for drawing blood or other fluids from the human or animal body.*"—*Dated 6th August*, 1861.

This invention consists in drawing off or abstracting blood or other fluids from the human or animal body by means of a suitably constructed cupping-glass or glasses, in combination with an air-pump or other similar apparatus, and arranged in such a manner that an alternate lifting and depressing or expanding and contracting of the skin of that part of the body to which the said cupping-glass or glasses are applied is to take place, with the object of preventing the choking up or obstruction of the pores, scarifications, or other capillary openings through which the blood or other fluid to be abstracted from the body is to flow into the said cupping-glass or glasses.

1956. W. Clark, *Chancery-lane, London*, "*Bleaching and clarifying saccharine matters*"—*A communication.*—*Dated 6th August*, 1861.

This invention relates to improved processes for bleaching and clarifying the saccharine juices of the sugar cane, beetroot, or other saccharine vegetable substances, whereby the employment of granulated animal black is dispensed with, and consists, First, in treating saccharine juices of all kinds, either in a heated or cold state, by means of animal black in a state of fine powder, together with argillaceous or other earths, stirring up the mixture with a suitable agitator. After stirring for a certain time the juices are bleached by means of fine black argillaceous or other earths, and one or several jets of steam introduced into the mixture, which produces a violent effervescence, and sets the whole mixture in motion, and, after continuing this for a certain time, the juices will become bleached. A mechanical agitator may be employed as well as the steam jets to produce more complete agitation of the liquid. Secondly, in clarifying saccharine juices and syrups by means of, first, fuller's earth, or other clay or earth mixed with fine black, and subjecting the whole to a violent agitation either in a hot or cold state; secondly, by means of fuller's earth, or other clay or earth mixed with fine black, and employing one or several jets of steam for producing agitation of the mass, as described; thirdly, by the employment of fuller's earth, or other clay or earth mixed with fine black, together with one or with several jets of steam, in combination with a mechanical agitator, for the stirring up of the mass, as described.

1958. P. Spence, *Newton-heath, near Manchester, and* J. Mellor, *Manchester*, "*Separating copper from its ores.*"—*Dated 6th August*, 1861.

In carrying out this invention the inventors submit the ores, in combination with an acid or other substances capable of acting after the same manner, to the action of heat in a furnace, so that a condition of copper soluble in an acid is produced, which solvent is subsequently added. The ores as they come from the manufacture of sulphuric acid, or in their native state (after washing), are ground, previous to placing them in the furnace.—*Not proceeded with.*

1966. T. G. Webb, *Manchester*, "*Manufacture of articles of glass.*"—*Dated 7th August*, 1861.

This invention relates to a method of facilitating the adaptation of the "posts" or "pontils" to articles of glass previously to finishing or melting. With this view the patentee places the article upon a table which is provided with apparatus for insuring a certain position in relation to parallel guides, against which the "post" or "pontil" is placed previously to its being pressed forward. For these guides he uses rollers, and so constructs the apparatus which regulates the position of the article that it may be adjusted to suit different sizes or shapes. As a modification of the above he can, in like manner, cause the article to be moved up to the "post" or "pontil" sideways.

1978. L. LE PAIGE, *Merxem, near Antwerp*, "*Treating fatty and oily matters obtained from wash waters to deprive them of their smell.*"—*Dated 8th August*, 1861.

For this purpose the inventor subjects the fatty and oily matters to the action of gases or vapours obtained from nitric and sulphuric acids —*Not proceeded with.*

CLASS 9.—ELECTRICITY.—NONE.

CLASS 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

1755. H. ASHWELL, *New Basford, Nottingham*, "*Apparatus for washing, cleansing, scouring, getting up, dyeing, boiling, and steaming.*"—*Dated 11th July*, 1861.

This apparatus consists of the following arrangement, that is to say, of a square, round, or other conveniently shaped trough, which trough, in a large apparatus, is firmly bolted to the floor. To the sides of this trough inside are placed two or more pairs of vertical guides, and on the outside thereof are similar guides; the inner guides are preferably made of wood, and the outer ones may be composed of the same material, or may be made of metal or other suitable substance. In these guides rods slide, and these rods are made of wood, or other suitable material, and are connected to a crosshead extending across the trough; where outer guides are used the crosshead will extend over the slides a suitable distance. To the centre of the crosshead one end of a lever is secured by a pin and hinge, or by other similar attachment; the other end of the lever is connected to a working lever, which is moved by another lever, and driven by being connected to a rod moved by an eccentric on a shaft actuated by steam or other power; or in some cases the patentee prefers to connect the crosshead to a rod terminating in the strap of an eccentric on a main shaft lying horizontally over the centre of the trough, and provided with a fly-wheel. To the crosshead is attached a frame carrying a cage composed of wood or metal rods or strips, or of perforated sheets; the top of the cage is composed of the same material as the sides and bottom thereof, and is so constructed that it can be opened for inserting the goods intended to be operated upon. Nearly over the centre of the trough, lying by the side of the crosshead, is a perforated metal pipe, through which hot or cold water is distributed in a shower over the whole of the top of the cage, the pipe being provided with a valve, so that the water can be shut off or turned on as may be required. The bottom of the trough is also provided with a pipe and stopcock, through which steam is admitted: similar pipes and stopcocks are provided for admitting other liquids. There is a stopcock or valve to the bottom of the trough to let out the liquid when required. The goods are put in the cage, and the lids or top are or is fastened down, the valve at the bottom of the trough being left open; the machine is put in motion, and the water, being admitted through the perforated pipe, will pass through the goods, and out at the valve; or if the valve is closed the water will remain in the trough, and the goods may be alternately raised and depressed in the water as long as is found convenient. Dyes or other liquids are admitted, as may be required, according to the work to be done through the various pipes.

1756. T. J. SMITH, *Queen-street, Cheapside*, "*Photographic albums.*"—*Dated 12th July*, 1861.

This invention consists in the manufacture of the leaves of such albums of parchment, vellum, textile fabric, or paper mounted upon textile fabric, such materials being more durable and less liable to be torn by the insertion and removal of the photographic pictures than the paper or cardboard hitherto employed in the manufacture of the leaves of books for this purpose.

1762.—C. MASCHWITZ, *Birmingham*, "*Taps or stock-cocks for liquids, steam, and gas.*"—*A communication.—Dated 13th July*, 1861.

The body of this stop-cock has an opening on its underside, in which a tubular piece is screwed, on the top of which is a conical valve seat. A conical valve fits the said valve seat accurately. The spindle of the valve works in a guide near the top of the said tubular piece. On the said tubular piece is a tubular case, the lower contracted end of which constitutes the exit pipe of the tap. The lower end of the valve spindle is fixed to a cross piece on the said exit pipe. By sliding the exit pipe upwards upon the tubular piece the valve is raised from its seat, and the water way of the tap is opened, and by sliding the exit pipe downwards the valve is brought down upon its seat, and the water way is closed. On opposite sides of the tubular piece a pin or projection is fixed, and the said pins engage in vertical slots in the exit pipe. At the top and bottom of the said vertical slots horizontal slots are made, into which the pins or projections on the tubular piece may be made to enter by turning the exit pipe when it is either in its highest or lowest position. The tap is thus locked or fixed in its open or closed state. The arrangement of pins or projections and slots somewhat resembles the bayonet fastening. For making the tap when closed additionally secure a nearly similar arrangement may also be adopted at the top of the tubular piece.

1765. L. GEORGE, *Paris*, "*Improvements in the method of soldering together two or more printing type letters, to facilitate the work of the compositor, and in the arrangement of type cases for the same.*"—*Dated 13th July* 1861.

This invention consists in soldering together two or more letters that occur most frequently in words in the English language. The letters are soldered by the following composition, which is used cold:—Two-thirds of mercury and one-third of pure tin mixed well together. This solder is put on a plate of lead, and the broad side of the type rubbed thereon, and the composition is afterwards done as usual, the solder becoming quite rigid at or about the expiration of half an hour.—*Not proceeded with.*

1774. B. TAYLOR *and* T. PRICE, *Bassaleg, Monmouth*, "*Tin and terne plates.*"—*Dated 15th July*, 1861.

The patentees claim the use and application in the manufacture of tin and terne plates of a pair of rolls to work immersed in a vessel containing the melted tin or terne metal, and so arranged within the same that the line joining their centres, or the line of pressure, shall be placed just so far above the surface of the melted tin or terne metal that, in passing the plate along the guides and between the moving rolls, the metal shall not rise on the plate above the point where it is in contact with the surface of the rolls, as set forth.

1775. J. C. COOMBE *and* J. WRIGHT, *Bridge-street, Blackfriars, London*, "*Glass, pottery, porcelain, and other ceramic and plastic wares.*"—*Dated 15th July*, 1861.

The patentees claim the application of fluo silicates and artificial silicates of the alkalies, alkaline earths, and other earthy bases, to the manufacture of glass, pottery, porcelain, and other ceramic and plastic wares, and more particularly the substitution of the fluo silicic salts, of the alkalies, alkaline earths, and other earthy bases, for the phosphoric compounds of the same or other bases, in the manufacture of glass, pottery, porcelain, and other ceramic and plastic wares.

1782. J. MABSON, *Newcastle-upon-Tyne*, "*Sewing machines.*"—*Dated 15th July*, 1861.

The inventor proposes attaching to sewing machines a bent arm or cloth presser, in which is a hole for the needle to pass through, and close to this hole is an opening or loop which serves as a guide for the braid. Upon the end of the cloth presser is attached a cross-piece, which can be adjusted by sliding feet to any desired width for quilting, and thus act as a gauge, preventing any irregularity in the width to be quilted. The foot sides travel on the quilting gauge, and are secured thereon at the required distance apart by small thumb screws.—*Not proceeded with.*

1784. W. CLARK, *Chancery-lane, London*, "*Stage scenery and apparatus.*"—*A communication.—Dated 15th July*, 1861.

This invention relates to the production on the stage of a theatre of scenic effects closely imitating nature, so as to facilitate and increase the illusion of the spectator. The inventor dispenses with the drapery slips that are usual, single varnishing point, and the side scenes. He also makes the sky of spheroidal form, to which motion may be imparted, and susceptible of producing the most varied luminous effects. The invention cannot be described without reference to the drawings.

1786. J. GOUCHER, *Worksop*, "*Stacking corn and other crops.*"—*Dated 16th July*, 1861.

This invention consists in stacking corn in such manner as to leave a passage or passages up through the stack for the circulation of air. The inventor prefers to form a hollow or skeleton frame upon and against which the corn or other crop is stacked, and to fix the foundation frame at a distance from the ground. He allows of free circulation of air under and up through the stack.—*Not proceeded with.*

1787. J. S. WELLS, *Nottingham*, "*An improved needle used in the manufacture of looped fabrics.*"—*Dated 16th July*, 1861.

This improved needle differs from the common bearded needle in the following respects:—In place of the long beard which is depressed by a presser which forms part of the machine or frame in which the common needle is used the inventor proposes to use a needle having a much shorter beard; or he makes the needle to terminate in a hook; and in that part of the needle called the eye (which in the common needle is a groove lying under the beard) he uses a slot made quite through the substance of the needle, and in this slot he inserts a small piece of metal, having a groove in its upper surface which receives the end of the beard or hook; the metal piece passes through the slot, and is rivetted or enlarged on the bottom side thereof, so that the piece cannot be displaced. The piece is capable of sliding from one end of the slot to the other end, and the grooved portion is inclined downwards both ways. This needle may be used without a presser. He also proposes to make needles each end having a beard or hook and slot with sliding piece as above mentioned.—*Not proceeded with.*

1795. J. H. BUTTERWORTH, *Rochdale*, "*Heating water or other fluids.*"—*A communication.—Dated 17th July*, 1861.

This invention relates to the novel employment and use of a metal or alloy fusible at a low temperature, for the purpose of retaining heat imparted thereto by fire, and in applying the heat so obtained for the heating of water or other fluids. The apparatus consists in a vessel or receptacle furnished with an arrangement of internal tubes, similar to a multitubular boiler around which the fusible metal is disposed, and is heated to produce heated water in the tubes, and which, when once in a state of fusion, may be kept heated at a minimum consumption of fuel. The water to be heated is circulated through the tubes, and becomes either generated into steam, or simply heated, as may be required, the object being to economise fuel by maintaining the heat once sufficiently obtained to liquify the metal by keeping such molten metal at a certain heat around the water tubes, which may be effected by a small amount of fuel.

1796. J. H. BUTTERWORTH, *Rochdale*, "*An improved mode of, and apparatus for, heating air, or for desiccating wet or moist substances.*"—*A communication.—Dated 17th July*, 1861.

This invention relates to the novel employment and use of a metal or alloy fusible at a low temperature, for the purpose of retaining heat imparted thereto by fire, and in applying the heat so obtained to the drying of any suitably required material. The apparatus consists in a vessel or receptacle furnished with an arrangement of internal tubes, similar to a multitubular boiler, around which the fusible metal is disposed, and is heated to produce heated air in the tubes, and which, when once in a state of fusion, may be kept heated at a minimum consumption of fuel. The air thus heated is forced by means of a blower or fan into the desiccating chamber or chambers, which are provided with metallic cloth carriers to convey the substance under operation through the chamber. The chambers are provided with an inclined bottom to facilitate the escape of aqueous vapours, beneath which the heated air is admitted, and the chambers may be connected by flexible or rigid joints, or otherwise arranged, the object being to economise fuel by maintaining the heat once sufficiently obtained to liquify the metal by keeping such molten metal at a certain heat around the air tubes, which may be effected by a small amount of fuel.

1798. J. MASON, *Birmingham*, "*Metallic pens.*"—*A communication.—Dated 17th July*, 1861.

The nibs of the pens made according to this invention are angular at their upper or back part, that is, in cross section through the middle piercing; the pen is made up of four planes inclined to one another at obtuse angles. The two middle planes pass into a curve as they approach the point of the pen, and the two outer planes may either extend only to about the middle of the nibs, or nearly to the point of the pen. In each of the side planes two or three side piercings are made, in a direction nearly at right angles to the slit of the pen. By means of the side piercings the rigidity which would otherwise exist in the nibs is avoided, and those parts of the said nibs which yield in writing are very nearly or quite flat. By the general figure of the pen it is enabled to take up a large quantity of ink, while the side piercings described prevent the rigidity which would otherwise result from its figure, and enable the nibs to yield readily under pressure.

1799. C. E. REDFERN, *New North-road, London*, "*The construction of locks and adaptation thereof to various useful purposes.*"—*Dated 17th July*, 1861.

This invention consists in constructing locks in the following manner, that is to say:—The inventor forms a shallow circular case of metal, say of three inches diameter, and half an inch deep. He also forms a parallel opening about three-quarters of an inch wide, radiating horizontally from the centre of the said case. Into this case he fits loosely a corresponding-shaped piece of metal, in which is adapted a spring bolt, of novel and peculiar construction, in the form of a bell crank lever, one of the arms of which is formed curved, and the other straight; the end of the bent arm has a hole formed through the same, which passes over a stud formed in the second-named case, the said stud being the fulcrum of the spring bolt. There are notches made in the said bolt at the angle or bend thereof, and projecting pieces formed in the first-mentioned or outer case for the notches on the bolt to catch against, to prevent the lock being opened by any other means than its proper key.—*Not proceeded with.*

801. SIR J. HARE, *Pas de Calais, France, and* B. RUSS, *Bristol*, "*Heating cylinder irons or heaters to be used for pressing the seams of garments &c.*"—*Dated 17th July*, 1861.

According to this invention the inventors propose employing a metal chamber of suitable form, through the end of which the gas pipe passes; the iron, which is made hollow or cylindrical, passes in at the end of the chamber through a hinged door or flap, which door is closed when the iron is in its place; the gas is now turned on by a tap close to the chamber, until the iron is sufficiently hot, when, by withdrawing it through the door or flap, a lever is caused to fall by the door coming in contact with it, which turns the gas almost out, leaving but a very small flame, until the iron is returned to the chamber; the gas is then again turned on full, passing through a sheet of wire gauze so as to prevent any smoke or soot getting to the iron, all smoke being consumed in a chimney at the further end of the chamber.—*Not proceeded with.*

1802. A. V. NEWTON, *Chancery-lane, London*, "*Machinery for obtaining fibres from the stalks or leaves of fibre-yielding plants.*"—*A communication.—Dated 17th July*, 1861.

The object of the First part of this invention is to obtain directly from stalks or leaves of fibre-yielding plants the fibres in the white state, and of full strength. To this end the fibres are separated from extraneous matter of the stalks or leaves (which have been cut from the plants before the sap has ceased to flow through such stalks or leaves, and while they are yet in the green state) by breaking, beating, scraping, or combing, or by other like mechanical operation, the extraneous matter being removed from the fibres whilst the fibres are protected from the action of the colouring agents by the presence of water or other equivalent fluid, which will prevent the extraneous colouring matter of the plant from impregnating the fibres. The Second part of the invention consists in an arrangement of mechanism whereby the stalks or leaves are held firmly and introduced slowly to the action of rapidly moving combs and scrapers, which break through, loosen, and scrape off the extraneous substances from the fibres. When this is effected, then the motion of the feeding mechanism is reversed. The portion so acted upon is, by this reverse motion, withdrawn, and the other ends of the stalks or leaves are presented in like manner to the action of the combs and scrapers.

1809. J. TILLOTSON, *Bolton*, "*Pawnbrokers' duplicate tickets.*"—*Dated 18th July*, 1861.

This invention relates to the application of the well-known process of perforation to the sheets of paper or pasteboard to be employed for pawnbrokers' duplicate tickets, so that the tickets may be readily torn apart.—*Not proceeded with.*

1811. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Capstans and windlasses.*"—*A communication.—Dated 18th July*, 1861.

This invention relates to certain improvements in capstans, and whereby they will operate continuously without stopping or surging. The main drum of the capstan rotates in the usual manner round a fixed stem or axis secured vertically in a suitable cast iron bed plate or base, and is rotated in the ordinary or in any other convenient manner. At the base of the drum is the "float," consisting of an inclined ring embracing the same; this ring turns with the drum, and is kept inclined by resting at one side on a roller or pulley carried in a movable carriage, whilst, at the opposite or lower side, it rests upon a shoulder formed on the base of the drum. The carriage which carries the roller or pulley is supported upon a circular railway formed for that purpose round the edge of the base or bed plate, and is provided with a projecting tongue or stop, which serves to keep it in its place by bearing against one or other of a series of stops or projections in the bed plate. By the aid of the stop on the carriage it may be placed in any desired position for giving the proper inclination to the "float" or ring upon which the rope rests, the inclination of the ring insuring the free passage of the lowest turn or coil of the rope, and enabling the capstan to be worked continuously without fear of the different coils riding or mounting over each other.

1813. J. A. JAQUES *and* J. M. FANSHAWE, *Tottenham*, "*A mode of stopping, plugging, or closing inkstands, bottles, &c.*"—*Dated 18th July*, 1861.

This invention consists in making the plug or stopper whereby such vessels are closed in the form of a screw made wholly or partly of vulcanised india-rubber, gutta-percha, or some other suitable elastic material.

1815. R. WALKER, *Eccleston, near Prescot*, "*Stopping and packing bottles.*"—*Dated 19th July*, 1861.

The nature of this invention consists in dispensing with the usual corks or other equivalents which are inserted or forced into the necks of bottles, and in substituting in their stead a washer or disc of india-rubber or other yielding material, which is either pressed upon the end of the neck of the bottle, or against which the end of the neck is pressed. The bottles are supported in a frame of wood or metal, and the ends of the bottles bear upon the tails of set screws, which, on being turned round, press the ends of the necks against the washers above referred to, thereby effectually stopping the bottles; or the washers may be pressed down on the bottles, which are securely held between the upper and lower rails of the frame.

1816. D. GALLAFENT, *Stepney-causeway, London*, "*Refrigerators for cooling liquids.*"—*Dated 19th July*, 1861.

This apparatus consists of one or more series of cylinders, each series being formed or composed of three cylinders in the manner following:—Within a cylinder of cast iron or other suitable material the patentee places a thin copper cylinder, so as to leave a space between the copper and the iron cylinder for the flow or passage of cold liquors. Within the copper cylinder he places a solid cylinder of wood, or hollow cylinder of metal, and of less diameter than the copper cylinder, so as to leave a space between the copper and wood cylinders for the flow or passage of hot wort. The cylinders aforesaid may be made somewhat larger in diameter at one end than at the other end, so that the annular space formed by the copper and wood cylinders may be increased or diminished as circumstances may require. To the wood cylinder, which is mounted on an axis or spindle, he communicates (by strap, band, or other suitable means) a rotary motion, the object being to cause the particles of hot wort to be brought in contact with the interior surface of the copper cylinder, which is effected by the friction of the wood cylinder against such particles of hot wort which roll over and over as they pass through the annular space formed by the two cylinders. The hot wort then passes to another series of cylinders or apparatus, same as those hereinbefore described, and so on until the required temperature is obtained. The object of employing a solid cylinder of wood or other material inside the copper cylinder is to reduce the capacity of the copper cylinder so as to correspond with the capacity or space formed by the copper and iron cylinders for the flow of cold water.

1820. R. C. NEWBERY, *Goswell-road, London*, "*Manufacture of enamelled cards.*"—*Dated 19th July*, 1861.

This invention consists in manufacturing cards from suitably-prepared paper-cloth. For this purpose the paper-cloth is manufactured by causing surfaces or sheets of pulp or paper to adhere on one or both sides of calico or other suitable woven fabrics, producing such a thickness as the particular cards to be manufactured therefrom may require, and using one or more layers or thicknesses of woven fabric and of paper or pulp, as may be required. The fabrics are then coated and enamelled in like manner to that in which ordinary cardboard, when prepared for card-making, has heretofore been enamelled, and the sheets thus produced are cut up into suitable rectangular pieces of the sizes of the cards required.

1826. W. E. NEWTON, *Chancery-lane, London*, "*Apparatus for copying letters, &c.*"—*A communication.—Dated 19th July*, 1861.

In carrying out this invention the leaves of the copying paper are bound or stitched in a flexible wrapper or cover in the form of a book, and in such quantities as will admit of their being rolled up with facility. The back edge of this book, with its flexible cover, is inserted in a groove made in a metal roller or cylinder, round which the book of copying paper can be wound or rolled. A couple of plain sheets of paper, which, if desired, may be made waterproof, and a sheet of calico rather larger than the size of the book, form, with the metal roller and copying paper, all the apparatus which constitutes the present invention, and which is used in the following manner:—The letter to be copied is placed under one of the blank leaves of copying paper, and the sheet of calico, after being damped, is placed over the leaf and letter, and a sheet of plain or waterproof paper may be placed over the calico; then, upon rolling the book with the letter placed therein round the metal cylinder the ink from the letter or writing will leave a counterpart on the leaf of copying paper

1828. M. GILBERT, *Manchester*, "*Boots and shoes.*"—*Dated 20th July*, 1861.

This invention consists in the novel application and use of the halves or hollow spheres or balls of india-rubber to the soles and heels of boots and shoes, which are permanently secured therein, for the purpose of forming cushions, or elastic treading surfaces for the feet. Beneath the portion of sole covered by the half spheres an aperture is made in the sole, by which means air is kept in circulation by the compression of the india-rubber balls; or a small flat tube may be arranged within the sole, terminating in an aperture beneath the foot, and in communication with the atmosphere, by an opening in or near the heel, so as to supply air to the foot.—*Not proceeded with.*

1829. W. PRICE, *Lambeth, Surrey*, "*Tools for cutting shives and other conical blocks.*"—*Dated 20th July*, 1861.

This invention consists in fixing upon and around a conical mandril or block a conical band of steel, which is formed with saw teeth for cutting wooden shives and other substances usually cut by saws, and with a knife edge for cutting cork and other substances requiring a knife edge for cutting them. The band does not extend round the whole circumference of the mandril, as there is a space left between the ends thereof, and the entering end is formed with a knife edge. The cutter is adjustable on the mandril, and is made to protrude more or less beyond the top or the base thereof, according to the thickness of the shive or other article to be cut, and is retained in its position by a ring driven over it and the mandril. The cutting is effected by rotary motion being imparted to the tool.

1830. R. THATCHER, *Oldham*, "*Lubricators.*"—*Dated 20th July*, 1861.

This invention consists, First, in lubricating revolving shafts, or other revolving or sliding parts of machinery, of every description, where it is required, by means of a sponge, which will absorb the oil or other lubricant, and give it to the article requiring lubrication; or, instead of a sponge, by a piece of flannel or other absorbent material applied in the manner stated. Secondly, in lubricating the top or sides of steam cylinders by the application of a specially constructed tallow cup.

1833. J. *and* J. COLE, *Coventry*, "*Construction of watches, &c.*"—*Dated 20th July*, 1861.

This invention cannot be described without reference to the drawings.

1834. M. HENRY, *Fleet-street, London*, "*Method of, and apparatus for obtaining an increased effect from lights.*"—*A communication.—Dated, 20th July*, 1861.

For the purposes of this invention one, two, or more lens-discs or lenticular bodies or appliances are employed, which act as projectors, and are placed very near to the luminous agent or light whose effect they are to augment. These projectors are formed of glass or some transparent material, and, preferably, have one convex and one flat surface—or both surfaces may be flat—one surface being smooth, while the other surface is corrugated, indented, undulated, serrated, fluted, or striated, which sort of surfaces is called throughout the specification the "uneven" surface. This "uneven" surface may be striated like to Degrand's lighthouse lens, or it may be partly serrated and partly fluted. In one form, for example, the projectors may be like a sort of disc or plate, with one surface smooth and flat, and the other or opposite surface "uneven." In another form they might be of the plane-convex shape, the convex side being smooth, and the opposite side either smooth or uneven. The smooth face, whether plain or convex, is that which is placed towards or nearest to the light. The projectors are, in some cases, placed with advantage five to six centimetres (or about 2in.) from the light, and in others from two to three centimetres, or, say, about four-fifths of an inch to one inch from the light. According to one mode of mounting them they may be fitted near the light on arms or brackets attached to a collar which is placed on the burner or convenient part of the lamp, light holder, or lighting appliance or apparatus, and which collar is furnished with a screw or other adjusting means by which the projectors may be raised or lowered at pleasure. Round a cylindrical projectors may be applied to or form part of lamp glasses; thus the lower part of the glass or chimney may have a corrugated, striated, or "uneven" outer surface formed with the glass, or a projector with uneven outer surface, applied thereto to produce the required effect.

1835. M. A. F. MENNONS, *Paris*, "*Safety locks.*"—*A communication.—Dated 22nd July*, 1861.

This invention consists, First, in the application to locks of different descriptions of a spiral spring, fixed to the external plate by means of a metallic scutcheon, and giving movement to a spindle on which fits the barrel of the key. Secondly, in the application to such locks of an independent ward, similar to those of the key set at the lower extremity of the spindle, which is either squared off or provided with one or several stops, corresponding with an equal number of slots formed at the open end of the barrel of the key.—*Not proceeded with.*

1845. N. E. DUMESNIL, *Rouen, France*, "*Materials for lubricating parts of machinery.*"—*Dated 23rd July*, 1861.

This invention consists in the use of a mucilage composed of or prepared from vegetable or animal matter in the water usually employed with alkali in the treatment of the body of fatty matter. In the manufacture of lubricating matter the fatty matter is usually treated by means of alkalies and water alone; but, under this invention, the water has previously mixed with it a mucilage composed of or prepared from vegetable or animal matter, and then the body of fatty matter is treated in the usual manner with the mixture of mucilage, alkali, and water.

1846. R. THOMPSON, *Charlton, Kent*, "*Machinery for cutting wood.*"—*Dated 23rd July*, 1861.

This invention consists in an arrangement of machinery whereby revolving cutting tools for chasing, grooving, moulding, and other similar work, can be moved (while in the operation of cutting or otherwise) in any direction required by the workman, giving him complete command over the tool to follow any line of cut traced out, without in any way interfering with the revolving action of the cutter or the driving power. The principle consists in mounting the cutting tools in a carrier or traverse block, such block being free to travel along a beam, revolving motion being communicated to the cutter by a gut or band in the following manner:—Motion is communicated from the driving power to a double-grooved pulley revolving freely upon a shaft, upon which shaft one end of a beam is pivoted. A second gut or band passes round the other groove of the double pulley, thence entirely round, so as to grip a pulley attached to the cutter holder, thence round a third pulley upon the opposite end of the beam, and back, past, and clear of the cutter holder pulley to the first pulley. The traverse block or carrier can thus travel along the beam, carrying with it the cutter, without interfering with the revolution of its pulley.

1848. F. HIRSCHFIELD, *Cannon-street West, London*, "*Ornamenting or decorating articles of iron.*"—*A communication.—Dated 23rd July*, 1861.

This invention relates to the application of what is known as marqueterie to the ornamentation of articles composed of iron, and consists in the application of marqueterie of copper and other metals, of various woods, of shells, of tortoiseshell, mother-of-pearl, and other suitable substances, to all kinds of articles composed of iron.—*Not proceeded with.*

1850. F. HIRSCHFIELD, *Cannon-street West, London*, "*Locks and keys.*"—*A communication.—Dated 24th July*, 1861.

This invention relates to certain peculiar constructions and arrangements of safety locks and keys, and consists, according to one arrangement, in the employment of a key having no bit, but provided, in lieu thereof, with one or more circular projecting rings or collars, of different diameters, formed upon the stem or shank near the end thereof, whilst the extreme end of the key is provided with a square or other suitably-shaped projection intended to fit into a corresponding hole in a guard-plate in the lock, and to turn the same partly round. The rings or collars act upon corresponding movable plates or tumblers, two of which, when three are used, are hinged

to a lifting-plate which is raised by the action of the guard-plate before referred to, whilst the third movable plate or tumbler is situate between the other two, and is hinged or pivotted to the main lock-plate; this third tumbler carries a projection which, when the lock is ready to open, coincides with and enters the notches in the edge of the two other tumblers, which are pressed by springs against the rings on the key. It is thus evident that, if these rings be not respectively exactly of the proper diameter, the lock cannot be opened. The main bolt is acted upon by pins in the guard-plate, and also operates the spring bolt through the intervention of a bell-crank lever carried by the main bolt itself.—*Not proceeded with.*

1855. H. NEVILLE, *Portsmouth*, "*Apparatus for taking photographs.*"—*Dated 24th July*, 1861.

This instrument is in shape similar to a common camera, about 18in. in length. At one end is attached a brass telescopic tube, forming what is termed "the coarse adjustment." Outside the last mentioned tube is placed a larger tube, having a fine threaded screw or rack and pinion forming the "fine adjustment." Attached to these tubes is a piece of metal or wood, dovetailed into which slides a box containing the prepared plate, which rests upon silver pins, and is secured in its proper position by means of springs attached to a lid covering it made of metal or wood. Inserted in the centre of this lid is a microscope for the purpose of focussing the object to be copied, which, when once adjusted, enables the operator to take any number of photographs without any further adjustment or alteration.—*Not proceeded with.*

1864. F. D. BLYTH, *Fenchurch-street, London*, "*Gimblets, augers, and brace bits.*"—*A communication.—Dated 25th July*, 1861.

This invention consists in so forming the pointed screw or gimblet that cutters of various sizes can be fixed on the screwed part of the spindle of the gimblet in such manner as to leave the point and a portion of the screw projecting beyond the cutter, so that in boring a hole the screw will partly prepare the way for the cutter.—*Not proceeded with.*

1868. R. KELLY, *Wilden, near Stourport, Worcester, and* J. SHAKESPEARE, *Dudley*, "*Machinery to be used in the manufacture of tin plates, and terne plates, and iron plates coated with lead.*"—*Dated 25th July*, 1861.

This invention consists essentially in the use of certain suitably arranged rollers and brushes for the purpose of, First, scouring or cleaning the plates prior to their immersion in the melted tin; and, Secondly, for polishing the sheets of metal after leaving the bath of metal.—*Not proceeded with.*

1875. F. N. THUREL, *Paris*, "*Fastening shoes, stays, gloves, &c.*"—*Dated 26th July*, 1861.

This invention consists in a new description of eyelet-hole, made, by preference, of metal, and composed of two distinct parts, which are the eyelet-hole proper, and a tail or shank for supporting and fixing the eyelet-hole; this part may be made distinct, and of a different material from the eyelet-hole. The patentee thinks it preferable, however, to cut out of the piece of metal which is to form the new eyelet-hole one or two enlargements wide enough to form one or two spiral eyelet-holes for fixing the new eyelet-hole either to the article to which it is to be applied, or to a ribbon, or to any other material which can be sewed or attached to the shoes, to dresses, stays, or other articles of dress. A lace is passed through the new eyelet-holes, and the two extremities are united by a ligature, or by a kind of pincer which holds the two ends of the lace, and which is opened to set them free.

1876. E. SANG, *George-street, Edinburgh*, "*Apparatus for indicating the direction of objects and measuring angles.*"—*Dated 26th July*, 1861.

This invention consists in the use of a piece of glass or other transparent substance so constructed as that, when a certain straight line fixed in regard to the piece of glass is directed to any object, and the eye brought near to its edge, so as to look partly at the object and partly into the glass, an image of the object may be seen as well as the object itself, the coincidence of the image with the object being a proof that the said straight line is accurately pointed to that object.

1877. W. WIGFALL, *Sheffield*, "*Brushes and brooms.*"—*Dated 26th July*, 1861.

This invention relates to an improved mode of securing the bristles, bass, or fibres into the headstock or handle of a brush or broom, and consists in inserting a peg amongst the bristles, bass, or fibre, and into the hole which receives them, so as to act as a tightening wedge thereon, and thereby firmly secure them in their place.

1878. W. E. GEDGE, *Wellington-street, Strand, London*, "*Weighing machine.*"—*A communication.—Dated 27th July*, 1861.

This invention consists in the application of the poise of the physical bodies known as the extension of fluids in the following manner:—The balance plate rests upon a bearing fixed on the upper part of a small rod, the centre of action of which is plumb with a cylindrical plate. This rod and plate may very well be compared with the piston of a small steam engine. Moved by the oscillation of the beam, this plate will enter a well of larger diameter than itself. At the side of the well is a glass tube, somewhat similar to that of a barometer. The tube is in communication at its upper extremity with the atmospheric air. The vacuum which exists between the external circumference of the piston and the internal circumference of the well is closed with a very supple and impermeable web or material such as bladder, sheets of foil, silver, or other. But if a piston could be adjusted as to work in a friction cylinder at so feeble a pressure as not to exercise any susceptible counterpoise, it would give more solidity to the machine, inasmuch as it would no more be subject to the wear of the impermeable web above mentioned. The well or bowl being first filled with a liquid (water, spirits of wine, mercury, or other), the piston moved by the beam presses upon the column of liquid within the well, which, finding no other escape, enters the perpendicular tube, and rises higher as weight is placed on, and descends lower as weight is removed or withdrawn from the machine. A graduated scale is fixed along this tube indicating the height of the column, and giving the height of the object submitted to the action of the weighing machine.—*Not proceeded with.*

1879. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Sewing machines.*"—*A communication.—Dated 27th July*, 1861.

The patentee claims, First, the general constructions, arrangements, and combinations of parts of sewing machines as described. Secondly, the combination in a sewing machine of a supporting table and an eye pointed piercing needle, with a lower needle or looping instrument having motions in six directions, in the manner and for the purpose described. Thirdly, the mode of imparting motion in six directions to a lower needle or looping instrument in sewing machines by means of an inclined crank pin, substantially as described. Fourthly, the combination of a tension apparatus, a check spring, and nippers arranged and combined substantially in the manner and for the purpose described. And, Lastly, the peculiar "take up" apparatus, consisting of the combination of two stationary eyes with an edge piece and reciprocating fork, operating substantially in the manner and for the purpose described.

1880. R. E. GAKROD, *Chelmsford, Essex*, "*Mitre boxes and shooting boards.*"—*Dated 27th July*, 1861.

This invention has for its object improvements in mitreing mouldings for picture frames, and such like things, and for this purpose the patentee applies to the ordinary mitre box or shooting board (as used by joiners) a stationary screw, to which power is applied by the thumb and finger, or any other suitable means, combined with a nut movable in or between guides, which nut has on its sides a claw or projection, so as to press on to the moulding when screwed down, and hold it fast whilst being planed or reduced to a level and proper length. On the inside at the lower end of the mitre box is a movable slide or gauge, which can be fixed in its place by a set screw, so that two or more lengths of moulding can be gauged to the same length.

1881. J. B. HERBERT, *Newman-street, London*, "*Fireguards.*"—*Dated 27th July*, 1861.

For the purposes of this invention the patentee employs a guard or screen of flexible wire work, which is attached at its upper end to a roller, on which, when out of use, it can be rolled up; the roller is enclosed in a suitable case, having a handle attached to it, and the roller is furnished with a spring, causing it, when it is left free to do so, to wind up around itself the guard or screen of flexible wire work. To the lower end of the wire work a bar is connected which serves to prevent the end of the wire work being lost within the case when the spring winds it up. When the fire guard so constructed is required for use, the handle on the case is hung upon a suitable hook on the front of the stove immediately over the fire (or the guard is otherwise secured in this position), and then by drawing down the bar at its end the flexible wire work is unwound from its rollers, so as to descend in front of the fire, and it is there secured by passing the bar under a hook or projection in the fender, or otherwise conveniently placed.

1883. E. P. COLQUHOUN *and* J. R. THOMPSON, *Laurence Pountney-hill, London*, "*Fire bars for furnace grates.*"—*Dated 27th July*, 1861.

The patentees claim making the front bearers of each range of fire bars movable and connecting them by a rod passing beneath the fire bars, in the manner and for the purposes described.

1885. J. ROBERTSON, *Park-street, Mile-end, London*, "*Apparatus for the treatment of bodily pain.*"—*Dated 27th July*, 1861.

This apparatus consists of a water-tight vessel made of tin or other suitable material, inside of which is placed another water-tight vessel of similar construction. The inner vessel is so formed and placed that there is a vacant space between it and the outer vessel at the bottom and sides, and the space at the top between the two vessels is covered in with some water-tight material. The mode of using this apparatus is to place such part of the person as is afflicted in the inner vessel, and to fill the space between the two vessels with hot water, by means of an orifice to be left for that purpose, which may be furnished with a funnel as a convenient means of introducing the water. It is desirable to have a flat turning on a hinge on each side at the top of the inner vessel, which, when fitted withflannel or other suitable material, may after the leg, for example, has been placed inside the inner vessel, be turned down against the limb with the view of preventing the escape of heat from the limb under treatment.

1886. SIR JOHN HARE, *Hardelot Castle, Pas de Calais, France*, "*Manufacture of sugar.*"—*Dated 27th July*, 1861.

This invention consists in manufacturing and baking sugar in blocks, either square, round, oval, hexagonal, octagonal, or other regular shape, and of various sizes and of uniform weight, according to the purpose for which they are intended, and casting them in moulds of metal, glass, china, or other suitable material, when they may be coloured to any desired tint, as fancy may suggest. The object is to produce sugar in suitably given sized blocks, of uniform weight, more particularly adapted for domestic purposes.—*Not proceeded with.*

1894. J. BADARD, *Marseilles*, "*Turning and planing metals, the tool advancing sideways, and cutting in an oblique position.*"—*Dated 24th July*, 1861.

The object of this invention is to employ a lathe or plane, no matter how small a shaving or chip is to be removed from the object submitted to them, and thus to save time in proportion to the small portion of material to be planed off. The inventor proposes to incline the tool so as to obtain the greatest dimension of shaving, and he finds that, to obtain its thickness, the lateral advancement of the tool should be multiplied by its perpendicular height, and the lateral advancement equals twice one and a half of the old system, and gives an economy of cent. per cent.—*Not proceeded with.*

1895. P. HALL, *Birkenhead*, "*A simultaneous manifold drilling machine.*"—*Dated 30th July*, 1861.

This invention has for its object the construction of a machine by which a large number of holes can be drilled at one time, and is capable of being readily adjusted so as to perform a great diversity of work, both as to the relative position of the holes, and the angles at which they are bored.—*Not proceeded with.*

1896. T. SAUNDERSON, *Princes-street, Dunstan-road, Kingsland*, "*A pasteboard, millboard, and cardboard metal for advertising purposes, in lieu of handbills.*"—*Dated 30th July*, 1861.

This invention consists in an imitation of medals in pasteboard, millboard, cardboard, and papier mâché, the sizes of the coinage of Great Britain and Ireland, or any other country, and printed in gold, silver, and copper bronzes, or gold, silver, and Dutch metals, or any colour or pigment, with and without any device, inscription, medallion, or design printed, embossed, engine turned, or stamped thereon, for any advertising, trade, or secular purposes.—*Not proceeded with.*

1897. T. BRADFORD, *Fleet-street, London*, "*Washing, churning, wringing, and mangling machines.*"—*Dated 30th July*, 1861.

This invention cannot be described without reference to the drawings.

1899. T. S. CRESSEY, *Burton-on-Trent*, "*Machinery used in the manufacture of casks.*"—*Dated 30th July*, 1861.

These improvements relate to machinery for shaping the ends of the staves of casks to prepare them for receiving the head. For this purpose, after the staves have been put together to form a cask, and whilst they are held together by the hoops which are employed to hold them previous to the cask being finally hooped, the inner face of the ends of the staves is subjected to the action of a rotary cutter or cutters, suitably formed to make the groove in the staves for receiving the outer edge of the head, and also to bevel the ends of the staves, and to cut away the middle portion of the staves just above the groove, so as to make the interior of the cask at that point circular. The cask to be acted upon is supported at each end on two rollers at a short distance apart, and the end which is to be prepared or receiving a head is held up to a flat plate, in front of which is a wheel of slightly less diameter than the inner diameter of the end of the cask; the inner face of the cask is pressed up against the under side of this wheel by means of the two rollers which support the end of a cask which is being acted on, these two rollers being carried by a spring lever, the spring of which constantly forces the cask upwards against the wheel above stated. The rotary cutter acts on the staves whilst they are pressed by the rollers against the wheel, and, consequently, cuts uniformly each of the staves, the cask being rotated slowly so that each of the staves passes in succession under the cutter. The cask is rotated by means of a band passing around it, one end of the band being attached to the hoop around that end of the cask which is being acted on, and the other end being attached to a drum which is caused to rotate slowly and wind the band around it, thus rotating the cask. The rotary cutter is carried by a frame which is capable of turning upon axes, so that the cutter may be lifted up out of the way when a cask is being placed into the machine. When one end of a cask has been prepared in the manner above described the cask is turned round, and the other end prepared in the same manner.

1902. J. M. HART, *Cheapside, London*, "*The arrangement or construction of parts of locks or fastenings.*"—*Dated 30th July*, 1861.

These improvements relate, First, to forming the tumblers or levers with open spaces or projections between the "gating" and that part acted upon by the key, adapted to interfere with the effect of means for illicit opening. Secondly, the improvements relate to forming the stump inclined on the front edge, and the tumblers or levers inclined to correspond, so as to facilitate the passage of the stump in throwing the bolt, particularly when locking takes place, without the aid of a key. Thirdly, the improvements relate to the application of a wall or plate of metal to the bolt, so as to leave space only sufficient for the passage and action of the proper key. Fourthly, the improvements relate to a combination of means adapted to increase the security of locks, and also to give facility for operating with them by proper keys. For this purpose the patentee forms the bolt with an extension at the back or other part adapted to be acted upon for the purpose of bolting. He also applies a handle to operate the main bolt, and by its position indicate the position of such bolt, and the application of stopping apparatus to prevent the return of the handle, when it has been turned to a certain extent, except by the application of the key to the lock. He also applies connecting means from the main bolt to the addenda bolt to cause the locking of the addenda bolt when the main bolt is fully shot, and so that the unlocking can only be effected by a proper key. He also applies a suitable abutment to receive the addenda bolt between it and part of the main bolt, and thereby form solid continuous bearing adapted to prevent the main bolt being forced back. Fifthly, the improvements relate to the application of a plate or a dog attached to the bolt of double locking locks, adapted to partially close the keyhole after the first belting, and thereby prevent the introduction of any other than a master or second locking key. Sixthly, the improvements relate to throwing the main bolt by the turning of the nozzle or keyhole; also to forming the nozzle or keyhole or other means for throwing such main bolt or other part in connection with the bolt, so that it may indicate the position of the main bolt as to whether it is locked or unlocked. Seventhly, the improvements relate to applying the main stump in connection with the drill pin or other part on or in which the key turns, and capable of moving with it, so that any motion given to the drill pin or its equivalent for the key by irregular influence may have the effect of displacing the main stump. Eightly, the improvements relate to obtaining compensating means to the spindle and handles of locks to admit of irregularities of fitting by enlarging the shaft way of the follower except at a bearing part, which may be midway of such shaft-way, or at other suitable part thereof. Ninthly, the improvements relate to the application of transverse plates, slotted or otherwise, compensated to each other in connection with the knobs. Also to forming the socket which receives the shaft or spindle so that the shaft or spindle may have its bearings at one point. Also to forming the axis or spindle or parts thereon to receive parts of the handle or handles by a sort of clutch connection covered by a suitable plate or rose.

1905. A. WOOD, *Leeds*, "*Refrigerating storehouses, &c.*"—*Dated 31st July*, 1861.

This invention consists in the introduction into storehouses, or other localities wherein operations are carried on requiring a constant or periodical low temperature, of large masses of ice, snow, or other refrigerating materials, which are inclosed in air-tight receptacles or chambers, situated by preference in the upper part of such buildings, and arranged in such a manner that they are effectually protected by coverings consisting of thick layers of good non-conductors of heat from the influence of the external atmosphere, whilst these receptacles are, at the same time, so arranged that between them and the rooms to be cooled by them there exists an air space, or air spaces, inclosed by means of sliding shutters, trap doors, or such like arrangements, constructed of materials which are good non-conductors of heat, thus forming a reservoir or reservoirs of cold air, which cold air may at pleasure be let into the room or locality to be cooled by opening the before-mentioned sliding shutters, the warmer air inside the room or other locality taking its place, and being refrigerated in its turn.

1906. J. F. FLANDERS, *Doctors'-commons, London*, "*Machinery for splitting, dividing, or shaving leather, &c.*"—*Dated 31st July*, 1861.

This invention relates principally to a novel or improved arrangement of the mechanism whereby the leather, skin, or sheet to be operated upon, is fed up to the knife or cutting instrument, and is supported during the cutting operation. The knife or cutting instrument consists of an endless metal band, extended over a pair of rollers, and provided with a sharp cutting edge, which, by the rotation of the pulleys, is kept in motion as the skin or fabric to be operated upon is fed forward. It is important that the skin or leather should be fed forward to the knife in a suitable and regular manner, otherwise the cutting instrument will not act properly. To this end the skin, leather, or sheet is supported upon an endless travelling cloth or table, to which a progressive motion is given by means of suitable gearing, actuated by the driving shaft. Another important matter is to maintain or hold the skin or leather firmly against the gauge roll during the cutting operation. The improvement in this part of the machine consists in subdividing either the supporting roller or the gauge roller into a number of contiguous small rollers, all of which will be susceptible of independent action without interfering with the rollers. By this arrangement any single roller may be made to yield to any sudden pressure, as where a lump of skin, flesh, or fat is required to pass. These pressing rollers are kept up to their work by springs, or by being made to bear against an elastic bed roller.

1909. B. BROWN, *King William-street, London*, "*Self-acting lamp or apparatus for the convenient passage of lighted gas.*"—*A communication.—Dated 1st August*, 1861.

This invention consists of a bent tube intended to be screwed against a wall. One end of this tube fits into a pipe through which gas or other illuminating fluid or liquid passes, and to the other and short bent end an elastic air-tight tube, two or three feet long, is fixed, to which is also fixed a small bent tube, serving as the plug of a cock, and fitting into a hole in a piece of metal constituting the seat of the cock, the same being formed with an arm, through the end of which a screw is passed, the point of which rests upon the before-mentioned small bent tube, the said screw being employed to adjust the extent to which opening in the cock is uncovered when out of use, or, if necessary, to close it entirely. A jet or small burner is forced into the top of the cock seat, and to the bottom thereof a handle is fixed. This apparatus is specially adapted for lighting cigars.—*Not proceeded with.*

1910. H. MEARING, *Great Randolph street, Camden Town*, "*An improved lucifer match and prepared paper for lighting the same.*"—*Dated 1st August*, 1861.

This invention is carried into effect as follows:—The wood is to be first dipped in melted sulphur, and, when dried, in a compound of chloride of potash in powder 8 parts, sulphur 1 part, rottenstone 4 parts, lampblack 1 part, and gum 2 parts, with sufficient water to form a paste. The paper is to be coated with the following solution: Amorphous phosphorus 4 parts, and graphite in powder 1 part, made into a solution by adding silicate of soda 1 part, and water 4 parts. The paper is to be coated with the solution by means of a brush. The light is to be obtained by drawing the match briskly across the paper. The advantages to be derived from the use of this match are security to life and property, and the utter impossibility of ignition by other means than friction on the before named paper.—*Not proceeded with.*

1911. R. HARRISON, *Port Penrhyn*, "*Apparatus for cutting slates and slabs.*"—*Dated 1st August*, 1861.

The novelty of this invention consists in cutting slates or slate slabs, laid upon a rest or fixed knife bolted firm to a frame, by means of knives or cutters fixed to the arms, and placed in the plane, of a wheel, and passing within a prescribed distance of the rest or fixed knife, according to the width of the slate to be cut off. These rotating knives extend nearly from the boss to the rim of the wheel. By giving a rotary motion to the wheel the different knives cut off any or that portion of the slate held over or beyond the edge of the rest or fixed knife. Attached to the face of the rest or fixed knife at right angles is a gauge in which notches or projections are cut to suit the sizes of the slates or slabs required, and by holding one end or side of the slate or slab to any notch or projection on the gauge, that portion of the slate or slab passing over the face or edge of the rest or fixed knife will be cut off by the next revolving knife on the wheel.—*Not proceeded with.*

1912. H. SHAW, *Dublin*, "*Wet gas-meters.*"—*Dated 1st August*, 1861.

This invention relates to the application to the meter of a reservoir or tank for the supply of such additional water or other liquid as may from time to time become necessary to make up for that which may be lost by evaporation or otherwise. The communication through which such additional supply of water or other liquid passes to the meter is by means of a valve or pipe, which valve or pipe may be opened as the water in the meter is lowered, and, when the required supply from the reservoir or tank is admitted, such valve will shut. Within the meter the patentee places a float, in which he makes a valve seat of any suitable material (metal, wood, or caoutchouc); as the water in the meter is raised to its proper level, so will it float the valve seat to its shutting off any further supply than what may be necessary.

1913. A. POWELL, *Liverpool*, "*Boots, shoes, &c.*"—*A communication.—Dated 1st August*, 1861.

The object of this invention is to make the seams or joinings hold more effectually, such as the junction of the vamps and quarters, and to strengthen the same by an arrangement which is an ornament to the boot or other covering. The inventor uses metallic rivets or studs for this purpose, and after passing the same through an aperture formed in the various thicknesses, he clinches the same in such manner that a considerable portion of the material is clipped or secured between the rivet heads. Ornamental washers may be used on one or both ends of the said rivets.—*Not proceeded with.*

1914. E. J. MUYGRIDGE, *San Francisco*, "*Apparatus for washing clothes, &c.*"—*Dated 1st August*, 1861.

This machine consists of an oblong box or trough, having vertical sides, and a sloping front inclined inwards at a suitable angle towards the bottom, the inner surface of which inclined front is corrugated, similar to an ordinary washing board; or the corrugated surface may be made detached, so as to be capable of being removed and inserted when required. The bottom of this box forms the segment of a circle, the centre of which is a point above the top of the trough, and almost vertical over the point of junction of the inclined front, and the curved bottom. There is an upright at each side of the trough, to which arms are suspended, carrying a pounder or beater. These pounders are constructed of vertical slabs set at suitable distances apart, and having their front edge inclined and corrugated, the more effectually to retain and compress the fabric under operation. Motion is given to the pounders or beaters so as to cause them to vibrate alternately by means of rods or levers, and connected to a crank mounted upon a shaft which is caused to revolve by a handle. A spigot or tap is provided for the purpose of drawing off the water.

1915. J. COOK, *East India-road, Poplar*, "*Smoke-consuming furnaces.*"—*Dated 1st August*, 1861.

This invention consists in forming an aperture through the bridge beneath the fire bars, and inserting in or fitting to the mouth of it a bent pipe, extending upwards at the back of the bridge to about the level of the top thereof, terminating, by preference, in an elongated mouth of or about the width of the bridge; but any other shaped mouth may be used. The inventor fits a valve to the pipe to regulate the drift.—*Not proceeded with.*

1916. M. PRATT, *Stafford*, "*Candle moulds.*"—*Dated 1st August*, 1861.

The patentee proposes to substitute for the ordinary metal moulds candle moulds made of glazed earthenware. He prepares fine dried powdered clay in the manner now commonly practised in the manufacture of encaustic tiles, door furniture, and other articles, and moulds it by pressure between metal dies.

1921. J. E. DROUOT, *Paris*, "*Apparatus for kneading.*"—*Dated 2nd August*, 1861.

This invention consists in an annular kneading trough supported and driven around a central support or column, which is also supporting the engine, and enclosing all the motive contrivances, radiating like from the centre towards every point where motion is required, and thus performing, by means of a screw-shaped beater and a carrying fork, the accurate imitation of manual kneading.

1922. W. E. NEWTON, *Chancery-lane, London*, "*Machinery for cleaning rice, coffee, &c.*"—*A communication.—Dated 2nd August*, 1861.

This invention cannot be described without reference to the drawings.

1924. G. BISH, *High-street, Stratford, and* J. DREDGE, *Adam street, Adelphi, London*, "*Improvements in forming bends and other forms or parts of non-metallic pipes, and in machinery or apparatus employed for such purpose.*"—*Dated 3rd August*, 1861.

This invention consists, First, in the application of heat (either dry or moist) to pipes and tubes such as are manufactured from paper, canvas, linen, felt, and other non-metallic substances, for the purpose of rendering them sufficiently pliable to bend freely, and to be bent or moulded into any required form. Secondly, in a method of bending or curving such pipes or tubes by means of a series of rings, the width of each of which in a line parallel with its axis is greater at one side of the diameter thereof than at the other, so that, when placed closely in contact, they assume the form of the curve or bend required. Thirdly, in the application of rings, as described, to the bending of pipes formed of malleable metal. Fourthly, in a method of making cast bends for pipes in non-metallic substances by moulding them on collapsible mandrils, capable of being easily withdrawn when the casting is set. Fifthly, in a method of making bends by wrapping strips of paper, linen, or non-metallic substances around collapsible mandrils, layer upon layer, until a sufficient thickness and strength are attained. Sixthly, in a method of manufacturing branch and service pipes of any description, such as T-pieces, and so forth. Seventhly, in a method of manufacturing socket joints by stamping out the sockets in the softened pipe, or otherwise, by working up the joint with extra thicknesses of paper, linen, or other suitable material. Eightly, in constructing tubes intended to be bent or curved with a thickness of material gradually increasing from the side intended to form the inner or smaller curve of the bend to that intended for the outer or larger curve thereof.—*Not proceeded with.*

1925. M. and R. M. MERRYWEATHER, *Long Acre, London*, "*Pumps.*"—*Dated 3rd August*, 1861.

These improvements have reference, First, to the position and the arrangement of the parts of double-acting horizontal pumps, and consist in placing both the suction and delivery valves in a chamber beneath the pump barrel, which the water enters and leaves at its extreme ends, so that any dirt or grit that may be drawn up with the water is ejected and prevented from injuring the pump barrel. Secondly, in surrounding a horizontal pump barrel concentrically with a cylinder communicating with the delivery outlet, so as to form an air vessel for equalising the stream of water. Thirdly, in an arrangement for lubricating the piston of pumps by mounting on the piston rod two pistons with a space between them; this space being filled with oil continually lubricates the piston. Fourthly, in the introduction into air vessels of flexible or elastic receptacles filled with air, by which

means all the advantages arising from the elasticity of air will be obtained, while the absorption of air by the water will be prevented.

1926. J. CROSS, *Manchester*, "*Fastenings for wearing apparel.*"—*Dated 3rd August*, 1861.

This invention consists in using an elastic or other band with an ornamental clasp or fastening for the purpose of turning up children's sleeves, so that, by putting the band inside the sleeves of the under clothes, and bringing it outside the sleeves of the outer clothes, and clasping or otherwise uniting the ends, the sleeves will be kept together, and thereby prevent any of them slipping untidily below or above the short sleeve usually worn by children; and if the clasp or fastener is a neat or elegant design it will make, in addition to its utility, a pretty ornament to the sleeve. This elastic or other fastener may have an ornamental clasp at each end, one part with a hook or projection, and the other part with a slot or hole for the hooked part to fit into; or the elastic or other band may be made of two or more folds, as an endless band, and thus be enabled to hook on the projecting piece or pieces of the clasp; or a single band may be folded at the end, and thus form a loop or catch; or an eyelet may be made in the band itself. It is evident the connection may be accomplished in many different ways, and that this improved fastener is also applicable to belts, brooches, pins, bracelets, and all similar articles.

1927. G. F. *and* J. JONES, *York*, "*Apparatus for protecting and arranging water pipes and withdrawing water therefrom, and preventing injury thereto by frost.*"—*Dated 3rd August*, 1861.

This invention relates, First, to supply pipes. It being usually inconvenient or impracticable to place these sufficiently deep in the earth to be beyond the influence of frost, the patentees protect the same by coating them with, or imbedding them in, some one or other of the substances which are the slowest conductors of heat (such as felt, straw, or hay bands, india-rubber, fine dry sand, or saw dust, clay, salt, or alum), and, when required, enclosing these in earthenware or wooden pipes or casing. Just where the protection due to depth ceases, the supply pipe is to terminate in a cylinder placed horizontally or obliquely, having a piston which, when pushed towards and left at the outward limit of its stroke, shall permit the free passage of the water from the supply pipe to the house main, and when drawn to its inward limit, and held so by a weight, shall stop and prevent the supply, at the same time permitting the water contained in the house main and branches to return to the cylinder, and thence to run off by a waste pipes with a drain, which waste, during the admission of the supply, is closed by the periphery of a second piston open longitudinally, travelling simultaneously and commensurately with that first mentioned. In the case of hydrants, drinking fountains, pumps, and standards for the supply of railway engines, sanitary water closets, or other purposes, the cylinder above described is to be placed vertically, and sufficiently low in the ground for its contents to be below the action of frost, and the piston in it to be rendered self-closing by means of a weight, spring, or other appliances, the water raised and not required immediately falling back for future use into the cylinder (calculated of adequate capacity), or, in the case of a pump into the well, and a considerable amount of water being thereby saved (now wasted), while any stoppage from frost is prevented. Second, the supply pipes branching from the street mains are furnished with a tubular lining of india-rubber, closed at the end next the main, and fixed at both ends to the unions; and to this lining, and near to the supply stop cock, another cock is to be provided, adapted for occasional connection with a small force pump, by means of which air is to be forced in and filled with compressed air, so as to obstruct the admission of the water, or, in the event of the contained water having become frozen, to facilitate the thawing thereof by pumping in air or water at a high temperature, the elasticity of the india-rubber tubing previously allowing the expansion of the water by freezing, and thus preventing the twisting of the external metal pipe.

1934. A. PRINCE, *Trafalgar-square, London*, "*Palate and tooth plates for dental purposes.*"—*A communication.*—*Dated 3rd August*, 1861.

The objects of this invention are to enable palate and tooth plates to be securely attached within the human mouth without the use of wires, springs, or other mechanical adjustment, and to supersede the American "sucking set of teeth," the fastness of which in the mouth depends solely on the pressure of the air, whereas, by this invention, the air is made use of chiefly to form the organs offastness or security to the plates out of the pituitary membrane, by causing portions thereof to pass through holes formed in the plates, thus fastening the same by means of button like protuberances of the pituitary membrane, which are necessarily the result of the application to the pituitary membrane of these plates so provided with holes.

1937. F. RICHMOND *and* H. CHANDLER, *Salford, and* W. B. RITCHIE, *Belfast*, "*Sack holder.*"—*Dated 5th August*, 1861.

The object of this invention is to retain the orifice of sacks distended while they are being filled. The improved sack holder consists of a pillar or other fixing, to which is connected by a set screw or other adjustable means a bracket, in which are fixed the studs for two levers or arms furnished at their lower extremities with holders to which the sack is suspended; the levers are coupled by tooth segments or other equivalent means, so that both are expanded or contracted simultaneously; one of the levers is provided with a ratchet segment into which a pawl gears to hold the levers apart.

1940. S. S. FITCH, *Upper Seymour-street, Portman-square, London*, "*Chest expander.*"—*Dated 5th August*, 1861.

This improved chest expander consists of a back piece of canvas or other suitable material, elastic or otherwise, fitting to the back, and extending from the back as low as the hips of the person to which the expander is applied, of suitable form for the purpose. To the lower part of this back piece is attached a belt of elastic material encircling the abdomen for securing the expander to the waist of the wearer, which is fastened in front by buttons or otherwise. The effect of the employment of this belt is to bring the back piece to its proper position on the loins. On each side of the upper part of the back piece is also attached an elastic strap, which is passed over the shoulder, and terminating under the arm is secured by buttoning or otherwise to the back piece, at a little below the centre of its depth, or in other suitable position. In this way the inventor dispenses with all the ordinary straps, buckles, stags for attaching the expander to the waist band of the trowsers or drawers, as is ordinary.—*Not proceeded with.*

1941. E. D. JOHNSON, *Wilmington-square, London*, "*Centre seconds watches.*"—*Dated 5th August*, 1861.

This invention relates to an improvement in the mode of fitting watches with both constant and independent seconds hands, the use of which by showing a continuous progression of time, and also the duration or suspension of short periods of action of whatever kind, is well understood. The object of the invention is to simplify the mechanism required to operate the two seconds hands. This is effected by driving both the constant seconds and independent seconds of whatever kind by the same train of wheels and prime mover.

942. J. POTTER, *Leeds*, "*Construction of straining pillars or posts for wire or other strained fencing.*"—*Dated 5th August*, 1861.

This invention cannot be described without reference to the drawings.

1943. R. A. BROOMAN, *Fleet-street, London*, "*Improvements in locks and other fastenings, and in keys*"—*A communication.*—*Dated 5th August*, 1861.

This invention cannot be described without reference to the drawings.

1949. G. POTTS, *Edinburgh*, "*Elastic steel mattresses.*—*Dated 6th August*, 1861.

In one modification of this elastic steel mattress, a wooden frame is used for the under side, and upon this there are fixed a number of double cone spiral springs, such as are ordinarily used. Upon and attached to the springs there is arranged a framework made of thin flat steel bands, and comprising an external frame connected by interlaced bands arranged by preference diagonally. This system of interlaced steel bands provides for any pressure applied to one part being distributed to and resisted by several springs, in consequence of which lighter springs may be used.—*Not proceeded with.*

1951. J. TURNER *and* R. B. DUNNET, *Liverpool*, "*Stamping, endorsing, and embossing machines.*"—*Dated 7th August*, 1861.

In constructing these improved machines the inventors secure near the top of an ornamental stand or pedestal, of about the usual shape, a stud or pin, to which they attach a toothed wheel, and joint or hinge a lever; to this lever they secure other two or more studs or pins to carry an equal number of toothed wheels, left free to revolve on their centres, geared together and to the fixed wheel above referred to, as secured to the stud in the stand or pedestal. To one of the wheels free to revolve on their centres, by preference the one furthest removed from the joint or hinge, they affix an arm to carry the engraved, embossed, or otherwise ornamented stamp or die.—*Not proceeded with.*

1953. J. MACMORRAN, *Leicester-square, London*, "*Machines for mincing meat, &c.*"—*Dated 6th August*, 1861.

This invention relates to that class of mincing machines wherein the meat or other substance is cut by being forced by revolving pins or propellers against stationary knives between which the propellers revolve. The body of the machine, instead of being cast in two pieces (as ordinarily done), is cast in one piece, open at both ends, so that the cylindrical part can be bored out and turned or enamelled inside. Another advantage of casting the body in one piece is that, as there is no joint, the pieces of the meat are not lost. The end plates are movable, and are attached by means of bolts and thumb screws, the same bolts also holding the knives. Upon unscrewing these nuts the knives and propellers can be drawn out endwise. The knives are sharpened at both edges, being thickest in the middle, so that they clear much better, and the meat not being wedged between them does not become heated, as in the ordinary machines. When one cutting edge has become dull, the knives can be reversed, and, consequently, they wear twice as long as the ordinary knives. The pins or propellers may be made in the ordinary form, with two or three blades or eccentric plates, but it is preferred to use the single blades, the action of which is to chop the meat or other substance against the knives. The spindle has a bearing at each end, having a conical bearing at the driving end in the end plate, and at the other end (when triple propellers are used) the last propeller is made wider than the rest, being conical on the outside, and bears inside a conical socket, which socket forms the delivery aperture, so that by this means the patentee combines a direct central delivery with a double bearing for the propelier spindle. The delivery aperture is furnished with a screwed ring or socket, inside which is fitted a series of movable rings with tubes of various diameters, either of which may be used at pleasure, according to the coarseness or fineness of the "cut" required.

1959. F. SILVESTON, *Coventry*, "*Watches.*"—*Dated 6th August*, 1861.

This invention consists in so arranging the works as to allow the balance to work below the surface of the top plate. This improved construction allows the works and movements to be more compact and flatter than the ordinary watches, and yet to be much stronger and less liable to derangement or injury, and it admits of increased facility to the watch finisher in springing the same, as he is enabled to increase the space, and thereby facilitate that object, without interfering with the thickness of the balance, as an aperture may be cut out of the top plate or formed in it, for the balance wheel to work in. Underneath the top plate, beneath the circular hole in which the balance wheel works, the patentee fixes an escapement bar, between which and the pillar plate the escapement and fourth wheel work, by which arrangement watches so constructed are not so liable to get deranged as the ordinary, or, what is technically called, "three-quarter plate," watches are. For the purpose of economising space in combination with the general construction, he forms a hole through the top plate for the barrel to partially work through, so that the top of the barrel shall be flush with its upper surface, which allows the advantage of additional strength of spring, according to the size of the watch desired. Over this he secures a name bar or plate, through which the axis of the barrel works; this top or outer name plate he secures to the top plate in the ordinary way, and upon this plate or bar a click or pall and ratchet may be placed for regulating or preventing the running back of the spring. But this click or pall and ratchet may also be placed on the opposite side of the watch or face side of the pillar plate, and upon the upper surface of the top plate and against the edge of the name plate or bar the cock, as before observed, is placed. The improved arrangement also enables him to place the works right or left handed, a term well understood in the trade. He purposes in every instance in the act of winding to turn the fusee towards the box containing the spring, which enables him to make his chain stronger and better suited for its work, as the chain being made thicker on the side that winds round the barrel, it is not liable to twist or turn over on its side, and, by making the spiral of the fusee in the usual way, the reverse side of the chain can be so constructed as to fit into it. From this it will be seen that one edge of the chain winds on the barrel of the spring, and the other edge on the fusee. But to prevent over-winding he prefers to use an outside stop, applying it upon the face or pillar plate, between its outer surface and the dial, as, in his opinion, it is safer in its action, and not so liable to injury.

1963. E. T. HUGHES, *Chancery-lane, London*, "*Wheel barrow wagon.*"—*A communication.*—*Dated 7th August*, 1861.

This invention consists in making the shell or mouth parts of the barrow capable of swinging on studs, or on a spindle attached to the framework, so that, when it is to be emptied, it can be upset in the same manner as the ordinary short wagon used by excavators.

1965. W. R. ROGERS, *Gray's-inn-road, London*, "*Machinery to be employed in the application of dowels to wood work.*"—*Dated 7th August*, 1861.

This invention relates, Firstly, to an arrangement of machinery for hingeing together under pressure the parts intended to be secured by means of dowels. For boring dowel holes at any required distance apart in the pieces to be united, the inventor fits a boring machine with clumps, which clumps the work and presents it either sideways or endwise to the action of the rotary cutters. On a cast iron main frame, fitted with parallel guides, he mounts a sliding table or frame, which carries a pair of adjustable swivel clumps. These clumps are made to advance to and recede from each other by means of a right and left handed screw shaft, mounted in the sliding frame, and operated by a hand wheel. They are held firm by clumping into, which, when slackened, will allow of the clumps receiving a quarter turn. Thus the clumps may be made to face each other, and embrace a piece of wood that is to be presented endwise to the casters, or to face the casters and present the work sideways to the cutters. The clumping jaws are operated by vertical screws. The cutters which he proposes generally to use in pairs are fitted to cutter spindles, which are mounted in adjustable socket bearings that slide by the means of a right and left handed screw shaft on a horizontal slide bar for the purpose of adjusting their distance apart.—*Not proceeded with.*

1971. J. COLDWELL *and* W. COLDWELL, *Sheffield*, "*Manufacture of sheep-shears.*"—*Dated 8th August*, 1861.

In carrying out this invention the inventors propose to use for the blades bars of iron in combination with steel, welded thereto by forging or tilting, and reduced to the proper size by rolling each of the blades. They can then form them at one heat. For the bow and shanks they use iron rolled to the proper size for the purpose; this iron they can weld to the blades and forge hollow for the shanks at one heat; the remaining processes are performed in the ordinary manner.—*Not proceeded with.*

1972. R. JUKES, *Sheffield*, "*Puddling furnaces.*"—*Dated 8th August*, 1861.

The object of this invention is to preserve as far as practicable the cast iron basin, and inside lining or fettling of a furnace. This the inventor accomplishes by arranging a series of tubes or pipes parallel to each other, and adapted in length to the plan of the bottom, in such manner that the ends of the pipes are connected within the boundary of the bottom by cross pipes, which renders the whole continuous. The first pipe is connected by a cross length at the end opposite the inlet orifice to the parallel pipe next to it; this pipe is again connected to it at the same end as the inlet orifice with the pipe next in succession, and so on, in order that the water or air flowing through or injected into the pipes traverses the whole space or area of the bottom, and passes off by the outlet pipe.—*Not proceeded with.*

1976. A. V. NEWTON, *Chancery-lane, London*, "*Sewing machines.*"—*A communication.*—*Dated 8th August*, 1861.

This invention relates to certain improvements in the details of sewing machines, whereby their action will be materially improved. To this end it is proposed to introduce improved tension apparatus, whereby a large amount of slack thread may be thrown off to form the slack loop through which the shuttle passes, thus allowing, among other advantages, of large sized shuttles being conveniently used. The invention cannot be described without reference to the drawings.

1977. A. V. NEWTON, *Chancery-lane, London*, "*Single thread sewing machines.*"—*A communication.*—*Dated 8th August*, 1861.

The object of this invention is to give security to seams formed by the tambour or single thread sewing machines, and prevent them from unravelling or ripping up when from any cause one stitch has given way. To this end it is proposed to introduce into the line of stitches, at suitable intervals, short stitches, which will serve to retain the loop of an adjacent long stitch that may have been set free within its own loop, the shortness of this latter having the effect of binding on the loop that has been set free by the brake in the combination of stitches. The short stitches may be thrown into the work alternately with the long stitches, or at every third stitch, or at any other suitable interval, but in practice it is preferred to make a short stitch after every long one. In order to adapt the single thread machine to this kind of work, the back traverse of the feeding bar is arrested after the formation of, say, every second stitch, by a cam which receives rotary motion from the looper shaft. The feeding bar being thus arrested will make a proportionately short forward traverse, and thereby feed the cloth the proper distance for throwing in of the short stitch.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

FRENCH TRADE: *Rapid Development*—AMERICAN TRADE: *A Southern Buyer in the District: The Future Supply of Hoops to the Planters: High Price of Hoops*—COPYING TRADE NAMES: LETTER FROM A WOLVERHAMPTON FIRM—COAL TRADE—HARDWARES: *Dull Foreign Demand, but brisk Yorkshire*—BOARD OF TRADE RETURNS: *Metals Specified.*

THE French trade is developing itself somewhat more rapidly than was at first expected, and a South Staffordshire house has just entered into an arrangement with some buyers in France for the supply of about 1,000 tons of finished iron. The order would be considered more valuable than it is were it not for the fact that the deliveries will extend over a protracted period of nearly twelve months. Still, if the specifications can be obtained, makers can roll the iron and stock it. The prices, whilst they are not the orthodox trade rates, still are by no means so low as some that are being accepted by houses who are not so careful as to the quality of iron they supply. The Frenchmen require a good article, and are not indisposed to pay a tolerably fair price for the production of a first-class house. Small quantities of iron are being sent out for India, Australia, and Canada; but the latter country is not requiring so much as it was expected it would be demanding at this time. The States are not altogether a blank, and a very few orders continue to arrive by almost every mail. There is now in South Staffordshire a gentleman, who has come from New Orleans, specially to make preliminary inquiries relative to a future supply of hoops for packing the bales of cotton. Provided that he can obtain the iron on the terms which he is prepared to offer, a good round order for hoops will be given out before he leaves. Great inducements are fairly held out for ironmasters to pay some attention to this department of the trade. As great a quantity as from 18,000 to 20,000 tons of hoops may in a few years—it is maintained—be sent out annually for the packing of cotton, and it is added that, whatever may be the arrangement which will be ultimately concluded between the Northern and the Southern States, British ironmasters will be able to send into the Southern ports at rates which will effectually secure for them nearly all the trade of that part of the world. Whilst it is urged that the district in which charcoal iron is made in the States belongs to the South, and should form a part of that confederacy, yet, if it should, the prices of that iron will be so high that the commodity cannot compete even with the best English iron; and the makers of the less valuable descriptions in Pennsylvania and Ohio cannot, it is added, undersell the British producer of the similar article, so soon as the trade with Britain is not impeded by the virtually prohibitive tariffs the imposition of which forms so marked a part of the grievance, that the Southern States will now bear no longer. There exists much inducement for some speculative ironmasters to charter a vessel with hoops for the Southern States, for they are now quoted there at £26 a ton!

The business done either in Wolverhampton on Wednesday or in Birmingham yesterday (Thursday), was scarcely any; and the reports spoke of an absence of improvement in the trade generally upon its condition a week ago. Prices for both finished and pig iron are fair subjects for negotiation. At the same time we know a case in which a house is quite full of orders for finished iron at the list rates.

The following letter, which closed the City article of the *Times* of Wednesday, is giving rise to expressions of general satisfaction amongst the ironmasters of South Staffordshire:—"Wolverhampton, and at Dyer's Hall Iron Wharf, Upper Thames-street, February 25th. Sir,—A few months ago reference was made in a 'City' article of the *Times*, to a proceeding by parties in this district in having assumed the name of our firm, with the exchange only of the first initial, under circumstances most likely to mislead persons in the distance. Recent events have caused these parties to stop their works, and this fact has been announced in numerous provincial papers in such a way (aided by a substitution of a Christian name) as is still more likely to deceive our friends and the public. We fear we have no remedy against such conduct unless you will kindly permit us to say, through your columns, that all our extensive establishments in Staffordshire are still in operation, and will continue to be carried on by—Your obedient servants, G. B. THORNEYCROFT AND Co."

Coal is still offered in large quantities without finding purchasers.

Hardwares are not in any better demand than they were last week. Some makers are not so well off as they were then; and there are not a few who are in no better condition than they were at the close of the past year. The advices received in the week from the foreign markets are not satisfactory. The less disturbed state of a portion of South America has not much improved the demand for that market; on account of Canada all the orders have been given out that are at present forthcoming. India is buying but very little, and Australia is still sadly overstocked. The orders on account of Marseilles in cheap ironmongery are slackening, and the Parisian demand is still for samples. One manufacturer of first-class japan and papier maché wares is just commencing the production of articles modelled after French patterns, and there is reason to believe that the products will be preferred in France to French make, not only on account of their excellence, but because of their cheaper price. The home trade is active in no market but the Yorkshire spinning district; whence, in consequence of the great activity in the production of alpaca fabrics for France, good orders are coming to hand. The demand is especially marked for engine fittings. Military arms are still affording much employment, and tubes for locomotives and other uses are in good demand. The trades of the populous districts around Birmingham and Wolverhampton are unimproved. The partial strike of the nailmakers is not yet at an end; and the usual intimidation of destroying the machinery of certain of the operatives who work at their own homes is being resorted to by certain of the disaffected. Copper is selling in Birmingham at £4 below the list rates, but at that price is only very slow of sale.

From the Board of Trade returns which were issued on the 22nd inst. we gather the following.—The total declared value of the British manufactures and produce exported during the year 1861, declined, from £135,891,227, in 1860, to £125,115,133, or nearly eleven millions The value of the exports to France increased under the influence of the tariff reforms in the two countries from £5,249,980, to £8,896,282. The cause of the decrease in the total is found when we come to the United States, the exports to which decreased in value from £21,667,065 to £9,058,356, as compared with the preceding year. The only principal articles to which the decrease has not extended are coal, pig iron, machinery, and leather goods. The value of the earthenware and porcelain exported fell from £1,450,644, to £1,070,659, though the exports increased to every country except the United States. The difference in hardwares and cutlery was not so great owing to a great increase in the exports to France and Brazil, those to the former country having nearly doubled; but the total value was still below what it ought to have been, being £3,425,260 against £3,770,609, in the preceding year. The plate, plated wares, jewellery, and watches exported, show a decline in value from £564,160 to £448,458. There was an increased exportation of machinery, exclusive of steam engines, to all countries except Russia and the Hanse Towns, and the value rose from £2,599,488 to £2,976,221. Steam engines to the amount of £1,243,467 were exported, against £1,238,333, although the increase was limited to the orders executed for Spain and India. The exports of metals, unwrought or part wrought, are shown in the following table:—

	1859.	1860.	1861.
Pig iron	£901 929	£974,065	£1,047,318
Bar, rod, and bolt iron	2,373,910	2,385,871	1,885,695
Railway iron	4,124 298	3,405,759	2,903,357
Iron wire	228,019	250,087	207,317
Cast iron	795,849	832,638	701,214
Wrought iron	3,084,720	3,317,349	2,868,923
Steel, unwrought	805,832	986,228	727,840
Copper, ditto	691,637	749,879	436,087
Copper and yellow metal			
Sheets and nails	1,504,442	1,804,151	1,426,031
Wrought copper	256,206	243,686	276,077
Brass, all sorts	149,050	211,693	173 772
Lead, all sorts	480,845	543,299	424,102
Tin, unwrought	354,109	361,592	343,300
Tin plates	1,522,618	1,5 0,813	907, 90

Pig iron, the consumption of which, of British manufacture in foreign countries was, two or three years ago, declining more than that of almost any other product of our national industry, was, last year, as already mentioned, one of the few principal articles, the exportation of which increased. Though the exports to America diminished to little more than one-third, as compared with those of 1860, so great an increase took place in the shipments to other countries, especially to France, Holland, and Prussia, as to result in an augmentation of the total declared value. There was an increase also in the exports of bar and rod iron to France, Holland, Italy, Canada, and India, but the diminution of those to other countries, especially to Australia and the United States, more than counterbalanced the gain in that direction. The decline in railway iron has been progressive of late years, and the immense drop from £916,361 to £176,897 in the exports to America, though considerably more than the total decrease, must not be regarded as the sole cause of the falling off in last year's exportation. There was a decline in the exports to Russia, Austria, Spain, India, Cuba, and Canada also. The decline in cast iron took place in the exports to India, Australia

Cuba, and the United States; and the much more extensive falling off in wrought iron in the shipments to the same countries and to Russia, the Hanse Towns, Spain, and Canada. Considering that about two-thirds of the steel exported has gone in former years to the United States, and that the exports to that distracted country last year amounted to only three-sevenths of the quantity sent in 1860, the decrease in that article is not so great as might have been expected; but the proportion of the total exportation of unwrought steel which is composed in other countries is progressing and rapidly increasing. The decline in copper and yellow metal was general, except a small increase to the Hanse Towns in sheets and nails. The export of lead to India and China continued to increase, but to all other countries there was a decline. The tin plate trade stands in a similar position to that in steel, two-thirds of the entire exports being, in ordinary years, taken by America, to which country there was exported last year only £417,360 in value, against £1,018,536 in 1860. There was an increase, however, in the exports to India and Australia. Notwithstanding the great decrease in the total value of the exports, the imports show an enormous increase, amounting to £154,712,706 for the eleven months ended November 30th, against £144,887,078 in the corresponding period of the preceding year. But there was a diminished supply of metals, especially of iron and lead.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

NORTHERN MATTERS: *Blyth Harbour and Dock Company: Explosion of a Locomotive Boiler: Railway Companies and Steam Navigation: Border Union Railway, &c.*—INCREASING DEFICIT IN THE COTTON STOCK—EXPORT OF MACHINERY AND METALS LAST YEAR—THE GREAT EXHIBITION: *Mersey Steel and Iron Company: Messrs. Forrester and Co.*—MERSEY DOCKS AND HARBOUR BOARD: *Expenditure on Dock Works*—THE GREAT EASTERN: *Paper by Captain Walker*—THE GREAT METROPOLITAN SEWER: STATE OF TRADE: SHEFFIELD: *State of Employment in Manchester—Rainbird's Pontoons*—INSTITUTION OF ENGINEERS IN SCOTLAND—SCOTTISH SHIPBUILDING: *Interesting Statistics by Dr. Strang.*

WE commence with the north. At the half-yearly meeting on Saturday of the Blythe Harbour and Dock Company, attention was again called to the desirability of proceeding with the dock division of the undertaking, such accommodation having become more and more necessary. The chairman said there were great difficulties in the way of raising the necessary capital, but if the thing could be managed the directors would throw no impediments in the way of an independent company. It would, however, be necessary to deepen the channel, and the difficulty to be got over would be that the channel would be in the hands of one body, and the dock in the hands of another. Commercial affairs are still dull on Tyneside. The large engineering establishments of the district continue, however, tolerably well employed. About seven a.m. yesterday (Thursday) week, while one of the Cramlington Coal Company's locomotive was being attached to a set of coal wagons at the washing dolly, the boiler exploded with terrific force, shaking the whole place to its very foundation, and scalding Weightman, the engineman, Bell, the fireman, and Halliday, the foreman at the washing dolley. The engine (No. 6) seems to have been manufactured by Messrs. Robert Stephenson and Co., in 1855, and was throughly repaired six months ago. The portions of the boiler blown away have been minutely examined by several practical engineers, and they are of opinion that the water must have been impregnated with acid, or some other chemical substance, as the plates show that in some parts they are only ⅛th of an inch in thickness. The Newcastle Chamber of Commerce, in discussing certain local bills for railway and other purposes now before Parliament, has passed a resolution which is to be communicated to the Board of Trade, condemning the policy of allowing railway companies to become steamboat proprietors. This seems a very useless if not ridiculous movement; for there is scarcely a large railway company in existence which is not, in one way or other, interested in steam navigation. It is confidently expected that the Border Union Railway will be opened from Riccarton junction—so that trains will be running from Carlisle to Hexham—in two months. The directors of the North-Eastern Railway have received a memorial signed by 192 of the leading mercantile gentlemen of Newcastle requesting the company to perfect the communication between its system and the Quayside at Newcastle. This would be an undoubted improvement, and will probably be adopted. A bill is now before Parliament authorising the formation of a Tyne Ferry Company, which is endeavouring to obtain powers for establishing and maintaining ferries at various points on the Tyne.

The yawning deficit in the cotton supply is now becoming every day more apparent and serious. This will be abundantly illustrated on an examination of the annexed figures referring to the stock on hand at Liverpool:—

		1862. Bales.	1861. Bales.
Stock,	Jan. 1	622,640	545,479
„	„ 10	558,540	540,450
„	„ 17	566,710	519,870
„	„ 24	561,640	595,730
„	„ 31	546,440	659,839
„	Feb. 7	550,180	719,420
„	„ 14	524,950	726,480
„	„ 21	479,250	791,240

As compared with last year, therefore, the stock shows a diminution of 40 per cent. Every week the deficiency will be made more painfully evident, and probably by May the stock held will not be more than a fourth the quantity on hand in May, 1861.

Although these statistics show that in one respect the commercial world is sadly out of joint, in our own particular departments things appear to have been pretty well maintained last year. Thus the Board of Trade tables issued this week show the following results in respect to the exports of machinery and metals:—

	1861.	1860.	1859.
Machinery ..	£4,219,688 ..	£3,837,821 ..	£3,731,301
Metals ..	14,476,344 ..	17,718,095 ..	17,458,541

The Mersey Steel and Iron Company has done its best to second the efforts which are being put forth to cause Liverpool to be worthily represented at the approaching Exhibition. The company has already forwarded two gigantic forgings in wrought iron in the shape of crank shafts for marine engines. One of these will be exhibited in the finished state by Messrs. Penn and Son, of London, in connection with one of their propeller engines for one of our iron-cased frigates; the other is a shaft in the rough, in other words, just as it was left by the hammer. This gigantic piece of ironwork was despatched from Liverpool by the London and North-Western Railway on Friday. It was 30ft. in length, by 20in. in diameter, and had two crank blanks. Each of these measured 5ft. on the shaft, and were 4ft. 4in. in depth; the distance from centre to centre of the crank spaces or blanks 10ft.; the blanks to be so cut out as to give a 4ft. 4in. stroke. The weight of this enormous forging was fully twenty-five tons; yet the whole fabrication and forging was completed in between five and six weeks. Besides the two crank shafts referred to, this company will be represented by one or more of its far-famed pieces of wrought iron ordnance. Messrs. George Forrester and Co., of the Vauxhall Foundry, scarcely represented at all in the Exhibition of 1851, will this year exhibit a sugar-boiling apparatus, which, when released from duty at the Great Exhibition, will be removed to its ultimate destination in Upper Egypt. It may be briefly, although imperfectly, described as consisting chiefly of two cylindrical vertical pans, each 7ft. in diameter, surrounded by a hemispherical copper dome, and having a truncated spherical bottom, under which the fires are placed. Each of these pans is 11ft. high, and up to about half their height they are filled each with 170 vertical copper tubes, each 4in. in diameter and 4ft. in length. Into the first of these pans the juice of the bruised cane is introduced, and there it is boiled for a considerable time, the vapour being passed over and condensed in a condenser. The liquid then passes over into the second pan, where it is farther boiled, and purified by passing through filters composed of animal charcoal. From this last process it is passed by pumping into a vacuum pan, where it is crystallised into sugar. This apparatus, which occupies a large space, is surrounded by a platform at the height of 9ft. 7in. from the ground. The platform is 50ft. long by 22ft. wide, is approached by two stairs, and the apparatus has a 20-horse power steam engine attached to it for working. Besides the firms named applications for space have also been favourably answered to Messrs. Fawcett, Preston, and Co.; to Messrs. Johnson and Co.; to Messrs. H. M. Lawrence and Co.; to Messrs. R. and J. Rankin; to Messrs. Vicars and Co.; to Messrs. Grayson, Messrs. Underwood, and to Mr. W. H. Walker, besides many other gentlemen or firms connected with engineering, shipbuilding, and other staple manufactures of Liverpool.

At the last weekly meeting of the Mersey Docks and Harbour Board, it was agreed to reduce the charge for omnibuses running on the dock railway from 1s. to 6d. each journey. A debate raised by Mr. Fernie as to the advisability of purchasing the Birkenhead Graving Dock Company's docks ended in a declaration of opinion that it was not desirable to adopt such a course. It was agreed to pay Messrs. Whaley, Burrows, and Fenton the sum of £293 15s. for 2½ miles of telegraph cable supplied by them, instead of the contract price of £250, in consequence of a thicker cable having been used than that originally contemplated. Mr. Bold moved that the engineer report to the board the amount paid in dockyard wages, monthly, during the years 1859, 1860, 1861, and up to the present time, on all works under construction on both sides of the river, showing the amounts separately due to the construction of the walls of the Great Float, Low-water Basin, and 50ft. Lock, wall of Woodside Basin, enlargement of Morpeth Dock and new entrances; main northern entrances; also the amounts paid to contractors during the same periods, specifying the nature of the work. Mr. Brocklebank said it was always with reluctance that he opposed the granting of returns sought for; but when he found that such a partial return as that now asked was moved for he felt bound to oppose it. He should move that the return asked for by Mr. Laird would impose great and unnecessary labour on the engineer and his staff; that it would be incomplete and partial, and would have a tendency to mislead those who really desired to have a true statement of the expenditure on the Birkenhead works, which real expenditure was set forward with great clearness in the annual reports of the engineer and the annual statement of accounts submitted by the treasurer. Mr. Darbyshire said he had been greatly in the dark as to the expenditure, and could not see why Mr. Laird's motion was opposed, unless it was that there was something to be afraid of. Mr. Bold said if the information were refused there would be an impression created that the board had a disinclination to show how they carried on their works, and that would create a bad impression elsewhere. If there was the slightest objection to give the return let the board decide it. Mr. Boult did not agree with Mr Bold when that gentleman said the information was for the whole board, because he believed it was intended for the Parliamentary Committee who were to sit in judgment upon them in a few weeks, and to show that the board were not going on with Birkenhead. He should move, as a rider to Mr. Bold's motion, that the treasurer do prepare, and incorporate with the return moved for by Mr. Bold, in such a form that the two accounts cannot be separated, a full account of all moneys expended and received by the trust on account of Birkenhead from 1859 to the present time. Mr. Holme suggested to Mr. Boult to add to his rider that the return should include the estimated cost of the completion of the Birkenhead works. Mr. Bold agreed to the rider as proposed by Mr. Boult, with Mr. Holme's addition; and after some further discussion it was adopted by the board, together with the original motion.

At the last meeting of the Liverpool Polytechnic Society, Captain Walker, late of the Great Eastern, read a paper descriptive of the last voyage of the "big ship," which sailed from Liverpool on the 10th of September, for New York. He stated that, with the exception of shipping the crew, the arrangements for the voyage were made independently of him. Captain Walker confirmed the statements as to the excessive rolling of the ship, but added almost nothing to the details previously given as to the series of disasters which brought the voyage to an abrupt termination in Cork Harbour, instead of at New York. He refused, however, to indorse the claim so generally and so strongly put forward by Mr. Towle, as the inventor of the means by which the great ship was eventually steered into Queenstown. After Captain Walker's paper had been read, Mr. James Smith described "A plan for steering the Great Eastern without a rudder." The plan consisted in the adaptation of tubes placed at a certain angle across the after-part of the ship, forming a junction where they intersect each other about the middle of their course. Into these tubes the water of the ocean is to be introduced, and its flow inwards and outwards would be so regulated by steering apparatus as would guide the course of the vessel. It was stated that the floating fire-engine on the Thames is propelled and steered on this plan.

The works of the great metropolitan sewer between Christchurch and the Harrow Bridge, Stratford, are rapidly advancing both on the north and south sides of the road. A tramway has been laid down for the conveyance of materials, and every preparation has been made for carrying out the construction of sewers in the district with all possible expedition, but from the nature and magnitude of the undertaking months will elapse before it is brought to a completion.

Trade at Sheffield does not appear to have improved during the past week. The agricultural machine and tool manufacturers in various parts of the country are forwarding good orders for steel and iron. Many branches of local industry still continue, however, extremely depressed. The demand experienced for iron in Derbyshire has been steady for home purposes, but there has been comparatively little done for exportation. The steel trade has improved, but is still by no means active. Many of the coal and ironmasters of Derbyshire have given notice to their men of a contemplated reduction of 10 per cent. in wages. Messrs. John Brown and Co., of the Atlas Works, Sheffield, have just successfully completed a large armour plate, which will shortly be sent to the International Exhibition as a specimen of what the firm can do in this new department of mechanical industry. The plate weighs upwards of nine tons.

The state of employment in the Manchester district exhibits no improvement. Captain Palin, the chief constable, reports that of 47,478 persons, the full number which might be employed in 215 factories, works, &c., 26,406 only were working full time at the date to which his figures extend, while 14,402 were on short time, and 6,670 stopped altogether. In forty-seven machinists' establishments capable of employing 7,206 persons, 5,286 were on full time, 859 on short time, and 1,081 were stopped altogether. In twenty-four foundries capable of employing 4,206 persons, 2,856 were on full time, 609 on short time, and 741 were wholly out of employment.

Two pontoons, constructed on the principle patented by Mr. S. Rainbird, and noticed recently in THE ENGINEER under this head, have been launched at Cornbrook. The pontoons will be conveyed to Liverpool and there subjected to practical tests.

At the last meeting of the Institution of Engineers in Scotland, Professor Macquorn Rankine in the chair, four new members were admitted, and it was agreed to conclude the session with a *conversazione*, a committee being appointed to make the necessary arrangements. Several donations of books were announced, including a valuable "Manual of Civil Engineering," by Dr. Macquorn Rankine, which is illustrated by numerous diagrams. Papers were read "On Veneer-cutting Machinery," by Mr. Isaac Whitesmith; and "On Movable Bridges," by Mr. David M'Call. Lengthened discussions followed the reading of the papers.

Messrs. J. and R. Swan have launched from their yard at Maryhill a small screw steamer, named the San Lucar, intended by the owners, Messrs. Barr and Co., shipping agents, of Liverpool, to run as a passenger steamer on the Guadalquivir, between Cadiz and Seville, in Spain. The steamer is to be engined by Messrs. Forrest and Barr, and will leave shortly for her destination. Other orders are likely to be executed by the same company on Spanish account. We have also to notice the launch of an iron ship, of 939 tons, from the building-yard of Messrs. John Reid and Co., Port Glasgow-road. Her measurement is—191ft. long, 32ft. 2in. beam, and 21ft. deep within the hold. She is classed 12 years A1 at Lloyd's, and is designed by her owners, Messrs. Temperley, Carter, Darke, and Co., London, for the East India trade. Messrs. Tod and M'Gregor, of Partick, have launched the Nan Zing, a paddle-steamer, built for Mr. Harkost, a Chinese merchant, and ordered through Messrs. Robinows and Marjoribanks, of Glasgow. The following are the dimensions of the vessel:—Length of keel and forerake, 210ft.; beam moulded, 27·6ft.; depth moulded, 14ft.; tonnage, 778 tons. She is fitted with deckhouse fore and aft, saloons for first and second class passengers, and her carrying capacity is 570 tons, exclusive of coals. She has a pair of oscillating engines, 200-horse power nominal, with patent surface-condensers, and all the recent improvements.

Dr. Strang, in some interesting statistics, illustrating the continued progress of Glasgow, states that, since 1851, the steam shipbuilding business of the Clyde has been annually increasing. Last year the number of iron vessels built or completed on the Clyde was as follows:—

	Iron Steamers.	Sailing Ships.	Both.
Number	81	5	86
Tonnage	60,185	3,060	63,245
Horse power	12,493	—	12,493
Cost of hull and fittings	£1,252,300	£50,560	£1,302,860
Cost of engines	£456,800	—	£456,800

At the commencement of 1862 the number of iron vessels building was as follows:—

	Iron Steamers.	Sailing Ships.	Both.
Number	27	12	39
Tonnage	28,362	3,660	32,020
Horse power	6,140	—	6,140
Cost of hull and fittings	£633,200	£60,660	£693,860
Cost of engines	£280,800	—	£280,800

The figures for 1861 include the Black Prince and Scotia, which added considerably to the extent of the tonnage and value of the vessels and machinery recapitulated, while the table for 1862 comprises the tonnage and cost of the Hector and the contracts taken by Messrs. Scott for three large paddle steamers ordered for France.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£ s. d.	Dis. p. ct.
IRON, English Bar and Bolt:—			
in London	pr tn	5 15 0	3
in Wales	„	5 0 0	„
in Liverpool	„	5 10 0	„
Staffordshire Bars (Deliv. into boats at works; Nom. rates last qr. day for favourite brands)	„	7 0 0	1½
Sheet, Singl.	„	8 10 0	„
Dbl.	„	10 0 0	„
Hoop	„	8 0 0	„
Rod, round	„	7 0 0	„
Nail Rod, sq	„	7 5 0	„
SHIPPING IRON, Staffordsh. Bars (Delivered in Liverp. of 10s. per ton less)	„	7 0 0	2
Sheet, Single	„	8 15 0	„
Double	„	10 5 0	„
Hoop	„	8 5 0	„
Rod, Round	„	7 0 0	„
Nail Rod, Square	„	7 5 0	„
IRON, Rails, in Wales, cash	„	5 7 6	nett
„ „ 6 months	„	5 10 0	„
Old, to cut up	„	0 0 0	„
Railway Chairs, in Wales	„	4 0 0	„
„ in Clyde	„	3 15 0	„
Pig No. 1, in Clyde	„	2 9 0	„
3-5ths No. 1 & 2-5ths No. 3		2 9 0	„
No. 1, in Wales	„	3 8 9	„
No. 1, in Tyne and Tees	„	2 12 0	„
Ditto, Forge	„	9 0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	„	3 10 0	„
Welsh Forge Pig (all Mine), at the Port	„	3 5 0	„
Acadian Pig, Charcoal	„	7 10 0	„
Scotch Pig, No. 1, in London	„	0 0	„

		£ s. d.	Di p. c
IRON, Swedish, Indian assortments	pr tn	11 5 0	2
Russian CCND to arrive	„	16 0 0	„
STEEL, Swedish Keg, ham.	„	15 10 0	2½
Ditto, rolled	„	15 0 0	„
Fagot	„	17 0 0	„
SPELTER, on the spot	„	17 15 0	nett
To arrive	„	18 0 0	„
Hard, remelted	„	17 0 0	„
ZINC, in sheets	„	23 0 0	„
COPPER, Tile, 14 to 28 lb.	„	102 10 0	2
Tough Cake	„	102 10 0	
Sheathing and Bolts	pr lb.	0 0 11¼	„
Sheet	„	0 0 11	„
Bottoms	„	0 1 0	„
Old	„	0 0 9½	„
Yellow Metal	„	0 0 9½	„
Burra	„	100 0 0	„
Russian do.	„	101 0 0	„
LEAD, British Pig	„	20 15 0	„
Spanish	„	19 10 0	„
W. B.	„	21 0	„
Sheet	„	21 15 0	„
TIN, English Block, nom.	„	120 0 0	„
Bar „	„	121 0 0	„
Refined „	„	122 0 0	„
Foreign Banca	„	124 0 0	„
Straits	„	118 0 0	„
TIN PLATES, Charcoal, IC	pr bx	1 9 0	„
Ditto IX	„	1 15 0	„
Coke, IC	„	1 3 0	„
Ditto IX	„	1 9	„
Do. at Newport, 1s. pr bx less		—	„
Do. at L'pool, 6d. „		—	
CANADA, Plates	pr tn	12 0 0	2
QUICKSILVER	pr bt	0	

RAILS.—There has been a good inquiry, although the amount of business done has been small, during the week, and the market remains firm.

SCOTCH PIG IRON has been very quiet during the past week, and the market closed yesterday in Glasgow at 49s. 1d. buyers, and 49s. 2d. sellers; while three months open was quoted 49s. 9d. per ton, mixed Nos. Warrants f.o.b. there

SPELTER dull of sale, and may be had on the spot at £17 15s. per ton.

COPPER unaltered.

LEAD continues firm.

TIN.—Good inquiry for English. Foreign rather firmer at £124 to £125 for Banca, and £118 for Straits.

TIN PLATES in moderate demand.

February 27th, 1862. MOATE AND Co., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Teak	15 10	17 0	15 0	16 0
Quebec, red pine	3 10	4 10	3 5	4 0
yellow pine	3 0	4 0	3 0	3 15
St. John, N.B., yel.	5 0	5 10	5 0	5 10
Quebec, oak, white	5 0	5 10	5 0	5 10
birch	3 10	4 0	4 0	0 0
Memel	0 0	0 0	0 0	0 0
elm	3 10	4 15	3 10	4 15
Dantzic, oak	3 10	6 0	3 10	6 0
fir	2 15	3 10	3 0	4 0
Memel, fir	3 10	4 0	3 10	4 0
Riga	3 5	3 10	3 10	3 15
Swedish	2 10	2 15	2 15	3 0
Masts, Queb. rd pine	5 0	6 0	5 0	6 0
yl. pine	5 0	6 0	5 0	6 0
rd pine	0 0	0 0	0 0	0 0
Lathwood, Dantz, fm	6 0	6 10	6 0	7 0
St. Peters.	8 0	8 10	9 0	9 10
Deals, per C., 12 ft. by 3 by 9 in.				
Quebec, wht spruce	13 0	18 0	15 0	19 0
St. John, wht. spruce	14 0	16 0	15 0	17 10

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Yel. pine, per reduced C.				
Canada, 1st quality	17 0	18 10	17 10	19 0
2nd do	12 0	12 10	12 0	13 0
Archangel, yellow	13 0	14 0	14 0	15 0
St. Petersbg. yel.	12 0	12 10	12 10	13 10
Finland	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	15 0
Gothenburg, yel.	10 0	11 10	10 0	12 10
white	9 10	10 0	9 10	11 0
Gefle, yellow	10 0	11 0	11 0	12 10
Soderhamn	10 0	10 10	11 0	12 10
Christiania, per C 12 ft by 3 by 9 in. yellow	22 0	25 0	22 0	24 0
Deck plank, Dntz per 40 ft. 3 in.	0 11	1 4	0 14	1 4
Staves, per standard M				
Quebec, pipe	60 0	70 0	50 0	55 0
puncheon	16 0	18 0	16 0	18 0
Baltic, crown pipe	160 0	170 0	170 0	180 0

SCOTCH PIG IRON REPORT.

			s.	d.		
No. 1	Gartsherrie	.. ..	55	6	f.o.b	Glasgow.
„ 1	G.M.B.	.. ..	48	6	„	do.
„ 3	Do.	.. ..	47	6	„	do.
M. Nos.	Do.	.. ..	48	0	„	do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths „ 3 .. G.M.B.	Cash prompt	49	3	per ton.
	1 mo. open	49	6	do.
	2 mos. „	49	9	do.
	3 „ „	50	0	do.

MANUFACTURED IRON.

	£	s.	d.	
Bars, Govan	7	0	0	
„ Common	6	17	6	
Drumpeller, Common	6	17	6	
Do. Best	7	17	6	
Plates and Sheets	9	0	0	to £10.
Rails	7	5	0	
Pipes	5	0	0	
Chairs	4	0	0	

GLASGOW, 26th February, 1862.

The concession on the part of the French Government in introducing iron on certain conditions free of duty into France, influenced a slight improvement in price, and a fair business was transacted betwixt 48s. 9d. and 49s. 3d. cash. To-day, however, there is really no animation—buyers and sellers equally indifferent at 49s. and 49s. 1½d. cash respectively. Maker's iron is cheap in proportion to warrants.

Exports last week were 9,627 tons, against 6,616 tons in the corresponding week last year. SHAW, THOMSON, and MOORE, Metal Brokers.

ROYAL INSTITUTION OF GREAT BRITAIN.

Friday, January 17, 1862.

Sir Henry Holland, Bart., M.D., D.C.L., F.R.S., Vice-President, in the Chair.

ON THE ABSORPTION AND RADIATION OF HEAT BY GASEOUS MATTER.

By John Tyndall, F.R.S., &c. &c.

Professor of Natural Philosophy at the Royal Institution.

Resuming with a new apparatus his experiments on the influence of chemical combination on the absorption and radiation of heat by gases, the speaker, in the investigation of which the evening's discourse would be a *résumé*, first examines the deportment of chlorine as compared with hydrochloric acid, and of bromine as compared with hydrobromic acid, and finds that the act of combination which in each of these two cases notably diminishes the density of the gas and renders the coloured gas perfectly transparent to light, renders it more opaque for obscure heat. He also draws attention to the fact that sulphur, which is partially opaque to light, is transparent to 54 per cent. of the rays issuing from a source of 100 C. while its compound, heavy spar, which is sensibly transparent to light, is quite opaque to the rays from a source of 100 C. He demonstrates, in confirmation of Melloni, the transparency of lampblack in thin layers; but shows how irreconcilable its deportment to radiant heat is with the idea generally prevalent at the present day, that lampblack absorps heat of all kinds with the same intensity.

All his experiments with gases have been repeated with a different source of heat, and he finds the result still more pronounced than formerly, that the compound gases far transcend the elementary ones in absorptive power. Taking air as unity ammonia, at 30in. tension, is 1195, this latter figure representing all the heat that issued from the source. A layer of ammonia, 3ft. long, is perfectly black to heat emanating from an obscure source. The coloured gases, chlorine and bromine, though much superior in absorptive power to the transparent elementary gases, are exceeded in this respect by every compound gas that has been hitherto examined. When, instead of tensions of 30in., we compare tensions of 1in., the differences between the gases come out still more strikingly. At this tension, for example, the absorption of sulphurous acid is 8,000 times that of air.

The speaker also referred to a new and extensive series of experiments on the absorption of radiant heat by vapours. The least energetic, as before, he finds to be bisulphide of carbon; the most energetic boracic ether. He shows that the absorption of the latter vapour (which is quite transparent) at 0·1 of an inch of tension is 600 times the absorption of the densely coloured vapour of bromine, while in all probability it is 186,000 times that of air.

The speaker was led by a series of perplexing experiments, which are fully described in a memoir recently presented to the Royal Society, to the solution of the following remarkable and at first sight utterly parodoxical problem—"To determine the absorption and radiation of a gas or vapour without any source of heat external to the gaseous body itself."

When air enters a vacuum it is heated by the stoppage of its motion; when a vessel containing air is exhausted by an air-pump chilling is produced by the application of a portion of the heat of the air to generate *vis viva*. Let us call the heating in the first case dynamic heating, and the chilling in the second case dynamic chilling. Let us further call the radiation of a gas which has been heated dynamically dynamic radiation, and the absorption of a gas which has been chilled dynamically dynamic absorption. Placing a thermo-electric pile at the end of his experimental tube, the latter being exhausted, the gas to be examined is permitted to enter the tube; the gas is heated, and if it possess any sensible radiative power the pile will receive its radiation, and the galvanometer connected with the pile will declare it.

Proceeding in this way with gases Professor Tyndall found that the radiation thus manifested, and which was sometimes so intense as to urge the needle of the galvanometer through an arc of more than sixty degrees, followed the exact order of the absorptions which he had already determined. After the heat of the radiating column of gas had wasted itself the air-pump was worked at a certain rate, the rarefied gas within the tube became chilled, and the face of the pile turned towards the chilled gas become correspondingly lowered in temperature. The dynamic absorptions of various gases were thus determined, and they were found to go strictly hand in hand with the drynamic radiation.

In the case of vapours the following method was pursued. A quantity of the vapour sufficient to depress the mercury column 0·5 of an inch was admitted into the tube, and this was heated dynamically by allowing dry air to enter till the tube was filled. The radiation of the vapours thus determined followed exactly the same order as the absorption which had already been measured. The dynamic absorption of the vapour was obtained by pumping out in the manner just described, and it was found to follow the same order as the dynamic radiation. In these experiments the air bore the same relationship to the vapour that a polished silver surface does to a coat of varnish laid over it. Neither the silver nor the air, both of which are elements or mixtures of elements, possesses the power of agitating in any marked degree the luminiferous ether. But the motion of the silver being communicated to the varnish, and the motion of the air being communicated to the vapour, molecules are agitated which have the power of disturbing, in a very considerable degree, the ether in which they swing.

The speaker finds by strict experiments that the dynamic radiation of an amount of boracic ether vapour, possessing a tension of only $\frac{1}{1\cdot012500000}$th of an atmosphere, is easily measurable. He also shows and explains the fact that, with a tube thirty-three inches long, the dynamic radiation of acetic ether considerably exceeds that of olefiant gas, while, in a tube three inches long, the dynamic radiation of olefiant gas considerably exceeds that of the ether. Aqueous vapour has been subjected to a special examination, and Professor Tyndall finds it a common fact for the aqueous vapour contained in the atmosphere to exercise sixty times the absorption of the air itself. The further he has pursued his attempts to obtain perfectly pure and dry air the more has the air approached the character of a vacuum. He further points to the possibility of determining the temperature of space by direct experiment.

Scents of various kinds have been examined. Dry air was passed over bibulous paper moistened by the essential oils, and carried into the experimental tube. Small as the amount of matter here entering the tube is known to be, it was found that the absorption of radiant heat by those odours varies from 30 times to 372 times that of the air which formed the vehicle. The speaker remarked that the absorption of terrestrial rays by the odour of a flower-bed may exceed in amount that of the entire oxygen and nitrogen of the atmosphere above the bed.

Ozone has also been subjected to examination. The substance was obtained by the electrolysis of water, and from decomposing cells containing electrodes of various sizes. Calling the action of the ordinary oxygen, which entered the experimental tube with the ozone unity, the absorption of the azone itself was in six different experiments—21, 36, 47, 65, 85, 136. The augmenting action of the ozone accompanied the diminution of the size of the electrodes used in the decomposing cells. Professor Tyndall points out the perfect correspondence of these last results with those of M. Meidinger by a totally different method of experiment.

The Big Ship.—The shareholders of the Great Ship Company held a meeting on Friday, and adopted the report of the directors, who appear to be puzzled what to do with the ship. They require £25,000 to fit her out entirely, and they have only raised £18.330, but still they expect to have her ready for sea by the middle of April. She will take a short voyage before she leaves for New York. It is singular, with all the calculations of Mr. William Hawes in favour of an Eastern voyage, that the vessel has not been yet sent to Calcutta.

INSTITUTION OF ENGINEERS IN SCOTLAND.

February 5th, 1862.

The President in the Chair.

ON THE MECHANICAL AND ECONOMICAL ADVANTAGES AND DISADVANTAGES OF SURFACE CONDENSATION.*

By Mr. John Frederick Spencer.

Two papers on surface condensation have been given to the engineering world during the past twelve months—the first by Mr. Davison, in this institution; and the second by Mr. Louch, to the Society of Engineers in London.

The rapid progress and introduction of the system of surface condensation during the past eighteen months has, however, been so great that there appears to be a general desire to receive further information on the subject, and the author of the present paper most willingly acceded to the request for the results of his experience. It is his sincere wish to treat the subject of surface condensation generally, and without reference to any supposed or actual superiority of the plans of A, B, or C, as it is considered the discussion will give the needful opportunity for the explanation of new or improved plans. When it is considered that within the past two years upwards of a dozen steamships have been fitted on the Clyde with surface condensers, and some of them of large power, this institution may justly claim a precedence in the receipt of any additional information on the subject of surface condensation.

Mr. Hall's surface condensers, twenty-four years ago, were chiefly made and fitted in the south; and at the present time engines of large power are being fitted with surface condensers by Messrs. Penn, Maudslay, and Humphrys. The papers previously referred to have described most of the plans of surface condensers now before the public, and it is assumed in the present case that the members of the institution are well acquainted with the distinguishing features of surface condensers, and do not require this information to be repeated. The question to be decided is, whether surface condensation has sufficient advantages to warrant its general introduction and adoption in preference to condensation by injection. The evils to be remedied by surface condensation may be briefly described as the loss of heat from blowing out in marine boilers, and the deposit of scale in all boilers. The chief advantages may be stated as the removal of the chief difficulty in the way of using higher pressure steam; being able to use the foulest water for condensing purposes, without risk of injury to the boiler, and the saving of repairs rendered necessary by such deposit.

In accordance with the title of this paper it is proposed, as fully as possible, to consider in detail the most important advantages and disadvantages of surface condensers, as proved by actual experience; for it is believed that all partial statements must sooner or later be disproved by an extended experience, and that to insure success we must have "the truth, the whole truth, and nothing but the truth."

The mechanical advantages to be derived by the adoption of surface condensation are:—

I. Freedom from all unsafe deposits on those internal parts of boilers exposed to severe heat.

II. The use of boilers of improved construction, and suitable for steam of higher pressure.

III. The use of the foulest water for condensing purposes, without incurring any risk of injury to the engines or boilers.

IV. Increased regularity of feed to the boilers, and consequently less risk of injury to them from a deficiency of water.

V. Increased uniformity of load on the air-pump, rendering it unnecessary for the engineer in charge to reduce the injection or condensing water in heavy weather.

It is believed those five advantages include all of importance as affecting safety or convenience, so far as the past and present experience can guide us. Each of them will be referred to in detail.

I. *Freedom from unsafe deposit, &c.*—This is a natural result of the separation of the condensing water from the condensed steam, and what is now required is actual results from the longest experience. This past Christmas a steamer fitted in August, 1857, with a new boiler and surface condenser, was carefully examined, and a report made on its actual condition. This report will be found in another part of the paper. Here it is only necessary to state that there has never been any necessity to scale the interior plates, as is usual with salt water boilers. In other instances of shorter experience the same freedom from inconvenient scale or deposit has existed.

II. *The use of higher pressure, &c.*—Of this there cannot be a doubt, as the general introduction of high pressure steam into seagoing steamers is prevented chiefly by the necessity of providing for the removal of scale and incrustation, and thus rendering it almost impossible to stay the boilers for a high pressure. All that is required to give an onward movement to high pressure marine engines is an increased experience of, and confidence in, the preservation and durability of the boilers. Even already surface condensation and high pressure steam of from 40 lb. to 120 lb. pressure have gone hand in hand across the Atlantic and up the Mediterranean.

III. *The use of foul water for condensing, &c.*—This is a real vantage ground, and one of the most hopeful features of surface condensation. Engineers are well aware that even pure land water is almost unknown; that many of our largest manufacturing works are situated near the sea, or where the most serious effects are produced on the boilers from impure feed-water; that boiler incrustation is a constant source of complaint and reference at the meetings of the Manchester Steam Boiler Association; and that many of the rivers in India and abroad are little better than liquid mud or sand. These facts, with numberless others to the same effect, are well known to practical engineers. Surface condensation steps in, and, like the magician's wand of old, converts impurity into purity, or enables the engineer to do so, which is the same thing in effect. At the present time the author is fitting seven surface condensers of 650 total horses' power to land engines where the river water is impure. The condensers are being made in consequence of the success of one that has been working for the past twelve months.

IV. *Regularity of the feed water.*—With marine engines at sea, working with injection condensers, it requires constant and anxious attention to maintain a proper balance between the proper quantity fed into the boiler and that blown out; and many a good boiler has been ruined by neglect on this point. With surface condensers, except in cases of priming, the necessity for blowing out scarcely exists, and the regularity of the feed is a source of increased safety and great relief to the engineer in charge. On several occasions the author has run at sea from twelve to eighteen hours without making any alterations in the feed valve arrangements.

V. *Increased uniformity of load on air pump.*—This advantage can only be thoroughly appreciated in heavy weather at sea. With an injection condenser in a sea way, unless sudden changes in the speed of the engines are met by corresponding changes in the amount of condensing water supplied, there is a danger of the air pumps being overloaded, and the giving way of the discharge valve is often the result, endangering the safety of the ship. With surface condensers it is quite unnecessary to stand by to regulate the supply of condensing water in heavy weather; and, in a strong sea in the Atlantic, the author has known days pass without the water-regulating valve being touched.

Those who are practically acquainted with the working of steam engines, especially marine engines, can appreciate the value of the advantages referred to as incidental to the use of surface condensers; and it must be admitted that the most favourable view has not been taken; for, among other advantages not named, may be mentioned that of the reduced size of air pump. This has not been referred to at present for two reasons—first, the reduction in size is partly counterbalanced by the addition of the circulating pump; and, secondly, the matter is referred to in a subsequent part of the paper.

It is now proposed to consider the mechanical disadvantages incidental to the adoption of surface condensation. They may be divided under five heads:—

I. The necessity for an additional pump, pumps, or other machinery for circulating the condensing water.

II. The additional space required for the surface condenser, and also in some cases for the condensing-water pump or machinery.

III. The alleged tendency to corrosion in the boiler when working with water supplied from surface condensers.

IV. The complication arising from a multiplicity of tubes or sheets forming the surface condensers.

V. The increased liability to leakage from the number of tubes or other joints in the condensers.

I. *Additional pump, &c.*—It cannot be denied that whatever plan of circulating the condensing water may be adopted (when a high vacuum is required), it is and must be additional to the air and feed pumps. There is, however, some compensation in this case, inasmuch as it has been proved, by indicator diagrams, that the total load on the air and circulating pumps is less than that on the injection air-pump, allowance being made for the difference in the capacity of the two air-pumps; and experience has proved that, with surface condensation, the same vacuum can be obtained with one-half the capacity of air-pump required with an injection condenser.

In the last discussion on Mr. Davison's paper the author gave three cases of comparison, showing the vacuum actually obtained, and the capacity of air-pumps on the two systems. These, being well-certified cases, are repeated here in illustration of the preceding remarks.

Steamship.	H. P.	Injection.		Surface.	
		Air pump. (Per minute)	Vacuum.	Air pump.	Vacuum.
		Cubic feet.	Inches.	Cubic feet.	Inches.
No. 1	50	70	23	45	24·5
„ 2	100	350	23	200	24·5
„ 3	400	1,100	25	500	27·5

As a further illustration may be mentioned the 500-horse power engines of H.M. frigate Arethusa, fitted by Mr. Penn with the author's plan of surface condensers. On trial with air pumps about one half the usual capacity for engines of equal power a vacuum of 26·5in. was obtained.

In the only case where the author had an opportunity of correct comparison with the same engines it was found that with 1½in. better vacuum, the load on the air and circulating pumps was about 10 per cent. less than that in the injection air-pumps.

All these facts, resulting from actual experience, being duly considered, the disadvantage of the additional pump is reduced to a minimum, and confined to its being simply an additional piece of machinery involving no increased duty.

II. *Additional space occupied.*—In many cases the additional space required in the engine room for the surface condenser and pumps has militiated considerably against the system. A very slight consideration, however, will somewhat paradoxically change this disadvantage into an advantage. It is quite true that more space is required for the surface condenser on board ship; but what benefits are derived from its use? Taking the lowest estimate a saving of 15 per cent. of fuel is realised. Take a case in actual practice—injection engines requiring 45 tons per day for a ten days' voyage, making a total stowage of 18,000 cubic feet. Now, attach to these engines surface condensers occupying an additional space, say, of 300 cubic feet, and we will make no deduction for the space occupied by the injection condenser—the saving of space for the voyage will be 15 per cent. of 18,000 cubic feet, equal to 2,700 cubic feet. It now becomes simply a credit and debit account: credit surface condensation with 2,700 cubic feet of space saved, and debit surface condensation with 300 cubic feet occupied, we have then a balance of 2,400 cubic feet in favour of surface condensation. Strictly speaking, in many cases the balance will be even more favourable. It is evident, therefore, the alleged disadvantage becomes an important element of economy of space when the whole question is fairly considered. Credit will also frequently have to be given for reduced diameter of cylinders and bulk of boilers. With the present limited experience of the actual economy resulting from surface condensation alone, and the well-known facility with which steamship proprietors claim all improvements, and, at the same time, insist on having as big engines and boilers as ever, the author has preferred abstaining from raising hopes that may not be realised for many years.

III. *The alleged tendency to corrosion.*—This is undoubtedly the most serious charge that can be brought against the system of surface condensation; and, if proved to any serious extent, will render its success exceedingly doubtful. That there is an element of truth in this most serious objection to the fresh-water system experience has proved. Cases have occurred—both in America and in this country—where boilers supplied with water from surface condensers have corroded much more rapidly than boilers working with salt-water. In making this admission, however, the advocates of surface condensation are fully aware that this corrosion has not occurred in all cases; and not only so, it is also believed that, with the present knowledge on the subject, such corrosion might have been prevented. In the cases of corrosion that have come under the personal observation of the writer its appearance has been that of a honey-combed action on the plates and tubes, of some deleterious substance held in solution by the water, and deposited in showers. These circumstances have chiefly given rise to the opinion that portions of the metal from the condenser tubes, and steam and feed-pipes, have been carried into the boilers, and gradually accumulated in sufficient quantities to act on the iron plates and tubes of the boilers. But as the galvanic or chemical action between copper and wrought iron is generally due to the presence of salt in the water, and as no serious injury arises from the presence of brass tubes in boilers, there is some difficulty in thus accounting for the corrosion, more especially as it has been found most severe when the water has been the purest. There is much difficulty in explaining the true cause of the corrosion, but the causes alleged will be stated, with a few remarks on each, and any experience of the author's that bears on the subject. All those who are interested in the success of surface condensation are appealed to to contribute their experience on this most important question. If there exists an evil that cannot be remedied, let it be known as such. The true spirit of engineering seeks to benefit mankind, and not to perpetuate a system that is no improvement on its predecessor.

There are two principal causes alleged as producing corrosion in distilled water boilers:—

1. A softening effect of pure soft water, without any mineral hardness in it.

In support of this view cases have repeatedly occurred where wrought iron boilers fed with soft land water have been destroyed in six months. Cases have occurred in the neighbourhood of Newcastle-on-Tyne. The only remedy for this would be chemically to counteract this injurious action, or at sea to mix with the pure water a portion of sea water.

2. Chemical or galvanic action from the presence of copper in the boiler, conveyed there in the water or grease from the steam and feed-pipes and condenser tubes.

From careful observation the author has formed his own opinion on the cause of corrosion, and is regulating his practice in accordance with it. He thinks that, although in some cases the excessive purity of water may be hurtful, the chief cause of corrosion is the want of change in the water, thus allowing of an accumulation of particles of copper from the condenser tubes, and chiefly from the steam and feed pipes, until the solution is sufficiently strong to affect the iron. The mixture of a small portion of salt water, sufficient to produce a gradual change of water, has been found to prevent any serious corrosion, as well as to check it when it has commenced.

* From the Transactions of the Institution.

No appreciable loss of economy of fuel will be caused by this plan, and it relieves the engineer from any necessity of supplying the waste of pure water occurring in surface condensation, by a reserve on board. It may also be found desirable to tin the steam side of the condensing surface, as well as to substitute iron for copper steam and feed-pipes.

Having thus glanced at the gloomy side of this barrier to the general adoption of surface condensation, the inquiry is made whether any boilers have met a violent death, or been consumed in say from twelve to eighteen months, or even two years? To this inquiry we may cheerfully and decidedly reply in the negative. In America, it is said, some boilers have died very young from surface condensation; but as the informants have not supplied date of birth or death, symptoms of illness, or appearance of the body after death, nor given us the results of any *post mortem* examination, we shall act wisely in waiting for more accurate information. In England present experience in boilers fed with water from surface condensers is very limited and short-lived. Speaking generally, there is no authenticated case of a boiler worked with distilled water that has suffered more, permanently, from corrosion than boilers fed with sea water, while there are instances of their suffering much less from corrosion than salt water boilers.

As stated previously, a small steamer was fitted with a new boiler and a surface condenser in August, 1857, and the following is a correct report of the state of this boiler at Christmas just past:—

Newhaven, Sussex, 18th January, 1862.

I. S. steamer Alar, 50-horse power, fitted with a new boiler and Spencer's surface condenser in August, 1857. Distance steamed to this date, 100,000 knots; steam pressure, 40 lb.; waste made up with sea water.

Condition of boiler examined this day by the undersigned:—

External cylindrical shell in sound and efficient condition externally and internally.

Furnaces, externally and internally in good condition, and apparently equal to new.

Flame chamber, top sides and back in good condition, and no signs of wasting. A small patch, 8in. by 3in., wanting at bottom, where plate is thinned by a leaky rivet.

Tube plates, sound and in good condition; quite equal to that of the external shell.

Tubes, 148 iron tubes 3¼in. in diameter; not feruled: 8 tubes have been renewed, and the remainder will require renewal this year.

Stays,—The long shell stays, angle iron, &c., as far as can be seen do not require renewal, many of them being in a perfect condition. The two upper rows of screwed stays at the back of the flame-box were renewed in April, 1861. A few of the screwed stays in furnace water-spaces are wasted, and require renewal; but it is believed the waste has been caused chiefly, if not entirely, by the wash of the water and grit when the ship rolls. The remainder of the screwed stays are in good condition.

Uptake.—As far as can be ascertained the plates and rivets are in good condition, and not wasted.

(Signed) Edward Fowler, Superintendent.
J. Johnson, Chief Engineer.

The following is a report on the condition of a 100-horse power boiler attached to a pair of the author's surface condensing marine engines. The boiler has been twelve months working:—

Boiler.—Apparently as good as new. There was a very thin scale of salt on the furnace crowns and tubes. The flat part of uptake was covered with a deposit of tallow and mud to the thickness of 2in. The uptake does not appear to have suffered any damage by the deposit thereon. A few of the top stays are a little corroded. That I consider is due to the wash.

(Signed) William Dixon, Manager to Messrs. R. and W. Hawthorn.

December 26, 1861.

To these reports is added a third of four London-made boilers working with injection condensers, and having steam up on an average of seven hours a day for four days in each week.

Report on the condition of four boilers started at Christmas, 1856—25 lb. steam, and distance run under steam 65,000 knots:—

Newhaven, January, 1862.

Uptakes renewed in the autumn of 1859; also the stays and angle irons at uptake end; top shell of boilers partly replated.

Christmas, 1861.—Uptakes thickened with ¼in. plate, new angle iron, and stay ends at uptake; new bottoms to shell; several patches in furnace crowns; 250 screwed stays renewed in each boiler; 240 brass tubes to be taken out of each boiler to scale the tube plates and tubes; these tubes pierced up and replaced.

(Signed) Edward Fowler, Superintendent.

These reports are trustworthy, and are not in any way "got up" to support surface condensation. Two of the Alar's tubes are produced for the inspection of the members.

One conclusion is certain, that while there is no occasion for alarm on this subject of corrosion, practical men cannot be expected to endorse many of the extreme statements published in favour of surface condensation; such as these—that land boilers last seven times as long as marine, and that boilers worked with distilled water last three times as long as those working with salt water. Such statements only retard the progress all so earnestly wish for. Even supposing that boilers supplied with water from surface condensers only last the same time as those fed from injection condensers, the advantages of the surface-condensing system are overpowering.

IV. *The disadvantage of complication*.—On this head little can be said. It is a decided disadvantage, although practically it will be found of little importance when compared with the credit side of the account. The introduction of the multitubular boiler was objectionable on the same grounds; but, nevertheless, it has been found that the advantages greatly predominate.

V. *The increased liability to leakage in the condenser*.—This disadvantage is one that can only be rightly valued from a more extended experience. If, after a number of years, it is found that surface condensers are as tight as when new, the disadvantage arising from a multiplicity of joints is only imaginary. At present it may be conceded as a practical objection. There is much reason to believe that a surface condenser, made and jointed on a correct principle, will become less liable to leak as it gets older. In the opinion of the author, facilities for examination and repair, together with extreme simplicity and fewness of joints, are the desiderata for all surface condensers. Practical experience will correct many of the mistakes in the plans of surface condensers now being made, and theoretical perfection must be made to give place to practical simplicity. In saying this the author does not for one moment presume to intimate that he has solved the problem; on the contrary his experience leads him to seek rather than to offer advice.

It is now proposed to consider the economical advantages and disadvantages of surface condensation.

Economical Advantages.

1. *The saving of the fuel wasted in blowing out a sufficient quantity of heated water and steam to avoid unsafe deposit.*

The amount of this saving in actual practice ranges from 15 to 25 per cent., and is an advantage in sea-going steamships that cannot be disputed: nor has it, in fact, ever seriously been so. That the amount of this saving cannot be correctly estimated by calculation is undoubted; and the author, from much consideration and observation, is confirmed in his opinion previously expressed to this institution, that in blowing out from, or just under the surface of the water in the boiler (the usual practice), much additional waste of heat occurs from the mixture of the steam and its latent heat with the water that is discharged by the scum-pipe.

2. *The introduction of high-pressure steam, and consequently the conomy resulting from increased expansion.*

It is impossible at present to say to what extent the introduction of surface condensation will immediately affect the increase of the working pressure. In all probability no general move will be made in this direction until it is ascertained what reliance can be placed on the durability of the boilers worked with fresh or distilled water. Those engineers who have so perseveringly striven to introduce high-pressure steam, with its attendant economy, deserve the best wishes of all who are earnest in steam engine improvement; and it is matter of sincere congratulation that they will now have the powerful aid of surface condensation. Their success, or rather the success of the system they advocate, is only a question of time.

3. *The saving of labour in cleaning boilers, as well as the saving of repairs and renewals.*

Of the saving of labour in cleaning boilers supplied from surface condensers there can be no doubt. The saving in repairs and renewals can only be credited when experience has proved its value.

4. *The saving of fuel arising from keeping the boilers free from any thick scale or incrustation.*

It is well known with ordinary injection engines the supply of steam gradually lessens each year, whilst a larger amount of fuel is consumed to obtain the diminished supply. This waste and loss is entirely obviated with surface condensation, as the amount of scale formed, with a considerable mixture of salt water, is quite insufficient to cause any appreciable loss of steam or waste of coal.

These four enumerated sources of economy in surface condensation are the most prominent and evident among many other incidental ones. Their exact monetary value cannot be given.

It remains now only specifically to allude to those disadvantages of surface condensation that tend to increase the cost of steam power.

1. *An increased first cost of machinery varying from 10 to 20 per cent.*

It has been asserted that the same amount of power will cost less with surface condensers than with the ordinary system, and for the reason that half the boiler power can be saved; and this statement is further supported by reference to a steamer in which it is said the same duty is realised from half the usual boiler power. The writer of that statement is most decidedly deceiving himself. Steam engines fitted with surface condensers cannot be made for the same money as those fitted with injection condensers. The average saving in steam or heat by surface condensation cannot be fairly taken at more than 20 per cent. or one-fifth, and it follows, therefore, that only one-fifth of the boiler power can be saved, and this amount of saving will only represent one-third or one-half of the extra cost of the surface condensers. That steam engines fitted with surface condensers and other improvements in machinery and boilers tending to economy of fuel may ultimately be profitably made, per indicated horse-power, at a price as low as, or even lower than that now charged, is not only possible, but highly probable.

At the same time every steam engineer is aware there are circumstances connected with the introduction of improvements for economising fuel that tend to increase the first cost of steam power, the user, nevertheless, receiving a larger return on his outlay by the reduced consumption of fuel.

2. *The increased cost of repairs to the additional machinery and the condenser.*

This increased cost will be slight, and is not worthy of serious consideration.

Having thus briefly stated the advantages and disadvantages, mechanical and economical, incidental to the adoption of surface condensation, it only remains to touch on one or two points that have escaped notice, and then, in conclusion, to sum up the whole.

How much surface is required per indicated horse-power is a question often asked, and the merits of various plans of condensers are decided by the amount of surface each requires per indicated horse-power, without any regard to the degree of expansion or the mode of using the steam. It is quite useless to compare the surfaces of a condenser receiving steam expanded fourteen or sixteen times with that of one where the steam is expanded twice or thrice; and, for the same reason, the bulk or space occupied by condensers cannot be compared without making due allowance for the mode of working the engines. For instance, with steam expanded ten times, one-third less condensing surface (about) should be required per indicated horse-power than when expanding once. The duty of the condenser is to be decided only by the weight of steam condensed per interval of time.

Furthermore, as the efficiency of a surface condenser bears a proportion to the difference of temperatures of the condensing and condensed water, in all cases more water is required to condense an equal weight of steam by surface than by injection. In a surface condenser, if a small surface is used, the discharging temperature of the condensing water must be low and the quantity large. With a large surface the reverse will be the case. But, practically, it is impossible to assimilate the temperatures of the discharged condensing water and that of the condensed steam, as is the case in an injection condenser.

In summing up it will be stated what condensing surface the author has found effective in cases where the steam is cut off at one-third, equivalent to expanding twice, and where either steam jackets or superheaters are adopted.

A sheet of indicator diagrams has been taken at sea by the author, from the air and cold water pumps of three different pairs of engines fitted with surface condensers.

The conclusions intended to be drawn from the preceding observations are—

1. That a positive and decided saving of fuel, varying from 15 to 25 per cent., may in all cases be realised by the substitution of surface for injection condensers in sea-going steamers.

2. That in all cases where water is foul or impure, and can be obtained in sufficient quantity, surface condensers ought to be adopted.

3. That present experience does not warrant the durability of boilers, worked with surface condensers, to exceed that of those fed with salt or impure water by more than 50 per cent.

4. That all serious corrosive action in boilers worked with surface condensers can be prevented by a gradual but sufficient change of water without seriously affecting the saving of fuel.

5. That at present surface condensers add from 10 to 20 per cent. to the first cost of marine steam engines.

6. That one-half the capacity of air-pump is sufficient to obtain any given vacuum when surface condensers are substituted for injection condensers.

7. That with an expansion of twice and superheated steam or steam jackets, one-half the boiler surface is ample for the condensing surface.

8. That in all cases a larger amount of condensing water is required for surface than for injection condensers.

9. That when surface condensers are adopted the boiler power may be safely reduced one-fifth, without any loss of indicated power.

The president said this was a most important paper, and which at this late hour of the evening they could not discuss. He had no doubt that it would call forth a good deal of discussion; and if Mr. Spencer could possibly be present on the 5th of March he would suggest that the discussion be postponed to that day.

Mr. Spencer replied that he knew of nothing at present to prevent his attendance at the time stated. He then showed a piece of baked tallow, which had been found on the top of the piston of a pair of engines that had worked about a year, as an illustration of the "care" sometimes taken to do justice to the machinery turned out by engineers. The whole of the space at the top and bottom of the cylinder was choked up, and the covers had not been off the cylinders for many months. He considered no one could say that such a state of things gave any engineer a fair chance. He then read the following report on the matter:—

Report on the state of the engines and boiler of the iron screw-steamer Sentinel, started January, 1861; steamed to present date about 30,000 knots:—

Cylinders.—The wearing part of fore-engine cylinder was covered with a thick coating of baked tallow; the after cylinder with a scale of rust; the clearance or space at top and bottom was entirely filled up with a mixture of baked tallow and mud.

Pistons.—Packing rings set quite fast, and by appearance to have been so for some months past.

Condenser.—In good working order, the small tubes having a slight coating of tallow adhering to them; was tested with steam to a pressure of 16 lb. to the square inch, and found quite tight.

Boiler.—Apparently as good as new; there was a very thin scale of salt on the furnace crowns and tubes; the flat part of uptake was covered with a deposit of tallow and mud to the thickness of 2in.; the uptake does not appear to have suffered any damage by the deposit thereon; a few of the top stays are a little corroded; that, I consider, is due to the wash.

Remarks.—From the state of the engines it is evident that the cylinder covers had not been lifted for eight or nine months, and generally the working parts and bearings had been very much neglected.

(Signed) William Dixon, Manager to Messrs. R. and W. Hawthorn.

Newcastle-on-Tyne, 26th December, 1861.

The president said that he was sure they were all very much indebted to Mr. Spencer for having read this very interesting paper this evening, and that they would give him their hearty thanks.

The vote was unanimously agreed to.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

Thursday, February 27, 1862.

Mr. Francis Campin, President, in the Chair.

ON THE SUPPLY OF POWER FOR ACTING PRIME MOVERS.

By Mr. A. F. Yarrow.

The author stated that all, of course, were aware of the enormous number of factories, of one class or another, that are situated in or near the principal towns and cities in this country; it is also evident that their numbers are rapidly increasing, either large or small, some requiring a large amount of power, and others a comparatively small amount. It is to this latter class that our attention must now be devoted, and under this head must be included all those branches of industry where a supply of power is essential. It is well known that, in obtaining motive power from a steam engine, a much greater economy is resulting from the use of large engines than from small; therefore it remains for us to determine what is the most suitable and advantageous means of transmitting the power of a large and economical engine, and distributing it in small quantities and at a comparatively small cost. To convey it by means of shafting might at first sight appear feasible, for it is rendered very efficient in cases where the motive power is not far from the machinery to be driven, as is the case where factories and workshops are situated in the immediate vicinity of one another; but upon a little consideration it becomes evident that friction, repairs, original outlay, difficulty of estimating the amount, power consumed, and various other minor details, are sufficient to prevent this system from being extensively carried out. It now appears that there is but one other means of effecting the object, viz., by transmitting the power through some fluid or gaseous medium. If a gaseous medium be employed air presents itself as the most suitable; and, if a fluid or liquid medium be used, water is the only substance that is applicable. A few words respecting the employment of air: in order to carry this out an engine fitted with a powerful air compressing pump must be provided at one end, and at the various points where the power has to be distributed air pressure engines must be placed, in which it may be allowed to expand to nearly its original bulk.

The author then proceeded more fully to illustrate this arrangement by quoting, as an example, the method adopted to obtain power at the bottom of a coal pit, where a steam engine would have been inadmissable; it was found that great heat was generated on the compression of the air in the one engine at the top of the pit, and that extreme cold was the result of its expansion in the other at the bottom; the former difficulty was, however, overcome by water being kept on the valve faces of the pumps, which absorbed the heat to a considerable extent, passing off in the form of steam, but the cold was so great in the lower engine that it was sometimes stopped by the formation of ice in the cylinder and exhaust-pipe.

The author then passed on to describe several varieties of water-pressure machinery, in order the better to judge of their relative efficiencies, and compare the merits of the two systems. The perfection to which this class of machinery has arrived appears to be due to the improvements carried out by Sir William Armstrong, the principal one consisting in the adoption of the "accumulator," which is to act as a reservoir, giving pressure by load instead of by elevation, and its use, like every provision of the kind, is to equalise the duty of the engine in cases where the quantity of power to be supplied is subject to great and sudden fluctuations. The author went on to say that its introduction, in 1851, by affording a continuous and uniform pressure of greatly increased intensity, has removed many of the obstacles to the extension of the water-pressure system, which has since been so rapidly introduced for giving motion to a variety of machines, in fact, new forms of application are constantly being developed, and no doubt can be entertained of its capability for further extension. Several water pressure engines were then briefly described, particular attention being drawn to one at the Chelsea Waterworks at Kingston. The object of this engine is to drive at any time when required a few lathes, forge-bellows, and several other tools which are placed in adjoining sheds: as there was a head of 210ft. this was deemed the best means for obtaining the required power. The engine consists of a single cylinder having a 4¼in. bore and 10in. stroke, working frequently up to seventy-five revolutions per minute. The cylinder is fitted up as an ordinary steam engine, and acts upon an over-head crank by means of a piston, piston-rod, and connecting-rod, in the usual manner, and is found to work with great ease and regularity. The relative advantages in the adoption of air and water for carrying out the object in view were then reviewed as follow:—There are certain characteristic properties that air possesses, due to its being a fluid. I refer, in particular, to the compressibility and elasticity of air; and, for all practical purposes, to the incompressibility and consequent non-elasticity of water. It is to these properties that we must look for the resulting differences in carrying out the two systems, and the particular difficulties to be contended against in each. It is a well-known and established fact that air and other gases, upon being compressed, render some portion of the heat they contain sensible; and, on the other hand, that heat must be absorbed in order to effect its perfect expansion. These two facts, it will be remembered, were distinctly referred to in the description of the air engine; and were found in practice to be of considerable importance, especially the latter one, as experience showed that, in carrying expansion to anything like an economical extent, the formation of ice was sometimes so great as to stop its action. This engine was worked at only 20 lb. per square inch, and, consequently, the expansion caused could not have been very great. Thus we see that, practically, the working pressure of the air ought not to exceed 30 lb.; for, as the pressure increases, the difficulties arising from the changes of temperature likewise increase

There is also another objection to the employment of air, owing to this property that we have just mentioned, viz., that it causes a great loss of power, although, according to Marriotte's law, the elastic force of a gas is in the same ratio as its density; it is only so, presuming that it is kept at a uniform temperature, consequently a greater resistance has to be overcome in the compression than according to that law would have been rendered necessary; also in

the expansion in the other cylinder the effect produced is not so great as would be due to its density, on account of its reduced elasticity caused by the decreased temperature.

The author next proceeded to consider some points in which other material differences in the working of the two systems exist. In the compressing cylinder, as the piston descends, the compression of the air is gradual, or, in other words, it requires a mechanical effect to compress it exactly equivalent to that caused by the expansion at the opposite end, if it were carried to its greatest extent (this is presuming the effect of temperature out of the question), which, of course, in practice would not be the case, and a consequent loss would arise. But the greatest barrier to the employment of air is the enormous dimensions necessary in the machinery required for its adoption, for it has been shown that a pressure of 30 lb. must not be exceeded, while the pressure that would be advisable if water were used would be under no circumstances less than 500 lb., consequently the relative sizes required to produce equal effects would be in the proportion of 30 to 500, that is to say, the capacity of the air engines would have to be seventeen times that of the water ones; this is supposing that there were no expansion, which would further tend to greatly increase the dimensions.

Feeling confident that sufficient reasons are now adduced for considering water decidedly the preferable medium of the two, attention must next be turned to the best mode for rendering it as effective as possible. One of the principal objections that will always be urged against systems of water pressure engines will be the loss of power due to the friction of the water against the sides of the pipes. We will, therefore now see to what extent that really affects it. The friction of a fluid upon a solid depends upon the following laws:—1st. That it is quite independent of the hydrostatic pressure to which it is subjected. 2nd. That it is proportional to the area of the rubbing surface. 3rd. That it varies with the velocity, but not in the same ratio; for practical purposes it may be assumed to vary as the square of the velocity. Having these laws before us as a guide we will now proceed to make use of an equation which at the same time complies with them, and also is found in practice to be sufficiently correct, especially for slow speeds.

Let H = the head or fall in feet per mile.

Let D = the diameter of pipe in feet. Then $H = \frac{2{\cdot}3\ V^2}{D}$ and $\therefore D = \frac{2{\cdot}3\ V^2}{H}$.

Let V = the velocity in feet per second.

In order more clearly to explain this very simple and useful formula I will take an example. Suppose we have a pair of engines at one extremity of the pipe, working collectively up to 600-horse power, it is required to find the necessary diameter of the pipe, in order to transmit this power to varying places, averaging one mile from the engines, presuming that the pressure of water be 500 lb. per square inch, and that we do not wish to lose more than 5 per cent.

Now $D^2 \times {\cdot}7854 \times 144 =$ area of pipe in inches.

$D^2 \times {\cdot}7854 \times 144 \times 500 =$ total pressure in lbs. on area of pipe.

$\frac{33{,}000}{D^2 \times {\cdot}7854 \times 144 \times 500} =$ speed of the water in feet per minute to be equivalent to 1 H.P.

$\frac{33{,}000 \times 600}{D^2 \times {\cdot}7854 \times 144 \times 500 \times 60} =$ actual speed of water in feet per second.

$\frac{}{} = \frac{5{\cdot}84}{D^2} = V$ substituting the value of V in the equation $D = \frac{2{\cdot}3\ V^2}{H}$

$\therefore D = \frac{2{\cdot}3}{H} \times \left(\frac{5{\cdot}84}{D^2}\right)^2$. Now, as 5 per cent. of the total power may be absorbed in forcing the water through the pipes, therefore H becomes equal to 25 lb., or 55ft. of head.

Then $D = \frac{2{\cdot}3}{55} \times \left(\frac{5{\cdot}84}{D^2}\right)^2$

$= \frac{2{\cdot}3 \times 34}{55 \times D^4} \therefore D^5 = 1{\cdot}42$ and $D = 1{\cdot}09$ft.

Thus it is seen that a pipe 13in. in diameter is sufficient to convey 600-horse power an average distance of one mile, with a loss of 5 per cent.

The author then proceeded to make some brief remarks upon the suitable kinds of engines for forcing the water into the mains, and the best descriptions of water pressure engines, and then passed on to estimate the probable working expenses. He considered that the economy of the pumping engines could not be depended upon for more than 75,000,000 lb., although Cornish and others have frequently been known to considerably exceed this; now, as it has already been shown that the friction in the main can easily be reduced to 5 per cent. of the total, it is allowing a large margin if that loss be reckoned including bends at 10 per cent., then as 80 per cent. can be depended upon for representing the mechanical effect of the pressure engines, that loss will be represented at 20 per cent., making a total of 30 per cent., which renders the actual power obtained from 1 cwt. of coal equal to 53,500,000 lb. raised 1ft., or about 4 lb. of coal per horse power per hour, which is, at least, one third the consumption of the smaller class of factory engines of the present day. The author then drew attention to the necessity of having duplicate sets of mains and pipes, as in case of an accident occurring to the one the other might be full and in readiness for action, and that they should be used alternately every two or three months in order that junctions might be made, and any repairs executed; also, that in the pipes for supplying the engines near their junctions with the main there should be placed some contrivance, so that, in case of an accident occuring to one of the engines, the water should be prevented from escaping, and consequently reducing the pressure. This could be effected by means of a valve so arranged that when the flow exceeded a certain speed it should immediately close and stop the further passage of the water. It would be necessary to have an air vessel or safety valve in the proximity of this valve to prevent any injurious effects from the concussion, in case it were brought into action. The author then perminated his paper by stating that he hoped he had been able to irove that a system of water pressure engines was far from being tmpracticable, but that a steam engine could be both economically and advantageously applied to give a safe and rapid motion to a multiplicity of engines intermittent in their action and distant from one another.

A discussion followed.

FACTORIES AND FACTORY WORKERS.—A return has been made respecting the cotton, woollen, worsted, flax, hemp, jute, hosiery, and silk factories in the United Kingdom subject to the Factories' Acts. It shows a number no less than 6,578, with 36,450,028 spindles, and 490,866 power looms, and motive horse-power equal to 375,294 steam and 29,389 water. 775,534 persons are employed in these factories, 308,273 males and 467,261 females; 69,593 are children under thirteen, about half boys and half girls. Taking the cotton factories, as cotton is king, we find that in 1850 they were returned 1,932 in number, with 20,977,017 spindles, 249,627 power looms, and 82,555 motive horse-power; but the cotton factories now are 2,887 in number, with 30,387,467 spindles, 399,992 power looms, and 294,130-horse power. The people employed in the cotton factories in 1850 were but 330,924; they are now 451,569. The males under 13 have increased in this interval from 9,482 to 22,081; and the females under 13 from 5,511 to 17,707; of the workers above 13 the males have increased from 132,019 to 160,475, and the females from 183,912 to 251,306. So that in the period since 1850, according to returns laid before Parliament then and now, the motive horse-power in the cotton factories is described as having increased no less than 256 per cent., which is very much faster than the increase either in raw cotton imported or cotton goods exported; the persons employed increased only 36 per cent., but the number of those under 13 163 per cent.

THE PADDLE, THE SCREW, AND THE HYDRAULIC PROPELLER.*

By C. G. GUMPEL.

To propel a vessel through the water, the only fulcrum obtainable is the water itself. It is, however, evident that the latter cannot offer any resistance to a pressure applied to it without yielding to a certain extent, according to the amount of pressure, in relation to the quantity of water so acted upon.

Fig. 1 illustrates this fact. When the immersed float A of a paddle-wheel is at rest, the hydrostatic pressure is equal on both sides of it ($a = b$). If we now, for the purpose of propelling the vessel in the direction C B, apply the power of the steam engine on the forward side of the float in the direction D E, it is easily understood that the combined force of D E and b on the forward side will readily overcome the pressure a on the back of the paddle, as the former two (D E and b) exceed the latter (a), by the pressure applied by the engine to the float, and the water will yield, in consequence of its molecular structure, until this yielding of the water, generally called slip, has increased to such an extent as to be equal in the resistance so created to the combined pressure of engine and water in front of the float. It is, therefore, impossible to exert a pressure on the water by means of a float or screw blade, and keep the water at rest. Without slip we could exert no power; the question, therefore, arises whether and to what an extent the slip or the yielding of the water may be considered as actual loss for the purpose for which the applied power is intended. Fig. 2 will serve us to illustrate this question. Let us suppose the engine power applied to the float A under favourable circumstances, that is, no escape of steam from the safety valve, and a minimum of slip at the float A, with a maximum velocity of the vessel, and assume the rolling circle to fall at the point a, which point would give the radius of a wheel running on fine ground, and at the same time the distance which the vessel moves at each rotation of the wheel. If the float is now fixed at the point B, or on the rolling circle a, it will be evident that the engine, under equal circumstances, will exert a greater pressure on the float in the inverse ratio of the distance of A and B from the shaft, the consequence of which will be a greater slip and simultaneous diminished velocity of the vessel. But suppose even the float at B to be enlarged in proportion to the increased pressure, we will still find a certain amount of slip; and, although less than the slip of the float A, we cannot obtain the same velocity of the vessel, as the rolling circle or effective point of the float lever is laid nearer the shaft F, while in most instances the steam is found deficient in quantity. It is plain, therefore, that although we have a greater amount of slip at the float A than at B, we not only obtain a greater velocity of the vessel, but also employ the engine power in itself more profitably.

By removing the float beyond A, let us say to C, it will be understood that under equal circumstances the engine power is incapable of exerting the same pressure on the float, in consequence of which the vessel will move with a diminished speed and the engines with a diminished angular velocity, while steam blows off freely from the safety valve. By diminishing, however, the size of the float until the slip has increased to such an extent as to make the rolling circle or efficient point fall in a, we find that the vessel has obtained the same velocity. As in the case of the float A all steam is used, whilst, however, the slip of C is greater than it was in the first case.

The conclusions to be drawn from these illustrations are the following:—To the full power of the steam engine and a certain draught of the vessel corresponds a certain rolling circle, which indicates the maximum performance of the vessel. Under no circumstances whatever can this maximum efficiency be obtained if the centre of the float of a paddlewheel is placed on the rolling circle. Wherever beyond the rolling circle the floats of a paddlewheel may be placed, and however great the slip of the float, so long as the rolling circle is kept at this maximum, slip, under such circumstances (as, for instance, in a small float placed at a distance from the rolling circle, C, Fig. 3), is no loss of power, and does not lessen the efficiency of the engine. As it is, however, impossible to adjust either the size of the float or its distance from the shaft of the paddlewheel, so as to gain the greatest efficiency of engine and propeller, it is easily understood that almost in nine cases out of ten the propeller is disproportioned to the power employed and the resistance to be overcome.

The same remarks apply to the screw, which shows the results of such disproportion in a much higher degree. It is no rare occurrence to see the water over the screw in the opening of the dead wood shoot up from one to three feet whenever one of the screw blades acts near the surface of the water. But, could even the lateral and upward yielding of the water be prevented, the slip presents another feature in the screw propeller, which is illustrated by Fig. 4, in which B, C, d, may represent the mean angle which the screw blade forms with the shaft C, D, assumed in this case to be 45 deg. It will easily be seen that, as the water yields to the pressure of the screw blade, at right angles from c to e, the vessel will recede from c to d, that is, the slip of a screw in the direction in which the vessel is propelled is greater than the natural slip (at right angles to the screw blade) in proportion as the rad. is to the cos. of the mean angle which the blade forms with the screw shaft. We see herein one of the reasons why a screw has proved so inefficient when acting against increased resistance, as when towing or working against a head wind or heavy sea. Another evil, however, and the most important one connected with the screw, is the centrifugal action of the screw blade, which is the natural consequence of the lateral slip inherent in this propeller: Fig. 5 will illustrate this peculiarity. While the part c of the blade travels to b the water will yield under a minimum amount of pressure (viz., without being uplifted), in a tangential direction, whilst with an increased pressure it will yield upwardly, and so augment the evil. In Fig. 6 a screw blade of a whole turn is projected in a plane, for the purpose of illustrating the path which a particle of water travels along the blade from the point near the hub, where it enters until it leaves, which line, in consequence of the centrifugal action (which takes place even under the most favourable circumstances, only in a less degree), will be a diagonal across the blade, forming a more or less acute angle with the axis of the screw, according to the pitch of the latter. It can easily be understood from this why a long screw is not efficient, as the vacuum created at e will tend to draw the water into the space of the screw at the back edge g, and so counteract the forward pressure of the screw blade. This property of the screw propeller gives the limit for the length of a screw, while the draught of the vessel gives the limit for its diameter; and with the desire of making the screw proportionate to the comparative large engine power to secure speed, a high pitch is given to the propeller, whereby lateral slip and the consequent centrifugal action are increased, and so the engine power squandered without obtaining the desired end. We can easily explain, therefore, Mr. Fairbairn's statement that under most favourable circumstances it was impossible to obtain a higher speed on canals than seven or eight miles with steam, while with horses a speed of from fourteen to fifteen miles was obtained—from this simple fact that the screw propeller of so small a diameter as used on canals is incapable of transmitting the requisite amount of power to the water. Another fact finds its explanation in the above.

With 400 nominal horse power the Vectis made 14 knots, being 3 knots above the stipulated speed. Engines of 250 nominal horse power were placed in the vessel, when she made, with the same screw, 14½ knots. It is undoubtedly true that if this vessel had a pair of engines of 1,000-horse power the screw would have been absolutely useless. A paddle wheel in which the natural slip (rectangular to the float) is in the desired direction shows better results under increased resistance against the vessel, or increased power of the engines from the very fact just now stated that the natural slip is in the desired direction. But in this propeller we meet with another evil consequent upon increased slip, which is the concussion occasioned by the entering float on the water. For, however favourable a paddle-wheel may act by proper immersion and feathering float, this concussion not only wastes a great amount of power, but actually prevents the other immersed floats, while in the best position for propelling, to employ this advantage. A paddle board, while pressing on the water, cannot act without slip; but while the water at a (Fig. 7), will yield the water at b, will follow the float d, and instead of presenting to the following float c a body at rest, it is already in motion unfavourable for the resistance it is intended to offer. To act, therefore, efficiently, a paddle should act with an increasing velocity, or at least a constant velocity during its immersion. But every time a float, as e in Fig. 7, enters the water, the concussion re-acts upon the whole wheel, and the floats c, d, A, in the most favourable position for propelling, are prevented from using this position profitably. The most propelling power is in such cases employed by the entering float, and the only way to lessen this evil is by proportioning the floats for a minimum of slip, and the engines for a large diameter of paddle-wheel. But long paddle-floats and large paddle-wheels, that is, huge paddle-boxes, are the most cumbrous disfigurements of a vessel, increase resistance, and make the whole edifice top heavy. Another evil inherent in the paddle-wheels as a propeller is the unequal strain thrown upon the crank and paddle-shaft, when the vessel is rolling, as in such cases very often the whole power of the engine (assisted by the momentum of the emersed wheel), is thrown upon the immersed wheel, which offers, by its too deep immersion, a greater resistance than is due merely to the resistance of the vessel, and so very often occasions the fracture of paddle or crank-shaft. The paddle-wheel is also greatly influenced in its efficiency by the varying draught of the vessel—as on long voyages, when the coals burnt raise the vessel and paddle-floats out of the water. The paddle-wheel almost completely destroys the sailing capabilities of the vessel, while for the purpose of war it is completely exposed to the enemy's shot, and its management for the purpose of manœuvring the vessel is far out of reach of the vessel's commander on deck.

With the lateral slip naturally inherent in the screw propeller another evil shows itself—that, namely, of causing the back part of the vessel to vibrate, in consequence of the water, as it leaves the peripheral edge of the blade, being thrown against the dead wood. In large screws this can be, and is partially, avoided by reducing this edge, as in Griffiths' propeller, or ending the extreme edge of the blade in almost a point, as in Lowe's screw, which occasioned little vibration. In small screws, however, this reduction of the peripheral edge, and consequent diminution of surface of blade, is not admissable, as it is the only and most effective part. The immediate result of this is expressed by the *Times*, April 10th, 1860, in the following words, when speaking of five stout ships which suffered in boisterous weather during a passage from Lisbon to Spithead, that—"These formidable charges for ordinary repairs are enormously increased by a system of propulsion which is not only costly in it elf but which shakes the ships to pieces besides. Indeed, we seem to be getting from worse to worse, for the vibration of the screw is said to be more destructive than that of the paddle." Isherwood states that two or three of the gunboats in the China waters, in 1859, were constantly under repair, caused by the vibration, and the great velocity with which their screws and engines had to work to get at least a moderate speed out of the vessels. A small screw is, therefore, the most wasteful, and, consequently, most expensive mode of propulsion, and has been, undoubtedly, the greatest impediment to the application of steam on canals and shallow waters. The position of the screw in relation to the vessel is the worst that a propeller possibly can have.

A vessel with a square stern, moving at twelve miles an hour, will leave a vacuum behind, while the same vessel, having fine lines, will allow the back-water to close in with a speed considerably less than that of the vessel, and the latter will, therefore, be assisted in its onward movement by the back-water's pressure. Anything which tends to remove the back-water from behind the vessel will tend also to increase the sensible resistance in front. The screw propeller does this, of which the costly Admiralty experiments will furnish examples (experiments on the Dwarf, October, 1846, &c. &c.). A disc placed before the screw, and the latter driven ahead by the engine, will actually draw the vessel backwards by force of the greater hydrostatic pressure on the forward side of the disc to that on the hind side, where the greater part is removed by the rotating screw. This tendency the screw exerts, more or less, even with the finest modelled vessels. A new form of propeller, consisting of two paddles alternately immersed and pushed directly against the water at the stern, has undoubtedly failed, in consequence of removing the back-water's pressure from the stern of the vessel. The boat with this propeller, after two or three trials, was declared a failure, and moored, for the inspection of the curious, near Greenwich pier.

There are, besides, many minor points in which the screw is deficient and faulty. The bearings of the Great Eastern screw had worn down to so great an extent in one voyage as to require repairs, evidently caused by the great weight (the screw) being poised at the end of the shaft, which in itself, in large and small vessels, is no inconsiderable weight. The screw, from its position, is seriously influenced by the pitching of the vessel, causing an alternate racing and stopping of the engines, and often fracture of the screw blade upon re-immersion after acquiring a high velocity.

The screw blades are subject to fouling the rigging swimming about the vessel, whereby the screw is made useless—a most serious default in the dangerous moments of storms, or in action with the enemy

The screw is not altogether protected from the enemy's shot. A good heavy and well-aimed shot at the Warrior's sternpost may disable screw and rudder, and leave the noble vessel at the mercy of the enemy.

The many evils indicated as being inherent in paddle and screw will give now the necessary requirements for a propeller, the principal of which is the direction in which the propeller acts upon the water, viz., in a horizontal direction, contrary to the vessel's motion. The paddle float, acting principally when entering the water, strikes it approximately in this horizontal direction. The screw acts obliquely, and hence the great deficiencies accompanying it, which deficiencies cannot be known until improvements have shown their extent. This continuous horizontal action has generally been sought to be obtained in the application of a channel enclosing the water acted upon, whereby, at the same time, the lateral and upward yielding of the water is prevented. Screws have been encased, and horizontal floats have been employed in the channel, without effecting the desired end. In some instances water has been taken up at the bow and expelled at the stern, after having been drawn through piping the whole length of the vessel, and so unnecessary friction created, while the expulsion of the water at the stern has added its share to the failure of these kinds of propellers. By placing, however, a channel under the bottom of the vessel, avoiding unnecessary length, making the two ends of the channel adjustable, to enlarge, diminish, or entirely close the openings, and now employing suitable machinery to suck the water into the channel at one end while expelling it at the other all the evils above enumerated will be avoided.

The manner in which, however, the water is to be effectually acted upon in the channel deserves particular attention. When Ruthven's reactionary propeller was discussed in the Institution of Civil Engineers the question of rotary or centrifugal *versus* reciprocating pumps was fully elucidated.

The real nature of Ruthven's propeller was, however, overlooked in this combat, and hence the employment of piston pumps in lieu of rotary. The reacting force of effluent water was established by Newton and Bernoulli. The real efficiency of a reactionary propeller depends, however, on the continuous efflux of the water, hence the employment of centrifugal force in Ruthven's propeller, the principal evil of which becomes apparent when the nozzles are closed, as the engine and propeller will go on working, churning the water in the rotary pumps—a fact which is fully borne out by the failures of rotary pumps in the employment of lifting water to a

* Being a condensed extract from a paper on Propelling and Propellers.

great height. Any obstruction, therefore, in the discharge pipes or openings will tend to waste the power of the engine. To avoid this evil piston or reciprocating pumps must be employed. It has, however, only too often been the case that this form of pump has been accompanied by the ordinary form of valve, whereby great friction is created, and the free flow of the water through the channel is prevented.

This deficiency can be overcome by the following arrangement, as indicated in the annexed sketches:—Fig. 8 represents the connection of the channel with two pumps, showing how the vertical motion of the pistons c and D produces the desired suction and repulsion of the water at A and B, the adjustable ends of the channel. The reaction of the water drawn in and expelled from the channel produces the required pressure on the partition E (which may be compared to a fixed paddle float) for propelling the vessel. It will be evident from this diagram that, by closing the ends of the channel, the pumps cannot work, and the engine stops. It shows that any obstruction or increased resistance at the mouth of the channel will not be accompanied by the waste of power, as in Ruthven's centrifugal wheel. Should, therefore, the opening be too small for the available power, that is, steam blow off at the safety valve, the openings of the channel can easily be so adjusted as to employ the whole steam, while acting with a larger surface (that is, opening of channel). No lateral slip can ensue, nor can the water yield upwardly, which it does with the paddle float or screw blade, as the opening of the channel is under the vessel. The fact that closing the ends of the channel will stop the engine is ample proof that the expulsion of water by means of this propeller is equal to pressing a rigid body against the fluid, in fact is superior, as a float or screw blade allows the water to disperse at the edges laterally and upward while the enclosed channel prevents as it guides the fluid in the proper direction to serve for the propulsion of the vessel. In a screw vessel it is often an absolute impossibility to employ a screw propeller sufficiently large to transmit the whole power of the engines to the water. A canal boat of 2ft. 6in. or 3ft. draught would be able to carry an engine of 60 or 70-horse power, but a screw for such a boat of 3ft. or even 3ft. 6in. diameter is positively useless for such a power. It is quite different with the proposed improved propeller, which is not limited by the draught of the vessel; and can always be constructed of sufficient size corresponding to the power of a steam engine a vessel is capable of carrying.

The manner in which the reciprocating action of the pumps is employed for acting on the water in the channel in the desired direction is illustrated by Fig. 9, showing a plan of the channel with its two ends and the two pumps placed at right angles to the longitudinal direction of the channel; whilst the partition E in Fig. 8 is made here, in Fig. 9, movable, so as to alternate the connection of one or the other pump with one or the other end of the channel. While the piston C ascends and draws the water through the front opening A the piston D descends and expels the water at the back B. When C and D arrive at the end of their stroke the movable partition E E turning round the axis F takes up a position parallel to the channel as in *g h*, so that the water can flow unobstructedly through the channels during the time the cranks of the two pistons are passing the dead points. When C, which drew in water, begins to descend, and D, which expelled water, begins to ascend, the partition E E assumes the position *k l*, so that C now expels and D sucks water into the channel.

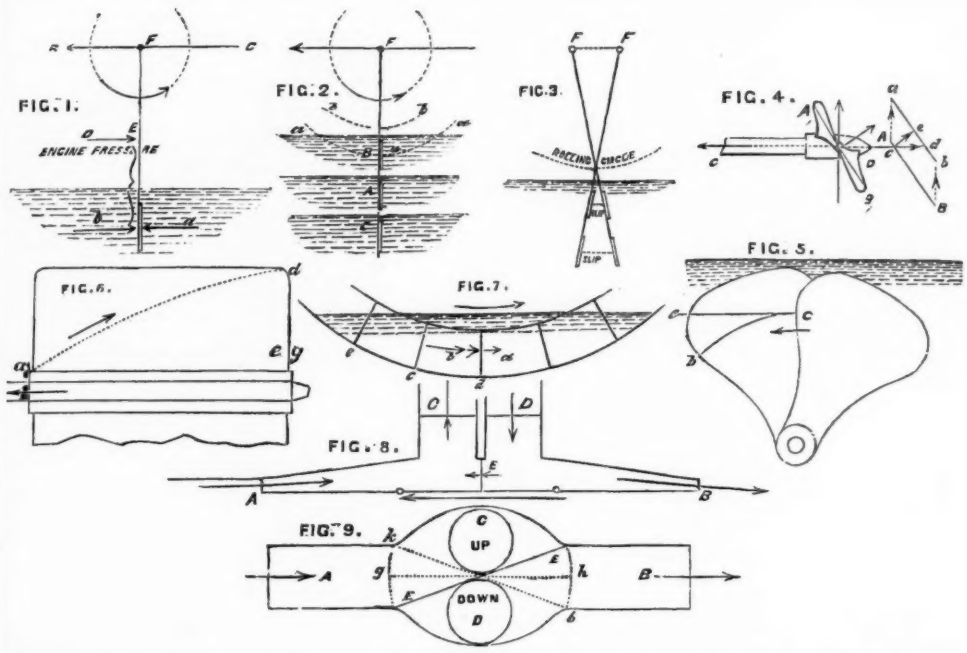
The mode by which the partition E E is actuated can be variously constructed; the simplest is a rotating drum on the crankshaft having a slit or groove so worked in its circumferential surface, whereby the desired reciprocating motion with the intervals of rest is imparted to a lever arm which gears into this groove by means of a small roller. This lever arm can be directly connected to the shaft to which the blade is fixed, or a reversing link motion can be inserted, which enables the engineer or officer to reverse the position of the partition E E, and with it change the current of water through the channel without reversing or even stopping the engine. The reversing-lever may be placed on deck so as to bring it under the control of the vessel's commander while managing the vessel. By the application of two channels, one on each side of the keel, and each supplied with a reversing lever on deck, the vessel cannot only be turned as on a pivot, but can be steered by means of these levers. In its application this propeller is principally adaptable to shallow waters, as, however small the draught, its efficiency will not be influenced. It is moreover capable of being constructed of sufficient size, so as to be proportionate to the largest engine a vessel is capable of carrying. Hence its utility in the application of steam on canals for towing long train of barges or for passenger conveyance, as this propeller can be adjusted for the varying velocities of both services. For gunboats it is of the greatest advantage, as it is neither influenced by the rolling or pitching of the vessel, nor is any part of it in any way exposed to the enemy's shot, which even the screw is to a certain extent. In gunboats above a certain size the whole can be constructed below the water line, and, whatever should project above, could be sheltered by an iron casing. No rigging floating in the water will destroy the efficiency of this propeller, while the screw is, in many instances, completely disabled by becoming entangled in the rigging. The greatest advantage, however, it offers is its capability of being efficient for a great power, so as to secure high speed, which, combined with the facility with which the commander on deck can, with his own hands, send the vessel ahead or astern with equal efficiency, steer her or turn her as on a pivot, without the least interference with the engine, and without even one word or sign of command. This propeller so applied to gunboats will, perhaps, prove more fatal to the enemy's vessels, by keeping close under their quarters, damaging rudder or rudder shaft and propeller bearings, and as quickly and nimbly turn and twist about and escape in so short a time as to make it impossible for the huge vessel of being placed in a favourable position for attacking these little fireflies. Compare the noble but cumbrous Warrior with three or four of these swift little vessels drawing only 5ft. or 6ft. of water, moving at the rate of from sixteen to seventeen miles, and carrying two huge guns, one at each end of the vessel, bringing them alternately into action by turning the vessel as on a pivot. The Warrior's stern post once severely damaged the huge vessel would soon fall a prey to the fire of these gunboats, which could so easily avoid the broadside. For coast defences they could not be surpassed, while even for distant (colonial) service they could be adapted.

The application of this propeller to river passenger steamers presents another favourable feature. Screws in such vessels as the Thames river boats are entirely out of the question, while the paddle-wheels are invariably of too small a size, and form the most cumbersome part of the vessel, besides distracting from the comfort of the passengers, and involving the tedious process of bringing a vessel to the pier with a continuous holloaing of "Go easy!" Her go astern, &c., can but remind one of the first introduction of steam for passenger boats. By applying this new propeller to a boat of about 20ft. beam (instead of 14ft. of the present boats, with an addition of about 10ft. across the paddle-boxes), a length of 130ft., and draught of about 1ft. 6in., the ends of the vessel could be formed spoon shape; the saloons extend back and front, leaving a passage all round, while saloon and passage would admit of a handsome deck to offer all possible convenience to the passengers. The commander of the vessel would have his position on the centre of the hurricane deck, with the two reversing levers near him, by means of which he could steer his vessel through the crowded navigation of the Thames without fear of bringing his paddle-boxes in collision with any pier or any other vessel; while he could, with the greatest ease, bring the vessel to when arriving at his destination.*

As no valve is employed, and the cylinders work in an upright position, no damage can be occasioned by even the muddiest water, whilst even a rigid body, which is small enough to enter the mouth

* Vide Mr. John Ferguson's paper at the Scottish Shipbuilders' Association "On River Steamers," besides the many articles in The Engineer, in which improved passenger steamers are advocated, and their introduction urged upon the attention of the public.

THE PADDLE AND THE SCREW.



of the channel, has ample room to pass freely through the latter without, in the least, damaging or even stopping the machinery. And should it be desirable even to prevent the entrance of any rigid body floating in the water, it can easily be effected by employing a grating at the ends of the channel, for which, however, there is very little need, as a body capable of doing any damage to the propeller either floats on the surface or sinks to the bottom.

The many advantages which can be claimed for this propeller, without assuming it to displace paddle-wheel or screw, are the following:—

1. Direct action, whereby lateral slip (as existing in the screw), with all accompanying evils, is avoided.
2. Deepest possible immersion.
3. All power transmitted to the water is employed for the intended purpose (as the churning or rotation of the water, with the simultaneous vibration of the vessel when propelled by a screw, as also the concussion observed in the paddle-wheel, and the uplifting of the water often into the paddle box is avoided, and is a great, and perhaps the greatest, part of the power saved).
4. Slip does not decrease the efficiency of this propeller, as it admits of adjustment (explained above).
5. By the same area of propelling surface (opening of the channel) a greater amount of power is transmitted to the water, in consequence of the combined action of sucking and pressing the fluid.
6. Rolling or pitching of the vessel does not influence this propeller in the least, whereby great safety in the steam engine is secured.
7. Its position, in relation to the vessel, is such as to allow the vessel the full advantage of fine lines for obtaining speed.
8. This propeller will admit of adjustation of the propelling surface (so as to proportion the transmission of power to the water in relation to any increased resistance against the vessel and to the available power in the prime mover).
9. Its entire management is under the control of the vessel's commander and officers, as not only the adjustation of the propelling surface, but likewise the reversion from ahead to astern, the steering, and the turning of the vessel as on a pivot, can be effected from the deck.
10. It admits of the vessel carrying full-sail rigging.
11. It offers no resistance against the water should the vessel be under sail alone (as the ends of the channels can be closed).
12. In vessels above a certain magnitude it can be placed below the water line.
13. It is out of reach of any rigging floating in the water.
14. It is easy of access, being placed inside the vessel.

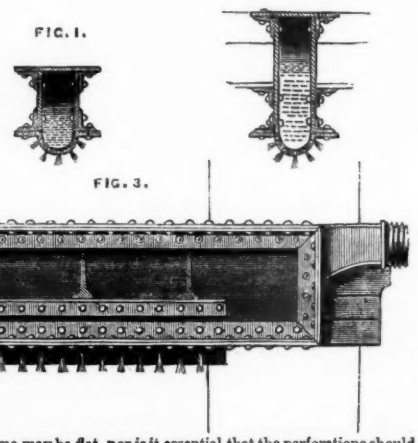
A trial of this propeller on a small scale took place on the lake in the Surrey Gardens on December 9th, 1861, of which a contemporary paper gives the following account:—

New Steamship Propeller.—A new propeller, of very ingenious construction, invented and patented by Mr. C. G. Gumpel, was exhibited and tried before a number of engineers and other scientific gentlemen, on the lake in the Surrey Gardens, on Monday. The model vessel in which the propeller was tried was of exceedingly faulty construction, long waves or undulations being created at the bows by the passage of the vessel through the water, on which account the propeller laboured under great disadvantages. Beneath the bottom of the vessel is placed a rectangular channel, expanded in the central part. Above this central part are placed two cylinders or pumps, so arranged that while one pump is drawing water the other is expelling it. There is also in the chamber a valve, which directs the water to and from the pumps, so that the water entering is drawn through the fore opening of the channel, and that, leaving, is forced through the after opening, both these openings being capable of adjustment as to area. Notwithstanding the great difficulties attending the trial, due to the bad form of the boat and insufficiency of boiler power, the propeller proved eminently successful, the water in the wake of the vessel remaining almost undisturbed.

HOOD'S BEAMS AND GIRDERS.

This invention, by William Hood, of Reading, has for its object improvements in beams and girders, and in applying the same in buildings For these purposes hollow iron beams or girders are constructed in such manner that they may be rendered suitable for conveying water into and distributing it in the buildings where such beams or girders are used. Girders so constructed and employed will also, by reason of their having water supplied to them, be prevented getting red hot, in case of fire, which would render them weak and unequal to sustain the weights thereon. The hollow beams or girders are made of iron, and suitable angle iron, as common heretofore; and they are also closed at their ends or other parts, as well as at their sides, and are suitably formed to admit of their being connected to supply pipes leading to water mains or other sources of supply; they are also made with suitable perforations for distributing the water supplied to them into the rooms or parts of buildings where such beams or girders are situated, by which means such beams and girders will not only be the means of conveying water to extinguish a fire in the locality where they are situated, but will at the same time be prevented from becoming highly heated, by reason of the passage of water through them, and will thus be caused to retain the requisite strength for upholding the weights thereon.

Figs 1 and 2 show two sections of hollow wrought iron girders or beams composed of plates of iron and angle iron rivetted together; Fig. 3 shows part of a side view of Fig. 2, near its end, where a screw or other suitable junction is applied to the closed end of the girder, in order that the girder or beam may be connected to a cistern or other suitable source of supply of water. In the two sections of girders shown the bottom surfaces or plates are of a bent or curved form, and this part in each is perforated with numerous small holes, so that when a supply of water is admitted and kept up to the interior of the beam or girder numerous streams of water will descend from the beam or girder. It is not, however, essential that the lower plate of which a girder is constructed should be curved,



as the same may be flat, nor is it essential that the perforations should be at the bottom, as in some cases provision may be made for retaining a quantity of water at the bottom of a girder or beam, in which case the holes or perforations will be at the sides of the girder or beam so that no escape of water will take place till a greater supply of water is forced or allowed to flow into the girder or beam.

Failure of a Sanitary Enterprise. — The Rugby Board of Health is seriously embarrassed by the discovery that the plan which it has pursued for four years, and upon which it has spent £4,000, for supplying the town with water, has irremediably failed. The increasing population of the town has for a long time made the scanty supply of water at present obtainable a growing inconvenience, and Mr. Hawkesley was called in to advise the board. That gentleman, after informing himself of the facts, gave his decided opinion that the river Avon was the only feasible source from which an adequate supply could be obtained. But the opposition of the neighbouring owners of water mills and other difficulties, on the one hand, and the narrowness of the powers at their command on the other, determined the board to look elsewhere for the desired supply. In an evil hour Mr. Hawkesley was induced to suggest that relief from their difficulties might be found by boring down to the water-bearing strata of the new red sandstone. The boring has reached the water-bearing strata of this formation, but it has also reached a deposit of rock-salt, the existence of which was wholly unsuspected, and the salt dissolving in the water brought up by the bore-hole communicates to it a degree of brackish salinity which renders it totally unfit for food, as well as for all ordinary domestic purposes. From an analysis of samples which have been successively taken it appears that the salinity has steadily increased, until in the last specimen there were found 1,256 grains of saline matter in the gallon of water. Of these 777 grains consisted of chloride of sodium, or common salt, the remaining constituents being principally sulphate of soda, or Glauber's salt, and sulphate of magnesia, or Epsom salt, with a small proportion of carbonate of lime and traces of bromine, iodine, and lithium. Further boring into the salt bed would probably increase the saltness of the water to the degree which would make it available as a brine spring for salt works; or, if the boring were continued to the next subjacent formation—the permian—it is not improbable that abundance of good water would be found, but this stratum lies many hundred feet below the bottom of the bore-hole, and could only be reached by the adoption of a costly apparatus and the expenditure of a considerable amount of time and money. For the water which they so much need the Rugbians must now look elsewhere, probably to the Avon, to which they must, we should think, have a better right than the millowners. As for the money expended, it is probably lost beyond recovery, unless some one will buy the site and continue the boring to that point at which the water would become a brine spring, serviceable for salt works, or, perhaps, a spa might be instituted on the spot, as Dr. Odling has reported that the water "would doubtless prove an efficient saline purgative, and the small quantities of bromine, iodine, and lithium would enhance its therapeutic qualities."—*Daily News.*

AMOS AND FRANCIS' MACHINERY FOR DRESSING SLATES.

FIG. 1.

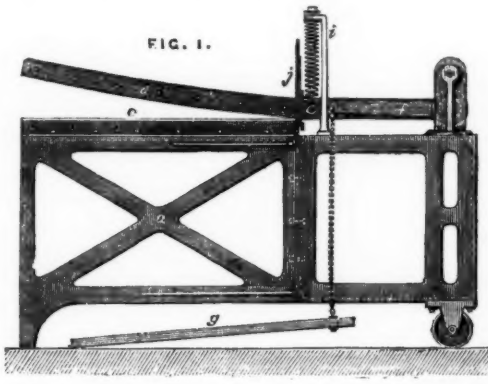


FIG. 3.

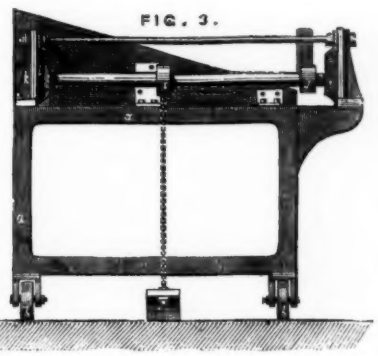


FIG. 2.

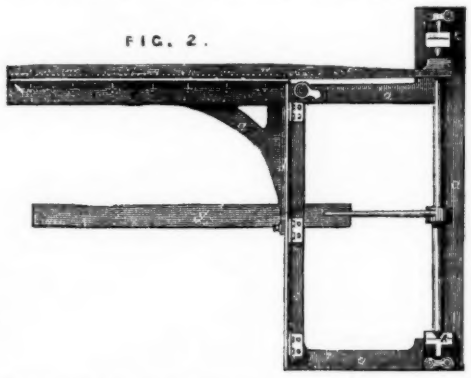
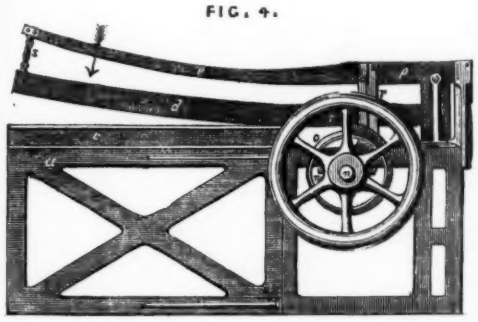


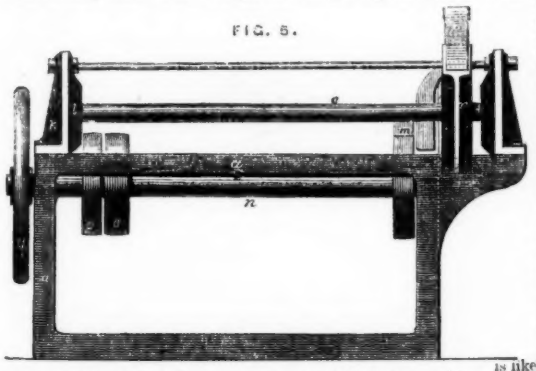
FIG. 4.



THIS invention, by Charles Edwards Amos, of The Grove, Southwark, and John Francis, of Penrhynn, North Wales, relates to an arrangement of machinery, whereby roofing slates may be cut, trimmed, or dressed to the different sizes used for building purposes.

The machine consists of a rectangular frame, which may, if necessary, be mounted on wheels for the convenience of transporting or removing the machine from one locality to another. This frame is provided with a fixed knife, and also suitable bearings for a lever or "sword arm," which carries a movable knife. The "sword arm" or lever is suspended by a spring or springs, so that when in a normal position the movable cutting edge is raised above the lower knife edge, and the two edges resemble a pair of open "shears," and act in the same manner. A treadle frame is attached by means of a link to a lever, which is upon the same spindle as the "sword arm," and the knife edges are brought together by the

FIG. 5.



pressure of the foot of the workman; or, if desired, the machine may be worked by mechanical power by applying power to the treadle lever, or the treadle lever may be dispensed with and the power may be applied direct to the "sword arm." The spindle of the sword arm is made adjustable to compensate for wear in the cutting edge and other working parts, and a gauge plate with suitable marks or points corresponding to the different recognised sizes of roofing slates is placed on the framework, so that the rough slates may be laid in their proper places and adjusted with facility. If desired, a double set of shears or cutting edges may be employed, so that two sides of the slate may be cut, trimmed, or dressed at the same time, but this will not be found a convenient arrangement in practice.

In the illustration, *a*, *a*, *a*, is the framework of the machine, which is supported at one end on wheels or rollers *b*, *b*, for the convenience of transporting the machine from place to place; *c* is a fixed cutting edge, made of steel or other hard metal, and secured to a cast-iron cheek or back plate, which is fixed on the top framing of the machine by screw bolts and nuts, so that it may be adjusted at pleasure; *d* is a knife, or movable steel cutter or shear, secured by bolts or screws to the vibrating sword arm d^1, which is mounted at its inner end on the horizontal shaft *e*. A horizontal lever or arm *f* is also mounted on the shaft *e*, and is provided at its outer end with an eye, into which is hooked a rod, rope, or chain, whereby the lever or arm *f* is connected with the treadle or foot lever *g* below. In order to support the sword arm and movable cutting edge in an elevated position, as shown at Fig. 1 (so as to be ready to operate upon a slate when it is brought up to the shears), a coiled spring *h* is attached by one end to the arm d^1, and by the other is suspended from the upper end of a bracket *i*, which is fixed on the top of the framing; a vertical gauge plate *j* is secured in a proper position on the framing by screw bolts or otherwise, and it must be so adjusted as to be exactly at right angles to the shears. The operation of the machine is as follows:—The workman takes in his hand a slate that requires to be dressed, and having presented one edge to the shears he places his foot on the treadle *g*, and brings down the lever *f* and sword arm d^1, and thus cuts and dresses one side of the slate. The dressed side is then placed against the vertical gauge plate *j*, and a fresh undressed side is presented to the shears, which by the workmen depressing the treadle *g* are made to trim this side also. The third and fourth sides of the slate are presented to the shears in like manner and are properly trimmed, their edges being cut at right angles to each other and to the proper size, which is done by bringing up the slate to certain marks on the gauge plate *j*. The stationary cutting edge *c* is adjustable vertically, as shown in Figs. 1 and 2, to compensate for wear; and in order to adjust the cutting edge of the upper or movable blade *d* the bearings of the shaft *e* are made adjustable, as shown in Fig. 3. The ends of this shaft are supported in the blocks *k*, *k*, which rest on thin pieces of wood, metal, cardboard, or other substance *l*, and by altering the position or thickness of this packing the shaft *e* may be raised or lowered bodily, as may be required.

Fig. 4 is a side elevation, and Fig. 5 an end view of another machine which is a modification of the one just described. In this instance the treadle is dispensed with, and the movable cutting shear is operated through the intervention of a cam *m* on the main driving shaft *n*, which is driven by a band passed round the pulleys *o*, *o*, and at one end carries a fly wheel *q*. Instead of employing a spring to support the sword arm d^1, and keep it elevated when in a quiescent state, as in Figs. 1, 2, and 3, a strong wooden spring or sword *p* is secured in standards *r*, *r*, above the sword arm d^1, to which it is connected at its outer end by the jointed links *s*; and the tendency of this spring sword is to force down the arm d^1 in the direction of the arrow. The normal or quiescent state of the shears in this arrangement of the cutting edges is therefore to be closed or shut like a pair of scissors; and in order to open them for the purpose of inserting the rough side of a slate to be trimmed the driving shaft *n* must be set in motion, and the cam *m*, by bearing against and lifting a pin *t* fixed in one side of the sword arm d^1, will raise the same and open the shears, so as to admit of a slate being placed between the cutting edges; but immediately the highest point of the cam passes from under the pin *t* the arm d^1 will be forced down by the elasticity and power of the wooden spring sword *p*, and will cut or trim the edge of the slate. It will be seen that the axle *e* of the sword arm d^1 is mounted in adjustable blocks *k*, *k*, as in the former instance, and the bearings of the main or cam shaft *n* are also adjustable vertically. It will be seen that the machine, shown at Figs. 4 and 5, is not provided with wheels *b*, *b*, to facilitate its removal from place to place, as the machine, when driven by mechanical power, is supposed and intended to be stationary; but, if desired, this machine may also be provided with wheels, the same as the smaller machine. The extreme simplicity of this machine is likely to bring it into extensive use in slate quarries.

JOHNSON AND HOCKIN'S MODE OF SECURING NUTS FOR RAILWAY FISH PLATES.

THIS invention, by Frederick Johnson and B. Hockin, of North-street, Smith's-square, Westminster, relates to fastening the nuts of bolts.

Figs. 1, 2, and 3 represent side and end elevations and plan of a bolt and nut, showing a method of securing the nut on the bolt by means of a wedge, which is slotted to receive a split cotter, as shown.

Figs. 4, 5, and 6 are also side and end elevations and plan of a bolt and nut, showing another method of securing the nut, more particularly adapted for marine purposes.

FIG. 1. FIG. 2. FIG. 4. FIG. 5. FIG. 7. FIG. 9. FIG. 11.

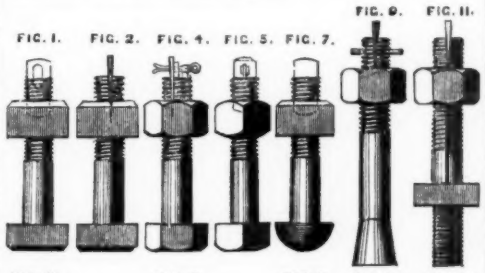


FIG. 3. FIG. 6. FIG. 8. FIG. 10. FIG. 12



Figs. 7 and 8 are elevation and plan of a bolt and nut, representing the nut secured by the wedge only, and applicable to railway fish plates.

Figs. 9 and 10 are elevation and plan of a bolt and nut with the nut secured in a similar manner to that shown in Figs. 1, 2, and 3, more particularly applicable to securing iron plates for war vessels, and for such like purposes; and Figs. 11 and 12 are also an elevation and plan of a bolt and nut applicable for stuffing boxes, steam cylinders, steam and other hammers, and such like purposes; this nut is secured by means of a wedge only, but the bolt itself has a saw cut or split extending to the collar on the bolt, as shown.

THE MANCHESTER ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

AT the last ordinary monthly meeting of the Executive Committee of this association, held at the offices, 41, Corporation-street, Manchester, on Tuesday, the 4th inst., Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the past month there have been examined 357 engines—1 specially; 490 boilers—5 specially, 9 internally, 63 thoroughly, and 413 externally; in which the following defects have been found:—Fracture, 5 (2 dangerous); corrosion, 29 (4 dangerous); safety-valves out of order, 12; water gauges ditto, 21 (5 dangerous); pressure gauges ditto, 9; feed apparatus ditto, 7; blow-off cocks ditto, 27, (1 dangerous); fusible plugs ditto, 7; furnaces out of shape, 3 (2 dangerous); total, 120 (14 dangerous). Boilers without glass water gauges, 8; without pressure gauges, 4; without blow-off cocks, 9; without back pressure valves, 42.

"No less than five boilers have exploded during the last month; in one case three working side by side being reported to have exploded simultaneouly. This, as well as one of the other explosions, was attended with loss of life. Not one of the boilers in question was under the inspection of this association.

"One of them, which had worked below ground, at the bottom of a colliery-shaft in the neighbourhood, I examined a few hours after the explosion had occurred, and found that the boiler, which had been made in 1860, was of plain cylindrical egg-ended construction, fired underneath, the diameter being 6ft., the length 20ft., the thickness of the plates ⅜in., and the working pressure not exceeding 40 lb. The boiler had given way at one of the transverse seams, and rent completely into two halves; these had not flown—as they usually do in such cases—in opposite directions with their butt ends foremost, like rockets, but one half had followed the other with the open ends facing one another. It was also remarkable that the leading half had become collapsed, and the mouth so compressed that there was barely room to crawl inside. This comportment of the parts, though peculiar, appeared to me on careful examination to be accounted for by the very confined and unyielding chamber in which the explosion had taken place, and indications of the course the parts had taken were recorded by scars upon the arched roof.

"The cause of the explosion was not at first sight very apparent; there was no reason to conclude that the pressure had been excessive, or that injury had been occasioned from shortness of water. A boiler of such dimensions, if well made and comparatively new, as this one was, would not burst even with a pressure of 100 lb. on the square inch, while a twin boiler working alongside at the time, and to which this was connected, was left uninjured, and has since been in use again. In addition to which the line of fracture was not the one that would have been taken by over pressure, and I, therefore, searched for signs of constitutional weakness at the bottom of the transverse seam, where the rent had evidently commenced. On examining this I discovered that the plate was internally grooved at the edge of the lap, just in the same way that the double-flued internally-fired boilers are so frequently found to be affected at their under side by the introduction of cold feed water. Within a few inches of this groove, just referred to (the position of which was a short distance behind the fire bridge), the feed was introduced, the feed pipe being carried down almost immediately to the bottom plate, on which the cold water thus necessarily impinged, the force of its current being increased from the fact that it was laid on from the top of the shaft, the height of which was sufficient to give it a pressure considerably in excess of that of the steam, so that in a few minutes the bottom of the boiler could be deluged with a flood of cold water. Sudden alternations of temperature in a boiler are always injurious, and it appears to me that the constant repetition of these in the present instance resulted in fracture at the bottom of the transverse seam, which instantly extended all round the boiler, and thus caused the explosion.

"From the foregoing I beg to recommend that all our members employing externally-fired boilers should introduce the feed as far from the furnace as possible, and should not allow the water to impinge directly upon the plates, but disperse it horizontally by means of an elbow delivering near the surface of the water. Under all circumstances it is conducive to the longevity, as well as to the safety of the boilers, to raise the temperature of the feed water before its admission as nearly to that of the steam as possible.

"Since writing the above a case of partial injury has occurred to one of the boilers under the inspection of this association, which is a further illustration of the mischief that arises from contraction of plates consequent on the sudden introduction of cold water. The boiler in question, which was of Cornish construction, and fired underneath, having been blown out at the end of the week, cold water was let into it, in order to save time in cooling, when a considerable leak was discovered at the bottom, and on examination one of the transverse seams was found to have cracked through the line of rivets for a considerable distance.

"In externally-fired boilers, if the water is blown out quickly after drawing the fires, it is quite possible for the plates at the bottom to be raised to a high temperature from the surrounding brickwork. It will be seen that internally-fired boilers are far less liable to this, since the temperature of the brickwork beneath them is never raised to the same extent as it is in the first flue of the externally-fired boiler; in addition to which, should a seam rent occur at the bottom of a Cornish boiler, the strain upon it is reduced, not only on account of the diminished area of steam pressure acting upon the ends, but also by the additional power of resistance afforded by the metal of the flues themselves, so that, while a seam rent in the case of the Cornish boiler results only in a leak, in that of the cylindrical externally-fired boiler it may result, as in the instance given above, in fatal explosion. I think it well that these points of comparison should be clearly brought out, since the system of external-firing is not without its strong partisans, but it must be seen from the above that a boiler internally-flued, as well as internally-fired, loses nothing by the contrast either with a boiler of plain cylindrical construction, or with others externally-fired."

RAILWAY NOTES.—Eight-wheel passenger carriages are in course of construction for the Metropolitan Railway.—The Great Western Railway Company's rolling mill at Swindon now produces from 250 to 300 tons of rails weekly. The Great Western Railway Company now have 317 broad gauge and 230 narrow gauge locomotives, or 547 in all.—The London and North-Western Company are about to expend £100,000 on additional rolling stock. The present stock of locomotives is 972, of which forty-six were received during the last half year.—The East Indian Railway Company are about ordering fifty passenger locomotives. The Trinity Chain Pier, near Edinburgh, erected many years ago by Captain Browne, and still in excellent order, is for sale for removal. It is 600ft. long, in three spans of 200ft. each.

THE STAR LIFE ASSURANCE SOCIETY.—The directors of this flourishing society presented to the share and policy holders, at the eighteenth annual meeting, held on Monday last, a very satisfactory report. During the past year 1,582 proposals were submitted for the assurance of £513,040. Of this number 1,115 have been completed, and policies issued for the sum of £361,960, yielding new premiums to the amount of £12,868 3s. 11d. per annum. The society's income amounts to upwards of £100,000. The accumulated fund has been increased during the year £53,701, and now stands at £414,231 5s. 9d. Great credit is due to the officers, and especially to the medical staff, for the careful selection of lives, for we observe that the mortality during the year has been much below that expected and provided for.

STEAM PLOUGHING.

On Monday evening, at the London Farmers' Club, Mr. James Howard, the well-known implement maker, of Bedford, read a paper, of which we give the principal portion, on the Rise and Progress of Steam Ploughing:—

Although, until a recent period, public attention had scarcely been turned to the question, steam ploughing is by no means a new subject; long before any of the names now prominently connected with it were heard of numerous patents had been taken out, a variety of schemes, more or less ingenious or practical, had been tried, thousands of pounds had been spent, and a surprising amount of inventive genius had been brought to bear upon the solution of the problem,—to what extent steam power can be rendered an economical substitute for horse power in the cultivation of the land.

As long ago as 1618 one David Ramsey and a Thomas Wildgosse obtained a patent for "Newe, apte, or compendious formes or kindes of engines or instrumentes, and other p'fitable invencons, wayes, and meanes, for the good of our Commonwealth, as well as to ploughe grounde without horses or oxen, and to enrich and make better and more fertill, as well barren peate, salte, and sea sande, as inland and upland grounde, within our Kingdomes of England and Ireland, and our Domynyon of Wales; as alsoe . . . . to make boates for the carryage of burthens and passengers runn vpon the water as swifte in calmes, and more saff in stormes, then boates full sayled in greate wynes."

This same genius, David Ramsey, took out other patent in 1630 and 1634, embracing the same objects; and from the titles of his patents it is probable that he purposed not only to plough but also to deposit manure and seed by steam power. Whatever may now be thought of steam ploughing, the wags of those days doubtless indulged in facetious remarks at the ominous fact that such an extravagant scheme as that of ploughing without horses, and by some mysterious agency, should be associated with a name so near to that of "Wildgoose."

In the same year that Ramsey took out his last patent a William Parham and others had a patent granted for "a certaine newe and readie way for the good of our Commonwealth, for the earinge and plowinge of land of what kinde soever, without the vse or helpe of horses or oxen, by meanes of an engine, by them newly invented and framed, and not formerly practized or vsed within our Kingdome of England or Domynyon of Wales, by the labour and strength of two men onlie to drive or enforce the saide engine, and of one other p'son to hould or guide the plowe or sullowe to be drawne with the same engine, whereby greate benefitt and comodytie may arise to our lovinge subiectes."

About forty years after Ramsey and Wildgosse another genius arose named Francis Moore, who took out no less than three patents, having for their object "the dispensing with animal power in tillage, navigations, &c. &c." Mr. Moore states "his machine to go without horses" is adapted not only to the traction of coaches, wagons, &c., but to ploughing, harrowing, and to every other branch of husbandry, as well as to "various branches of manufacture where draught horses are now employed." 'Tis said that Mr. Moore had such faith in his inventions that he not only sold his own horses, but by his advice many of his friends imitated his example, fearing their value would be affected by the general introduction of his machine.

About the same time, 1770, another inventor appeared, a Mr. Richard L. Edgeworth, who patented an engine with "an endless railway," almost identical with that patented by the late lamented Mr. Boydell.

I will not burden you with a description of any more of the numerous schemes of the last or the early ones of the present century, which, although perhaps amusing, would take up your time without affording an adequate amount of information; but I will bring you down to 1810, in which year a Major Pratt obtained letters patent for a steam ploughing apparatus. One of his schemes was to place the engine and anchor on opposite headlands, or in boats as Mac Rae's (drawings of which I exhibit, and which I shall shortly allude to). The implement described by Major Pratt may be regarded as the first "balance plough," the ploughs being placed back to back, or heel to heel, and working on a fulcrum in the frame, one set being thereby raised out of work while the other set was lowered into work.

Between 1810 and 1832 numerous inventions were propounded and patents taken out for ploughing, digging, or trenching the land, by engines working in various ways, but I find nothing of real value until the latter year, when the celebrated John Heathcoat, M.P., a lace manufacturer, of Tiverton, obtained a patent "for certain new and improved methods of draining and cultivating land, and new or improved machinery and apparatus applicable thereto." Mr. Heathcoat was not only a man of great inventive talent, but of strong common sense, and his plans were more practical and his notions sounder than any of the schemes propounded previous to his time, and, I may add, to the majority of those since brought before the public. To carry out his scheme Mr. Heathcoat obtained the valuable services of Mr. Josiah Parkes, formerly Consulting Engineer to the Royal Agricultural Society of England.

The main features of Mr. Heathcoat's plan will be gathered from the plans which I exhibit. His engine travelled along the headlands, and when ploughing bogs was constructed with an endless web, forming an endless roadway. His anchor, called by him "an auxiliary carriage," also moved along the headland as the work proceeded. Mr. Heathcoat described in his specification a means of making his anchor self propelling. The engine he proposed to fit with two winding barrels one on each side so as to work either one or two sets of implements at a time.

In connection with Mr. Heathcoat's scheme I may mention one fact, highly honourable to the foresight and public spirit of the Highland and Agricultural Society of Scotland. As long ago as 1837 this society offered a premium of £500 for the first successful application of steam power to the cultivation of the soil. Mr. Hall Maxwell, the zealous and indefatigable secretary, writes me:—At the society's show held at Dumfries the same year £100 in addition was subscribed to pay the expenses of exhibiting and working what was called 'Heathcoat's Plough.'" The trial of Mr. Heathcoat's plough, although to some extent satisfactory, was not considered sufficiently perfect to be entitled to the premium. The society, however, continued to offer the prize until the year 1843.

Some twenty years afterwards the Royal Agricultural Society of England followed the example of the Highland Society by offering a prize of a similar amount, and it would have done well and saved a great deal of "heart-burning" if it had also followed the Highland society in the simple wording of the offer, viz., "the first successful application of steam power to the cultivation of the soil."

To return, however, to the progress of invention, Mr. Heathcoat was followed by Alexander Mac Rae, who, in 1839, obtained a patent for "machinery for cultivating land by steam power." The primary object, it would appear, was to adapt his apparatus for use in British Guinea, where the fields are intersected by wide ditches or canals. His engine and anchor, as you will perceive by the drawing exhibited, are placed like Major Pratt's in boats or punts, and the chain employed to drag the plough is an endless one, a barrel being placed upon the framework of the implement for taking up the "slack."

Mac Rae, although his engine and anchor are shown working in boats, described his apparatus as applicable to unlevel lands by the engine and anchor along the headlands.

The implement of this inventor is worthy of notice, for, as the drawings show, it is arranged with the ploughs point to point, as Messrs. Fiskin's and Mr. Fowler's, to which it bears a strong resemblance; Mac Rae also anticipated our friend Mr. Williams, of Baydon, by having each plough independent of the other, like the coulters of a drill.

In 1849 Mr. H. Hannam, of Burcote, near Abingdon, a well known agriculturist, in connection with Messrs. Barrett and Exall, constructed an apparatus for steam ploughing which may be regarded as the first attempt to work ploughs or cultivators by the ordinary portable engine, and also to be the first attempt to plough the land by an engine stationed at one corner or outside of the field. Again, although ropes were mentioned in some of the earlier specifications, we have no evidence that wire ropes were ever employed for steam ploughing until those supplied to Mr. Hannam by Messrs. Barrett and Exall. From Mr. Exall I learn that the ropes were 1,600 yards in length, and from the drawing exhibited it would be seen that they were coiled and un-coiled by a stationary windlass having two winding barrels in the same manner as those now in use. The ropes were also passed round pulleys at the corners of the fields, as shown in diagrams, and now so well known.

It appears that both the plough and the cultivator were worked by the apparatus; the plough being one of simple construction by Messrs. Barrett and Exall—of the latter being the well-known Ducie cultivator.

Mr. Exall informs me that in working the latter both ropes were made fast to the "drag-link," or head of the implement; and, as the motion was reversed, the cultivator came round with very little attention.

About sixty acres were ploughed or cultivated by this apparatus at the rate of about five acres per day, when it appears the rope, from deficient strength, or probably from bad handling, gave way. Other difficulties also presented themselves, which induced the parties named to abandon the scheme. Doubtless, had more perseverance been shown, the parties would have been rewarded with greater success; but I very much question whether any system of rope traction would have become a permanent success but for the introduction of ropes made of steel wire, which has contributed very greatly to their durability.

In 1851, at the Great Exhibition, Lord Willoughby D'Eresby showed a complete steam ploughing apparatus, consisting of two engines, with a winding barrel on each, *i. e.*, an engine for each headland. These advanced as the work proceeded. A number of ploughs on Lowcock's turnwrest principle were placed in a frame and wound or drawn from engine to engine by a chain. I went down into Lincolnshire purposely to see this apparatus at work, and believe if a wire rope instead of a chain had been employed his lordship would have succeeded.

This plan of working two engines—one on each headland—had previously been patented by John Tulloh Osborn in 1846, and was also tried by the enterprising Marquis of Tweedale: a long and interesting account of the marquis's apparatus is given in "Stephens' Book of Farm Implements."

Following up the course of invention we next come to the scheme of Messrs. Fiskin, of Stockton-on-Tees. I exhibit drawings of this apparatus, from which it will be seen that a stationary engine was employed, a main object of Mr. Fiskin being to dispense with wire-ropes and give off the power of the engine by means of a light endless hempen cord, worked at a high velocity, which passed round pulleys on a self-moving anchor, and thence to winding-drums placed upon the implement, the revolution of which imparted motion to the ploughs.

Two important features will be noticed in this apparatus: first, the anchors were self-propelling, their onward motion being effected by the revolution of the pulley placed on the anchor and around which the rope was passed; second, the plough was on the balance principle, and was steered in either direction by means of locking the wheels.

This apparatus was exhibited at the Royal Agricultural Meeting in 1855, and created quite a sensation; it also made a very favourable impression. The judges, in their report, commend the mode of traction, and state they consider it "an implement of considerable promise;" however, no further encouragement was given to the inventors by the society, not even by the award of a medal.

It appears that Messrs. Fiskin had been at work upon the apparatus for some years, and that three years before the Carlisle meeting, viz., in 1852, the Highland Society sent a deputation to Mr. Fiskin in Perthshire to see it in operation; an able report was drawn up by Mr. James Stirling, C.E., and a grant was voted by the society to aid Mr. Fiskin in maturing his invention. Through the courtesy of Mr. Hall Maxwell I have been furnished with a copy of the interesting report furnished to the Highland Society by the consulting engineer, upon Mr. Fiskin's plans.

In 1854 Mr. Fowler exhibited at the Royal Society's Meeting held at Lincoln his steam draining plough and apparatus. In the report of this meeting, published in the "Journal," a diagram is given of this machine. The judges, in speaking of its wonderful performances, wind up with these remarks:—"Surely this power can be applied to more general purposes; we earnestly recommend the idea to our engineers and mechanists."

Whether those to whom the idea was commended took much notice of it or not we do not know, but we do know that the idea commended itself to a farmer in the person of Mr. Smith, of Woolston, who in a published letter informed the public that he commenced his experiments after reading this report. Mr. Smith subsequently ordered an apparatus of Mr. Fowler, and with which he proposed to work, and subsequently did work his cultivator. I am aware that Mr. Smith has set up a claim to the invention of the whole apparatus, but in 1856, at a meeting of the Society of Arts, Mr. Smith admitted "that his first windlass was constructed by Messrs. Ransomes, under the direction of Mr. Fowler" (see page 175 in the Journal of that society.)

I do not mention this to detract from the great merit due to Mr. Smith as a pioneer in steam cultivation, but simply that the merit should be properly divided or given to the right party; and I will remark, in passing, that I believe Mr. Smith has done as much or more than any other man in arousing the country to the importance of steam culture, and to the fact that land can be economically worked by steam power; he has also proved that land can be successfully and continuously farmed by simply "smashing" or stirring, and that inversion of the soil is not so absolutely necessary to successful cultivation as it was generally believed to be.

Having now traced very imperfectly the history of our subject to the time when we may say it was fairly launched, perhaps it will be well if for a time we break off the narrative, and advert briefly to some of the causes which prevented the promising schemes of the past being developed and brought into use; it, perhaps, would be easy to sum up the reasons in a few words.

Political economists tell us that the "machinery of a country will naturally correspond with its wants, and with the history and state of its people." This is undoubtedly true, the schemes we have described having been invented before they were really wanted or before their need was felt. For instance, not longer ago than the Shrewsbury meeting, in 1845, a model of Atzlar's American steam plough was exhibited in a room at Shrewsbury, and the town placarded informing the visitors of the fact, and yet no one went near except two Russians who dropped in towards night to look at it.

As the tillage work of a farm does not differ very greatly from what it was a generation ago we may perhaps inquire more particularly into the reason of this lack of interest. I think no *one* reason is sufficient to account for the apathy upon the subject of machinery. There can be no doubt that a redundant population, and the paralysing effect of the old poor-law, had considerable influence in retarding the use of machinery in farming; also the widespread and deeply-seated conviction that the employment of mechanical power diminished the demand for hand labour, and this conviction, which was shared by all classes, led people to take very little interest in labour-saving inventions.

Again, for want of railways, coal was at such a price, and so distant from the farm, that in most districts half the horse power that would have been saved by the introduction of steam power would have been employed in hauling coal for the use of the engine.

The revolution which has taken place in farm practice by the substitution of the steam threshing machine for the flail and the horse gear has, doubtless, been brought about mainly through the intersection of the country by railways.

This, again, has led the farmer to appreciate the value of and imbibe a taste for steam-driven machinery; it has, moreover, accustomed him to expend comparatively large sums of money in the purchase of machinery. We are creatures of habit, and 'tis astonishing, when we begin to spend money on machinery or anything else, how easy it is to jump from £300 to £500, and from £500 to £800.

However, to resume my subject on the progress of steam power, perhaps it will suffice if I divide the inventions, which, since 1855, have been brought before the public, into the following classes:—

1. Engines to travel over the surface, drawing their implements with them.

2. Locomotive engines working on railways and drawing implements after them.

3. Engines moving along the headlands and working implements by means of wire ropes.

4. Engines stationary whilst at work, and working implements by means of wire ropes.

A number of schemes under each head have been either brought before the public or patented, and, without using names more than absolutely necessary, I will simply allude to the alleged advantages and disadvantages of each system. I would here take the opportunity of stating that, in endeavouring to bring steam cultivation into practice, I believe no one has worked harder or spent his money more freely than Mr. John Fowler, and so far as I am concerned I hope he may be amply repaid for his great efforts.

With reference to the engines which move over the land, although exercising their powers direct on the implement they draw, they labour under these disadvantages—their weight is immense, and they have to propel themselves over surfaces more or less uneven or more or less yielding: the consumption of fuel and water is at least fourfold that of a stationary engine, and the repairs, owing to the irregularities of the surface of the land and greater friction — would probably be tenfold. The weight of such a machine passing over the land is also most objectionable. George Stephenson always stuck to it that the wheel and the rail were man and wife, and ought never to be separated. Perhaps we shall not go so far, but depend upon it there is a great deal of force in the remark. I think the reasons I have adduced, coupled with the undulating character of our country, sufficient to account for the want of progress these schemes have made. Mr. Romaine, to whom much praise is due, has worked hard to carry out the principle of a rotatory cultivation moving over the surface—a scheme so ably advocated by Mr. Wren Hoskyns. I believe, however, Mr. Romaine has abandoned the plan in favour of rope traction, for which he has obtained one or two patents.

As to the scheme of laying down rails all over a farm and working locomotive engines upon them, whatever may be the economy and dispatch of such a system when once carried out, I think it highly improbable, considering the outlay to be £20 to £30 per acre, that it will ever come into use in this country, at all events not until landlords generally are much richer or much more free in spending their money in improving their estates.

Next in order are the engines which travel along the headlands as the work proceeds. These doubtless employ their power more direct, and with a smaller quantity of rope than engines stationary at one point, but they have these drawbacks: when the soil is at all wet the passing of a heavy engine along the headlands and the necessary coal and water haulage after it destroy in great measure the fertility of the headland, as well as leaving a good deal of hard work to be done by horse power in bringing the land to a tilth.

Again, in hilly countries the engine is at work sometimes on a steep ascent and sometimes on as steep a descent, at times inclining to the right, and at others to the left; this will doubtless render the cost of keeping the engine in repair much greater than one that is stationary and always working upon the level. Another disadvantageous feature is that a headland all round must be left unbroken if the field has to be worked a second time be steam.

Lastly, we will take the engines stationary while at work. The main objections urged against these schemes are, the extra length of rope required, and the loss of power by the employment of pulleys round which the ropes are passed; the advantages claimed are, they are less costly to purchase and to keep in repair, more simple of construction, consequently better adapted for ordinary farm labourers, and irregular shaped fields can be ploughed as well and almost as quickly as square ones. By stationing an engine at one point fields of 30 or even 50 acres each can be cultivated without any remove of engine or apparatus, and if the farm be well laid out twice this quantity can be done from one point. A pond or a well sunk at convenient spots saves all water carting, and the coal is all brought to one point instead of having to be carted after the engine.

Some parties have greatly exaggerated the loss of power entailed by the passing of ropes round pulleys. I have heard it stated in this room that for every pulley used a horse power is sacrificed.

Now, so far from this being the case, I find by most careful experiment, that when working a cultivator drawing 15 cwt., and the ropes arranged in a square, the loss of power from friction is 25 lb. per pulley, just one-sixth of a horse power. Even this is not so great a disadvantage as at first sight would appear, for if the pulleys were reduced to two, and the same strain put upon them, the friction would be increased one-third; this arises from the fact that the ropes would then have to pass half round the pulley instead of one-fourth only.

Mr. Pike, in my neighbourhood, has a field of 50 acres, in which he stations an 8-horse engine at the extreme corner where he has dug a pond. This 8-horse engine, without ever moving, breaks up this field of heavy tenacious soil to a depth of 7 or 8 inches, at the rate of 7 or 8 acres per day: so much for loss of power from pulleys and extra length of ropes.

In making these remarks I wish it to be understood that I am dealing with general principles, and not with the scheme or inventions of any particular person. I have endeavoured, and shall endeavour, to avoid saying anything that might give offence to any inventor. I would have avoided any expression of opinion if I could well have done so. I am aware that I have left many points untouched, but when introducing a subject I think it is not well to exhaust it, but rather desirable to leave room for discussion.

I have abstained from criticising or dwelling upon the various machines which have been introduced since steam ploughing has become a fact in this country. I have taken this course for two reasons.

Because as a patentee and a manufacturer it would not have been in good taste for me to have done so, and because I thought there was no necessity, inasmuch as most of you are acquainted with the merits of the machines in use—at all events if you are in ignorance it is not the fault of the inventors, for we have not "hid our lights under a bushel."

Having now very imperfectly sketched the rise and progress of steam cultivation, I will in a few words sum up what I consider has already been achieved.

Some four or five hundred farmers have purchased steam cultivating apparatus, of one kind or other. From the Britannia Ironworks, Bedford, alone about two hundred steam cultivators have been sent out.

The experience and the opinions of a large majority of the purchasers have been published, and all, or nearly all, have testified to their approval and appreciation of steam power. From these reports, and other opportunities I have had of gaining information, I gather that the results are as follow:—

1. That although not entirely a substitute for horse-power in tillage, steam is a valuable auxiliary.

2. That for the hard work of the farm steam is a cheaper power than horse-power.

3. That deeper and more efficient cultivation is obtained.

4. That it enables the farmer to perform his tillage operations at the best season of the year.

5. That better crops with less manure can be obtained, especially on clays and loams.

6. That the drainage of the soil, owing to the loosening of the subsoil, is rendered more efficient, and that no furrows are required, even on the strongest land.

7. That not only a considerable diminution in the number of horses can be effected, but that the horses that are still necessary can be kept at less expense.

As to the future of steam tillage I shall say but little. What effect the general adoption of steam power on our farms will have upon the

country no one can foresee. To expect that steam will do as much for agriculture as it has done for manufactures and commerce would be idle; but that it will enormously increase the productiveness of the country no one who has paid the least attention to the subject can for a moment doubt. Whether it will increase correspondingly the profits of the farmer we must wait to see; but it is worthy of remark that the most highly remunerative amongst the manufacturing trades of this country have been those which require a large plant in the shape of steam-driven machinery.

That the new order of things will have a considerable influence on the labourer I have no doubt. The great advances which have been made of late in agriculture, and the changes which are taking place, force on our notice the fact that a more intelligent and a more careful class of labourers are becoming indispensable to the farmer; and by employing these in the use of a higher order of machinery they will doubtless progress in intelligence accordingly. The dead level of wages will break down under this altered state of things, and yet with increased profit to the farmer; while there will be a field for the more intelligent and useful farm servant, which, under the old order of things—however willing to encourage the skilful the farmer might be—was difficult to be found.

In conclusion, nothing indicates more clearly the great advance which is being made in the agriculture of this country than the introduction and spread of a better class of farm machinery. The machinery of a country has ever been a gauge of the intelligence of its inhabitants; iron-clad ships and rifled guns are not the implements of warfare of barbarous or semi-barbarous nations; nor are steam-driven threshing machines and steam ploughs the implements of a backward or bigoted agriculture.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

WATER TUBE BOILERS.

SIR,—Agreeably to Tyro's request, I enclose you a sketch of the water tube boiler he refers to.

Fig. 1 is a longitudinal section; A is the fire-box similar to a locomotive; C, C, are the water-tubes running across the square flue which opens into the smoke-box B; D, D, are stays.

Fig. 2 is a cross section at X, X, the same letter refers to both; E, E, are side plates fitted much as "Tyro" describes, except that I do not like depending on the angle irons he proposes, as it causes too much strain on the bolts round the edges of such plates, and therefore I use stays, H, H, and nuts.

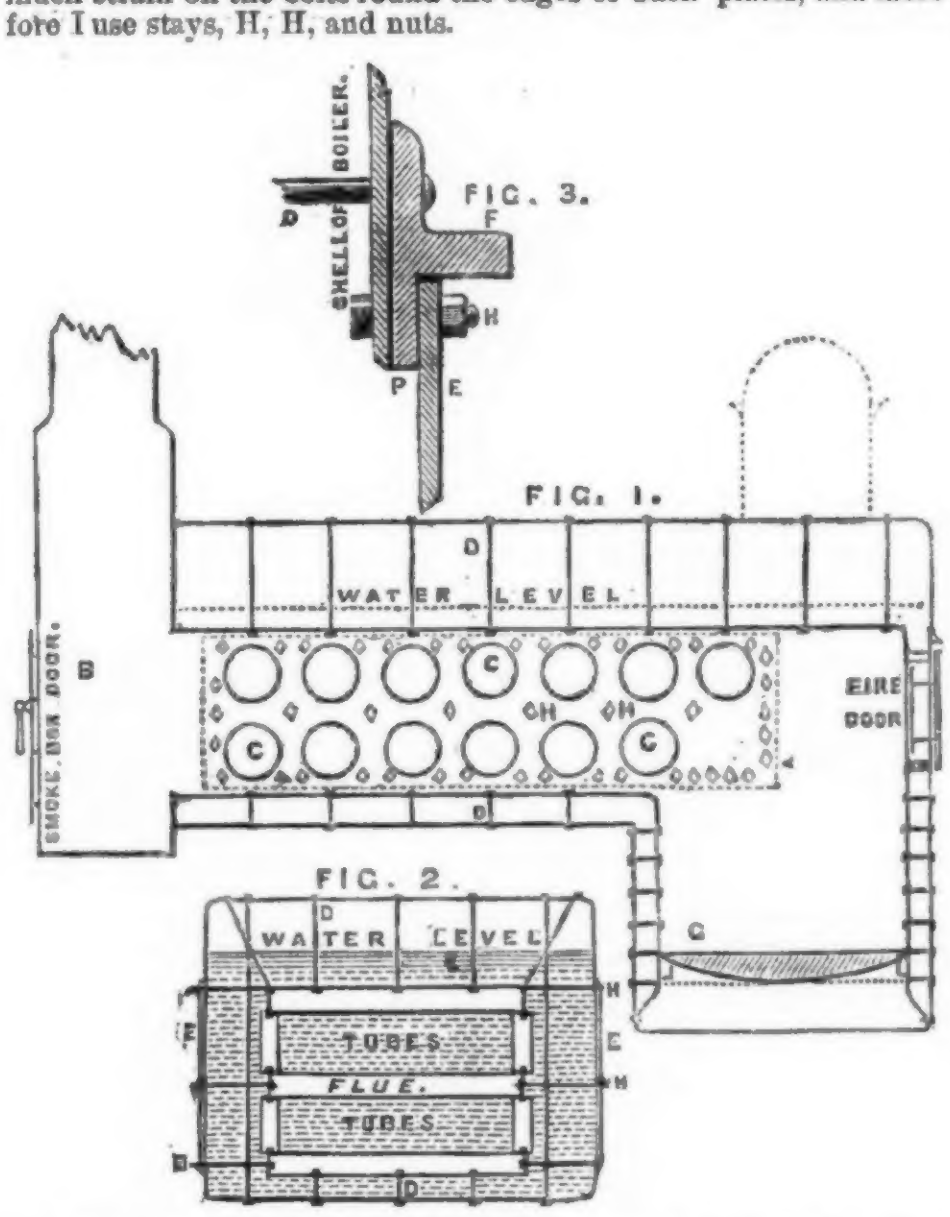


Fig. 3 is an enlarged sketch of the means of fitting the plate to the boiler; F shows a cross section of part of a rectangular angle iron frame, which runs all round the opening which is covered by what I may term the man hole door, the angle P being planed so as to make a tight joint with E, by means of a little red lead.

I think "Tyro" will understand the details without my trespassing further on your space. V. P.

February 15th, 1862.

THE HARTLEY ENGINE BEAM.

SIR,—Would you oblige by granting a space in your valuable journal to correct an error that seems to have fixed itself upon the public mind regarding the mode of casting the Hartley beam. It appears to be the opinion of many that the beam was an open sand casting. Speaking from personal inspection of the casting at the time it was made, I beg to state that it was not an open sand casting, but what is more properly called a dry sand casting. The mould was made, dried, covered with loam plates, and weighted down to secure proper runners and heads for feeding the mass of metal while in a state of fusion, and likewise to add a certain amount of pressure to give greater density and closeness to the iron. The runners and heads, with the overflow jets, stood 15in. higher than the top of the casting. These heads were properly fed with metal as long as ever they could get the rods to work, and every care was taken by the agents of Losh, Wilson, and Bell, regardless of expense, to secure good castings.

I trust, sir, these remarks will correct the error that appears to be entertained by many readers of the public papers in reference to the way in which the beam was cast. Indeed, the idea of making such a massive casting of open sand never entered the mind of this eminent firm or any of their agents, and it may be questioned whether such an idea would enter the mind of any practical founder who has been accustomed to make large castings.

Walker Ironworks, Newcastle-on-Tyne, FOUNDER.
March 3, 1862.

[We have received another letter, of the same purport as the above, from another correspondent.—ED. E.]

THE NEW HARTLEY ENGINE BEAM.

SIR,—It is very satisfactory to see with what care your different correspondents have handled this matter in its different details. Still, in looking at the two last letters which have appeared in THE ENGINEER on the subject, it makes the matter darker than ever why such a beam should break, being, as in "P. J.'s" letter, only loaded with $\frac{1}{28\cdot5}$ of its breaking weight, and in "S.'s" letter $\frac{1}{13\cdot5}$. It may be quite right and proper to look to in the matter in this light, but still, as a practical engineer, I quite agree with what Mr. Wm. Rendall, in his letter, states, "that the beam had many a hundred times been working to its breaking strain," whatever that strain may have been. Some say there were 40 tons' weight of water and spear rods, others 50 tons, and certainly by the calculation in "S.'s" letter there could never have been more than 60 tons at any time.

To any practical engineer, therefore, who looks plainly into the nature of the circumstances of this sad case, there need be no mystery on the subject why such a beam broke, and I think it is but right and just for the guidance of others that as much of the truth on such subjects as possible should be known, so as to prevent, as far as it is in the power of man, such fearful destruction and loss of life. I say, therefore, without fear of contradiction, that the Hartley engine beam broke because it was then "working up to its breaking strain," and that the probability is that neither spear rods nor anything else gave way to cause the "shocks" we read of, but rather that the beam dropped asunder when it no longer could withstand the strain suspended from it over the pit mouth.

With all due respect for the makers, as many of your correspondents say, I think plates of open sand castings of cast iron, 8ft. deep by only 4¾in. thick, used for a beam, however well stayed or braced together, a very unsafe structure, both from the want of proportion and from the nature of the castings, both of which points have already been pretty well ventilated in your columns; but I may state that I have seen open sand castings made in plates 6ft. and 8ft. square, several inches thick, that would not stand lifting out of the sand, but fell to pieces with their own weight in the founders' hands after being cool.

It is very well known to practical men now-a-days how very difficult it is indeed to get pulleys, spur wheels, and other such castings, "to stand," if they are the least out of proportion, as sometimes they have to be with large bosses, &c. Thirty years ago we had no such difficulties to contend with, as cast iron in these days was something that we could depend upon—something that we could calculate by. In many districts yet, I am aware, where the ore is of a particular nature, tough and strong cast iron can be produced still; but there are many places where the "minerals" may not be of the best quality, and what with this and forcing sometimes a poor cast iron is produced indeed. Look at the beams of steam-engines—say for 40 or 80-horse engines—now and what they were many years ago; the difference in section is very remarkable, engineers having kept on adding to the weight, as they became alarmed with this and the other "break down," occasioned, no doubt, by the weakened nature of the material used compared with what it was in former times.

As another instance of the fickle and uncertain nature of cast iron, it is a fact that there have been several instances of late both of cast iron beams for land engines, and side levers for steamboat engines thrown aside, after being cast and bored ready to receive their centres, the cause being their dropping asunder when being fitted, when no unusual shock or strain came against them whatever. Had these side levers got to work, and with a heavy sea given way, we might have had some fine calculations as to how many fractions of the breaking weight was on them when they snapped asunder.

I trust what I have said may be the means of clearing away a great deal of the mystery as to why such a beam should break when of such gigantic proportions as the one at New Hartley, and, if beams for engines are to continue to be made of cast iron, no such thing as an open sand casting will ever be allowed, and that ample allowance will be made for the nature of the material by adding weight in due proportion. G. B.

Edinburgh, 5th March, 1862.

STEAM ON COMMON ROADS.

SIR,—We have read with great pleasure the article inserted in THE ENGINEER of Feb. 21, and written by a contributor to the *Mark Lane Express*.

We, as traction engine manufacturers, are fully aware that all makers and users of traction engines will have much to contend with before we overcome the prejudices of the public against traction engines. When the first locomotive was made for railroads the public were quite as prejudiced, or more so, than they are against traction engines for common roads; and even when the portable steam engines was brought out for thrashing, a few years ago, the public were of an opinion that the farm yards would be all burnt out, but now that prejudice is overcome. They must travel by railroads, and they must have their corn thrashed by steam; and so it will be by the traction engines in a very few years, when, doubtless, there will be as many common road locomotives as railroad locomotives.

A few weeks ago we were trying a new traction engine we had completed, and we were informed we should not be allowed to run such a dangerous thing as the innocent steam horse at three miles per hour, and it was stated by many ignorant persons it was dangerous in the extreme, and would frighten horses, and do a great deal of harm, but against all this we were determined to let them see it would not do so much harm as they represented. We took it the next market day, with a large thrashing machine behind it, by steam backwards and forwards, through the market, and, to the great astonishment and surprise of all who saw it, there was not one horse that shied or took fright at it; but, on the contrary, passed and repassed it as though it was one of their own nature.

A spirited horse will as soon shy at a pot cart as at a steam engine; and if the former is the case, and it breaks the vehicle, it is stated as an accident; but if it shies at a steam engine the owner is brought before the magistrates and fined. This is, as your article states, putting the saddle on the wrong horse, but this sort of prejudice will be overcome. Inventions will go on. We must get the work done at a cheaper rate, and the only way at present thought of is by steam. We travel at the rate of sixty miles an hour on land, and upwards of twenty on the water by steam, and we must draw loads on the common roads by steam. In our county court last month a nobleman sued a person for damage done to a gate (that crossed a public road which runs through plaintiff's park) by his horses running against the gate and breaking it. The defendant contended the gate was put there to protect the plaintiff's park and deer, and the deer ran about and frightened his horses so much they run against the gate, broke it, and might have seriously injured the horses. The plaintiff proved there had been a gate there for centuries. Verdict was for plaintiff, his honour stating the deer had as much right there as the horses, and as it was the horses that broke the gate defendant must pay the damages. It will be plainly seen that if the horses had not taken fright at the deer the deer would never hurt the horses, and it is just so with the engine on common roads. Let the driver of the steam engine mind his own horse, and the person who is driving the spirited and shieing horse mind it, and we are quite sure, if the spirited horse does no harm to the steam horse, the steam horse will never hurt the spirited animal.

Thrapston. SMITH BROTHERS.

FOREIGN AND COLONIAL JOTTINGS.—The cabinet of Mr. Lincoln is prepared, it is stated, to ask Congress to guarantee 2 per cent. upon a capital of £600,000 or £700,000 for 20 or 25 years for the purposes of an Atlantic cable if England will do the same.—A project of building frigates for the Turkish Government in England is stated to have been given up.—According to accounts from the Cape of Good Hope arrangements are being made for fortnightly mails to England by a line of steamers from Table Bay to Port Louis. The whole coast of the subsidy required will be £22,000 a year. Of this Mauritius has resolved to contribute £3,000; Natal, £2,000; and the Cape, £6,000 more, thus making up between them £11,000. The other moiety is anticipated to be furnished by the Imperial Government. — The Cunard line of steamers requiring additional accommodation at Jersey city, U.S. the proprietors of the line have expended a large sum in erecting additions to their lock near the ferry. The extension is 300ft. in length.—Negotiations are in progress between the British and French Governments regarding the increase in the weight of letters between the two countries, which is proposed to be 10 instead of 7½ grammes; the English Government wish to make it 15 gr. or ½ oz., which would make it the same as English inland letters. Either change will be very beneficial, and will, besides, prevent innumerable mistakes.

MISCELLANEA.

THE Armstrong water engine patent expires on the 11th of May next.

SCHIELE's patent for the "anti-friction curve" expires on the 23rd of November next.

THE Canadian rock oil is now burnt in signal lights and at stations on the Great Western Railway of Canada.

MESSRS. PIGGOTT, of Birmingham, are about putting in a gas holder 110ft. in diameter and 60ft. high at the South Metropolitan Gasworks, Old Kent-road.

DURING the past week the North Eastern Railway Company have discharged a large number of hands upon their system, and it is said further reductions are contemplated.

THE total cost of the Warrior before being ready for sea, £354,885, was made up thus:—Hull, £251,646; engines, 71,875; masts and rigging, £18,536; fittings and alterations, £12,828. This does not include the cost of her armament, £13,000 more.

MESSRS. EASTON, AMOS, AND SON are about commencing the construction of steam fire engines similar to that lately brought over from New York, and now forming a part of the fire engine establishment at Mr. Hodges' distillery, in Lambeth.

THE reports of the factory inspectors for the half-year ending with October state that 30 persons were killed by the accidents of the six months, and 289 had to lose a limb, or part of a limb; the latter number is rather high, the former is below the two previous corresponding half-years.

WE mentioned, in our last number, that, so far as we were aware, Messrs. Brown of Rotherham had the only machine in the kingdom for rolling steel tyres in the hoop. A correspondent informs us that Messrs. John M. Rowan and Co., of the Atlas Works, Glasgow, have a machine for this purpose, and that it has performed excellent work. We are happy to make this correction, and we may add that machines for rolling steel tyres appear likely to be in extensive demand.

IN THE ENGINEER of September 27th last, we illustrated a two wheeled fire engine patented by Mr. William Roberts, of Messrs. Brown and Lenox's, Millwall. An engine on this plan has been made for the volunteer firemen of Stockport, where it has been publicly and successfully tried. With ten men only, the discharge is understood to have been 63¾ gallons per minute, the usual discharge of the London Brigade engines, with thirty men, being 88 gallons.

WE understand that Messrs. Piggott, of Birmingham, are about to erect at the Liverpool Gas Works a gas holder of the great diameter of 240ft., with two "lifts" of 35ft. each, making a height of 70ft. The capacity of the holder, therefore, will be upwards of 3,100,000 cubic feet. The Imperial Gas Company's holder at their Hackney-road station, the largest yet erected in this country, is 201ft. in diameter and 80ft. high, while the same company have a holder also at Fulham 200ft. in diameter and nearly 70ft. high.

IN a paper upon the Crumlin Viaduct, read by Mr. Henry N. Maynard, C.E., before the South Wales Institute of Engineers, in January, 1860, the author touched incidentally upon the application of rivetted wrought iron to engine beams, and gave drawings and estimates for such beams of various sizes. Mr. Maynard writes us to say that a suitable wrought iron beam for the Hartley engine could now be made for about £200, which is less than what the cost of a cast iron beam would be.

MR. HOLROYD, secretary of the London, Chatham, and Dover Railway, having stated at the late meeting of the shareholders that "the board had submitted a plan of the proposed bridge at Blackfriars to the Conservancy Commissioners and the Admiralty, which they had approved, but they had not received any definite answer from the Corporation of the City of London, has found, on inquiry, that the board had received no official approval of the plan either from the Admiralty or the Conservancy Commissioners, although as regarded the latter, from the communications made by them to the company's engineer, there was reason to believe that they were satisfied with the design as submitted to them."

A SERIES of experiments have been carried out on board several of the screw gunboats belonging to the Steam Reserve at Chatham, by direction of the Admiralty, for the purpose of ascertaining the comparative advantages of wood and coal as fuel in getting up steam. The object more particularly kept in view was to ascertain whether, in the event of a fleet of gunboats being suddenly despatched to the Canadian lakes, wood is likely to prove more economical than coal. The result of the trials, so far as they have been carried, has been in the highest degree satisfactory. It has been ascertained that, in using the ordinary pitch pinewood which abounds in Canada, steam can be generated in the boilers in about half the time necessary when coal alone is used.

THE following appointments of naval engineers have been made since our last:—Charles P. Turner, chief engineer, to the Styx; James Duffield, first-class assistant-engineer, to the Shannon, vice Webber; W. W. Webber, first-class assistant-engineer, to the Asia, as supernumerary, for hospital treatment; Frederick T. Pendleton and James Scott, first-class assistant-engineers, to the Styx; William Lawson, second-class assistant-engineer, to the Styx; James Lamont, chief engineer, to the Asia, for charge of Simoom when the latter is paid off; John Gray, engineer, and R. E. Denison, first-class, and John Pardie, second-class, assistant-engineers, to the Peterel; J. Knight, in the Hero, promoted to acting first-class assistant-engineer; James Frazer, confirmed as second-class assistant-engineer in the Virago; James W. Watson, acting second-class assistant-engineer, to the Indus, as supernumerary; Henry Brown, confirmed as second-clast assistant-engineer in the Dauntless; Thomas M'Farlane, confirmed as second-class assistant-engineer, in the Princess Charlotte; Peter Colquhoun and James M'Millard, acting second-class assistant-engineers, to the Cumberland, as supernumeraries; William Edwards, acting second-class assistant-engineer, to the Indus, as supernumerary. The under-named second-class assistant-engineers have been promoted to the first-class:—R. Ditchburn and John G. Taylor, late of the Conqueror; Henry Peters and Benjamin Carr, supernumeraries in the Indus, James Daly in the Desperate, Thomas Bramley in the Hogue, Edmund J. Murphy in the Firebrand, James Ankers in the Edinburgh, and Alexander Purves in the Bulldog.

THE traffic receipts of railways in the kingdom amounted for the week ending the 22nd of February, on 10,109½ miles, to £462,859, and for the corresponding week of last year, on £9,871¾ miles, to £474,699, showing an increase of 237½ miles and a decrease of £11,840. The gross receipts on the following fourteen railways amounted in the aggregate, on 6,430½ miles, to £344,826; and for the corresponding week of 1861, on 6,274 miles, to £358,146, showing an increase of 156½ miles and a decrease of £13,320. The decrease on the Eastern Counties Railway amounted to £487; on the Great Northern to £1,140; on the Lancashire and Yorkshire to £4,570; on the London and North-Western to £3,994; on the Manchester, Sheffield, and Lincolnshire to £959; on the Midland to £1,470; on the North-Eastern to £2,608; and on the South-Eastern to £728—total, £15,956. But from this must be deducted £772, the increase on the Caledonian; £386 on the Great Southern and Western; £151 on the Great Western; £94 on the London, Brighton, and South Coast; £1,112 on the London and South-Western; and £121 on the North British—together £2,636; leaving the decrease, as above, £13,320. The goods and mineral traffic on those lines amounted to £202,483, and for the corresponding week of 1861 to £214,339, showing a decrease of £11,856. The receipts for passengers, parcels, &c., amounted to 142,342, against £143,807, showing a decrease of £1,464. The traffic receipts on sixty-seven other lines amounted, on 3,678¾ miles, to £118,033, and for the corresponding week of last year, on 3,597¾ miles, to £116,553, showing an increase of 81 miles and of £1,480. The falling off in the traffic of the past week as compared with the corresponding period of 1861 is principally in the goods and mineral traffic of the great lines, and indicates the depression of trade in the manufacturing districts. The traffic receipts of the past week show an increase of £3,724, as compared with those of the preceding week ending the 15th of February.

BEATTIE'S MODE OF EXTINGUISHING FIRES IN BUILDINGS AND SHIPS.

FIG. 1.

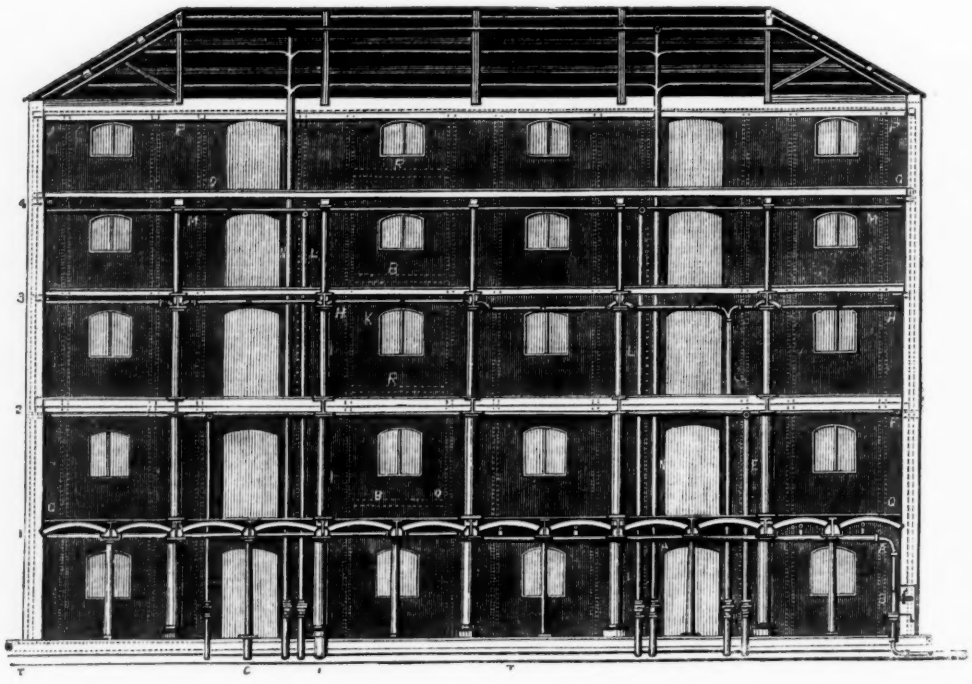


FIG. 2.

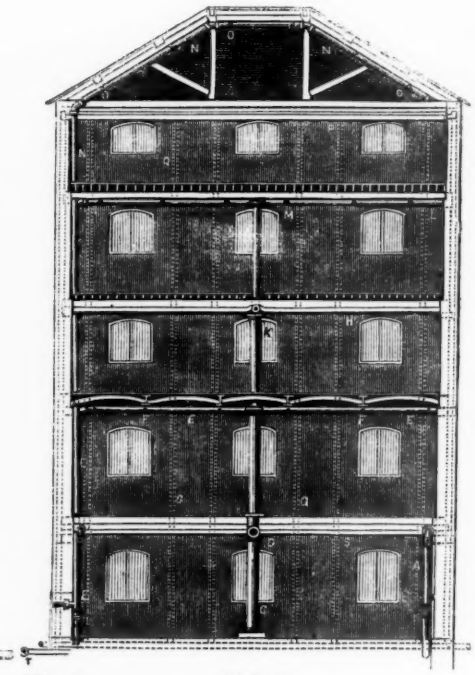


FIG. 11.

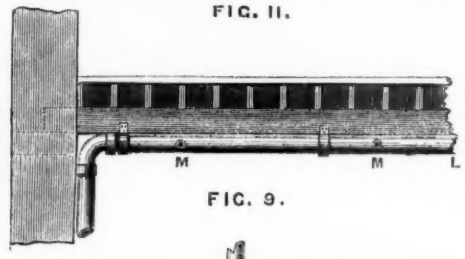


FIG. 12.



FIG. 5.

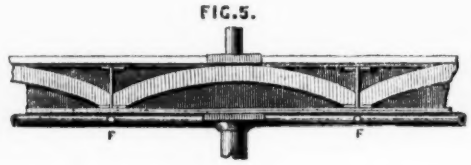


FIG. 6.

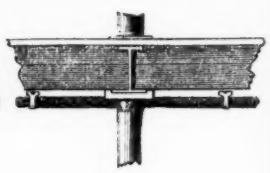


FIG. 9.

FIG. 10.

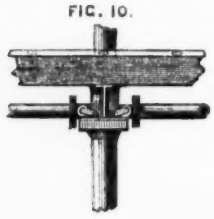


FIG. 3.

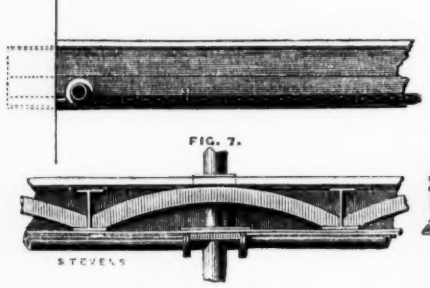


FIG. 4.

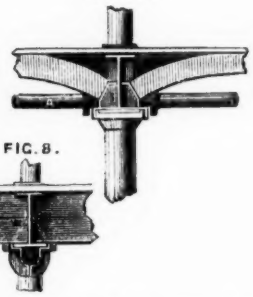
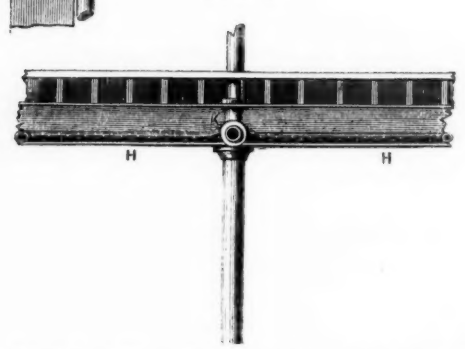


FIG. 7.

FIG. 8.



In this arrangement, by Joseph Beattie, of Lawn-place, South Lambeth, he places in the brickwork or other material of which the main building is composed one or more main pipe or pipes, of suitable metal and of sufficient strength and bore, from the basement or ground floor to the roof or other parts of such building, and has branch pipes, of suitable metal, bore, and strength, from such main pipe or pipes into each floor, and, if required, into each room, and carries such branch pipes round the ceiling or other part or parts of such rooms and other parts of the building, and has perforations in such branch pipes, and mouths or roses made ornamentally or otherwise, and has suitable joints and cocks or other apparatus, so that when a fire has taken place in any one or more of such room or rooms, the water can be forced by steam or other power from below through the main pipe and branch or branches into such room or rooms as required, for the extinction of the fire therein.

Fig. 1 shows a vertical longitudinal section of a building with arrangements, as follows:—

The first floor consists of brickwork arches springing from transverse iron girders, which should be of wrought iron, which girders are supported on cast iron pillars. In the lower angles of the iron girders are placed pipes or troughs, as shown, for the passage and diffusion of water, and such pipes or troughs form skewbacks, from which the brick arches may spring. These pipes or troughs are supplied with water, by means of a supply pipe, from the main T, as shown at A, A, which connects and supplies all such pipes or troughs, and which supply pipe is furnished with a valve at B. The water may also be supplied through one or more of the hollow columns, as at C, which support the floor, and which are connected with the pipe D, D, and the pipes or troughs. The flues, which are formed in the brickwork of the walls, and which may be connected with the main pipe below and the troughs above by suitably formed branch pipes built in cement in the walls, may also serve to supply water as well as to keep the walls cool. The skewback pipes may be constructed to allow the passage of water above the brick arch as well as below, and the arch be constructed so as to diffuse and distribute the water through open joints and passages. By these arrangements the brickwork is protected and kept cool, and they may be applied for the distribution of water where wrought or cast or corrugated iron is used instead of brickwork arches.

The second floor is an example of the application of these improvements to a floor of a different construction to the first. The arrangement of pipes in this case consists of one or more ascending supply pipes E, E, in connection with the water main T. The supply pipes E, E, are provided with suitable branches on each side, to which the smaller diffusing pipes F, F, can be attached, having outlets through which the water may be scattered and diffused.

The third floor is of a different description, being an ordinary wooden floor supported on iron girders. The arrangement here shown consists, in one case, of supply and conducting pipes G, G, from which the diffusing smaller pipes H, H, having outlets run, some of which pipes H, H, are placed in the lower angles of the girders. In the other case the supply of water can be introduced through the hollow columns, as shown at I, I, into the conducting pipes K, K, from which the diffusing pipes H, H, diverge on each side.

The fourth floor is a wooden floor, on wooden joists and beams, to which is attached an arrangement of pipes somewhat similar to that of the second floor, L, L, being the supply and conducting pipes, and M, M, the diffusing pipes. This description of floor being more commonly in use, this arrangement, or some modification of it, would be applicable to ordinary buildings.

The roof, constructed of wood, is supplied with the arrangement of pipes so placed as to keep the roof cool and play upon the interior of the apartment and also on the floor N, N, being the supply and conducting pipes, and O, O, the diffusing pipes, having suitable outlets. At P, P, is shown an iron gutter or cornice running round the walls, into which the outlets from the water passages or flues formed in the brickwork, and shown also by dotted lines Q, Q, discharge themselves. The water is thus distributed by means of the gutter (which does not entirely touch the wall, but only at intervals) equally over the surface of the wall and keeps the wall cool, both by causing the circulation of the water in the flues, which may also be connected horizontally, as at R, R, and by its diffusion over the inner surface of the wall.

Cost of the Warrior.—The return moved for by Captain Jervis of the total cost of the Warrior before being ready for sea had not been issued when Mr. Laird made some remarks on the relative cost of ships of war built in the royal dockyards and in private yards. Mr. Laird expressed his belief that ships of war cannot be built for less than £30 per ton, and hoped that the country would not be led away with the idea that ships built in the royal dockyards cost thirty to fifty per cent. more than they really did. The return of the cost of the Warrior, prepared in the office of the Controller of the Navy, has since been issued, and shows that the cost of that ship's hull exceeded £40 per ton, being more than £10 above the sum named by Mr. Laird. This difference in a ship of the great size of the Warrior amounts to more than £61,000 more than ought to have been paid, according to the estimate of the honourable member for Birkenhead, the accuracy of whose judgment on such a point no one can think of disputing. The total cost of the ship was £354,885, being £251,646 for the hull, £71,875 for her engines, £18,536 for her masts and riggings, and £12,828 for fittings and alterations, including £3,283 for fittings chargeable to the contractors, but which, it appears, were not so charged by the Admiralty. The reasons for this favour shown to the contractors at the cost of the public, and for the alterations, do not appear on the face of the returns. After all this expenditure she does not seem to have satisfied the requirements of naval officers, who are asking, in reference to the statements made by Lord Clarence Paget, whether she has ever been tacked under sail alone; and suggesting that, as Captain Cochrane has not sent home any official account of her performance, it would be well if some member of Parliament would move for a copy of her log.

Krupp's Steel Works.—Mr. Bessemer has supplied plans of his apparatus for converting pig iron directly into steel, to Herr Krupp, for erection at his works at Essen. From what is known of the working of the Bessemer process upon the manganesian ores of Prussia, it is altogether probable that Herr Krupp's entire manufacture of steel will ultimately be produced without resorting either to puddling or cementing. Herr Krupp is about erecting a plate mill, the standards of which are to be 15ft. apart, so as to roll plates 14ft. wide, thus enabling the barrel of a locomotive boiler to be rolled in a single plate. Messrs. Caird and Co., of Greenock, are about receiving from Essen a cast steel crank weighing 15 tons. Krupp is now executing an order for 250,000 steel rifle barrels for Russia, the barrels to be made solid and afterwards bored out. The same maker will exhibit a 250-pounder rifled cannon in the coming Exhibition.

The Central American Inter-oceanic Canal.—At a meeting of the Royal Geographical Society, held on Monday evening, Captain Bedford Pim, R.N., read a paper on "Proposed Transit Route across Central America." The proposed route has its Atlantic terminus at Monkey Point, on the coast of Mosquito, where there is a secure anchorage formed by Gorgon Bay. The railway would extend from Monkey Point to San Miguelito, on Lake Nicaragua, a distance of sixty or seventy miles. From San Miguelito the new transit route crosses Lake Nicaragua, and it is proposed to cut a shallow canal of 6ft. deep through the narrow neck of land of twelve miles, which separates that body of water from the Pacific, and form a Pacific terminus at Salinas Bay, a harbour of great capability. The entire length of the route would not exceed 130 miles. The author then drew attention to the commercial advantages of the undertaking, and expressed his wish to obtain all the information he could on the subject.

Canadian Railways.—It appears from an official report issued by the Government of Canada that in 1860 1,880 miles of railway were in operation in that splendid *appanage* of the British crown, the cost having been on an average about £10,000 per mile. One accident happened to every 5,551,907 miles travelled, and one passenger was killed to every 14,995,150 miles travelled. The number of persons killed annually by railways in Canada has averaged 50. Of the number of persons injured 22 per cent. were intoxicated at the time they were hurt. The average cost of fuel per mile run by the engines was 6d.; and the repairs of engines involved a cost of 6·34d. per mile run. The average speed of express trains, including stations was 24·3 miles per hour, and between stations 29·5 miles per hour. The average number of cars in passenger trains was 3·2; in mixed trains 7·5; and in freight trains 11·6. The total number of persons employed was 6,606. At the end of 1860 there were in Canada 394 engines, of which 57 were built in Canada, 228 in the United States, and 109 in Great Britain. The oldest engine was on the St. Lawrence and Industrie line: she is called the Dorchester, and ran 4,300 miles in 1860. She was built by Messrs. Stephenson and Co. of Newcastle-on-Tyne in 1849, and is still serviceable. The Portland, No. 108, of the Grand Trunk of Canada was put in service in 1851, and from that time to the end of 1860 had run 193,635 miles, being still reported in good order.

TO CORRESPONDENTS.

**** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

S. M.—*If you cannot procure such a work through a publisher of engineering works we cannot refer you to one*

A LEARNER.—*What a question! You do not give the depth of the water at the head of the shute. State your question fully.*

CHAMAR.—*There are about 3,000 collieries in the kingdom, raising* 80,000,000 *tons of coal, worth on the spot, probably* £25,000,000.

G. D.—*You can address the secretary, Mr. F. R. Sandford, at the Exhibition building, South Kensington, but we think the situations must have been already filled.*

T. K. R. (Kilconnel.)—*There is no Indian railway known as the Jubbulpore Railway, but the Great Indian Peninsula line is intended to run to Jubbulpore. The address of the secretary of the company is* 3, *New Broad-street, E.C.*

J. P. (Preston.)—*We do not think that gold can be precipitated in solution so as to preserve its metallic lustre. Bronze powders are not true powders, but consist of innumerable flat scales. We regret that we are unable to answer your other question.*

J. L.—*The principle adopted in calculating the steam space in a locomotive boiler is precisely the same as that employed in calculating the contents of a tub. To illustrate any particular case, however, would require too much space. From the whole cross-sectional area of the barrel of the boiler, deduct the water area, and multiply the remainder by the length of the barrel. Make additions or reductions, as may be required, for domes, steam pipes, &c.*

AN INQUIRER.—*Unless you wish to cut off earlier than half stroke, a slide-valve with sufficient lap is the best expansion valve. The best pistons are, we believe, what is known as the "Swedish piston," in which the rings keep tight by their own elasticity, although steam may be let in behind them, as was formerly done by Mr. Spiller, of Battersea, and more lately by Mr. Mille , of Dublin. We believe Messrs. Burrett, Exall, and Co.'s valve is patented. One of Mr. Exall's patents expires this year, and it may be the one for the valve. The best air-pump bucket is of brass, with an india-rubber valve working on a seat perforated with holes sufficient in number for the discharge from the condenser.*

HARTLEY ENGINE BEAM.

(To the Editor of The Engineer.)

SIR,—Your correspondent "S." will much oblige by letting your readers know why he reduces the value of S441 to S296 for open sand castings? and whether he has proved this by experiment? A. C. H.

Middlesbro', March 3rd, 1862.

LOCOMOTIVE POWER.

(To the Editor of The Engineer.)

SIR,—In connection with the valuable paper of Mr. Dixon's, which I have read in your journal, could you kindly answer me the following questions, or would any of your correspondents kindly do so?

1. The resistance to traction of the tender of an engine, the brake being on, and all six wheels tight, at a speed of 25 and 50 miles per hour respectively, tender weighing, say, 15 tons?

2. The resistance of a brake van, under the same circumstances, having only four wheels, weight = 7 tons?

3. The average cost of 1,000 lb. of tractive power of an engine?

4. Depending somewhat on question 3. The cost, irrespective of wear and tear, of conveying a train of coal up a gradient of one mile of one in 200?

Engine, train, and coal, say		450 tons.
Engine and train	225	"
Nett coal	225	"
	450	

5. The percentage which it is fair to allow for wear, &c., on engines, exclusive of road? J. S. W.

MEETINGS NEXT WEEK.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.—Thursday, 7.30 p.m., "On Building Stones," by James B. Walton, Vice-President.

SOCIETY OF ARTS.—Wednesday, 8 p.m., "The Mauritius: its Commercial and Social Bearings," by James Morris.

Advertisements cannot be guaranteed insertion unless delivered before eight o'clock on Thursday evening in each week. The charge for four lines and under is half-a-crown; each line afterwards, sixpence. The line averages nine words; blocks are charged the same rate for the space they fill. All single advertisements from the country must be accompanied by stamps in payment.

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Letters relating to the advertisement and publishing department of this paper are to be addressed to the publisher, MR. BERNARD LUXTON; *all other letters and communications to be addressed to the Editor of* THE ENGINEER, 163, *Strand, London, W.C*

THE ENGINEER.

FRIDAY, MARCH 7, 1862.

THE NEW BRIDGES OVER THE THAMES.

FIVE years ago the metropolitan bridges were but eight in number, viz., London, Southwark, Blackfriars, Waterloo, Hungerford, Westminster, Vauxhall, and Battersea, all crossing the Thames within a distance of five miles. Two more, Chelsea bridge and the Pimlico railway bridge, have since been completed; a railway bridge at Fulham, and a suspension bridge at Lambeth are nearly finished, and two more railway bridges and a suspension bridge have been projected within the limits of the City. All this is exclusive of building an entirely new bridge, now nearly ready for opening, in place of the old bridge at Westminster, the displacement of Hungerford bridge by a railway, and the proposed rebuilding of Blackfriars bridge. Thus, five years hence we shall probably have at least fifteen bridges in the same distence of five miles; viz., two stone bridges (London and Waterloo); four iron highway bridges (Southwark, Blackfriars, Westminster, and Vauxhall); three suspension highway bridges (Temple, Lambeth, and Chelsea); five iron railway bridges (Charing Cross—city extension—London, Chatham, and Dover; Charing Cross; Pimlico and West London), and one wooden bridge, (if not rebuilt), that at Battersea.

The new bridges represent nearly every principle of construction, a great variety of foundations, and a very wide divergence in their artistic features. The piers of the Pimlico bridge were put in in coffer dams, those of Chelsea and Westminster bridges upon piles and concrete enclosed by cast iron, and the Charing Cross and Lambeth bridge piers are cast iron cylinders, sunk into the clay and filled with concrete. The new Westminster bridge exhibits a combination of cast and wrought iron in arches, no allowance being made for expansion; the Pimlico and Fulham railway bridges have arches formed of wrought iron plates, the Charing Cross bridge will have eight spans, each 154ft. wide, of lattice girders, the Chelsea bridge has iron chain cables, and the Lambeth bridge is to have wire cables, both suspension bridges having trussed roadways.

We have, on previous occasions, expressed our opinion of several of these modes of construction. We have expressed our doubts of the propriety of exposing wrought iron to compression in arches of wide span. If wrought iron arched ribs are to be made, they should, we think, be formed after the manner of tubular girders, so as to have great lateral stiffness. At present the 175ft. spans of the Pimlico railway bridge are formed of ribs only 4ft. deep, connected by occasional cross bracing. If enough iron were employed the arrangement might be as secure as cast iron arches, but, in that case, the wrought iron arches would cost twice as much as cast iron ribs.

The new Lambeth bridge, judging from the illustrations which have been published, is likely to be the plainest in appearance of any of the metropolitan bridges below Battersea. Of the principle of construction adopted by Mr. Barlow we have frequently spoken in praise, but there will be many who, caring little for the economical features of trussed suspension bridges, and contrasting that at Lambeth with the noble span doomed to be removed from Hungerford, will pronounce most unfavourably against the former. In their eyes, too, the railway girders, already being placed at Hungerford, will come in for sharp criticism. It is greatly to be regretted that the new Charing Cross bridge, occupying the finest site on the Thames, should be nothing more than a quarter of a mile of monotonous trussing—a sort of garden railing on seven pegs. The retention of the two thick piers of the present bridge, along with five cylindrical stilts as intermediate supports, will always give the work the appearance of having been attempted on two piers only, the cylindrical piles having, apparently, been added afterwards to keep it from tumbling into the river. Of course, too, eight spans are not the proper number for a bridge. Who ever heard of a fine bridge with an even number of spans? We might as well look for an odd number of columns in a Greek peristyle. As a work of construction, too, we do not think that Mr. Hawkshaw's new bridge is quite the thing. He had, it is true, an awkward problem to solve in obtaining an unbroken width of nearly 50ft. without arches. To this end he has placed his girders nearly 49ft. apart, supporting the roadway on cross girders, 67ft. long over all, and placed 11ft. apart from centre to centre. There are no less than 104 of these girders, the aggregate length of which is a mile and a quarter, and each of which, 4ft. deep in the centre, is strong enough for a good sized bridge by itself. These cross girders, however, are hung below the bottom flanges of the main girders of 154ft. span, and the means of suspension consist only of four insignificant strips of angle iron at each end of each cross girder, these angle irons being secured by five or six rivets. With four locomotives abreast on the four lines, the strain of 50 tons or so of live load upon these rivets is not unlikely to work them loose after a comparatively short time. Why the cross girders were not made to bear directly on the upper part of the bottom flanges of the main girders we do not understand. The latter would then have been lowered at least 4ft., with the same headway under the bridge, the piers being, at the same time, 4ft. shorter. It is true that, if steamboats and other craft can confine themselves accurately to the spaces between the cross girders,—spaces 9ft. 6in. wide in the clear, and 67ft. long,—they will have 4ft. more head room under the bridge than would be the case were the main girders brought down to the level of the bottoms of the cross girders. But this nice steering is hardly likely, especially with sailing craft, and thus we think ourselves justified in regarding the headway of the Charing Cross bridge as the headway only under the cross girders. Under the direction of the same engineer the City bridge for the New Cannon-street branch of the Charing Cross line will, we presume, be of similarly unprepossessing design. Of the mere stability of the work there would, probably, be no question were the cross girders differently supported.

The Blackfriars bridge inquiry is still pending in the Bridge House Committee, and we are unable to say what risk there may be that Mr. Page's fine design may be rejected. The railway people, who are waiting to put up a bridge just below, are moving to the utmost to obtain the adoption of a five-arch structure. Their engineer will not stand much, we apprehend, upon elegance of design, if we may be allowed to judge from the manner in which he swamped a large and handsome bridge, erected by his own father at Rochester, by putting up a hideous affair in plate iron close beside it. We are forced to the conviction indeed that, with but few exceptions, our bridge architecture is fast relapsing into ugliness, for there have lately been erected, or commenced, a number of bridges, like the Saltash, the Lambeth, &c., which are anything but pleasing in appearance. In the Blackfriars competition, even, one well-known engineer actually proposed a succession of bow-string girders, a class of bridge spans of which, we feel sufficiently assured, no handsome example could ever be executed. In works of such a monumental character as great metropolitan bridges this decay of public taste is much to be regretted.

IRON SHIPS OF WAR.

THE too easy acquiescence of the House of Commons in reference to the Admiralty proposals, of which we complained last week, produced a very bad effect even before our remarks came before our readers. The silence with which Lord Clarence Paget's speech on the navy estimates was received on the first evening (in so far as the *material* of our ships of war is concerned) not only encouraged the noble secretary to adhere, barnacle-fashion, to wood still, but actually seduced him into a decidedly retrogressive path. Lord Clarence Paget knows perfectly well that to go on building small unprotected wooden ships is only to expend the cost of those ships blindly and wastefully. So well does he know this that before he took the House of Commons into his counsels he had decided on building incombustible small vessels. The desire of the Admiralty to keep the dockyards still jogging on as at present is, however, so strong, that no sooner did the House betray its indifference than Lord Clarence determined to declare their intention to cling to the wooden system for another year at least. This is how it happened that while we were announcing his determination to abandon wood, partially at least, he was asserting his intention to adhere to it. This formal contradiction between his words and ours shows, however, even more forcibly than any argument could show, how extremely baneful is that ignorant complacency of Parliament to which we pointed with so much pain last week.

In the discussions which took place in the Parliamentary Committee on Thursday a claim was made by Mr. Laird, Sir Morton Peto, and others in the iron interest, but it came too late to produce any good effect. In fact we are rather afraid that the introduction of small iron vessels of war will be delayed rather than hastened by the advocacy of Mr. Laird, in the same way as Parliamentary Reform is supposed to have been kept back by the agitation of Mr. Bright. Every body knows that Mr. Laird is now, and has long been, all but exclusively an iron shipbuilder, and it is a characteristic of Englishmen—and by no means an improper one—to suspect that a man's interest usually exerts a powerful influence upon his opinions. If Mr. Laird will take our advice, therefore, he will give Parliament the benefit of his extensive knowledge unalloyed by any special pleas on behalf of iron ships, or Mersey docks, or armed river craft as defences, for on all these points he will be likely to repel more sympathies than he will conciliate.

We are fully prepared to admit that the tenacity with which the Admiralty holds to its own establishments for building ships, and therefore to the wooden ships for producing which alone those establishments are at present fitted, is perfectly intelligible, and by no means inexcusable. But this does not lessen our duty in the matter. It may moderate the tone of our reproaches, but it must not deter us from expressing our strong sense of the sacrifices to which the country is being continually subjected by an obstinate persistence in systems which ought to be already obsolete. If Parliament are content to sanction the continued construction of war vessels which a single shell-gun in an iron enemy would destroy in ten minutes, we can only regret their indifference and folly; but we shall not cease to enforce upon our readers, at least, the urgent necessity of the change from wood to iron.

TESTS AND TESTING.

OUR experience in the arts appears to be very nearly represented by the means and modes by which we test the identity and fitness of materials and the quality of their artificial combinations. When men began to dig, to hew and to build, they must have soon found the need of proving their work. There must, too, have been some rough sort of preliminary trial of the materials upon which they wrought. It would have been impossible, even had they possessed the tools and skill of modern times, for the earlier builders to have employed earth, stone, brick, and timber, with anything like the confidence with which those materials are now applied. We may suppose, therefore, that, until standards of strength and durability had been established, all progress in even the ruder arts of construction was exceedingly slow. As for the geometrical principles of construction, the walls of primeval dwellings must have been reared by the aid of experiment and with a perception of the principles of stability. The beaver's dam and the cell of the honey bee, the swallow's nest and the rabbit's burrow, may owe nothing to reason and everything to instinct, but we can hardly conceive man as driving a stake in the ground without the exercise of some amount of reflection and a reference to some previous observation. There must have been something like measures in the beginning, and measurement is one of the most conclusive modes of material determination. We may imagine the antediluvian builders, although accustomed to measure by the foot, the digit and the palm, gauging one stone by another, and ranging a score of timbers successively beside a model beam to insure a common length and thickness. The portable measuring staff, the type of our own pocket-rules, must have come afterwards. But is it not worth noting that, in the most nearly perfected engineering practice, we have now gone back to the "copying" principle, and that the most accurate workmanship is now attained without the intervention of a graduated scale? When the level and plummet were "invented" is not known, but the Tower of Babel could hardly have been carried up a dozen "courses" without them. Whatever period we may assign as that of their original application, we must own that they are typical of the most beautiful perception of the laws of stability. Weighing, we may suppose, was a subsequent refinement, and we have only to imagine ourselves unprovided with a system of weights to understand the vast importance of the discovery of such a mode of quantitative comparison. A natural perception, quickened by a common want, might, perhaps, readily enough discover how to measure so palpable a quality of matter as weight, but we are, nevertheless, aware that, certainly within the experience of living men, tribes of savages have been content to barter their goods according to the weight roughly ascertained by lifting them with the hand or foot. The scale-beam, therefore, was a true invention or discovery, and the grand perception of Archimedes, in discovering all the properties of the lever, fell hardly short of inspiration. We have only to reflect upon what commerce, currency, science, and the arts would be without means for the accurate determination of weight, whether in grains or in tons, to perceive the just rank of weighing apparatus among all other artificial appliances.

Measures and weights, as quantitative tests, must have preceded all but the most simple and necessary means of qualitative comparison. The former, after a time, enabled many of the grandest scientific propositions to be verified, and we now measure inaccessible objects, invisible gases, and, by the thermometer, photometer and electrometer, the imponderable agents, heat, light, and electricity. By means of the steam indicator and the dynamometer, acting in connection with apparatus for indicating time, we measure mechanical power with the greatest exactness, mapping out in visible characters the exact relations of pressure and velocity.

The tests which are especially resorted to by the engineer are, in themselves, too numerous for enumeration

within the limits of our present space. The testing machine gives the tensile strength of materials, the trial by applying weights at the middle of bars supported at the ends gives the tranverse strength, and the hydraulic or other press gives the resistance to crushing. The hydraulic press, too, is employed as a test for the strength of boilers and pipes and for the stiffness of girders. The falling ram affords a test also for rails, axles, wheels, and, more especially, springs. Five minutes' working of wrought iron will enable a blacksmith to pronounce upon its quality, for it is not every kind of iron that will draw into a horse nail, that will bend cold, or that will weld soundly. A blow of a hammer and the cut of a chisel on the edge of a casting will show what the iron is like, and steel can generally be correctly valued by working a fragment into a cutting tool. So, too, a blow from a hammer will show whether a pipe or a railway wheel be sound. A few blows upon a stone, soaking it in water and afterwards freezing it, will generally show whether it is fit for building, and the virtue of bricks may be very well ascertained by striking a pair together and by soaking them in a tub of water. Timber may be tested in many ways, but the eye of an experienced workman is often enough to guide him aright. The rise of vapour from the ground in the morning will often show where a well may be dug with the certainty of abundance of water, the position of the leaves of aquatic plants in a swamp will show the direction of the current, and a lighted candle will indicate a draught of air. Dubuat measured the velocity of streams by watching the motion of gooseberries in the water, their specific gravity being so nearly that of water that they would float just clear of the bottom. Many of these expedients can hardly be called "tests," yet they are tests in so far as they afford the means of ascertaining or verifying physical *data*.

When we enter upon the science of chemistry we find innumerable tests, many of them of the most beautiful and conclusive character. These it would be manifestly impossible to deal with in detail here, but they will amply reward the student for his pains. To a certain extent, too, the engineer has to resort, now and then, to chemical tests. The application of sulphuric acid as a test of the presence of lime is one; in gas making, the test by a solution of acetate of lead for sulphuretted hydrogen, and that by turmeric paper for ammonia, are others. In selecting a source of water supply, too, some chemical knowledge is next to indispensable. Thus a water which will remain colourless on the addition of the least quantity of acetate of lead is very soft, and will gradually dissolve the lead pipes through which it passes. On the contrary, a hard water will throw down the smallest quantity of lead, as will be seen by a whitish precipitation when a solution of lead is added. Water tainted by organic matter will gradually become turbid on the addition of a few drops of a solution of permanganate of potash, and the addition of the least quantity of a solution of prussiate of potash to water containing any portion of iron will instantly produce a perfectly opaque liquid of the deepest Prussian blue.

A subject so comprehensive as tests and testing might be treated in a hundred ways, and it would be difficult to deal with it in other than a desultory manner. It is one, however, which no engineer or practical man can study too much. Whether the test be that of the fitness of materials or of workmanship, or of the qualities of material combinations, its application cannot fail to increase the confidence of the engineer in his work, and it will often afford him the means of establishing his own convictions in the minds of others.

French Matters.—The new Hotel de la Paix, on the Boulevart des Capucines, at Paris is progressing rapidly. When quite finished it will cost about £750,000. There are 120 windows in each floor, and the carpetting required will measure about twenty-five lineal miles! The building externally is very handsome, and when the new Opera House and the surrounding "Place" are finished this will be one of the finest parts of the capital.—The French Workmen's Commision for the Universal Exhibition of London has published a circular to the workmen of Paris, informing them that, being convinced of the great advantages which would result to the whole country if the workmen could take part in this great Industrial Exhibition, they had submitted to the approbation of Prince Napoleon a project for facilitating the journey to England of workmen chosen from each of the branches of French manufacture. That proposition has been adopted, and the Imperial Commission has charged the Workmen's Commission to proceed to the choice of the delegates. The circular states that a sum of 40,000f. has been accorded by the Imperial Commission and the city of Paris towards the expense, and suggest that a subscription shall be opened in every manufacturing establishment in aid of the fund.

Diving Bells.—Sir John Rennie has published a letter in which he states, "As far as my researches go the first time that the diving bell was employed for building under water was at Ramsgate Harbour, in the year 1813, when the East Pier Head having failed it was necessary to rebuild it in a depth from 10ft. to 17ft. at low water of spring tides, and the late Mr. Rennie, being the engineer-in-chief of that harbour at that time, introduced the diving bell for that purpose; he therefore designed a bell of an oblong form, which was made of cast iron, having a sufficient number of solid ground-glass circular lights fixed in the roof of the bell to afford the requisite light to divers when working in the bell. In the centre of the top of the bell was fixed a water-tight gun-metal nozzle, to which a leathern hose was attached, the other end of the hose being connected with a double barrelled air pump, by means of which the requisite supply of air was sent down to the divers in the bell. There was a valve inside the bell, by means of which the quantity of air to be supplied was regulated, and which closed, in the event of any accident occurring to the hose or nozzle, so that the water could not enter; beneath this valve there was also a strong shackle to which any weight could be attached. The bell was worked by travelling trams fixed above, which could be worked in any direction as desired, according to the form and nature of the work to be executed below, which was entirely directed from above, so that the divers in the bell were only required to adjust the stones to the joints, while the bell, the divers in it, and the stone attached to the roof of the bell, were raised or lowered together as desired, according to a code of signals which were worked by striking a hammer in the bell. The whole of this diving bell apparatus answered admirably, and the work performed by it under water was equally well done and almost as rapidly as above. Mr. Rennie also employed the diving bell and apparatus in a similar manner, but entirely afloat, in a properly constructed barge or vessel for that purpose. These 'universal cranes,' as they may strictly be termed, since that period have come into general use, and are adopted in almost all building operations."

Trial of the 10-in. Armstrong Gun.—The "300-pounder Armstrong gun," as the 10-in. smooth bore 136 lb. gun lately made at Elswick is called, was tried at Shoeburyness on Wednesday week in the presence of the Ordnance Select Committee of Woolwich Arsenal. Not being yet rifled it was used with a solid spherical shot weighing 140 lb., and with a charge of 40lb. of powder. It is intended to try the power of the gun as a smooth bore against armour plates, after which it will be finished as a rifled gun adapted for projectiles of 300 lb. and upwards.

A Thames Tunnel Hoax.—A class of men were brought into close connection with the working, whose habits were foreign to such operations; and, however characteristic may be the daring of Irish labourers when under the happier influences of an open sky and free air and the applauding voices of their comrades, there was something, in the circumstances by which they were surrounded in the tunnel, so new and incomprehensible, that their energies seemed entirely paralysed, except for flight. Any unusual activity amongst the miners—any sudden gush of sand, or rattling of gravel upon the frames, would drive them precipitately from their post. An incident which occurred while the shield was being restored, after the first irruption, will illustrate the effect of panic even upon men, who, under ordinary circumstances, could act with firmness and courage. Mr. Brunel, transcribing from his son's journal, records the following:—"At two o'clock in the morning of the 17th October (1827) Kemble, the overground watchman, came stupefied with fright to tell me that the water was in again. I could not believe him—he asserted that it was up to the shaft when he came. This being something like positive, I ran without my coat as fast as I could, giving a double knock at Gravatt's door in my way. I saw the men on the top, and heard them call earnestly (down the shaft) to those who they fancied had not had time to escape; nay, Miles had already in his zeal thrown a long rope, swinging it about, calling to the unfortunate sufferers to lay hold of it, encouraging those who could not find it to swim to one of the landings. I instantly flew down the stairs. The shaft was completely dark. I expected at every step to splash into the water. Before I was really aware of the distance I had run I found myself in the frames in the east arch. Nothing whatever was the matter, but a small run in No. 1 top, where I found Huggins (foreman) and the *corps d'elite*, who were not even aware that any one had left the frames." As some of my readers may prefer to have the evidence placed before them in the quaint phraseology of one of those who had permitted himself to be overpowered by the sympathetic influence which panic is found to exercise, I venture to transcribe in a note the statement as it appears recorded in my journal. ["I seed," said Miles, "them there Hirishers a come a tumbling thro' one of them small harches like mad bulls—as if the d——l kicked 'um—screach of Murther! Murther! Run for your lives! Out the lights! was the d——l, like a cart-load o' brick shot on my head—my ears got a singing, sir—all the world like when you and me were down in that 'ere diving-bell—till I thought as the water was close upon me. Run legs or perished body, says I! when I see Pascoe a-head o' them there miners coming along as if the d——l was looking for him. Not the first, my lad, says I, and away with me—and never stopped till I got landed fair above ground. Then I began bellowing like mad for the rascals to get ropes and throw 'um down, making sure the water was coming up the shaft. Well, sir, we was a swinging about the ropes, but the d——l a one would lay hold. So I looked down, and what should I see? why nothing at all, sir! All a hoax!"]—"*Memoir of the Life of Sir Marc Isambard Brunel, Civil Engineer.*" *By Richard Beamish, F.R.S.*

The Defence.—This iron frigate was tried at Portsmouth on Friday. The weather was somewhat boisterous. The following are the six runs made, and their results:—First run: mean time, 3 min. 47 sec.; speed in knots, 12·543; revolutions of engines, 67½. Second run: mean time, 6 min. 15 sec.; speed in knots, 9·600; revolutions of engines, 65½. Third run: mean time, 4 min. 33 sec.; speed in knots, 13·186; revolutions of engines, 67½. Fourth run: mean time, 6 min. 24 sec.; speed in knots, 9·375; revolutions of engines, 68. Fifth run: mean time, 4 min. 25 sec.; speed in knots, 13·584; revolutions of engines, 67. Sixth run: mean time, 6 min. 24 sec.; speed in knots, 9·375; revolutions of engines, 68. First means: 11·071, 11·393, 11·282, 11·480, 11·479. Second means: 11·232, 11·338, 11·381, 11·480. True mean speed in knots, 11·357. At the close of the runs at the measured mile the ship was laid fair for Spithead, and, when in a fit position, the helm was put hard a-port, and a complete circle made in 6 minutes 30 seconds, and, with the helm the contrary way, in 7 minutes 6 seconds, the time being taken, in both instances, not before the ship felt her helm. The speed of the ship while making the circles, with the helm hard over, was, by ship's log, 9 knots. The draught of water of the ship was aft, 25ft. 4in.; forward, 24ft. 4in. The pressure of steam was 20 lb.; vacuum, 24in. The propeller was an improved Griffiths, with a diameter of 18ft. and a pitch of 21ft. At the conclusion of the experiments the ship's head was laid for the harbour, and in passing along the harbour channel, in line with Southsea beach, an accident occurred which might have been, but fortunately was not, attended with very serious consequences. It had been observed, with no small alarm, that on the ship completing her first run at the mile, in taking a sweep to the eastward along the edge of the Sturbridge shoal to bring her head round again for a second run to the westward, she for some time took no notice whatever of her helm after being put hard over, and ran in dangerous vicinity to shoal water; but just in time she came up to her helm, and escaped, most probably, a disaster. The same uncertainty was found in putting her at the circle, and, in fact, her time in completing the circle was not taken until she fully felt and answered her helm. In entering the harbour channel, in line with the beach of Southsea, the speed was slackened from "full" to "three-quarter" at about its narrowest part, when the ship's bow inclined towards the shore, and all the exertions of the pilot and the men at the wheel had no effect—the ship's bow had taken the ground. "Astern full speed!" was the order instantly given, and off she came; but she had got so far on the shoals that of necessity the stern next took the ground, and for some minutes so hung. Head-sails loosed and the engines going ahead at full speed, however, again extricated the ship from her perilous position, and shortly afterwards she was safely berthed alongside the dockyard. This deficiency of command over the ship in the steering power is developed in the Defence to a greater extent than in the Warrior; but the Warrior under "slow speed," and especially with the wind abaft, also possesses this very undesirable quality to an alarming extent, or, at least, she did when undergoing her trials of speed as the Defence has done. One most remarkable quality of the Defence's steering, and one that may possibly lead to the discovery of the defect as regards it, is, that although she may be under full steam, and the order is given "hard a-starboard" or "a-port," as may be required, it will take some forty-five or fifty seconds before she gives any token of feeling the effects of the alteration of her helm. Yet, once she pays off, no ship can do so more readily; that is, taking into consideration her length, as the time given in making her circles, &c., will fully prove. Whether rising floors, no keels, double bilge pieces, and small rudders have anything, if not all, to do with this defective steering, we must leave scientific men to decide. The ship's outer appearance, in both hull and rig, is certainly anything but pleasing to the eye, or in accordance with our previously understood notions of beauty or grace in marine architecture. Her straight line of bulwark fore and aft, without the slightest spring—in fact, depressing, if anything, at either end—her queer-looking stem, with her anchors hanging as near to it as possible, and her light bowsprit projecting from it almost below the level of her upper deck—all this gives her an uncanny, almost weird-like appearance; but when to these points is combined the appearance of her rig aloft, her short fore and main topmasts (she is bark rigged), and long mastheads with double topsail yards stowed polecrewise, with no topgallant masts, then the picture is complete, and the oldest seaman who looks upon her can but acknowledge that, to say the least, he never saw the like before.—*Times.*

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

2950. Fedor de Wylde, Great College-street, Camden-town, London, "Improvements in paper-making machinery."—A communication from Louis Dupont, Nancy, France.—*Petition recorded 23rd November*, 1861.

2972. Charles Stevens, Charing-cross, London, "An improved indelible anti-corrosive ink."—A communication from Louis Croc, Paris.—*Petition recorded 26th November*, 1861.

3221. Alfred Vincent Newton, Chancery-lane, London, "Improved means for reducing the friction and wear of slide-valves of steam engines."—A communication from Mr. A. Buchanan, Jersey, New Jersey, U.S.—*Petition recorded 24th December*, 1861.

3274. Edward Thomas Hughes, Chancery-lane, London, "Improvements in saddles."—A communication from John B. Peck, Yonkers, Westchester, and Thomas B. Peck, New York, U.S.—*Petition recorded 31st December*, 1861.

87. Anthony Gaffer Southby, Bulford, Wiltshire, "Improvements in the preparation of pulp for paper-making."—*Petition recorded 13th January*, 1862.

112. Edward Lord, Todmorden, Yorkshire, "Improvements in check-straps applicable to looms for weaving."

115. Joseph Ridsdale, Minories, London, "Improvements in preparing sheet lead for covering floors, stairs, and other like purposes."—*Petitions recorded 15th January*, 1862.

137. Samuel Dreyfous, "An improved throstle spinning frame."—A communication from M. Charles Leyherr, Laval, France.—*Petition recorded 18th January*, 1862.

150. John Stenhouse, Upper Brunswick-terrace, Barnsbury-road, London, "Improvements in the protection of metallic surfaces, and in rendering certain substances less pervious to air and moisture."—*Petition recorded 21st January*, 1862.

171. John Tomlinson, Liverpool, "Improvements in washing machines."

173. Frederick William Werner, Mannheim, Baden, "An improved method of, and apparatus for, destroying vermin."—*Petitions recorded 23rd January*, 1862.

213. James List, Carisbroke, Isle of Wight, Hampshire, "An improved means and instrument for obtaining distances and heights and distances between distant objects without computation."

215. Stephen Smith and Thomas Smith, Nottingham, "Improvements in the manufacture of cord and twine from mill spun yarns."

222. Samuel Cunliffe Lister and James Warburton, Manningham, near Bradford, Yorkshire, "Improvements in preparing cotton for spinning."

228. Rudolph Bodmer and William Wilson, Newport, Monmouthshire, "Improvements in the process of manufacturing artificial stones, parts of which improvements are also applicable to the manufacture of artificial fuel."—*Petitions recorded 28th January*, 1862.

229. John Henry Brierley, Aldermanbury, London, "An improved clasp or fastener for reversible belts, bands, or straps."

233. John McKean and James Gabbott, Walmer Bridge Mills, near Preston, Lancashire, "Improvements in sizeing or dressing yarns or textile materials."—*Petitions recorded 29th January*, 1862.

254. Horatio White, Mornington-place, Hampstead-road, Middlesex, "Improvements in shirt-collars."—*Petition recorded 31st January*, 1862.

269. William Smith, Bury, Lancashire, "Improvements in machinery for the manufacture of bricks, tiles, or other articles of a similar nature or character."

273. John Hill, Piccadilly, London, "Improvements in the construction of portable chairs and other articles for sitting or reclining on, road, bath, invalid, wheel, and children's carriages, ambulances, or vehicles for carrying sick or wounded persons."—*Petitions recorded 1st February*, 1862.

283. David Joy, Manchester, "Improvements in machinery for forging metals, also applicable to other purposes."

285. Charles Stevens, Charing-cross, London, "An improved axle-tree."—A communication from Victor Boulanger, Paris.—*Petitions recorded 3rd February*, 1862.

313. Robert Russell, Derby, "Improvements in stove grates and kitchen ranges."

317. Edward Cooper Willis, Addison-road, Kensington, London, "Improvements in the treatment of wax and other substances of a similar nature."

319. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in the preparation of pulp for paper."—A communication from Paul Emile Mollet, Paris.

321. John Dearman Dunnicliffe, Nottingham, "Improvements in the manufacture of lace or net bonnet-fronts and other similar articles, and in apparatus used in this manufacture."—*Petitions recorded 6th February*, 1862.

325. Hugh Adams Silver, Silvertown, Essex, "Improvements in the manufacture of trays, cases, and other similar articles and bottles in ebonite, vulcanite, or other hard india-rubber."

327. Alexander McKenzie and Francis Panthel, Glasgow, Lanarkshire, N.B., "Improvements in sewing machines."

329. Henry Macaulay and Alphonso Florencio Notley, Rotherham, Yorkshire, "Improvements in fire-guards."

331. Henry Brinsmead, Ipswich, Suffolk, "Improvements in apparatus for moving, elevating, cleaning, and dressing grain."—*Petitions recorded 7th February*, 1862.

333. John Howie, Hursford Colliery, Kilmarnock, N.B., "Improvements in regulating the consumption of fuel in furnaces."

337. James Carrington, Queen's Gate-mews, Kensington, London, "Improvements in the construction and fitting up of stalls and horse-boxes."—*Petitions recorded 8th February*, 1862.

339. Marc Antoine Francois Mennons, Rue de l'Echiquier, Paris, "Improved apparatus for the administration of vapour baths."—A communication from Eliacin Edouard Pomier, Egriselles-le-Boceage, Yonne, France.

341. Richard Philp and John Philp, Lower John-street, Golden-square, London, "An improvement in propellers for propelling ships, boats, and other vessels in water."

343. Bedford Clapperton Trevelyan Pim, Junior United Service Club, St. James's, London, and George Fawcus, North Shields, Northumberland, "Improvements in uniting iron plates and in uniting and fixing armour-plates on ships and other structures."

345. George Smith, Holland-grove, North Brixton, Surrey, "Improvements in shawls."—*Petitions recorded 10th February*, 1862.

353. Ellis Sutton, Radcliffe, Lancashire, "A certain improvement in machinery or apparatus for preparing cotton and other fibrous substances for spinning."

355. William Lyall, Amiens, Somme, France, "Improvements in machinery for preparing flax, hemp, and other fibrous substances."

358. John Brinsmead, Charlotte-street, Fitzroy-square, London, "Improvements in pianofortes."

361. James Jennings McComb, Pump-court, Temple, London, "An improved fastening for securing cotton and other bales or packages."

363. John Hetherington, Manchester, "Improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning."—*Petitions recorded 11th February*, 1862.

366. John Robb, Aberdeen, N.B., "Improvements in ventilation, and in apparatus employed for that purpose."

367. James Brickhill, Stepney-causeway, Commercial-road East, London, "Improvements in the cylinders and pistons of steam engines."

369. Andrew Hinshaw, Aldermanbury Postern, London, "Improvements in hooped skirts."—A communication from John Coulthard Kelly, New York, U.S.

370. Richard Archibald Brooman, Fleet-street, London, "Improvements in preparing and ornamenting cast iron and other metals in order to fit them for articles of furniture and decoration and other similar uses."—A communication from Jean Baptiste Godin, Guise, France.

371. John Steven Joseph, Rhostyllan, near Wrexham, Denbighshire, North Wales, "Improvements in coke ovens, and in utilising the waste heat from the same."

373. Alexander Samuelson, Cornhill, London, "Improvements in building ships and vessels."—*Petitions recorded 12th February*, 1862.

376. John Steven Joseph, Rhostyllan, near Wrexham, Denbighshire, North Wales, "An improved retort oven, and the utilisation of the spare heat from the same."

383. Charles Denton Abel, Southampton-buildings, Chancery-lane, London, "Improvements in towing boats or other vessels on rivers, and in apparatus employed for that purpose."—A communication from Jean François Call, Paris.

391. James Edward McConnell, Wolverton, Buckinghamshire, "Improvements in parts of boilers and furnaces for locomotive and other engines."

393. James Edward McConnell, Wolverton, Buckinghamshire, "Improvements in railway brakes and in warming railway carriages."

395. William George Valentin, Oxford-street, London, "An improved mode of and apparatus for coking coal."—*Petitions recorded 13th February*, 1862.

396. Samuel Benjamin Whitfield, Birmingham, "Improvements in the manufacture of iron bedsteads, and in the manufacture of ornamental iron tubes or columns for the construction and ornamentation of iron bedsteads."

397. Arthur John Dodson, Clapham, Surrey, "An improved composition for coating, covering, or protecting ships' bottoms, applicable also for coating or covering railway sleepers, telegraphic wires, and other surfaces, and likewise as a cement and as a substitute for metal for certain constructive purposes."

398. William Clark, Chancery-lane, London, "Improvements in mounting

and fixing the handles or knobs of doors, furniture, and other articles."—A communication from Mr. Félix Hilaire Gallimard, Boulevart St. Martin, Paris.

399. THOMAS DUNCAN MCFARLANE, Glasgow, Lanarkshire, N.B., "Improvements in sewing machines."

400. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in machinery or apparatus for propelling ships or boats."—A communication from Charles Arnaud and Joseph Labriola, Paris.

401. WILLIAM FORD SMITH and ARTHUR COVENTRY, Gresley Ironworks, Ordsal-lane, Salford, Lancashire, "Improvements in, and applicable to, lathes for turning and cutting screws."—*Petitions recorded 14th February*, 1862.

406. GEORGE HENRY LAW, Rochester-road, Camden New-town, London, "Improvements in the construction of steam and other boilers."

408. CORNELIUS TURNER and JACK SHAW, Airedale Woollen Felt Mills, Leeds, Yorkshire, "Improvements in felted fabrics."

412. RICHARD BUNTING, Sheffield, Yorkshire, "Improvements in the manufacture of bolsters and scales, and in machinery employed therein."

414. ROBERT BELL, Westland-row, Dublin, "Improvements in treating fabrics or articles composed of animal and vegetable substances for the purpose of separating one class from another."

416. JOHN GREEN, Newtown, St. Martin, Worcestershire, "Improvements in the method of and apparatus for signalling, which improvements apply to signals used with steam ploughs or cultivators."—*Petitions recorded 15th February*, 1862.

418. FRANCIS WILLIAM GERISH, East-road, City-road, London, "Improvements in pumps."

420. JOHN HODGKINSON and DANIEL GREENHALGH, Bolton, Lancashire, "Improvements in machinery or apparatus for preparing or combing cotton, wool, and other fibrous materials."—*Petitions recorded 17th February*, 1862.

430. JOHN LEES, Rookery, Salterhebble, Halifax, Yorkshire, "An improved trap for catching rats, mice, birds, and other animals alive."

434. WILLIAM FIRTH, Burley, Leeds, Yorkshire, "Improvements in machinery for digging or turning up soil."—*Petitions recorded 18th February*, 1862.

436. JOHN TOMLINSON PENDLEBURY, Elton, near Bury, and GEORGE PENDLEBURY, Tottington-lower-end, Lancashire, "Improvements in machinery for doubling, folding, or plaiting cloth."

440. WILLIAM BRIDGES ADAMS, Holly Mount, Hampstead, Middlesex, "Improvements in springs and their arrangement for moving and stationary purposes."

444. WILLIAM DAVIS, Spencer-road, Stoke Newington, London, "Improvements in increasing the illuminating effect of coal-gas and other gases."

446. JOSEPH GREGORY, Wellington, Somersetshire, "Improvements in candlesticks."

448. JAMES WILLCOX, Ludgate-hill, London, "Improvements in the manufacture of frills and ruffles, and in the machinery or apparatus employed therein."—A communication from Chauncey Orrin Crosbey, New Haven, Connecticut, U.S."—*Petitions recorded 19th February*, 1862.

450. JOSEPH FRIEDLAENDER, White Abbey, Antrim, Ireland, "Improvements in machinery for scutching, breaking, and preparing flax, hemp, jute, and other fibrous substances."

454. ROBERT TAYLOR PRITCHETT, St. James's-street, Westminster, London, "Improvements in targets or butts."

456. JAMES PATERSON, Middle Temple, London, "Improvements in means or apparatus for facilitating the evaporation of saccharine solutions."—A communication from George Alexander Drummond, Montreal, Canada.

458. LORD ALFRED SPENCER CHURCHILL, Rutland-gate, Hyde Park, London, "Improvements in electric telegraphs."—*Petitions recorded 20th February*, 1862.

Invention Protected for Six Months by the Deposit of a Complete Specification.

509. JOHN IMRAY, Westminster Bridge-road, Lambeth, Surrey, "Improvements in hinges."—*Deposited and recorded 25th February*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

512. WILLIAM MCNAUGHT, Manchester.—Dated 25th February, 1859.

514. ROBERT FIELDEN, jun., and THOMAS FIELDEN, Walsden, Lancashire.—Dated 25th February, 1859.

579. JOHN MACMILLAN DUNLOP, Manchester.—Dated 5th March, 1859.

604. WILLIAM AVERY, Birmingham.—Dated 16th March, 1859.

528. GEORGE HORNER, Falls-road, Belfast, Antrim, Ireland.—Dated 28th February, 1859.

526. JAMES HOWDEN, Glasgow, Lanarkshire, N.B.—Dated 28th February, 1859.

539. HENRY MOULE, Fordington, Dorsetshire.—Dated 1st March, 1859.

810. FRANCIS MORTON, James-street, Liverpool.—Dated 31st March, 1859.

531. COLLINSON HALL, sen., and COLLINSON HALL, jun., Navestock, Essex.—Dated 28th February, 1859.

543. JAMES TEMPLEMAN, Glasgow, Lanarkshire, N.B.—Dated 1st March, 1859.

544. JOHN PILE, West Hartlepool, Durham.—Dated 1st March, 1859.

545. DAVID LICHTENSTADT, Henry-cottages, Park-road, Peckham, Surrey.—Dated 1st March, 1859.

576. RICHARD ARCHIBALD BROOMAN, Fleet-street, London.—A communication.—Dated 4th March, 1859.

Patents on which the Stamp Duty of £100 has been paid.

445. HENRY CONSTANTINE JENNINGS, Great Tower-street, London.—Dated 28th February, 1855.

454. GEORGE MACKAY MILLER, Inchicore, Dublin.—Dated 1st March, 1855.

478. ROBERT BOBY and THOMAS COOPER BRIDGMAN, Bury St. Edmunds, Suffolk.—Dated 3rd March, 1855.

529. JAMES BULLOUGH, Accrington, Lancashire.—Dated 9th March, 1855.

Errata.

303. Omit from title the words "applicable also for other purposes."

451. For "Stochr" read "Stoehr," and for "schloss, Gereath" read "Schloss Gereuth."

Notices to Proceed.

2619. HENRY BLOXAM, jun., Shrewsbury, Shropshire, "Improvements in sights for rifles and ordnance."—*Petition recorded 19th October*, 1861.

2620. HENRY LAMPLOUGH, Holborn-hill, London, "Improvements in the means for igniting the wicks of candles and lamp wicks."

2624. EDWARD OLDFIELD, Adelphi Ironworks, Salford, Lancashire, "Improvements in self-acting mules for spinning and doubling."—*Petitions recorded 21st October*, 1861.

2642. GEORGE ARCHER, Raunds, Northamptonshire, "Improvements in sewing boots and shoes."

2646. CLAUDE BRISON and ANTOINE CHAVANNE, Lyons, France, "Improvements in ovens, kilns, or furnaces for manufacturing or other purposes."—*Petitions recorded 23rd October*, 1861.

2661. TIMOTHY MORRIS, ROBERT WEARE, and EDWARD HENRY CRADOCK MONCKTON, Patent-office, Trafalgar square, London, "Improvements in magnets, induction coils, and in insulating wire and metal for electric and other purposes."

2663. WILLIAM DICKS, Floore, Northamptonshire, "Improvements in water-meters."—*Petitions recorded 24th October*, 1861.

2668. WILLIAM WHARTON, Birmingham, "Improvements in the manufacture or construction of springs for railway or other vehicles."

2674. EDOUARD ALEXANDRE, South-street, Finsbury, London, "An improved pedal-box to be applied to flutinas or small organs, and other similar musical instruments."

2675. THOMAS MOORE, Regent-circus, Piccadilly, London, "Improvements in windlasses, and in checking or stopping chains worked thereby."

2677. THOMAS RICHARDSON, Newcastle-on-Tyne, and ROBERT IRVINE, Hurlet, Renfrewshire, "Improvements in treating bones and gelatine."

2680. BERNARD JOACHIM LA MOTHE, New York, U.S., "Improvements in the construction of metallic railroad cars and other vehicles."—*Petitions recorded 25th October*, 1861.

2682. FREDERIC BARNETT, St. Mary-axe, London, "Improved electric danger signals for railways and other cognate purposes."

2693. GEORGE HUTTON, Manchester, "Improvements in hats, caps, and other such coverings for the head."

2694. WILLIAM SMITH, Leek, Staffordshire, "Improvements in the preservation of stone, brick, and other such materials used in building, applicable also to the waterproofing of walls."—*Petitions recorded 29th October*, 1861.

2698. WILLIAM RYDER and THOMAS RYDER, Bolton-le-Moors, Lancashire, "Improvements in machinery for fluting rollers."—*Petition recorded 28th October*, 1861.

2703. OLIVER BAYLISS, Birmingham, "Improvements in double-sighted double rifle guns, for military and sporting purposes."

2710. RICHARD GIBBON, Royal Brewery, Brentford, Middlesex, "Improvements in machinery or apparatus for preparing grain for brewers."

2711. JOHN EAGLESFIELD, Devizes, Wiltshire, "Improvements in gas-burners."

2712. JOHN SAMUEL JACKSON, Pendleton, Lancashire, "Improvements in the treatment of woven fabrics known as cords."

2714. JOHN HAYWARD, Everton, Liverpool, "Improvements in means or apparatus for raising water or other fluids."

2716. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in the preparation or treatment of skins and hides."—A communication from Dr. Friedrich Knapp, Munich, Bavaria.—*Petitions recorded 29th October*, 1861.

2719. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improvements in the construction of horticultural cases."—A communication from Léon Albert Binst, Levallois, France.

2728. ALFRED TOPHAM, JOSEPH TOPHAM, and JABEZ TOPHAM, St. Pierre-les-Calais, France "Improvements in the manufacture of lace."—*Petitions recorded 30th October*, 1861.

2735. GEORGE HOLCROFT, Manchester, "Improvements in the construction of blast furnaces for smelting ores."

2736. LYNALL THOMAS, Union-street, Berkeley-square, London, "Improvements in rifled ordnance and projectiles."

2749. MICHAEL HENRY, Fleet-street, London, "Improvements in steam engines and boilers."—A communication from Henry Giffard, Boulevart St. Martin, Paris."—*Petitions recorded 1st November*, 1861.

2752. JAMES SMITH BROOKS, Cambridge-villas, Mare-street, Hackney, London, "A new or improved back or chest-protecting brace or braces."

2753. ALFRED FERNANDEZ YARROW, Arundel-square, Barnsbury, and JAMES BRACEBRIDGE HILDITCH, Barnsbury-villas, London, "Improvements in machinery used when ploughing, tilling, or cultivating land by steam power."

2760. THOMAS LOCKIE, Glasgow, Lanarkshire, N.B., "Improvements in the manufacture of wrought iron wheels."

2762. SAMUEL WILLIAM WORSSAM, King's-road, Chelsea, Middlesex, "Improvements in machinery for cutting wood."—*Petitions recorded 2nd November*, 1861.

2779. EDWARD BOWEA, Upper Norwood, Surrey, "Improvements in the manufacture of elastic fabrics."—*Petition recorded 5th November*, 1861.

2780. FREDERICK HILLS SCHRODER, Hampstead, Middlesex, "Improvements in evaporating and in machinery employed therein."—*Petition recorded 6th November*, 1861.

2819. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in obtaining alkaline phosphates."—A communication Edouard Aubertin, Paris.—*Petition recorded 9th November*, 1861.

2841. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in skates."—A communication from Daniel Hartwell Shirley, Boston, Massachusetts, U.S.—*Petition recorded 12th November*, 1861.

2850. WILLIAM CLARK, Chancery-lane, London, "The application of electricity in refining cast iron for the purpose of converting it into wrought iron or steel, with or without the addition of other agents."—A communication from François Alphonse Adéodat Dufournel, Boulevart St. Martin, Paris.—*Petition recorded 13th November*, 1861.

2896. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in reaping machines."—A communication from Cyrus Hall McCormick, Chicago, U.S.—*Petition recorded 18th November*, 1861.

2907. BENJAMIN DAVENPORT GODFREY, Milford, Worcester, Massachusetts, U.S., "An improved boot or shoe with a wooden shank part and a flexible fore part to the sole."—*Petition recorded 19th November*, 1861.

2918. LYNALL THOMAS, Union Berkeley-square, London, "Improvements in the mode of manufacturing and constructing wrought iron ordnance."—*Petition recorded 24th November*, 1861.

2949. EUGENE ALEXANDRE ROUVIERE, Rue de Malte, Paris, "An improved pump."—*Petition recorded 23rd November*, 1861.

3041. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in pumps."—A communication from Calvin Woodward and George Mills Woodward, New York, U.S.—*Petition recorded 4th December*, 1861.

3191. JOSEPH WESTWOOD, London-yard, Poplar, Middlesex, "An improvement in the construction of hydraulic presses."—*Petition recorded 20th December*, 1861.

3221. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improved means for reducing the friction and wear of slide-valves of steam engines."—A communication from Andrew Buchanan, Jersey, New Jersey, U.S.—*Petition recorded 24th December*, 1861.

192. WHITMORE BAKER, Downham, Norfolk, "Improvements in fire-arms adapted to prevent their accidental discharge."—*Petition recorded 25th January*, 1862.

217. JOHN HUNT, Birmingham, "An improvement or improvements in the manufacture of gas and other chandeliers."

223. GEORGE HENRY MORGAN and EDWARD MORGAN, Grand Junction-terrace, Edgeware-road, London, "Improvements in carriages."—*Petitions recorded 28th January*, 1862.

273. JOHN HILL, Piccadilly, London, "Improvements in the construction of portable chairs and other articles for sitting or reclining on, road, children's, and invalid carriages, ambulances, or vehicles for carrying sick or wounded persons"—*Petition recorded 1st February*, 1862.

354. WILLIAM MACNAB, Greenock, Renfrewshire, N.B., "Improvements in steam engines."—*Petition recorded 11th February*, 1862.

380. WILLIAM HEWITT, Birmingham, "Improvements in rein-holders."—*Petition recorded 13th February*, 1862.

412. RICHARD BUNTING, Sheffield, Yorkshire, "Improvements in the manufacture of bolsters and scales, and in machinery employed therein."—*Petition recorded 15th February*, 1862.

456. JAMES PATERSON, Middle Temple, London, "Improvements in means or apparatus for facilitating the evaporation of saccharine solutions."—A communication from George Alexander Drummond, Montreal, Canada East.—*Petition recorded 20th February*, 1862.

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 1st March, 1862.

1837, 3d.; 1833, 5d.; 1833, 5d.; 1840, 1s.; 1841, 2s. 6d.; 1842, 3d.; 1843, 9d.; 1844, 3d.; 1845, 3d.; 1846, 1s. 7d.; 1847, 6d.; 1848, 3d.; 1849, 2d.; 1850, 3d.; 1851, 10d.; 1852, 3d.; 1853, 6d.; 1854, 3d.; 1855, 3d.; 1856, 3d.; 1857, 6d.; 1858, 11d.; 1859, 9d.; 1860, 3d.; 1861, 3d.; 1862, 7d.; 1863, 3d.; 1864, 3d.; 1865, 9d.; 1866, 3d.; 1867, 3d.; 1868, 3d.; 1869, 3d.; 1870, 3d.; 1871, 7d.; 1872, 3d.; 1873, 5d.; 1874, 6d.; 1875, 7d.; 1876, 7d.; 1877, 6d.; 1878, 3d.; 1879, 1s. 7d.; 1880, 6d.; 1881, 5d.; 1882, 10d.; 1883, 6d.; 1884, 10d.; 899*, 1s. 4d.; 1360*, 4d.

*** Specifications will be forwarded by Mr. Bennett Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

(Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.)

1984. L. VASSIVIERE, *Lyons*, "*Smoke-consuming apparatus.*"—*Dated 9th August*, 1861.

The position of this apparatus is on the furnace under the boiler (where furnaces and boilers are used), and forward of the furnace bars. The smoke should be made to pass this apparatus at its lower part; it then ascends into small round holes made quite through the thickness of the interior plate, and from thence the smoke passes through a nipple round which circulates heated air, which, meeting at the summit of the nipple, the smoke mixes therewith, and furnishes the latter with the oxygen required to establish combustion. This mixture traverses an upper plate (which is placed on the hollow nipple to receive its tube), and this upper plate is also provided with a round hole. Between this upper plate and the nipple a space of about the eighth of an inch is left to let the heated air pass to supply the required oxygen, and establish combustion of the smoke, which operation takes place immediately above the space mentioned, and in the hole of the upper plate which is sufficiently heated to insure the inflammation of the mixture.—*Not proceeded with.*

2017. E. A. RIPPINGILLE, *Prestolee, Farnworth, near Manchester*, "*Steam engines.*"—*Dated 14th August*, 1861.

This engine is for the purpose of utilising the power of the injection water as it is forced by the atmospheric pressure into the condenser, and is applicable to all jet-condensing engines. In constructing this the patentee employs a cylinder closed at both ends, with piston working in the same, having its piston-rod coupled to work simultaneously with the air-pump piston. Passages communicating from the valve-chest admit the injection water to one or both ends of the cylinder, and from the cylinder, through the eduction-port, into the condenser communicating with the valve-chest in the supply pipe for the injection water, which must be of equal area to the area of ports of the engine. The valve or valves is or are worked by an eccentric, for which purpose he employs the loose eccentric, which would require no supervision in reversing the engine. The size of the injection engine is regulated by the size of the air-pump in single-acting engines; the diameter of the injecting engine should not be more than half the area of the air-pump; in double-acting engines one-fourth the area. The valve ports and eduction passages must be in size in proportion to the speed of the engine—from one-fourth to one-tenth the area of the injection cylinder. It is desirable in arranging and connecting this engine to place the injection cylinder as near the condenser as practicable, and elevated above it, so that the water from injection cylinder may have no obstruction in its passage to the condenser. The injection engine must act simultaneously and identically with the piston of the air-pump, and for this purpose he connects the piston-rod of the injection engine to corresponding moving parts of the air pump, and, where practicable in marine engines, the injection may be situated over or in a line with the air-pump, with the piston-rod coupled to the air-pump rod, having sufficient room between to admit a crosshead coupled to the end of single lever with connecting-rod from the lever working on to the crank on the main shaft, or, where convenient, a connecting-rod carried from a crosshead direct to the crank or other moving parts of the engine.

2030. Z. COLBURN, *Tavistock-street, Bedford-square, London*, "*Apparatus for heating water intended for the supply of steam boilers.*"—*Dated 17th August*, 1861.

This invention consists of apparatus for heating the water intended for the supply of steam boilers to a temperature not only above that at which water boils in the open air, but up to or above the temperature at which the water is maintained in the boilers when in regular working. The heat for thus heating the feed-water for one or more boilers is not to be derived from any waste heat escaping from the furnaces or flues of the boilers themselves, but is to be derived from the steam escaping from a supplementary engine, worked by steam of a pressure considerably higher than that maintained in the boiler or boilers, the feed-water for which is to be heated, and with a back-pressure greater than the full pressure in those boilers.—*Not proceeded with.*

2056. G. T. SELBY, *Smethwick, Staffordshire*, "*Surface condensers.*"—*Dated 19th August*, 1861.

This invention consists in making the tubes of condensers of a spiral or worm form for the whole or part of their length, instead of straight, as heretofore. The spiral or worm form will admit of expansion and contraction in the length of the tube, without affecting the joints where the ends of the tubes are fixed tight and fast in the plates or sides of the cistern of the condenser.

2061. T. PEDRICK, *Park-place, Brixton*, "*Obtaining and applying water motive power.*"—*Dated 19th August*, 1861.

In carrying out this invention the patentee uses the force of water set in motion by pistons or plungers (which pistons and plungers may be put and kept in motion by hand, by steam power, or the fall or force of water), which he proposes to effect by the use of an axle or shaft (or of axles or shafts, whereby the pistons or plungers connected therewith, and working in water cylinders or pumps of equal size, are duly acted upon, the said cylinders being each of them connected to other cylinders by a tube or pipe of considerably less bore than the respective areas of the cylinders. Of course, instead of four cylinders there may be a greater number, eight or twelve for instance, if thought expedient. The cylinders are to have the necessary appliances for rendering the pumping action or motions of the pistons or plungers effective, and communicating the power obtained to the purposes required.

2062. B. *and* I. HARGREAVES, *Burnley, Lancashire*, "*Valves of steam engines.*"—*Dated 20th August*, 1861.

This invention is carried out in the following manner:—Instead of feeding the steam from the end of the valve flange the inventors make a transverse slot in it, through which the steam passes and feeds the piston, the passage or thoroughfare being made larger in proportion in order to admit of a large exhaust. They also make an alteration in the eccentric by working the connection on two circles, to reverse the speed of the valve at the change of the piston.—*Not proceeded with.*

2068. R. A. BROOMAN, *Fleet-street, London*, "*Steam mill or apparatus for transmitting motive power.*"—*A communication.*—*Dated 20th August*, 1861.

This invention consists in transmitting motion to a shaft or shafts, by preference in a vertical position from a locomotive engine free to travel round a circular platform. This shaft is connected to the locomotive by a lever, and carries a drum or drums, pulley or pulleys, round which the driving straps pass. In some cases gearing is used for transmitting the power. The central shaft carrying the drums may be above or below the level at which the locomotive travels.—*Not proceeded with.*

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

1993. A. S. *and* A. R. STOCKER, *Wolverhampton*, "*Horse shoes, boot heels, wheel tyres, rails, and axles.*"—*Dated 10th August*, 1861.

This invention consists in the application and use to, and in the manufacture of, metal safes, wheel tyres, rails for railways, and horse shoes of bars and plates of metal, and treated in the manner hereinafter described. In preparing bars and plates for the purposes above mentioned according to this invention the patentees take puddled bars or plates of wrought iron and place them in the ordinary converting furnace, and operate upon them in the same manner as is generally practised when converting iron into steel. These bars or plates are intended only to be partially converted, so as to leave the inner part of the metal in its fibrous condition, whilst the outer surface or surfaces are hardened to a greater or less depth, and on one or more of its surfaces as circumstances may require. Having thus far proceeded they then next form them into a pile of any desired number, also of suitable length, breadth, and thickness; they then heat the pile to a fusing or welding temperature and pass it through an ordinary rolling mill, whereby the whole becomes thoroughly incorporated and welded together in one solid mass, and rolled out to the dimensions requisite for the purpose intended.

1995. W. S. T. CLARKE, *Charing-cross, London*, "*Railway brakes.*"—*Dated 10th August*, 1861.

This invention consists in intersecting the axle or axles of driving-wheels of locomotives transversely with a current of electricity, and intersecting the axle or axles of the locomotive, and the axles of the tender and carriages, and the axle or axles of the locomotive and the axles of the tender, luggage vans, guards' vans, and wagons or trucks, transversely with a single or with separate currents of electricity, whereby most efficient grip or bite on the rails will be obtained.

2000. H. GREAVES, *Abingdon-street, London*, "*Apparatus to be employed for the water conveyance and delivery of coals, &c.*"—*Dated 12th August*, 1861.

This invention consists in the arrangement of a pontoon, vessel, or raft on which the inventor places one or more lines of railway, suitable for receiving trucks, carts, or wagons in which the coals or other materials are placed, and in which they are conveyed from the place of arrival to that of their destination.—*Not proceeded with.*

2002. W. E. GEDGE, *Wellington-street, Strand, London*, "*Breaking apparatus for railway and other vehicles.*"—*A communication.*—*Dated 12th August*, 1861.

This invention cannot be described without reference to the drawings.

2005. W. EDWARDS *and* E. EDWARDS, *Coventry*, "*Apparatus connected with railway brakes*"—*Dated 12th August*, 1861.

The inventors construct, and by suitable bearings attach to and under the floor of the carriage connected with the usual buffers, or with the buffer springs of the carriage, or with additional buffers or buffer springs fitted for the purpose, and also with such brakes as may be desired to be used or applied, an apparatus which, upon shutting off of the steam, or upon reversing the engine attached to the train, or upon any other powerful arresting cause, acts on the whole of the brakes fitted to such carriage, and the train is very speedily brought to a stand. After applying the power of the engine or other means, and communicating back motion for the purpose of shunting on to a siding, or otherwise, the whole of the brakes become released, and cease to act or retard the motion of the carriage.—*Not proceeded with.*

2018. N. COX, *Chester*, "*Improvements in the construction of iron ships, the said improvements relating to the method of attaching or securing bulkheads to the frames or ribs thereof.*"—*Dated 14th August*, 1861.

In order to strengthen the frame and shell of the ship where the bulkheads are fixed the inventor proposes to add two, three, or four additional frames, placed in front of the others, and rivetted to them, so that the frame forms as it were a vertical hollow beam with one side removed; to these compound frames he affixes plates in a similar way to those forming the sheathing on the outside; the side of the ship at that part will now be a hollow box of great strength. To the inner plates he fixes another angle frame or rib, and to this in the usual way he rivets the bulkhead.—*Not proceeded with.*

2028. A. LEBAUDY, *Paris*, "*Towing vessels or boats on rivers.*"—*A communication.*—*Dated 15th August*, 1861.

This invention consists in laying an iron chain along the bed of a river to the extent to which it is required to tow vessels, which chain is made to pass up on board a vessel acting as tug boat at one end of the same, where it is wound several times round a drum fixed on a shaft connected by suitable gearing to a steam engine fixed in the boat. After leaving the drum the chain is made to pass along the deck to the other end of the boat, whence it again descends to the bed of the river. As the before-mentioned drum is caused to revolve by the motion of the steam engine it winds up the chain in front of the tug boat, and lets it out again behind, the boat being thus caused to proceed in the direction in which the chain is being wound up.—*Not proceeded with.*

2041. R. D. CHATTERTON, *Highbury-terrace, Middlesex*, "*Transmitting motive power, especially applicable to piston propellers.*"—*Dated 15th August*, 1861.

This invention consists in arranging round the periphery of a drum one, two, or more series of wedge shaped projections, each of which series bears against and upon a friction roller, supported between or upon the cheeks or sides of a wheel in such manner as to cause the wheel to rock by the action of the wedge projections. When for transmitting power to piston propellers, that is, such propellers as affect the propulsion of the vessel by the direct action of the piston on the water, ropes, chains, or other like means of attachment are first made fast to each of the cheeks of the wheels; they are then carried under them, are passed through guides on the covers of the cylinders in which the propelling pistons work, and are

turned back and secured to the crossheads of the piston rods. The power transmitted from and by the wedge-shaped projections on the main drum forces the pistons from the top to the bottom of the cylinder, while the return stroke is effected by the pressure of the water, aided, if need be, by springs. In this case, from continuous rotatory, reciprocating motion is obtained. For the purpose of obtaining increased or multiplied velocity, as compared with that of the main wedge drum, then instead of ropes or chains connecting rods may be employed for connecting the wheels carrying the friction rollers with cranks. When transmitting power to piston propellers the inventor finds it advisable to employ two sets of piston propellers, one set opening at or towards the stern, and the other set at or towards the bow, in order to move a stern or a head as required; and when using such two sets of piston propellers, instead of reversing the main wedge drum, the inventor connects one set of friction wheels and propellers, and at the same time disconnects the opposite set, so that the vessel may be propelled forward or astern without stopping or interfering with the motion of the main wedge drum.—*Not proceeded with.*

2054. Z Colburn, *Tavistock-street, Bedford-square, London, "Suspension bridges."—Dated 19th August*, 1861.

This invention consists in the substitution, in place of the ordinary flexible iron or other chains or the flexible wire cables of suspension bridges, of continuous and rigid wrought iron or steel suspending bars, flanged or otherwise stiffened, the axis of each of which is curved as nearly as may be to the catenary curve, corresponding to a wire of uniform diameter and weight, and suspended from two points, so as to have the same span and versed sine. From these rigid curved bars the roadway, which may or may not have stiffening trussing in addition, is suspended in the usual manner by vertical or diagonal suspending rods or wires.—*Not proceeded with.*

2063. G. Ingram, *Old-street, London, "Trams to be used in connection with the wheels of carriages on common roads."—Dated 20th August*, 1861.

This invention consists in forming an endless tram through the medium of jointed link couplings, channelled throughout on the inner surface, in which the wheels take, and are caused to run, bearing guide rollers being employed for directing and giving increased freedom to the action of the said tram, and the said tram being applicable to a line or train of carriages by causing the first pair of wheels to be provided with a tram arranged as above described, whilst the remainder thereof are to be furnished with a tram passing round the peripheries, so as to form one continuous channel-way round the same.

2069. S. Whittaker, *Haverstock-hill, and* R. A. Jones, *Aylesbury, "Improvements in operating upon railway signals, and in indicating their position by means of electricity."—Dated 20th August*, 1861.

This invention relates, primarily, to the means employed for indicating the position of an auxiliary signal to the attendant working the same when the signal is not within view, and is intended to remedy the evils arising from the constant slacking of the wire for working the signals. The patentees arrange the wires and electric battery to form contact at the signal post, and indicate the position of the signal to the attendant at the signal lever. Contact springs are placed at right angles, or nearly so, to each other on a bracket or platform fixed to the signal post, in such position that the signal rod shall work through an orifice in the said bracket or platform. On the signal rod is to be fixed a collar free to revolve with the said rod, on the under side of which collar are two pins or projections for forming contact with the said springs. One of the wires from the battery is in connection with these pins or projections, and other wires with the contact springs on the aforesaid bracket or platform. In working the signal the said pins or projections are brought round, and form contact with the said springs when the signal is either "on" or "off," the circuit being completed by wire to the earth; but, should the signal be at an intermediate point, contact is then broken. At or near the signal lever-handle where the policeman or attendant is stationed they place an indicator, consisting of an ordinary galvanometer with a suitable index marked with suitable words, such, for instance, as "off," "signal wrong," and "on," to denote the position at which the signal is standing. The wire used for working the auxiliary signal is also used for connecting the battery with the indicator. For night signalling they place within the signal lamp a thermometer, having electric wires inserted in the tubes in contact with the mercury, and connected with the wires for actuating the signal, so that the mercury in the thermometer will be acted upon by the heat of the lamp, and, therefore, should the lamp go out, that fact would be indicated through its effect on the mercury in the thermometer. The invention also relates to applying springs instead of weights and levers, as heretofore, for operating upon railway signals.

2076. G. F. Muntz. *French Halts, Birmingham, "Sheathing iron ships or vessels."—Dated 20th August*, 1861.

This invention consists in sheathing iron ships with copper or Muntz's metal, or other suitable compound metal, so as to insulate such copper or metal electrically by employing fastenings made of non-conducting material, for which purpose the patentee prefers nails or plugs made of a compound of india-rubber, known as vulcanite or ebonite, and he places between the metallic sheets and the iron ship sheets of india-rubber or other sheets of non-conducting material; these may either be attached to the metallic sheets by Duff's patent process, or held in place by merely driving through them the nails or plugs which are used to attach the metallic sheets to the ship.

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2030. J. C. Rivett, J. Vickers, *and* S. Hayes, *Prestole New Mills, Farnworth, "Spinning and doubling."—Dated 17th August*, 1861.

This invention consists in applying to the flyers or spindles of spinning and doubling machines a peculiarly shaped boss or head, furnished with one or more diagonal slots, which are enlarged or otherwise shaped within the boss or head to allow the yarn or thread to pass with ease to the leg of the flyer, by which it is wound on the bobbin in the usual manner. By means of these improvements the guides between the rollers and the flyers are dispensed with. Another part of the invention consists in substituting cork for the usual flannel or cloth washers or strips which are placed between the bottom of the bobbins and the bolster rail for giving the requisite drag or friction to the bobbins.—*Not proceeded with.*

2038. C. W. Kesselmeyer, *Manchester, and* T. Mellowden, *Oldham, "Velvets and velveteens."—Dated 15th August*, 1861.

This invention cannot be intelligibly described without reference to the drawings.

2039. J. Combe, *Belfast, "Machinery for hackling flax, &c."—Dated 15th August*, 1861.

This invention cannot be described without reference to the drawings. The patentee claims, First, stripping the tow off the hackles of sheet hackling machines by means of sheets of stripper bars arranged and operated as described. Secondly, causing the hackles to approach and recede from the flax holders of inclined sheet machines in the manner and for the purpose described.

2043. J. Livesey, *New Lenton, Nottingham, "Improvements in textile fabrics for embroidery trimmings and other ornamental purposes, and in machinery employed in making the fabrics into trimmings."—Dated 16th August*, 1861.

This new textile fabric consists of a narrow band or braid made with pile loops; the loops are worked at different intervals, and the fabric is so manufactured as to allow of its being worked into curves and ornamental form. The invention further consists in an arrangement of machinery carrying scissors in such manner as to enable a workman with facility to cut or leave uncut such portions of the pile as are desired, for the purpose of forming any ornamental work required with the new textile fabric. The invention also consists in arranging machinery in such manner as to bring two or more threads into work to be twisted round each other, so that at different intervals of the twisting the bands or braids hereinbefore referred to may be placed between these threads to hold them in the position required to form different designs, these threads may also have wire threads twisted with them when required, and needles may be added and used for further fixing the patterns of the trimming or design required.

2044. A. V. Newton, *Chancery-lane, London, "Improvements in knitting and in machinery therefor."—A communication.—Dated 16th August*, 1861.

This invention relates to the knitting of stockings, or other articles of irregular form upon a circular or straight series of needles, by bringing the whole series of needles at once into connection with their driving or operating mechanism, and throwing any number at a time out of connection with such mechanism as the form of the article to be knitted may require, leaving all the others in operation, and allowing the knitting to proceed in any number of immediately adjacent needles at once, with a separate yarn to each needle.—*Not proceeded with.*

2046. T. Settle, *Bolton, "Preparing cotton, wool, flax, and other fibrous substances for spinning."—Dated 17th August*, 1861.

This invention applies to such descriptions of machinery as are employed for preparing, roving, and slubbing cotton, flax, and other fibrous substances previously to spinning, wherein the apparatus known as the presser flyer is used, the present improvement relating to such apparatus termed the presser flyer. The portion of the flyer called the presser, and used to conduct the cotton or flax on to the bobbin or spool, has hitherto been furnished with an eyelet through which the roving of cotton, flax, or other fibrous substances is passed, and which, by constant friction, becomes filled with loose filaments of cotton or flax, impeding the free delivery thereof, and materially injuring the yarn. This improvement consists in forming a groove or channel in the presser, the yarn being passed once or twice round the presser arm, and into the groove, which will be found sufficient to guide it in the required direction, and instead of through the eyelet, as usual.

2057. E. Sutton, *Radcliffe, Lancaster, "Preparing cotton and other fibrous substances for spinning."—Dated 17th August*, 1861.

This invention relates to that description of machinery used in the preparation of cotton and other fibrous materials known as the scutcher or opener, and is designed for the purpose of extracting dirt and extraneous matter from the fibres under operation. The invention further consists, First, in fixing a plate, perforated or otherwise, and of suitable material, behind the beaters used in such machines, and in perforating the covers of such beaters, the plate being secured near to and behind the beater cover or covers, and provided with hinges and screws to regulate the admission of air behind the beaters. Beneath or at the under side of the beaters, and at certain convenient positions, pipes or tubes are arranged in connection with a revolving fan, so as to exhaust the air and with it the dirt from beneath the beaters, and thereby to separate dirt and extraneous matter from the cotton preparatory to spinning. The Second part of the invention consists in affixing to the carding engine a roller or cylinder furnished with a number of blades upon the periphery, that are placed in contact with the "licker in," and driven at a suitable speed in the opposite direction thereto, for the purpose of separating the dirt from the cotton as it passes into the carding engine.

2052. R. Caunce, *Nottingham, "Carding engines."—Dated 17th August*, 1861.

This invention consists in passing a stripping bar, suitably clothed with wire, under the tops or flats of carding engines, for the purpose of stripping them. The blank side of the stripping bar is fitted at each end with an adjustable concave or other formed slide, which moves or slides on a plain or grooved arc, concentric with the main carding cylinder shaft, and is fitted in the sides or bends of the carding engine. The upper or stripping side of the stripping bar is fitted at each end with an adjustable incline or curved elevator for raising the tops in such wise as to enable the stripping bar to pass under to strip them. The stripper bar, after passing from under the tops, is carried over them by a suitable chain towards the top first stripped, and during its passage is itself stripped by the segment of a roller suitably covered with wire, and this segment, during its backward motion, is doffed by a comb. In applying the invention to the hand stripped carding engine it may be desirable to connect the tops or flats with suitable links, so as to prevent them getting out of position.—*Not proceeded with.*

2072. J. Platt, *Glossop, "Looms for weaving."—Dated 20th August*, 1861.

This invention relates to the arrangement and construction of power looms, which are more particularly adapted for weaving that class of fabrics known as Scotch carpeting, and which has hitherto been manufactured in looms worked by hand. Under one modification or arrangement of the mechanical parts the loom is fitted with an ordinary jacquard apparatus for producing the predetermined figure on the fabric to be woven. The motion of the jacquard barrel is derived from the crank shaft of the loom by means of a disc wheel, cam, or other equivalent therefor, or by levers from the bottom shaft, so as to render the motion of the jacquard barrel automatic, and bring the cards round in regular succession. The required sequential movement of the shuttle boxes, by means of which the different coloured wefts are thrown across the shed in the required succession, is obtained from the crank shaft. On this shaft is a pinion which gives motion to a wheel arranged on a horizontal shaft beneath, and carrying also a disc wheel, the periphery of which is made of varying radii. Extending over the disc wheel is a curved lever, which is carried on a shaft at the back part of the loom framing; the free end of this lever is connected by means of a rod to a rocking lever overhead. The front end of this lever is attached by a rod to a shuttle box frame, and at the backward end of this lever is hung a counterweight. When the loom is put in motion the disc wheels act upon an antifriction roller, carried by the overhanging curved lever, so that this lever rises and falls in accordance with the projections or depressions formed on the periphery of the disc wheel. In this way the shuttle boxes are raised and depressed in regular succession, and the different coloured wefts are thrown in according to the predetermined arrangement, the pattern being meanwhile formed by the jacquard mechanism. A corresponding arrangement of mechanism is fitted on the opposite side of the loom, so that both series of shuttle boxes move exactly in accordance with each other.

2090. A. Jervis, *Coventry, "Machinery for the manufacture of pleated, ribbed, and looped fabrics."—Dated 21st August*, 1861.

In carrying out this invention the warp is divided so as to form two distinct and separate sheds, which may be called the upper and lower sheds, which for pleated or ribbed fabrics are capable of being woven into distinct cloths, but are connected together at certain points, and in such a manner as to produce the desired ribbed or fluted appearance. The weaving operation is carried on in an ordinary loom, in which there are two shuttles employed; or rising or falling or rotating shuttle boxes may be used for the purpose either of bringing up the proper shuttle (if two or more are used), or of bringing the single shuttle opposite to the shed which is to be woven into cloth.—*Not proceeded with.*

Class 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

2051. P. Hart, *Hampton-wick, "Mills."—Dated 17th August*, 1861.

In dressing mill-stones according to this invention the inventor proposes to dress only the runner stone in any well known or approved manner, and to provide the fixed stone or bed-stone with a smooth or approximately smooth or unchannelled surface.—*Not proceeded with.*

2060. W. Firth, *Burley, Leeds, "Machinery for digging or turning up soil, mowing, reaping, and other agricultural purposes."—Dated 19th August*, 1861.

This invention consists in an arrangement of a series of picks for digging, or knives or cutters for mowing or reaping, worked by springs. The springs are regulated by wheels or cylinders and tappets, or other suitable mechanical contrivances, so that, being coiled or drawn up by the wheels or cylinders, they are liberated by the tappets, so as to act upon the digger, and thus produce one stroke of it, or more than one stroke, at each action of the spring, knife, or cutter, which is repeated in the same manner, so as to produce a successive series of strokes.—*Not proceeded with.*

2078. N. Fisher, *Milton, near Blincorth, "Agricultural implements for grubbing and cultivating land."—Dated 20th August*, 1861.

This invention cannot be described without reference to the drawings.

2081. T. Lambert, *Great Henny, Essex, "An improved agricultural implement for rolling ridges and furrows or straight work."—Dated 21st August*, 1861.

This invention consists in mounting two or more metal rollers loosely side by side upon a rod, and at suitable distances asunder, the said rod and rollers being held in a framing to which shafts or other appliances are connected for enabling the rollers to be drawn by horses. The rollers employed for rolling ridges and furrows are suitably formed for that purpose, whilst the other or intermediate rollers which keep the aforesaid ridge and furrow rollers at the proper distance asunder are formed cylindrical, and of considerably smaller diameter, so that for straight work, by removing the ridge and furrow rollers, and connecting the cylindrical rollers together, a plain roller may thus be produced adapted for straight work.—*Not proceeded with.*

Class 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

2026. W. Wilds, *Hertford, "Apparatus for ventilating."—Dated 14th August*, 1861.

This apparatus for ventilating consists of a box or case, the bottom of which is formed of woven wire, perforated metal, or like recticulated or perforated material, and at top are fitted flaps or lids by which it is opened and closed, and which are connected by cords, chains, or like agents passing over pulleys to a suspended balance weight. The patentee prefers when he uses two flaps or lids to hinge or joint them to a rail, bar, or style fixed across the box, and to support the pulleys over which pass the chains or cords which are fastened to the flaps in standards fixed upon the rail, bar, or style, and to connect these chains or cords to a chain or cord by which the balance weight is suspended. The apparatus is fixed at the ceiling or the roof of the room or place to be ventilated, in such manner that air may pass through it when open to or from such room or place, communication being provided between it and the atmosphere, which may be conveniently done, for example, when the ventilator opens under another floor, by providing a grating, air brick, or opening at one or both ends of the air trunk formed between the joists; or it may be effected otherwise to suit the construction of the building. By means of the balance weight the flaps or lids may be completely closed, or may be opened, more or less, to admit and regulate the passage of air through the bottom of the box to or from the room or place to be ventilated.

2034. F. A. Kain, *Redhill, Reigate, Surrey, "Artificial stone or earthenware applicable for bricks, tiles, retorts, railway sleepers, &c."—Dated 15th August*, 1861.

In carrying out this invention the inventor crushes to powder and sifts the small and refuse or other slate in combination with other materials, and also vitrifies the same in kilns at a high temperature.—*Not proceeded with.*

2045. H. C. Hill, *Staleybridge, Lancashire, "Fire-proof buildings."—Dated 17th August*, 1861.

This invention consists in making the beams, girders, columns, and other parts employed in the construction of buildings, hollow, for the purpose of containing water or other liquid, and in connecting these beams, girders, columns, and other parts so that the water or other liquid with which they are filled may circulate therein or be renewed when required. By this means, in case of fire in the building, the main supports can never become so hot as to be injured or weakened by the results of heat.

2055. J. Robb, *Aberdeen, "Improvements in ventilating."—Dated 19th August*, 1861.

The principle adopted by this invention is that of admitting the necessary supply of fresh air at a low level, and carrying off the heated and vitiated air at a higher level. In ordinary cases the method employed is to provide an opening at the bottom of the windows for the ingress of the fresh air, and a similar opening at the top or upper part of the windows for the escape of the heated and vitiated air, such openings being covered with perforated card, paper, gauze, cloth, or other perforated material.—*Not proceeded with.*

2080. C. A. Wheeler, *Swindon, "Improvements in preventing wind-draughts at the foot of doors, and allowing them to open over carpets or other substances without the use of rising hinges."—Dated 21st August*, 1861.

This invention consists of two pieces of moulding the width of the door, made in any kind of wood or metal, the lower or bottom piece being much stouter and heavier than the upper piece, and they are attached to each other by cords or chains, leaving a space between the two pieces of moulding to allow the lower moulding to rise and pass over the carpet, or any other substance the door may have to travel over. The upper piece of moulding is made fast to the face of the door by screws, or nails, or brads, suspending the lower piece of moulding one-eighth of an inch or more from the floor; and in front of these mouldings, between them and the door, is a piece of an air-tight cloth, or india-rubber, or other flexible material the width of the door, which flexible material is attached to the upper piece of moulding, or to the face of the door, and which rests upon the floor. The lower piece of moulding, being suspended in the manner already described, rises and falls with the opening and shutting of the door, and presses against the flexible material, preventing any wind or draught from entering the room.—*Not proceeded with.*

2024. W. Clark, *Chancery-lane, London, "Improvements in the construction of buildings whereby to utilise the waste heat passing up the chimneys."—A communication.—Dated 21st August*, 1861.

This invention relates to an improved arrangement of the flues of the several fireplaces of a house or other building, which are all made to unite in a chamber placed under the roof, and furnished with an opening for the escape of the smoke. This chamber is made incombustible, that is, the materials of which it is composed consist of bricks or stones for the sides, and iron for the bottom; a door is placed for affording access to this chamber, which is also of iron; the aperture for the escape of the smoke may be varied in size, according to the number of flues opening into the chamber. This aperture may also be furnished with a smoke-distributor. Water cisterns may be placed in this chamber with a float open to the exterior serving for various domestic purposes, such as baths, water-heating apparatus, or other uses. Air reservoirs may also be employed with this smoke chamber, the air of which, being heated therein, is conducted thence for the purpose of heating apartments.—*Not proceeded with.*

Class 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defences, Gun Carriages, &c.

2033. P. *and* T. W. Webley, *Birmingham, "Elevating rifle sight."—Dated 15th August*, 1861.

This invention consists of a new or improved elevating rifle sight, in which the slide is moved and the leaf or nap elevated by means of a rack and pinion, instead of the direct application of the hand, as in elevating rifle sights of the ordinary construction.—*Not proceeded with.*

2042. T. Murcott *and* C. Hanson, *Haymarket, London, "Breech-loading arms."—Dated 16th August*, 1861.

This invention applies to those guns in which a charge chamber is fitted at the rear of the barrel, and consists in arrangements, hereafter described, for opening and wedging up the chamber for the insertion of the charge into it, and for tightly and securely closing it prior to, and at the discharge of, the arm. Behind the chamber for holding the charge the patentees cut a slot across the metal in a piece with the metal which forms the chamber; they then make a curved tail on the rear and lower end of the metal. To the stock under the chamber they hinge the front end of a lever, the rear end of which, when the breech is closed, lies and is held by a catch against the trigger guard. Between the front of this lever and the trigger guard there is hinged a vertical wedge. Upon the lever being brought down, that is, in a direction away from the trigger guard, it takes hold of the curved tail on the charge chamber, causes it to play upon the stud or bolt passed through the slot, disengages the chamber from the rear of the barrel, and it causes it to tilt upwards at front to receive a charge. On the lever being returned to the trigger guard the vertical wedge causes the nose of the chamber to descend, drives it forward into the rear of the barrel, and rises to wedge and hold the whole chamber securely in its place. The back of the wedge abuts against the rear of the chamber frame.

Class 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

2004. A. Salomons, *Old Change, London, "A bodice skirt."—Dated 12th August*, 1861.

This invention consists in forming in one article a bodice and skirt, as hereafter described. The bodice proper encircles and is secured on the body of the wearer by any suitable fastening; it extends upwards to any height desired, but terminates in front at the waist, while the sides and back are carried outward from the body, and are kept extended by metal springs, whalebone, or other suitable stiffening agent. The skirt or petticoat, whether hooped or otherwise, is sewn or attached in any other convenient manner to the bodice, so as to form one article of apparel.

2048. M. H. Randle, *Ludgate-hill, London, "Petticoats for distending articles of dress, and preserving the shape or form thereof."—Dated 17th August*, 1861.

To form a petticoat the inventor takes a sufficient number of lengths of steel spring (such as used by watch makers), and forms them into circles or hoops, attaching to each end a slide, a buckle or fastener, and stamps holes or curves in the centre of the steel spring of sufficient length to enable the lady to make whatever circumference she may wish. The advantage to be derived from this invention is that a lady can extend it at pleasure, and also draw the steels out for washing the garment.—*Not proceeded with.*

2070. S. Warwick, *Lower-road, Islington, "Concertinas."—Dated 20th August*, 1861.

The object of these improvements is to afford double action to each of the reeds used in a concertina, and the inventor produces the same note from the same reed in both cases by the press and draw movements of the instrument.—*Not proceeded with.*

Class 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

1632. J. C. Martin, *High-street, Barnes, "Treating bones."—Dated 15th August*, 1861.

The patentee claims treating bones with hydrochloric acid applied to bones in succession until the hydrochloric acid is saturated with earthy phosphates, and the obtaining phosphates or superphosphates from such saturated solution by evaporation, as described.

2037. A. F. Menard, *Paris, "Tanning."—A communication.—Dated 15th August*, 1861.

This invention relates to a new and rapid system of tanning leather of every kind, and consists, First, in the use of bark in bundles, instead of being reduced to powder, as in the ordinary method. Secondly, in the peculiar arrangement of the apparatus to be employed. Thirdly, in the employment of carbonic acid and other gas, whether the tanning is performed in a vacuum, by hydrostatic pressure, or by the old method. Fourthly, in the mode of operating upon the skins in the vats by the injection of various gases combined with electric and galvanic currents, to effect the rapid tanning of the leather. Fifthly, in placing the skins in calcareous, magnesian, aluminous, silicious, or ferruginous solutions in which are injected various gases, in combination with an electric and galvanic current for the formation of substances required in tanning. Sixthly, in the mode described for constantly preserving the strength of the tanning solution at any temperature or condition of the atmosphere, and preventing the formation of gallic acid by means of carbonic acid. Seventhly, in the application of carbonic acid and other compounds of carbon to form chemical compounds with the mineral substances described. Eighthly, in rendering leather more pliable and more impermeable to water by the saponification of fatty matters with sulphurets of carbon.

2053. W. Bennett, *London-street, Paddington, "Composition to be used as fuel, and in the lighting of fires."—Dated 19th August*, 1861.

The patentee claims the manufacture of fire lighters and fuel by the immersion or dipping of dried peat into melted resin.

2058. W. H. Smith, *Philadelphia, "Preparation, application, and manufacture of peat."—Dated 19th August*, 1861.

The patentee claims, First, the vulcanisation of raw peat, or its reduction to a homogeneous pulpy mass, by means of heat as a solvent, the said heat being engendered by the direct application of steam or ordinary fuel, or induced chemically by friction accompanied by trituration, as described. Secondly, the vulcanisation of mixed peat, or peat in combination or admixture with various acids, alkalies, ores, earths, and so forth, for the purpose of altering the colour and texture of the said peat, rendering it more or less hard, dense, compact, plastic, combustible, and so forth, either by heat alone, or heat induced by and accompanied with mechanical tritura-

tion. Thirdly, the application of vulcanised peat to the various useful and ornamental purposes. Fourthly, the application of vulcanised peat to the process of trituration through perforated metallic plates, the said process, although in common use for many years having never been applied to peat prepared in accordance with the within specified process of vulcanisation.

2067. R. A. BROOMAN, *Fleet-street, London*, "*Preserving meat, &c.*"—*A communication.—Dated 20th August*, 1861.

This invention has reference to a previous patent dated 18th July, 1860 (No. 1742), and consists in preserving meat and other animal substances by means of gluten, and principally of gluten prepared as described in the specification of the patent above referred to, and which is designated by the inventor "lucine."

2085. A. STEIN, *Edinburgh*, "*Distillation.*"—*Dated 21th August*, 1861.

The object of this invention is, First, to improve the quality of the spirits, whether "grain" or malt, produced from the class of stills now in use under the patents of Robert Stein, No. 5721, December 4th, 1828, and Aneas Coffey, No. 5974, August 5th, 1833, denominated as "Coffey and Stein's" patent stills. Secondly, to render the "spent wash" or "dreg" which is discharged from these stills, after the spirit has been extracted from it, more valuable for the feeding of live stock, to which purpose it is now principally applied. It is proposed, by suitable modifications and additions, to pass the whole, or such portion of the alcoholic matter as may be found desirable, into the rectifier in a liquid state; it is then to be worked off by fresh steam, and no part returned to mix with the wash in the distilling column, reserving to the distiller power to withhold any portion of the alcoholic vapour from passing into the rectifier, and passing it direct from the purifier into a spirit worm to be condensed and cooled. As spirit is often required of a superior quality, it is proposed to add to the apparatus a third or additional rectifying column, when the spirit may be again rectified for certain purposes in use in this country or for exportation.—*Not proceeded with.*

CLASS 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

1994. H. WILDE, *Manchester*, "*Improvements in electro-magnetic telegraphs, and in apparatus connected therewith.*"—*Dated 10th August*, 1861.

This invention cannot be described without reference to the drawings.

LOCOMOTIVES FOR FOREIGN RAILWAYS. — The principal line of railway in Brazil, the Dom Pedro II., requiring a number of new locomotives, tenders were invited from English and American builders. The prices and terms of the latter prove to be so much more favourable than those named here that it is understood the engines will be ordered in the United States.

FATAL BOILER EXPLOSION AT BRIERLEY HILL—FIVE LIVES LOST.—On Thursday morning a fearful boiler explosion occurred at the Corbyns Hall Malleable Iron Works, situate about two miles from Dudley, which resulted in the death of five men, and serious injury to several others. The works are the property of Mr. Henry Sparrow, and the exploded boiler was of about 30-horse power, its main use being the working of a powerful steam hammer. At six o'clock in the morning a number of the men were employed at the puddling furnaces, when a fearful explosion took place, which shook the place to its foundation. The boiler fell at a distance of 100 yards. At the inquest, on Saturday, Thomas Madon, the day engineer at this boiler, said that when he left work at half-past five on the previous evening the engine was in perfect working order. The boiler was filled by a donkey engine, which witness also had charge of. Mark Simpson was the engineer in charge of the steam hammer and the donkey engine at the time of the explosion. The boiler was what is called an egg boiler, and had been in use eight years. He had examined the boiler on the morning of the explosion, and found some of the plates ¼in., and some put in about twelve months ago were $\frac{7}{8}$in. thick. Did not think the plates had been heated. The plates were both bent and rent in that part which rested upon the ground, but he could not tell whether they were rent by the explosion or by the fall. The plates presented no appearance of having been burnt. The rents were near the rivets of the boiler. The crown plate on the top of the upright flue was the only plate blown out, and that was found afterwards in the flue. It was forced down into a space eight inches smaller than itself, and therefore it collapsed. There was also a slight surface crack. The boiler was worked at from 45 lb. to 50 lb. pressure on the square inch. There was a safety valve in good condition, and also a steam whistle in perfect working order. Heard the whistle blow last on the 15th ult. The safety valve was six inches in diameter, and there was also a steam clack. The clack was blown off, but the whistle was not. The boiler was repaired during the first week in January, as were also all the other boilers. There was a new plate put in the bottom of the boiler. There were eight weights on the safety valve, making altogether about 1,540 lb. The steam indicator always showed the pressure. Never saw it indicate more than 52 lb., and it generally worked at about 45 lb. or 50 lb. pressure. Did not know the cause of the explosion, and could not account for it. Never saw an exploded boiler before. There was an iron balance-rod suspended from one end of the steam clack for the purpose of hanging a weight upon when the hammer was not at work; this was done to ensure safety, inasmuch as the clack would thereby rise more easily. Did not know whether this weight was on at the time of the explosion. John Carters, another working engineer, deposed that at about twenty minutes before the explosion witness saw Mark Simpson, the steam-hammer engineer, on duty, lying down in the forge engine-house. Could not say whether he was asleep or not. His engine was not at work then, but steam was still being raised in the boiler, and he ought to have been attending to it. The boiler was heated by the puddling furnace flues, which are always in operation. The distance from the forge to the steam hammer is about six yards. Upon examining the boiler in the course of the day witness found that the crown-plate of the upright flue was blown out, and the side plates on the bottom part of the boiler were bent and rent open by the fall. Thought they were rent by the fall, because if they had been rent by the explosion the steam would have rusted the edges. From the colour of the plates and the general appearance presented witness was of opinion that the boiler was full of water. There was no appearance of the boiler plates having been heated. Could only account for the accident by supposing that the boiler burst from over pressure. Benjamin Stevens, also a working engineer in Mr. Sparrow's employ, and who was on duty during the night, deposed he saw Mark Simpson several times during the night in his (witness's) engine house. Simpson was there about ten minutes before the explosion. He was then lying down, and had been for about half an hour. Witness went out of the engine house, and did not return before the explosion took place. Mr. John Riley, foreman boiler maker at Messrs. Cochrane and Co.'s Works, Woodside, said he did not know the boiler before it exploded, but he had examined it since, and had come to the conclusion that it exploded from over-pressure. It was 21ft. 3in. long and 9ft. in diameter, cylindrical in shape, with egg-ends, a vertical tube inside, and four branch tubes. The plates at the top were $\frac{5}{8}$in. thick, and on the outside shell of the boiler, near the bottom, they were $\frac{7}{16}$in. thick. The flue was $\frac{5}{8}$in. thick all over. The boiler was very well made all over, the plates in good condition, and all the rivets properly arranged. There was a crown plate on the top of the vertical tube which had evidently been hot; but he was not prepared to say whether it was made hot by the boiler being short of water, or from it having been forced down into the hot flue. If the water had gone down into the flue—as it naturally would—of course it would have prevented the plate getting hot in the flue. None of the other plates in the boiler presented any appearance of having been heated. The crown plate was bent near the line of the centre rivets, and the two sides were thus nearly brought together. Witness thought the boiler was quite safe up to 60 lb. on the square inch. Thought the explosion occurred through excessive pressure. No further evidence was taken on Saturday, the inquest being adjourned for the purpose of obtaining the attendance of the Government Inspector (Mr. Baker) and two or three material witnesses. It may be mentioned, in support of the evidence given above as to the cause of the explosion, that Mr. Lavington Fletcher, C.E., chief engineer to the Manchester Association for the Prevention of Steam Boiler Explosions, examined the boiler and the scene of the explosion on Friday, and expressed an opinion to the effect that the explosion resulted from over-pressure.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

PRESENT CONDITION OF THE SOUTH STAFFORDSHIRE IRON TRADE: *Abundance of Unemployed Labour: Orders to be Given Out: The Increasing Application of the Bessemer System*—THE ASSIGNMENT OF MR. SAMUEL GRIFFITHS: *What it is, and how Occasioned*—PIG IRON AND COAL TRADES—HARDWARE TRADES: *Slight Improvement*—GROWTH OF CHUBB'S LOCK TRADE—FALL IN COPPER—ANOTHER FAILURE — THE BANKRUPTCY OF MESSRS. PITT AND FLETCHER — BIRMINGHAM CANAL—SOUTH STAFFORDSHIRE WATERWORKS — FACTORIES IN THE MIDLANDS — INSPECTORS' REPORTS ON RAILWAY ACCIDENTS—FATAL BOILER EXPLOSION.

THE iron trade of South Staffordshire is in that state which occasions an accession to the unemployed operatives every week. Works are now constantly visited by men who previously have been in almost regular work at some of the leading establishments in the district. Such a feature the trade has not presented for many years past. The labour difficulty has been a formidable one for a long time, but, if the present condition of trade is not soon improved, the superabundance of workmen will obviate any great difficulty to the reduction of wages when necessity arises, and will increase the number of skilled operatives in work. The reports yesterday (Thursday) in Birmingham, and on Wednesday in Wolverhampton, were to the effect that trade, instead of improving, is becoming less satisfactory. The continental prospects also were referred to as partaking of the same feature. But the continued success of the Federal arms in America was noted as favourable to the earlier return of some trade with the New World, though not perhaps of so extensive a character as would be anticipated if the successes were on the side of the Confederates. The home trade presents features as satisfactory as can be expected, and they are regarded to become increasingly so with the nearer approach of the long days, during which workmen can continue their employment the full hours without artificial light. There are several good inquiries in and about to be placed upon the market for iron chiefly of the girder class, but including also some cast iron. One of the orders already out embraces 5,000 tons, and its possession is being vigorously contested. Some four others are spoken of, and they embrace lots averaging from 2,000 tons to 1,000 tons and under—all for civil engineering purposes. The intelligence communicated in the leading columns of THE ENGINEER last week relative to the rapidly increasing application of the Bessemer process has not had a beneficial effect upon the tone of the South Staffordshire market. Nor was it even improved by the assignment of Mr. Samuel Griffiths. That well-known metal broker, it will be remembered, engaged somewhat extensively in the iron trade soon after his previous failure, and the difficulty which he experienced in paying the instalments due upon the purchase of one of them following upon the somewhat expensive diversion of contesting a Parliamentary borough in a time of dull trade and falling prices, so complicated his position that he had to avail himself of the new Bankruptcy Act, and effect a deed of assignment, by virtue of which his works will be carried on by three inspectors. He agrees, it is understood, to pay twenty shillings in the pound by eight quarterly instalments, to terminate with the year 1864, and beginning with 1863. No payment, therefore, is of necessity to be paid in 1862. The proportion of creditors who have assented to the deed is set down as representing £80,000, and the assets are valued at £30,000. Mr. Griffiths has been carrying on certain of his works by the title of Messrs. E. B. Thorneycroft and Co., a very near resemblance to that of Messrs. G. B. Thorneycroft and Co., the well-known old established firm of Wolverhampton, but the deed is understood to contain a recital setting forth that he was never partner in the so-called firm of E. B. Thorneycroft and Co.

The pig iron trade is still inanimate.

Coal is a little more active than last week, but prices are very low.

The general hardware trades of Birmingham and Wolverhampton are in certain of its branches slightly improved upon their condition last week, but they are in a state which is most unsatisfactory compared with what it should be at this season.

Messrs. Chubb and Son, of Wolverhampton, and St. Paul's Churchyard, London, have received the order for the locks that will be required in the International Exhibition building. We understand that the order was given by the commissioners without any application on the part of Messrs. Chubb. As a relief to the generally unsatisfactory tone in which trade matters have to be written of in these days it is gratifying to learn that there are long-established firms who are busier now than they ever were. Among those who are so situated Messrs. Chubb and Son occupy a prominent position. Thirty-nine more men are now employed by that firm than at the time of the first Exhibition, and, notwithstanding that last year was a period of activity unprecedented in the history of that firm, orders have just been received at the Wolverhampton works from the London office authorising the making by the men of as much time as they like.

As we last week expected it would be, the price of copper has been reduced. The reduction was declared on Monday, and is as follows:—Manufactured one halfpenny per lb.; unmanufactured £4 10s. per ton; making tough cake and tile, £98; best selected, £101 per ton; sheets, 11d. per lb.; yellow metal sheathing, 9d. per lb. There has been a corresponding reduction in the price of brass wire, tubes, and other rolled metal.

We find that amongst the products from this district that will obtain a position among the ornamental objects in the nave of the International Exhibition will be trophies of pottery from Messrs. Kerr, of Worcester; and from Messrs. Copeland, of the Potteries; and trophies of jewellery from Messrs. Elkington. With the trophies of steel by Mr. Bessemer, and by Messrs. Naylor and Vickers, of Sheffield, that will be placed in the South-Eastern transept, there will be a large collection of ornamental ironwork from the Colebrookdale Company, and a beautiful screen manufactured by Messrs. Skidmore, of Coventry, and ultimately to be erected in Hereford Cathedral. And one of the three fountains will be that by Messrs. Minton, in Majolica ware, 36ft. in diameter, and it will be erected under the Western dome.

The failure is announced of Messrs. J. Gold (Kimberly and Gold), of Lionel-street, Birmingham, hinge and shoe-tipmakers, trading as "Gold and Co." The debts and liabilities amount to about £12,000.

Messrs. Pitt and Fletcher, of Willenhall, iron merchants, came up for their last examination and discharge in the Birmingham Bankruptcy Court on Monday. Mr. Hodgson, who appeared for the bankrupt Pitt, stated that Mr. Knight, who was for the assignees, had asked for a cash account and a purchase and sales account, and that he had agreed to an adjournment to enable the bankrupt to file it. Mr. Knight, added that as the bankrupt's balance sheet would be ready for filing before the cash account was ready, he proposed to take a short adjournment, and adjourn again if necessary. An adjournment for three weeks was agreed upon.

The condition of the leading carrying concerns in this district is one of the best *criteriæ* of the state of the leading industries. The Birmingham Canal Company, who derive the entire of their revenue from this locality, have not made so much money this year as they did even last, and that period was a reduction upon 1859. Aided, however, by a saving under the heads of "repairs" and "water" of a total sum of £4,555, as compared with 1860, the total profits of the year have been £45,354; which sum, after providing for the usual dividend of £2 per share on the whole of the shares, would leave a surplus of £408. In two months the branch by which the company are connecting the old canal with Cannock Chase will be completed. On its completion the canal will go right into a mineral field that before it only encircled but did not touch.

The authorities of Birmingham and Tipton are uniting to resist the attempt of the railway companies to obtain an extension of their immunity from assessment to municipal and parochial rates.

An half-yearly meeting of the South Staffordshire Waterworks Company was held on Tuesday last. The report stated that since the last half-yearly meeting the Conygree Reservoir had been completed, and that it was now ready for use. The two new pumping engines were also in a condition for working, to supply the extensive districts of Dudley and Westbromwich, and this would enable the company to dispose of the old engines and plant at Dudley. The report further stated that during the last half-year there had been an increase of the revenue, and that during the same period 717 houses had been connected. The profit and loss account from June to December showed a total revenue of £5,332 3s. 10d., which left a balance of £1,628 7s. 5d. The directors did not, however, recommend a dividend. The chairman believed that the concern could pay 3 per cent. on the capital expended; but there were some exceptional items. So, rather than declare dividend, the directors preferred to raise its position in the money-market.

We gather the following statistics, relative to the factories which come within the operation of the Factories' Acts, and are situated in Warwickshire, Staffordshire, and Worcestershire, from the returns made to the House of Commons on the motion of Mr. Baines. These returns comprise the number of factories subject to the above-named Acts in each county, and distinguish the material and process, and show the amount of power, the number of hands employed, and other particulars:—There are fifteen cotton factories in Warwickshire and Staffordshire, three being spinning mills in the latter county, with an aggregate of 81,116 spindles, and 880-horses' power (steam and water), and employing 793 hands, about five-eighths being young women. Four in Warwickshire are employed in weaving, having fifty-nine power looms, and steam power of sixteen horses, and employing 122 hands, the proportion of the sexes being nearly equal. The remainder do not come under either description. Three are in Warwickshire, and employ 127 power looms, steam power of thirty-four horses, and 323 hands, considerably more than two-thirds of whom are young women. The remaining five are in Staffordshire, and employ 694 power looms, steam and water power of 211 horses, and 1,189 hands, the proportion of females being about the same as in Warwickshire. There are no woollen factories in these counties, and but one in Worcestershire. This employs only seven hands, and steam power equal to six horses. There are twenty-two worsted factories in this county, seven of which are engaged in spinning, employing 16,996 spindles, steam and water power equal to 334 horses, and 671 hands, nearly five-sixths of whom are young women. Twelve are engaged in weaving, employing 385 power looms, worked by steam power of 292 horses, and 1,026 hands, about half of whom are male adults. One establishment is engaged in both spinning and weaving, employing in the former branch 1,416 spindles, and in the latter thirty-nine power looms, moved by steam power equal to thirty horses, and an aggregate of 201 hands. Two worsted factories are not inclusive under either head, and these employ twenty-one hands, aided by steam power equal to sixteen horses. The silk factories are the most numerous in these three countries, numbering 359, of which twenty-five are engaged in spinning, 327 in weaving, and six both processes, besides one which cannot be classed under either description. Of the total number 331 are in Warwickshire, seventeen in Staffordshire, and eleven in Worcestershire. Of the spinning mills four only are in Warwickshire, employing 6,732 spindles, steam and water power of fifty-six horses, and 391 hands, nearly half being young women; eleven in Staffordshire, employing 35,978 spindles, steam power of 101 horses, and 985 hands, the proportion of young women being somewhat higher than in Warwickshire; and ten in Worcestershire, employing 19,133 spindles, steam and water power of sixty-two horses, and 634 hands. The weaving establishments are, with one exception, in Warwickshire, and, exclusive of that one, employ 2,065 power looms, worked by steam power equal to 345 horses, and 3,328 hands, of whom 1,400 are males, and 1,928 females, all above thirteen years of age except twenty-seven. The other factory is in Worcestershire, and employs eleven looms, worked by water power of six horses and twenty-three hands. There are six silk factories in Staffordshire engaged in both spinning and weaving, and those employ 18,950 spindles, and 210 power looms, worked by steam power equal to 104 horses, and 1,242 hands, of whom nearly half are young women.

The particulars of a fatal boiler explosion at an iron works in this district, which resulted in the almost instantaneous death of five men and boys, and the serious injury of a yet larger number, are given in a separate account, which appears elsewhere.

From the reports of the inspecting officers of the railway department of the Board of Trade relative to accidents which happened in the latter half of last year we gather that Captain Tyler ascribes the accident between Leamington and Kenilworth, in June last, by the breaking down of a bridge, to one of the iron girders having been spliced instead of being renewed when it became defective in 1853. That it should have been patched and retained until failure occurred is (Captain Tyler says) too much in accordance with ordinary railway practice, which does not take sufficient account of the increased weight of the engines of the present day. Relative to the accident which occurred in the same month between Burton-on-Trent, and Tutbury on the North Staffordshire line, from part of a passenger train leaving the rails, the inspecting officer reports that if the permanent way had been kept in that high condition and substantial state in which a passenger line ought always to be maintained, the engine, unsteady as it was, would not have given way. Respecting the collision between a passenger and a goods' train, in September, on the loop line of the West Midland Railway at Droitwich, Colonel Yolland says that the train was insufficiently supplied with brake power, and that the practice of railway companies generally is to supply the slow and fast trains with the same proportion of brake power. The driver of the passenger train, who had been in trouble before, was fined £1 1s., and the guard of the goods' train, who had never been reported before, was discharged. "It appears to me," reports Colonel Yolland, "that these punishments are decidedly misplaced."

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

BRITISH AND IRISH MAGNETIC TELEGRAPH COMPANY: *Position of the Undertaking*—LIVERPOOL AND THE INTERNATIONAL EXHIBITION—TRIAL TRIP OF THE CHINA (S. S.)—MERSEY DOCKS AND HARBOUR BOARD: *Birkenhead Jealousy again Asserting Itself*—NORTHERN MATTERS: *Dock Accommodation on the Tyne: Whittle Dean Water Company: Sunderland and South Shields Water Company: Sanitary Condition of Newcastle: Amelioration of the River Wansbeck*—STATE OF TRADE: *Derbyshire: Sheffield: Manchester: Leeds*—STOCKPORT AND WOODLEY JUNCTION RAILWAY—ROYAL SCOTTISH SOCIETY OF ARTS: *Mr. Cumberland Hill's Time Gun*—APPLICATION BY MR. WHITWORTH FOR A POWDER MAGAZINE LICENSE—CALEDONIAN RAILWAY—CLYDE SHIPBUILDING.

IT appears that at the annual meeting of the British and Irish Magnetic Telegraph Company, held last week at Liverpool, the undertaking being the result in great part of Liverpool wealth and enterprise, the report of the directors alluded to the competition at unremunerative rates which had been started by a new company in one of the company's districts, and opinions were expressed in the discussion which arose that the result could only be ruinous to those who had been advised to commence such a system. Resolutions were passed authorising the raising of additional capital for further extensions, and the directors were urged to inquire into the accounts of the Submarine Telegraph Company, in which the company held £23,000, and many of the shareholders were individually interested. Lord Otho Fitzgerald consented to represent the company's interests at the board of the Submarine Company. The report alluded to the retirement of Sir C. Bright from the engineership of the company, but the directors had secured his services as consulting engineer. A special meeting succeeded the general meeting to pass the necessary resolutions for carrying out extensions to the West of England and other places.

Some particulars have already been given as to the arrangements in progress at Liverpool for the International Exhibition. A few

more details may now be added. The Mersey Steel and Iron Company will, in their own name, and in the names of one or two of the chief engineering firms in the kingdom, exhibit from 150 to 200 tons of forgings. These will consist of some of the largest forgings ever made, and will include the celebrated wrought-iron gun "Prince Alfred," which weighs about ten tons; it is a muzzle loader 10½in. in diameter of bore and capable of throwing a ball of from 500 to 700 lb. in weight. It is 12ft. in length; its diameter at the breech is 35in., and at the muzzle 18in. One of the largest marine battery plates ever forged will also be contributed by this firm, and they will exhibit the first battery iron-plate target which was ever fired at, and which was broken by a shot from their stupendous wrought-iron gun presented to Government. Besides the "Prince Alfred" gun, they will also exhibit several other of their wrought-iron field guns, of different calibres; together with crank-shafts, and other masses of wrought-iron. Messrs. Thomas Vernon and Son, iron ship builders, will exhibit models of the Woodside Great Landing Stage, and bridges; and of several wrought-iron bridges which they have constructed in different parts of the world; together with specimens of iron applied in naval architecture, a complete model, plan, and specifications of a first-class merchant ship, of about 1,200 tons, and a model of an iron caisson of very peculiar construction, made for the Government Dockyard at Malta. Messrs. Peto, Brassey, and Betts, of the Canada Works, will exhibit a model of a patent simultaneous manifold drilling machine, adapted for drilling any number of holes at the same time; also a multifarious machine for punching any number of holes, to any design, at one operation. Messrs. H. M. Lawrence and Co., of the Sandon Works, will exhibit an ice-making machine. Ice is produced by the process of evaporating ether in contact with salt water, which remains fluid at a lower temperature than fresh water, and, by flowing among a series of vertical troughs filled with fresh water, the latter is converted into ice. The same gentleman will also exhibit McNeil's semaphore target.

The screw steamer China made a short trip yesterday week in the Mersey, and tested her surface condensers, the result being considered very satisfactory.

The Mersey Docks and Harbour Board at its last meeting accepted the tender of Messrs. R. James and Co. for supplying coal for the steam engines, &c., for two years from March 1. It was agreed after some discussion to proceed with new portions of the Morpeth lock and dock in the manner suggested by the engineer, who was also authorised to take delivery of the Woodside Landing Stage from the contractors, Messrs. Vernon, without prejudice to certain questions pending between the board and that firm. The bill promoted by the board in the present session of Parliament for powers to construct extensive new works on the Liverpool side of the river will not pass unchallenged from Birkenhead, the Birkenhead Commissioners having adopted a lengthy petition on the subject. The petition which was agreed to at the last meeting of the commission stated that the commissioners withdrew their opposition to the Docks Bills of 1857 and 1858 upon an agreement and understanding that the works should be *bonâ fide* proceeded with and completed as required by the act. It also alleged that the constitution of the Dock Board was such as to secure a preponderating influence in favour of Liverpool interests conflicting, or might be considered at variance with those at Birkenhead, and that the Dock Board had all along shown great apathy in carrying on the works at Birkenhead, but great activity in constructing works for the extension and improvement of the dock system at Liverpool. It then pointed out the time at which the Birkenhead works were to be completed, and the present state of the works, showing that they were in a backward state, whilst £1,400,000, besides large sums from a surplus income, had been expended on works at Liverpool. It was contended that if the powers now sought for were granted the object of Parliament would be entirely frustrated, and the completion of the works at Birkenhead indefinitely delayed. The petition proceeded to say, whatever may be the requirements of dock accommodation at Liverpool, such requirements would have been amply provided for at Birkenhead if the board had proceeded with the works there authorised with the activity and vigour which they ought to have exercised; and if the works at Birkenhead were now pushed forward in the manner they ought to be all the requirements of the port for additional dock accommodation would be amply provided for for many years to come. The bill promoted by the Mersey Dock Board for spending £1,000,000 in more docks has been withdrawn.

The north supplies one or two items worth noting. At the half-yearly meeting of the Blyth and Tyne Railway Company the chairman said he saw very little prospect of the River Tyne Commissioners proceeding at present with the docks talked of at the Low Lights. He thought the River Tyne Commissioners were mistaken in their views on the subject, as a large portion of the traffic arising from the northern coal field was being abstracted from the Tyne by Sunderland, where there was better dock accommodation. In fairness to the Tyne Commission it should be added that this is a statement upon which there seems to be a good deal of difference of opinion in the district. The annual report of the directors of the Whittle Dean Water Company, submitted to the proprietors at their meeting at Newcastle, this week, shows that the company's business is gradually extending, the revenue having advanced from £21,071 in 1860 to £21,723 in 1861. The increase of income has, however, been absorbed by a large augmentation in the working charges, caused chiefly by the expenses entailed upon the company last summer by the unexpected deterioration of the water in one of the reservoirs. With reference to the capabilities of the company for meeting the progressive requirements of the increasing population an extended report has been received from Mr. Bateman, the eminent water engineer, and will shortly be made public. The Sunderland and South Shields Water Company has just declared a dividend at the rate of 8 per cent. per annum. Operations connected with a new pumping station at Cleadon are now approaching completion, and no extraordinary expenses have been incurred during their progress. Various comments have been made of late in several of our contemporaries reflecting on the sanitary condition of Newcastle; and Mr. Dawson, the Town Inspector of Nuisances, has just issued a report to show that since his appointment in 1854 his labours have not been without good results. But he admits the force of the strictures which, from various sources, have been made on the state of the town, and, as a remedy, he suggests the active interposition of the Town Improvement Committee, and a more liberal exercise of the powers with which they are endowed, assisted by a large fund, to effect on a large scale the thorough sewerage, paving, and flagging of streets, constituting nearly one-half of the area of the borough. For this purpose he recommends the raising of a sum of £50,000, and from the judicious expenditure of that amount he anticipates great benefits would accrue. Mr. Dawson, who also holds the office of road surveyor, proposes the abandonment of the Macadam system, especially within the town, believing that such a course would prove conducive to the cleanliness of the streets and the comfort and health of the inhabitants. Mr. T. S. Hunter, of Edinburgh, has published a letter to the North Seaton Coal Company, in which he suggests certain improvements in the river Wansbeck. Mr. Hunter proposes to deepen the channel from the ferry eastward to what may be considered as a bar to 16ft. at ordinary spring tides, to enlarge and deepen the estuary, and to construct two training walls or breakwaters of stone. The cost of these improvements he sets down at £25,000; but if the company should be unwilling to expend this sum he suggests that 100 yards of piling on each side of the river mouth, supported by diagonal piles and wailings, with a proper amount of dredging, might effect a considerable improvement at a much less cost.

A little more activity has been observed in the Derbyshire district of late for rails and railway ironwork required for continental lines. At Sheffield the iron agents are doing better, the demand for iron during the present month having been decidedly more active. The demand for steel is good, particularly for bar and crinoline steel, the orders for the latter, both on home and foreign account, being still considerable. The Birmingham gun and rifle manufacturers are sending fair orders for steel, although in other respects the local trade done with Birmingham is depressed. The aspect of the continental markets is, on the whole, favourable.

The state of employment at Manchester, although very unsatisfactory, might yet be much worse. Captain Palin, the chief constable, returns the position of the machinists and foundries as follows:—Machinists, full number which could be employed, 7,206; actually working full time, 5,288; working short time, 839; wholly out of employment, 1,079. Foundries, full number which could be employed, 4,206; actually working full time, 2,839; working short time, 624; wholly out of employment, 743.

The Leeds Chamber of Commerce observes in its monthly report on the business of that town and district:—"The manufactured iron trade continues much the same as before. The machine makers are still working short time, and have but few orders on hand. The machine tool trade is scarcely so good as before, but most of them keep their hands pretty well employed. The locomotive makers are still employed on old contracts, which will last them for some time yet."

If the weather should prove favourable the Stockport and Woodley Junction Railway is expected to be opened for traffic in June. The capital advanced for the construction of this line is to receive a minimum dividend of 4 per cent. per annum, with half surplus profits from the Manchester, Sheffield, and Lincolnshire.

At the last fortnightly meeting of the Royal Scottish Society of Arts a report was read from a committee on Mr. Cumberland Hill's time-gun apparatus. It stated that the suggestion of the firing of a time-gun by the employment of an electro-magnet, whose armature would withdraw a detent, and allow a spring to drive a hammer-head forcibly on a percussion cap, was not new, and had been brought under the notice of the society by Mr. Frederick Richie on the 25th April, 1859. Mr. Hill, however, was entitled to originality for his modification of the arrangement of the spring, whereby it was allowed to pull out the tongue of an ordinary artillery friction tube or fuse, instead of forcing down a hammerhead. The committee were of opinion (1) that the production of time signals by the employment of a galvanic current to force an electro-magnet, which in its turn directly liberated a spring, was uncertain in its results, and, when successful, entailed the use of comparatively large batteries, which cost much to procure, and were costly to keep in proper working order; and (2) that the introduction of Mr. Jones' clock into the circuit, as practised at the Observatory on the Calton Hill, and the Castle, enabled the battery power and cost to be reduced to a minimum; whilst the certainty and accuracy of its action, and the consequent precision of the signalling, had not hitherto been equalled. In conclusion the committee were of opinion that the gun apparatus proposed by Mr. Hill would not be an improvement on the present system of firing the time-gun, the working gear of which it would be difficult to surpass for efficiency and accuracy.

On Friday, at the New Bailey, Manchester, the application of Messrs. Joseph Whitworth and W. W. Hulse, the well-known mechanicians, for a license to erect a powder magazine and cartridge-filling shop at the Firs, Rusholme, was formally renewed. The application, according to the words of the notice, was for a license, "first, to erect and keep a magazine for the purpose of storing gunpowder and cartridges, not exceeding 200 lb. in weight, situated east of the Firs; and, secondly, for a licence to erect a certain other building, at least fifty yards from the above-mentioned magazine, for the making or filling of cartridges, pursuant to the statutes in such case made and provided." Such explanations had been given by Mr. Whitworth that the opponents to the scheme were now perfectly satisfied that it was not intended to carry on any very dangerous operation in the magazine. Mr. Pope said the notice had been expressly limited both as regarded the distance and the quantity of powder to be kept in the magazine, which would be 12ft. square or 11½ft. internal measurement. It would be sunk 6ft. below the ground, and there would be walls 6ft. above. The walls would be of unusual strength, and ventilation would be provided by means of a cavity between the outer and inner walls. Air would be admitted from apertures on the outside. Every precaution would be taken to secure good ventilation, and also to provide against the possibility of fire entering from without. The floor was to be covered with lead and india-rubber matting. Access would be made through double doors down a flight of steps. At Colonel Hamilton's suggestion the roof would be constructed of flags. Every precaution had been taken, so that an explosion, should it occur, would be directed upwards through the roof. On a suggestion from Mr. Trafford Mr. Hulse said they were quite willing to go down seven instead of six feet into the earth. Lead and flags should be used for the roof, and as much soil, both thereon and against the walls, as was consistent with ventilation, which was the most important consideration of all. The cartridge-filling shop would be as light as it could be made on weather-proof principles. Six men would be sufficient to fill cartridges for the whole nation; but as a rule only one man would be employed.

The half-yearly report of the directors of the Caledonian Railway states that the works of the line to Peebles, and of the Douglas branch, are being rapidly proceeded with, and those of the Drumbowie section of the Cleveland extension have been contracted for. The directors are promoting in Parliament a line about two and a half miles in length, from the Granton branch to the port of Leith, and will also recommend the company to subscribe £30,000 for a line from the Greenock section to Wemyss Bay, a rising watering-place on the Clyde. At the half-yearly meeting on Wednesday the shareholders received a dividend at the (under all circumstances) excellent rate of 5½ per cent. per annum.

The screw steamer Cortes, recently launched by Messrs J. and G. Thomson, Clydebank, Govan, made a satisfactory trial trip on Friday. The Cortes, which is intended to ply between Cadiz and Havana, belongs to the Spanish Steam Navigation Company, and she was built under the superintendence of Capt. Soulé and Mr. James Cochrane, joint superintendents of the company. The Cortes is shiprigged, and her dimensions are—Length of keel, 280ft.; breadth of beam, 39ft.; and she measures 2,100 tons. She is propelled by a lifting screw, which is driven by direct-acting engines of 500-horse power. The Cortes has well ventilated berths, by means of "jalousees," for 250 first and second-class passengers, and her main saloon will dine comfortably 140 persons. The run between the Lights was accomplished in 59½ minutes, the engines making 57 revolutions per minute, and working admirably. This speed, which is equal to 13¾ knots an hour, was gained, although the screw was not completely immersed. A steam winch works the windlass, by means of which the anchor is "weighed" with the greatest ease, and a vast amount of manual labour thereby saved.

Progress of the International Exhibition.—Now that her Majesty's Commissioners are in possession of the building, the arrangements for the reception and disposal of goods are those which occupy most attention, and the advancement of the building itself, or rather that portion of it which remains unfinished, is not so much heeded. From the eastern dome all the external scaffolding has been removed, and the huge erection stands out, with its entire outline, in relief against the sky; the glazing of it is not quite completed. Internally Mr. Crace has commenced the decoration of it, but the forest of scaffold prevents the progress of the work from being observed from below. The ribs of the eastern portion of the nave bear at the tops the names of the different parts of the United Kingdom, and of the colonies and dependencies; those of the south-eastern transept the names of the principal manufacturing towns in England, Ireland, and Scotland. The western annexe presents, at present, the appearance of some confusion; the steam pipes are being laid and the shafting erected for the machinery. The eastern annexe also is backward, as might have been expected from the late date at which it was commenced. There is no doubt that these buildings will be ready very shortly, but, in the meanwhile, the storing of the goods, which are beginning to come into the building, is a matter of some difficulty. Exhibitors, however, are warned that this must not be allowed to form an excuse for delay in the transmission of their goods; everything that is sent her Majesty's Commissioners will find room for, and the 31st of March is positively fixed as the last day on which goods can be received

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

	£ s. d.	Dis. p. cs.
IRON, English Bar and Bolt:—		
in London ..... per ton	5 15 0	2
in Wales ..... "	5 0 0	"
in Liverpool ..... "	5 10 0	"
Staffordshire Bars .. "	7 0 0	1½
Sheet, Sngl. "	8 10 0	"
Dbl. "	10 0 0	"
Hoop ..... "	8 0 0	"
Rod, round "	7 0 0	"
Nail Rod, sq "	7 5 0	"
SHIPPING IRON, Staffordsh. Bars "	7 0 0	2
Sheet, Single .... "	8 15 0	"
Double.... "	10 5 0	"
Hoop ..... "	8 5 0	"
Rod, Round ..... "	7 5 0	"
Nail Rod, Square.. "	7 5 0	"
IRON, Rails, in Wales, cash "	5 7 6	nett
" 6 months "	5 10 0	"
Old, to cut up "	0 0 0	"
Railway Chairs, in Wales "	4 0 0	"
" in Clyde "	3 15 0	"
Pig No. 1, in Clyde .... "	2 9 0	"
3-5ths No. 1 & 2-5ths No. 3. "	2 9 0	"
No. 1, in Wales..... "	3 10 0	"
No. 1, in Tyne and Tees "	2 18 0	"
Ditto, Forge ..... "	2 9 0	"
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom. "	3 10 0	"
Welsh Forge Pig (all Mine), at the Port .. "	3 5 0	"
Acadian Pig, Charcoal.. "	7 10 0	"
Scotch Pig, No. 1, in London ..... "	0 0 0	"

	£ s. d.	Dis. p. cs.
IRON, Swedish, Indian assortments..... per ton	11 5 0	2
Russian C C N D to arrive "	16 0 0	"
STEEL, Swedish Keg, bars. "	15 10 0	2½
Ditto, rolled..... "	18 0 0	"
Fagot..... "	17 0 0	"
SPELTER, on the spot .. "	17 15 0	nett
To arrive ..... "	18 0 0	"
Hard, remelted ..... "	17 0 0	"
ZINC, in sheets ..... "	23 0 0	"
COPPER, Tile, 14 to 28lb. "	93 0 0	2
Tough Cake..... "	93 0 0	"
Sheathing and Bolts ..per lb.	0 0 11	"
Sheet..... "	0 0 11	"
Bottoms..... "	0 0 11½	"
Old ..... "	0 0 9	"
Yellow Metal ..... "	0 0 9	"
Burra..... "	97 0 0	"
Russian..... do. .. "	0 0 0	"
LEAD, British Pig ..... "	20 15 0	"
Spanish ..... "	19 10 0	"
W. B. ..... "	21 0 0	"
Sheet ..... "	21 15 0	"
TIN, English Block, nom.. "	120 0 0	"
Bar " .. "	121 0 0	"
Refined " .. "	123 0 0	"
Foreign Banca ..... "	125 0 0	"
Straits ..... "	118 0 0	"
TIN PLATES, Charcoal, IC..... per box	1 9 0	"
Ditto IX ..... "	1 15 0	"
Coke, IC ..... "	1 3 0	"
Ditto IX ..... "	1 9	"
Do. at Newport, 1s. per box less	—	"
Do. at L'pool, 6d. "	—	"
CANADA, Plates.... per ton	12 0 0	2
QUICKSILVER ..... per lb	0	

Rails.—Moderate demand, and prices firm.

Scotch Pig Iron.—There has been a fair amount of business done this week, but the market now closes rather quiet, with sellers at 49s. cash for Mixed Nos. Warrants f.o.b. in Glasgow.

Spelter continues very dull, and may easily be had on the spot for £17 1s. to £17 17s. 6d. per ton. The stock is at present very large, being 5,123 tons, or 1,035 tons more than on the 1st March last year.

Copper.—On the 3rd inst. the smelters announced a reduction of a half-penny per pound on manufactured, and £4 10s. on cake and tile.

Lead in fair demand.

Tin.—English, firm. In Foreign Banca is worth £124 to £125, and Straits £117 to £118 per ton.

Tin Plates in good demand for exportation, and prices very firm.

March 6th, 1862. Moate and Co., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load —	1861. £ s.	£ s.	1862. £ s.	£ s.
Teak.....	15 10	17 0	15 0	16 0
Quebec, red pine ..	3 10	4 10	3 5	4 0
yellow pine..	3 0	4 0	3 0	3 15
St. John, N.B., yel.	5 0	5 10	5 0	5 10
Quebec, oak, white	5 0	5 10	5 0	5 10
birch	3 10	4 0	3 10	4 0
Memel.....	0 0	0 0	0 0	0 0
elm.....	3 10	4 15	3 10	4 15
Dantzic, oak	3 10	6 0	3 10	6 0
fir.....	3 15	3 10	3 0	4 0
Memel, fir	3 10	4 0	3 10	4 0
Riga.....	3 5	3 10	3 10	3 15
Swedish	2 15	3 0	2 15	3 0
Masts, Queb. rd pine	5 0	6 0	5 0	6 0
yl. pine	5 0	6 0	5 0	6 0
rd pine	0 0	0 0	0 0	0 0
Lathwood, Dantz, in	6 0	6 10	6 0	7 0
St. Peters	8 0	8 10	9 0	9 10
Deals, per C, 12 ft. by 3 by 9 in.				
Quebec, wht. spruce	13 0	18 0	15 0	19 0
St. John, wht. spruce	13 0	16 0	15 0	17 10

Per load —	1861. £ s.	£ s.	1862 £ s.	£ s.
Yel. pine, per reduced C.				
Canada, 1st quality	17 0	18 10	17 10	19 0
2nd do ..	12 0	12 10	12 0	13 0
Archangel, yellow..	13 0	13 10	14 0	15 0
St. Petersbg, yel...	12 0	12 10	12 10	13 10
Finland.....	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	18 0
Gothenburg, yel...	10 0	11 10	10 0	18 10
white	9 10	10 0	9 10	11 0
Gefle, yellow	10 0	11 0	11 0	12 10
Soderhamn	10 0	10 10	11 0	12 10
Christiania, per C				
12 ft by 3 by 9 in.....yellow	22 0	25 0	22 0	24 0
Deck plank, Dntz per 40 ft. 3 in.	0 14	1 4	0 14	1 4
Staves, per standard M				
Quebec, pipe	60 0	70 0	50 0	55 0
puncheon	16 0	18 0	16 0	17 0
Baltic, crown pipe	160 0	170 0	170 0	180

SCOTCH PIG IRON REPORT.

		s.	d.	
No. 1	Gartsherrie	55	6	f.o.b Glasgow.
" 1	G.M.B.	48	6	" do.
" 3	Do.	47	6	" do.
M. Nos.	Do.	48	0	" do.

WARRANTS.

			s.	d.	
3-5ths No. 1 and 2-5ths " 3 .. G.M.B.	Cash prompt	.. ..	49	1½	per ton.
	1 mo. open	.. ..	49	4½	do.
	2 mos. "	.. ..	49	7½	do.
	3 " "	.. ..	50	0	do.

MANUFACTURED IRON.

	£	s.	d.	
Bars, Govan	7	0	0	
" Common	6	17	6	
Drumpeller, Common	6	17	6	
Do. Best	7	17	6	
Plates and Sheets	9	0	0	to £10.
Rails	7	5	0	
Pipes	5	0	0	
Chairs	4	0	0	

Glasgow, 5th March, 1862.

There is no change to report in the pig iron market, 49s. 1½d. sellers and 49s. buyers of Mixed No.'s Warrants, cash prompt. Business is being done on the most limited scale.

Shipping orders come in sparingly, but, on the whole, are better than the corresponding period of last year.

Exports last week were 10,904 tons, against 9,080 tons in the corresponding week last year. Shaw, Thomson, and Moore, Metal Brokers.

The Patent Office Library.—Every week additions are made to the densely packed collection of books forming the library of the Patent Commissioners. It is now difficult to enter or leave the reading room, and anything like accommodation for visitors is out of the question. Even the attendants, ever seeking to render assistance, are absolutely in the way, and every visitor is in the way of his neighbour.

Steam Shipbuilding on the Clyde.—Last year eighty-one steamers were turned out by Clyde shipbuilders. The collective burden of these vessels was 60,185 tons; the aggregate power of their engines was 12,493 horses; the cost of their hulls and fittings was £1,251,300; and the cost of their engines £456,800. At the commencement of the current year twenty-seven steamers were in progress, of a total burden of 28,362 tons and 6,140-horse power. The cost of the hulls and fittings of the twenty-seven last-mentioned steamers was estimated at £633,200, and the cost of their engines at £280,800. This estimate includes the three large paddle steamers ordered for a French company, and which Messrs. Scott are building.

Thames Embankment.—On Thursday week the commissioners reassembled at the offices of the commission in Victoria-street, Westminster, Captain Douglas Galton, R.E., in the chair, and took into consideration five plans for embanking the Surrey side of the Thames. The first plan submitted was by Mr. W. A. Brooks, C.E. He proposed four quays for the line of embankment. The first from Fore-street, Lambeth, to Westminster Bridge; the second between Westminster Bridge and Bankside, Southwark; the third off St. Saviour's Dock, Bermondsey, and the fourth from the Thames Tunnel to King and Queen Steirs, Rotherhithe. The estimated cost of the embankment from Lambeth Palace to Bankside would be £162,492. Mr. Austin proposed a 30ft. embankment wall, with conduits into which the sewers would discharge, combined with docks between the embankment walls. Mr. T. E. Weller's plan consisted of a solid embankment from Westminster Bridge to Blackfriars, following the present line of the river's frontage. Mr. J. Lightfoot's embankment would run from Vauxhall to Lambeth, with a roadway in front of all the premises to Rotherhithe, with docks between the roadway and the premises to London Bridge; also a new bridge opposite the Horse Guards, and a new street to unite York-street and College-street. Mr. Giles suggested an embankment from Vauxhall to Lambeth Bridge, and a roadway 60ft. wide to Bankside, and a new road from Nine Elms to Lambeth. The commissioners then adjourned.

INSTITUTION OF CIVIL ENGINEERS.

4th March, 1862.

JOHN HAWKSHAW, Esq., President, in the Chair.

THE first paper read was "Description of the Loch Ken Viaduct, Portpatrick Railway," by Mr. E. L. J. Blyth, M. Inst. C.E.

This viaduct was situated on a curve of half a mile radius, and carried a single line of railway over the loch at an oblique angle, so that the width of the waterway was increased from 265ft. to 360ft., the depth of the water at the point of crossing being 29ft. in summer. It consisted of seven openings—three of 130ft. each in the centre, spanned by wrought iron girders of the bow and string form; two semicircular arches of masonry, of 20ft. span, in the abutments; and two openings of 20ft. each at the ends, provided with flat cast iron girders. Owing to there being scarcely any current it was not deemed necessary to set the piers in the line of the loch, but they were placed at right angles to the viaduct, and each pair of girders was at a slight angle to the adjacent ones.

The foundations consisted of strong gravel, except in the case of the east abutment of the main openings, where a running sand was met with, and in this instance the lower courses of the masonry were laid on a bed of hydraulic lime concrete 2ft. in thickness. The two deep-water piers were each formed of two towers, 8ft. in diameter, placed 8ft. apart, and connected above the water-level by semicircular arches of masonry. For each tower of the piers a cast iron tube 8ft. in diameter, in six pieces, was sunk, the tubes being 36ft. and 42ft. in length for the east and west piers respectively. When the masonry was brought up to the surface the upper castings of the tubes were removed. Around the piers 4,000 cubic yards of loose rubble stones were deposited, so as to produce an artificially deeper foundation. The tubes, when placed in position, sank from 1ft. to 2ft., by their own weight, until they reached the gravel and sand, where they remained quite firm. This formed a good test of the sufficiency of the foundation, as the weight of the tubes on their narrow edges was equal to from 8 tons to 9¼ tons per square foot, while the total weight on the foundations of the finished structure, including the moving load, was only about 6¼ tons per square foot.

The method adopted in sinking the tubes was that of ordinary well sinking. Two plate iron screw pans, of an inverted cone shape, were employed; one 2ft. in diameter at the top and 1ft. deep, and the other, which was only used for the harder portions of the excavation, 1ft. in diameter at the top and 1ft. deep. There were openings in the sides, covered with leather flaps, to prevent the material from escaping when the pans were filled. Three arms of round iron projected through the sides of the pans, and being connected to a long rod with a cross handle at the upper end, the screw pans were worked by four men, and when full were raised by tackle. The larger pan raised about one cubic foot of material each time, and the smaller one about one-fourth of that quantity. By these means the tubes were sunk in some instances as much as 18in. in one day, the minimum being 2in. per day in the case of the north tube of the west pier, where large boulder stones were encountered, rendering necessary the use of a screw pick. When the tubes had been lowered the desired depth concrete was deposited within them, varying from 12ft. to 18ft. in depth in each tube. On this concrete ashlar masonry was laid, the cordon course being of granite, in large blocks, for receiving the ends of the girders, which rested on wrought iron plates, laid on thick sheets of vulcanised india-rubber, to lessen the effect of vibration.

The bow and string girders were each 136ft. 8in. in length, and were segmental in form, the rise being 17ft. 6in., so that the segment was almost identical with a catenary curve, or the true curve of equal pressure. The sections of the upper and the under booms were identical. They consisted of a main plate, 24in. broad and ⅜in. thick, and of two channel irons, each 8in. by 4in. in section and ½in. thick, placed at a distance of 8in. apart, between and to which the struts and ties, of the same section of channel iron, were rivetted. The transverse girders for carrying the roadway were 6in. in depth at the ends, where they rested on the channel irons of the under booms, and 15in. deep in the centre. The middle web of these girders was ½in. in thickness, and there were angle irons, 3in. by 3in. by ½in. in section, at the top and the bottom of the web on each side. Every alternate girder projected 2ft., from which T-iron struts were carried up to the crossings of the diagonal bracing. The weight of the girders and roadway between the points of support was 88 tons, and of the ballast (2in. in depth) 14 tons, making a total dead load of 102 tons; and taking the rolling load at 1 ton per lineal foot the total load on one span would be 232 tons. The area of the upper boom was 33in., and of the under boom, exclusive of rivets, 27·4in. The distance between the centres of gravity of the upper and the under booms was 17·04in. The tensile strain on the under boom amounted to 4·04 tons per inch, and the compressive strain on the upper boom to 3·35 tons per inch. When the whole of the load was upon the girders there was no compressive strain on any of the diagonals, but there were tensile strains varying from 3·4 tons to 7·5 tons, or equal respectively to 9 cwt. and 1 ton per square inch of section.

The author considered that the bow-and-string girder possessed advantages over the Warren or other lattice girders, with parallel top and bottom members; as in the latter class it was not possible to make the top and bottom members theoretically correct, without great labour and waste of material, and as, owing to the great variation in the strains on the diagonals, it was necessary that they should be of varying dimensions, involving in some cases even different sections of iron.

The girders were built in position on staging, and the greatest amount of deflection of any one girder from its own weight was ⅜in. Subsequently, when a locomotive engine, weighing 34 tons, was placed in the centre of each span, and afterwards was run over, first at 10 miles an hour, and then at 25 miles an hour, the deflection amounted to from $\frac{1}{16}$in. to ¼in. in each girder, there being no perceptible difference in either case. Finally, when four engines were coupled together, so as to give a load equal to 1 ton per lineal foot, the deflection only amounted to from ¼in. to ⅜in.

It was stated that the total cost of this viaduct had amounted to about £13,000.

The second paper read was "Description of the Centre Pier of the Bridge across the river Tamar, at Saltash, on the Cornwall Railway, and of the means employed for its Construction," by Mr. R. P. Brereton, M. Inst. C.E.

This communication embraced, in a narrative form, a detailed account of the preliminaries connected with the Albert Bridge, which crossed the river Tamar where it was only 1,100ft. wide, with precipitous banks and a depth of water to the surface of the mud of 70ft. A dyke of green stone trap intersected the clay slate formation at this point, and cropped out to the surface above the water on the western bank of the river. It was ascertained, by borings made in the bed of the river, that rock extended from the eastern side to beyond the middle of the stream, covered with mud or silt to a depth of from 5ft. to 16ft. Subsequently a thorough examination of the bed of the river where a centre pier would probably be built, by means of one hundred and seventy-five borings made within a cylinder at thirty-five different places, over an area of 50ft. square, enabled an exact model of the surface of the rock to be prepared, showing the irregularities and fissures that might be expected. Eventually it was decided, from the information thus obtained, to erect one pier only in the deep water, instead of three, as would have been necessary for the spans required by the Admiralty; and when it was determined to proceed with the construction of the bridge, in 1852, it was decided that there should be two spans of 455ft., two of 93ft., two of 83ft. 6in., two of 78ft., two of 72ft. 6in., and nine of 69ft. 6in.; the total length, including the adjoining land openings, being 2,200ft.

The centre or deep water pier, intended to carry the weight of one-half of each of the two main spans, consisted of a column, or circular pillar, of solid masonry, 35ft. diameter and 96ft. high, carried up from the rock foundation to above high water mark. Upon this were placed four octagonal columns of cast iron, 10ft. diameter, carried up to the level of the roadway, which was 100ft. above high water mark. Upon the tops of the columns cast iron standards were fixed, to receive the ends of the tubes and chains which constituted the trusses of the bridge. The weight at the bottom of the masonry foundation was about 9½ tons per square foot, increased, when the bridge was loaded by passing trains, to about 10 tons per square foot.

In the construction of the masonry pier a wrought iron cylinder of boiler plates, 37ft. diameter and 90ft. in length, and open at the top and the bottom, was sunk through the mud of the bed of the river to the rock. The water was then pumped out, and the mud excavated; the masonry being built up inside, and the cylinder above the ground afterwards removed. It was expected that, by forming a bank round the cylinder after being sunk to the rock, sufficient water-tightness would be ensured for getting in the masonry. To provide, however, for the contingency of excessive leakage, the cylinder was so constructed as to admit of the application of air pressure. As the surface of the rock, although very irregular and ragged, had a general dip to the south-west, the bottom of the cylinder was formed with a corresponding bevel, one side being 6ft. longer than the other. A dome, or lower deck, was constructed inside, at the level of the mud, and an internal cylinder, 10ft. in diameter, open at the top and the bottom, connected the lower with the upper deck of the cylinder. The 6-ft. cylinder, previously used for the borings, was fixed eccentrically inside the other, and an air jacket or gallery, making an inner skin round the bottom edge below the dome, was formed, about 4ft. in width, divided into eleven compartments, and connected with the bottom of the 6-ft. cylinder by an air passage below the dome.

Details were then given of the construction of the larger cylinder, and of the mode of launching and floating it to its position. When accurately adjusted over the intended site water was gradually let in, until the cylinder penetrated through the mud about 13ft., and rested on some irregularities upon the rock, which caused it to heel over towards the east about 7ft. 6in. By letting water in upon the dome or lower deck, and loading the higher side with iron ballast, the cylinder forced its way through the obstructions at the bottom edge, and took a nearly vertical position. The air and water pumps were then set to work, and the greater part of the mud and oyster shells, which filled the compartments of the air-jacket at the bottom, was cleared out, and the irregular surface of the rock excavated; the bottom of the cylinder being now 82ft. below high water. Subsequently a leak having broken out through a fissure in the rock on the north-east, or higher edge, considerable difficulty was experienced in maintaining sufficient pressure with the air-pumps to keep the water down and the bottom dry. The leak was at length reduced by driving close sheet piling into the fissure. When at its full depth the cylinder was 87ft. 6in. below high water at the lowest place, and then a hemp gasket was worked under the edge of the cylinder, all round the outside, to assist its water-tightness. A ring of granite ashlar, 4ft. in width and about 7ft. in height, was then built in the air jacket; and a bank of clay and sand was deposited round the outside of the cylinder to compress the mud. When the water was pumped out of the body of the cylinder below the dome, and the excavation of the mud was being proceeded with, a leak broke out, and the water overpowered the pumps. Additional engines and pumps were provided, and efforts were made to diminish the leakage, with varying success; but as it required four pumps to keep the water down to 54ft., recourse to air pressure in the body of the cylinder below the dome became imminent, and preparations for its application were made. To provide against the buoyancy, or upward pressure against the dome and cover, the 37-ft. cylinder was loaded with 750 tons of ballast, in addition to its own weight of 290 tons. The pumps were then got into good order, and, by continued pumping, succeeded in keeping the water down. The mud was excavated, the cylinder below the dome securely shored across, and the rock levelled, when the masonry, in thin courses of granite ashlar in cement, in the body of the cylinder was commenced. As soon as the masonry reached the level of the air jacket ring it was thoroughly bonded, the plates of the air jacket being cut out as it proceeded. Upon the top of the bonding course, two courses of hard brickwork in cement were laid, making a perfectly water-tight floor over the whole diameter of the column. Meanwhile the masonry of the air-jacket, where the leak occurred, was taken down, and the leak was diminished by additional sheet piling. The leak was discovered to have broken out at the same fissure as before, and had torn away the rock underneath the masonry of the air-jacket and bottom edge of the cylinder, but the masonry itself was undisturbed.

The next operation was to draw off the water above the dome, and remove the ballast, to allow the masonry to be proceeded with, which it eventually did at the rate of from 5ft. to 7ft. in height per week. When it was 46ft. in height the influx of water was entirely stopped. After the masonry had been completed to the level of the plinth the upper part of the cylinder was unbolted at the separate joints, and floated to the shore.

March 11, 1862.

JOHN HAWKSHAW, Esq., President, in the Chair.

THE paper read was "Description of the Delta of the Danube, and of the Works, recently executed, at the Sulina Mouth," by Mr. C. A. Hartley, Assoc. Inst. C.E.

In the autumn of 1856, by virtue of the Treaty of Paris, the European Commission of the Danube, consisting of representatives from each of the seven contracting powers, was charged to execute the works necessary below Isakcha, to clear the mouths of the river, as well as the adjacent parts of the sea, of the impediments which obstructed navigation. This commission, to which the author had acted as chief engineer, was authorised to levy rates, to cover the expense of such works, on the express condition that the flags of all nations should be on a footing of perfect equality.

In the preliminary studies of the three principal branches and mouths of the Danube, advantage was taken of the charts made by Captain Spratt, R.N., C.B.; and aided by these, and by the author's own surveys and personal investigations, a brief description was given of the chief characteristics of the progress of the river through its delta. The Danube, after a course of 1,700 miles, during which it received more than 400 tributaries, and drained upwards of 300,000 square miles, passed in a single channel, 1,700ft. wide and 50ft. deep, the Bulgarian town of Isakcha, situated on the right bank, at 30 and 40 English miles respectively below the large corn exporting ports of Galatz and Ibralia. Isakcha was 76, 78, and 90 miles from the sea, following the courses of the Kilia, the Sulina, and the St. George branches, and 58 miles in a straight line. The head of the delta was reached, at Ismail Chatal, or Fork, 15 miles lower down, and here the fresh waters divided, never to reunite; $\frac{14}{17}$ths of their volume passing in an easterly direction by the Kilia branch, and the remaining $\frac{3}{17}$ths in a south easterly direction by the Toultcha branch. At 11 miles below Ismail Chatal this latter branch separated into two channels, the St. George and the Sulina discharging respectively $\frac{2}{17}$ths and $\frac{1}{17}$th of the whole volume of the river.

A short account was then given of the three channels, from which it appeared that the waters of the Kilia were delivered to the sea by twelve distinct mouths, only navigable for fishing vessels; that the river portion of the St. George offered no real obstacles, having an average width of 1,200ft., and a minimum depth of navigable channel of 16ft., at seasons of extreme low water; and that in the upper reaches of the Sulina disaster of every kind was imminent, from the many intricate windings and numerous shoals—the navigable width being rarely more than 300ft., and the depth over the shallows, during seasons of low water, varying from 10ft. to 14ft.

The delta proper was described as being bounded on the north by the Kilia branch, on the south by the Toultcha and St. George branches, and on the east by the Black Sea; the enclosed space comprising an area of 1,000 squares miles, and forming a triangle of which the Ismail Chatal was the western apex, and the sea coast, from the mouths of the St. George to those of the Kilia, the base. During extraordinary high floods the delta, being unprovided with artificial banks to contain the swollen waters, was almost entirely submerged; whilst at seasons of drought its banks were elevated from 10ft. to 12ft. above the level of the river at the Upper Chatal, and from 8ft. to 10ft. at the Chatal of St. George. In the lower reaches of the three branches the level of the river was but little affected by variations in the upland waters. Adjacent to the mouths it never varied more than 1ft., except when influenced by the wind. During high floods the inclination of the surface water of the Sulina branch was 3in. per mile, while during extreme low water it did not exceed 1in. per mile. At times of ordinary high water, when the current had attained a velocity of from two and a half to three miles an hour, the Danube, before it divided at Ismail Chatal, delivered a volume of water equal to nineteen and a-half millions cubic feet per minute; while in the dry season, when the current was reduced to one mile per hour, the flow did not exceed seven and a-half millions cubic feet per minute. At times of extraordinary floods, such as that which occurred in March, 1861, the velocity was increased to five miles per hour, and the volume of water then delivered amounted to sixty millions cubic feet per minute, or eight times the quantity discharged at ordinary low water. It was stated, as the result of careful observations, that when the waters were most surcharged they carried to sea at the rate of one cubic inch of sedimentary matter, supposing it to be solidified into coherent earth, per cubic foot of water, and that not more than one-fortieth part of this proportion was transported when the floods had subsided. Thus, at the former period, upwards of 600,000 cubic yards of diluvial detritus passed into the sea by the several mouths of the river in twenty-four hours, and at the latter not more than 15,000 cubic yards. The results of these investigations accounted, in a great degree, for the changes which took place from time to time in the position and extent of the sand banks forming the bars across the several mouths. At times of high floods these bars were further from the shore, their magnitude was considerably increased, and the depth over them was diminished; their distance from the shore and their height being much influenced by the direction of the prevailing winds. The depth of the sea opposite the delta decreased to the north; thus, at three miles from the land, the depth was sixteen fathoms opposite the St. George's mouth, and only ten fathoms opposite the Sulina and Kilia mouths.

During the interval from 1830 to 1857 the shallows of the Kilia advanced fully one mile in the direction of the Sulina mouth. This, combined with the uncertain and changeable nature of the many branches issuing from the Wilkov basin to the sea, and the distance of the bars from the shore, were the chief considerations which induced the author to form an unfavourable opinion of the Kilia—in spite of its possessing the best river channel—and to recommend, in preference, the improvement either of the St. George or of the Sulina, where the sea depths were greater, and the advance of the sand-banks was less remarkable. In comparing the merits of the two latter branches the author arrived at the conclusion that, in nearly every respect, the St. George offered decided advantages over the Sulina. It was true that, in order to reach the Kedrilles bar of the St. George, double the length of works would be necessary; but when once the sand-banks were passed the greater sea depths opposite the St. George would insure, for a longer period, a constant good navigable depth at the sea entrance. The St. George's mouth was situated at the most salient angle of the delta, was nearer to the Bosphorus, by eighteen nautical miles, than the Sulina, and was more favourably placed with regard to the safe manœuvring of vessels during N.N.E. winds.

Although there was a great difference of opinion as to the merits of each of the three principal branches, or mouths, all the technical authorities, who had studied the question on the ground, agreed in recommending that, whichever mouth was chosen, the system of improvement should be that of guiding the river water across the bar, by means of piers projected from the most advanced dry angles of the mouth; so as to concentrate the strength of the river current on the bottom of the proposed improved channel, by an artificial prolongation of the river banks into deep water. After considerable discussion the commission resolved to improve the bar channel of the Sulina, by guiding piers of a temporary character, in order to give the speediest relief to the navigation in the cheapest manner; but it was distinctly guaranteed that this should not prejudice the choice of the mouth to be selected for permanent treatment. The author then received instructions to provide works which, for the expenditure of a sum limited to £80,000, should have the effect of the giving an increased depth of at least two feet, over a period of from six to eight years. This duration of time was based on the assumption that, during such an interval, either the St. George would be opened, or it might be considered expedient to limit the improvement of the Danube to rendering permanent the provisional works.

The designs for the provisional works were then matured; and as it was found, in practice, that the cost of strong timber cribs, to be loaded with stone and sunk at intervals of 20ft. along the line of works, would exceed the original estimate, choice was finally made of a structure composed of timber piling and *pierre perdue*, surmounted by a timber platform 14ft. wide, strengthened occasionally by solidly constructed cribs of the same width. The works were commenced on the 21st of April, 1858, a temporary staging, fixed on piles, being always run out from 200ft. to 300ft. in advance of the permanent piling. This staging supported nine crab engines, by which three rows of three piles, each 13in. square and 7ft. apart, were frequently driven, in one day, to a depth of 16ft. into the hard fine sand of which the bottom was composed. The piles were then immediately secured by double longitudinal walings and double cross-ties, the whole being surmounted by two thick trampieces and planking, at 4ft. above the level of the sea. From this permanent platform the close piling on the side next to the sea was driven. The daily rate of progress, during fine weather, was 20 lineal feet; and as soon as this length of sheet piles was completed stones were thrown down to protect the footing in the sand, which was liable to be washed away by the action of the sea. This scouring action of the sea was so serious, when the skirt of the bar was reached, that it threatened at one time to demand for the completion of the works double the quantity of stone originally estimated. Several plans were tried to reduce its pernicious effects. That eventually adopted, and which was perfectly successful, was to advance the open pile work with all possible expedition, and then to pave the proposed seat of the pier with stones, delivered from barges. This pavement withstood the attacks of the sea, and offered no great obstruction to the penetration of the sheet piles, which, without being shod, had frequently been driven 10ft. into the ground, after having been forced through 8ft. of rubble stone. The section of the finished stone work was described as being a solid mass of closely-packed third-class rubble, resting on a broad base, and narrowing upwards at slopes varying from 2 to 1, near the pier heads to 1 to 1, and 1½ to 1 near the shore, until slightly below the level of the water, it became a mere ridge against the close piling. The time occupied in the actual construction of the piers was thirty-one months, exclusive of three winter months each year, during which the Danube was frozen over, and all work was suspended, but inclusive of 207 days when it was impossible to work, on account of stormy weather. The length of the north pier was 4,631ft., that of the south pier was 3,000ft., and the depth of water in which they were built varied from 6ft. to 20ft. In their construction 200,000 tons of stone and 12,500 piles had been employed, and the cost had not exceeded ten guineas per lineal foot. The stone was brought from a distance of sixty miles, and its price delivered in place varied from 4s. to 5s. per ton; the oak, used for the longitudinal and transverse timbers and for the planking and fender piles, cost 2s. 3d. per cubic foot, while the fir timber piles were delivered ready for driving for 4d. per cubic foot. The workmen, of whom there were generally 300, were composed of men belonging to more than ten different nations. Labourers were paid 2s. 6d. and carpenters 4s. 6d. per day.

The chances which had taken place at the Sulina mouth, consequent on the projection of the piers, were then noticed. The depth on the bar, since the year 1829, had varied between the extremes of 7ft. and 12ft., the least depth occurring during the

subsidence of high water floods, and the greatest when the deposits lodged by those floods had been dispersed by autumnal and winter gales. In April, 1858, when the works were commenced, there was a navigable channel only 9ft. deep over the centre of the long shoal forming the Sulina bar. In November, 1859, when the works had been brought to a close for the winter, the north pier had advanced 3,000ft. and the south pier 500ft., and then the depth on the bar was 10ft., which was increased to 14ft. by the following April, although the works had remained stationary. Hopes were consequently entertained that the action of the north pier would, in itself, be sufficient to maintain an improvement; but these expectations were disappointed, as in August, when the north pier had reached a length of 4,600ft., the depth on the bar had diminished to 9½ft. Every exertion was then made to bring the opposite pier into play. Accordingly, during the next three months, the south pier was advanced 1,500ft., and as it was now within 600ft. of the north pier the good effect of concentrating the whole force of the river current directly on the bar became at once apparent. Thus, on the 30th of November, 1860, there was a navigable channel of 12ft., and on the 28th of February, 1861, of 16ft. Then came the breaking up of the ice in the river, and the furious descent of the extraordinary high floods, which caused so much damage at Galatz, and submerged the whole delta; but this time, instead of the depth on the bar being diminished, the swollen waters confined between the two piers and directed in a proper line fairly swept away the remains of the bar on to the south bank and into deep water. From that time to the present the depth had never been less than 16½ft., and frequently it was as much as 17½ft., over a navigable width of 500ft. This result had been accomplished by works the cost of which had not exceeded the sum that had been paid in one year only for lightening vessels over the bar, and without taking into accoun: the excellent shelter which had been afforded, and the great risks which vessels formerly ran of being wrecked off the entrance.

In conclusion the author expressed his gratitude to the members of the European Commission of the Danube for the generous support he had always received, and especially to Major Stokes, R.E., the representative of Great Britain, whose enlightened policy, if allowed to prevail, could not fail eventually to insure to the commerce of all nations the best possible means of water communication with the rich cora-growing countries bordering the shores of the Lower Danube.

OCEAN MAIL SUBSIDIES.

The return just issued of the estimated expense of the Post-office packet service for the current year shows a diminution of £79,059 from the total of last year, and £153,881 from that of the year 1860-1. The reduction on the present occasion is entirely due to the disappearance of the charge for the Galway contract. Annexed are the several items, which make up the total of £915,897 :—

Estimate for the Post-office Packet Service for the Year 1862-3.

Contracts.	1862-3	1861-2
Holyhead and Kingstown, for conveyance of mails	£85,900	£85,900
Aberdeen and Lerwick, for hire of steam vessels to convey mails	1,200	1,200
Thurso and Stromness, for conveyance of mails	1,300	1,300
Southampton and the Channel Islands, ditto	4,000	4,000
Liverpool and the Isle of Man, for hire, &c.	850	850
Liverpool and Ramsay, Isle of Man, for conveyance of mails	100	100
Penzance and Scilly, ditto	300	300
Southampton and Cowes, ditto	750	750
Ryde and Gosport, ditto	50	50
Dunvegan and Lochmaddy, ditto	233	233
Greenock, Portree, and Stornoway, ditto	200	220
Stornoway and Aultbea, ditto	156	156
Ardrossan and Arran, ditto	80	80
Greenock, Rothesay, and Ardrishaig	1,260	1,360
Dover and Calais and Dover and Ostend, including £3,100 for extra charges	18,600	18,600
Southampton, Vigo, Oporto, Lisbon, Cadiz, Gibraltar (Of the £2,500 nominally paid for this service, 15,500 is virtually on account of the India, China, Australia, and Mauritius services.)	20,500	29,500
Liverpool and Halifax and Boston, and to and from Liverpool and New York and Nassau .. £176,340		
Deduct proportion to be paid by the Government of Nassau 1,500		
	174,840	171,840
Galway and ports in America	—	78,000
Halifax, Bermuda, and St. Thomas, and Halifax, and St. John's, Newfoundland	14,700	14,700
West Indies	238,500	238,500
Brazils and Buenos Ayres, extension of the West Indies contract	30,000	30,000
Greytown and Blewfields (This service was accidentally omitted from the Estimate for last year.)	744	—
Turk's Island and St. Thomas	300	300
West Coast of America, between Panama, Callao, and Valparaiso	25,000	25,000
West Coast of Africa and England	30,000	30,000
Cape of Good Hope and England, £32,400, less £6,000 paid by the colony	26,400	32,400
Point de Galle and Sydney, £134,672, less moiety to be paid by the colonies	67,336	67,336
Australia and New Zealand	14,000	14,000
Alexandria, Ceylon, Calcutta, Hong Kong, and England, including a branch from Marseilles to Malta, £102,125; less 55,344 to be paid by the Indian Government, and £15,458 to be paid by the Australian colonies, and also £15,000 for abandonment of reduced fares for Government passengers on the vessels of the Peninsular and Oriental Steampacket Company	76,773	94,375
Aden and Bombay	22,000	22,000
India, by alternate weekly communication to Bombay and Calcutta, for the conveyance of additional mails	21,000	21,000
Southampton and Alexandria	5,000	5,000
China (three months only included in Estimate for 1861-2)	24,000	6,000
For allowance to Government agents on board the contract packets	5,940	5,165
Total for contracts	£911,992	£991,695
Packet Establishments. (That proportion only of the expenses of the packet Establishments which is borne by the Post-office Department is included in the Packet Estimate; one-half of the salaries and allowances being provided for by the Admiralty.)		
Dover	300	300
Holyhead	256	256
Liverpool	415	415
Southampton	787	724
Pensions	547	566
Contingencies	1,600	1,600
Total charge for the Post-office Department packet service	*£915,897	†£994,956

* Of this sum, taking as a basis the cost of the service when that service does not exceed the amount of the Ocean postage, and in all other cases the amount of ocean postage received, about £470,000 may be considered as expenditure for purely postal services.

† Only £919,956 was voted, £75,000 having been withdrawn in respect of the service between Galway and America.

The Patent Laws.—Mr Beecroft, M.P., of Leeds, has presented a petition from residents in that town, praying for an amendment of the patent laws.

The Mails.—A memorial from the most eminent firms in the American trade has been addressed to the Postmaster-General, praying that, on the arrival of the American mails at Queenstown, and if too late for the regular trains, special trains may be run to bring them on to Dublin, and special steamers employed, if required, to bring them to Holyhead.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

March 4th, 1862.

J. P. Joule, LL.D., F.R.S., President, in the Chair.

A paper by Professor W. Thomson, LL.D., F.R.S., Honorary Member, was read, entitled "Observations on Atmospheric Electricity."

I find that atmospheric electricity is generally negative within doors, and almost always sensible to my divided ring reflecting electrometer. I use a spirit lamp, on an insulated stand a few feet from walls, floor, or ceiling of my lecture room, and connect it by a fine wire with the insulated half ring of the electrometer. A decided negative effect is generally found, which shows a potential to be produced in the conductors connected with the flame, negative relatively to the earth by a difference amounting to several times the difference of potentials (or electro motive force) between two wires of one metal connected with the two plates of a single element of Daniell's. I have tested that the spirit lamp gives no idio-electric effect amounting to so much as the effect of a single cell. The electric effect observed is therefore not due to thermal or chemical action in the flame. It cannot be due to contact electrifications of metallic or other bodies in conductive communication with the walls, floor, or ceiling, because the potentials of such must always fall short of the difference of potentials produced by a single cell. I have taken care to distinguish the observed natural effect from anything that can be produced by electrical operations for lecture or laboratory purposes. Thus I observe generally in the morning before any electrical operations have been performed, and find ordinarily results quite similar to those observed on the Monday mornings when the electrical machine has not been turned since the previous Friday. The effect, when there has been no artificial disturbance, has always been found negative, except two or three times, since the middle of November; but trustworthy observations have not been made on more than a quarter of the number of days.

A few turns of the electrical machine, with a spirit lamp on its prime conductor, or a slightly charged Leyden phial, with its inside coating positive put in connection with an insulated spirit lamp, is enough to reverse the common negative indication. Another very striking way in which this may be done is to put a negatively charged Leyden phial below an insulated flame (a common gas burner, for instance). The flame, becoming positively electrified by induction, keeps throwing off, by the dynamic power of its burning, portions of its own gaseous matter, and does not allow them to be electrically attracted down to the Leyden phial, but forces them to rise. These, on cooling, become, like common air, excellent non-conductors,* and, mixing with the air of the room, give a preponderance of positive influence to the testing insulated flame (that is to say, render the air potential positive at the place occupied by this flame).

Half an hour, or often much more, elapses after such an operation, before the natural negatively electrified air becomes again paramount in its influence on the testing flame.

That either positive or negative electricity may be carried, even through narrow passages, by air, I have tested by turning an electric machine, with a spirit lamp on its prime conductor, for a short time in a room separated from the lecture room by an oblique passage about two yards long, and then stopping the machine and extinguishing the lamp, so as to send a limited quantity of positive electricity into the air of that room. When the lecture room window was kept open, and the door leading to the adjoining room shut, the testing spirit lamp showed the natural negative. When the window was closed, and a small chink (an inch or less wide) opened of the door, the indication quickly became positive. If the door was then shut, and the window again opened, the natural effect was slowly recovered. A current of air, to feed the lecture room fire, was found entering by either door or window when the other was shut, This alternate positive and negative electric ventilation may be repeated many times without renewing the positive electricity of the adjoining room by turning the machine afresh.

The out of doors air potential, as tested by a portable electrometer in an open place, or even by a water dropping nozzle outside, two or three feet from the walls of the lecture room, was generally on these occasions positive, and the earth's surface itself, therefore, of course, negative;—the common fair weather condition, which I am forced to conclude is due to a paramount influence of positive electricity in higher regions of the air, notwithstanding the negative electricity of the air in the lower stratum near the earth's surface.

On the two or three occasions when the in-door atmospheric electricity was found positive, and, therefore, the surface of the floor, walls, and ceiling negative, the potential outside was certainly positive, and the earth's surface out of doors negative, as usual in fair weather.

* I find that steam from a kettle boiling briskly on a common fire is an excellent insulator. I allow it to blow for a quarter of an hour or more against an insulated electrified conductor, without discovering that it has any effect on the retention of the charge. The electricity of the steam itself, in such circumstances, as is to be expected from Faraday's investigation, is not considerable. Common air loses nearly all its resisting power at some temperature between that of boiling water and red hot iron, and conducts continuously (not, as I believe, is generally supposed to be the case, by disruption) as glass does, at some temperature below the boiling point, with so great case as to discharge any common insulated conductor almost completely in a few seconds.

The Prince Consort Memorial.—One of the letters addressed to the Memorial Committee, and read at their last meeting, was from the Ross of Mull Granite Company, who state that they can supply a monolith of red granite larger than any known column in existence. The obelisk in front of the Winter Palace at St. Petersburg, they say, is the largest one in Europe, measuring 93ft. They state that they can exceed that by at least 7ft. in length, and with a corresponding excess in diameter. This stone, said to have been hitherto unnoticed, is reported by their manager, Mr. Marshall, to have been discovered in the Tormore locality, and, what is still more remarkable, to be already quarried on three sides. It is described, moreover, as lying just at the surface of the ground, with a fine open field in front on which it could be rolled out and "scabbled." It has an even surface, is quite detached at top and bottom, is perfectly sound, and of a good red colour. It is upwards of 100ft. in length, and will average about 12ft. in diameter. The column at St. Petersburg, they state, measures 12ft. at the base, and only 4ft. at the top; its height being 93ft. Besides this letter, there is also one to the effect that in the granitic formation between Penryn and Helston monoliths can be shown at this moment of several thousand cubic feet, perfectly sound and without a single defect. These are but two examples, among many others, of the information which has been elicited on the subject. The committee have been occupied in the consideration of the enormous difficulties with which the operations, first of quarrying a monolith of the desired dimensions, then of transporting it to its ultimate destination, and finally of rearing it, would be attended. Assuming, for which there is reason, such a stone, at a rough calculation, to weigh some 600 tons, a ton being a horse load, a faint idea may be formed of the prodigious labour and risk of conveying it to the metropolis by sea, and still greater by land. Again, suppose it to have been brought up the Thames as far as Chelsea, the question of moving it through, in some cases, narrow and tortuous streets would require a practical solution. These, of course, are considerations for the exercise of engineering skill, and are only now alluded to as confronting the proposed undertaking from the commencement. Among others, Sir Roderick Murchison is rendering the committee valuable assistance as to the various quarters where a monolith of the requisite proportions might possibly be found. The Duke of Argyll, who has granite quarries on his estates unleased, is understood to have made a generous proposal in the event of their capacity being proved to yield a stone suitable for the proposed national monument.

ORDNANCE *v.* ARMOUR PLATES.

(From the *Times*.)

Some interesting and important experiments were made at Shoeburyness on Tuesday, the 4th inst., in the presence of the Lords of the Admiralty and a large number of scientific officers and gentlemen, with a view of testing the resistance offered by an iron target built up to resemble a section of an iron frigate's side, and specially designed by Mr. Fairbairn, sen., to show how the teak backing to the armour plates might be dispensed with, and increased strength obtained by a combination of ironwork alone. It is necessary, in order to fully understand the object and result of this experiment, to state that when our first iron frigates were designed of the Warrior class nearly all artillerists and scientific men were agreed in the opinion that the armour plates would require a wooden backing to deaden and distribute over a larger surface the tremendous concussion with which the shot would strike. It was accordingly determined that the first frigates should be plated with 4½-in. armour, backed up with a double layer of teak beams laid transversely, in all 18in. thick, and on this plan the Warrior, Black Prince, &c., have been constructed. A target representing a section of the Warrior thus built was fired at last October at Shoeburyness during nearly two days, and, though every description of solid shot from Armstrong guns and 68-pounders were hurled at it singly and in salvoes of six at a time, this method of construction was shown to be practically invulnerable. No such satisfactory results in the way of resisting the tremendous impact of the shot have been obtained from any other target tried at Shoeburyness before or since. But the Iron-plate Committee had been led by many experiments, some previous and some subsequent to that at the Warrior target, to believe that greater advantages would be gained by increasing the thickness of the armour plates and reducing that of the teak backing. Accordingly, in the three iron frigates now building by the Thames Ironworks, Mr. Laird, and Mr. Mare it was decided to increase the thickness of the armour plates from 4½in. to 5½in., and to diminish that of the teak from 18in. to 19in. The Admiralty, however, reserved to themselves the right of still further altering the contract up to a certain date, and having the plates of 6½in. without any teak backing at all, in case there should be found in the interim such a combination of ironwork as would offer equal resistance, and thus do away with the necessity of putting a destructible material like wood between indestructible armour plates, which, when once fixed, ought never to be removed. This object was so desirable that many attempts have been made to overcome the difficulties which this method of construction presented, the greatest of all being that of fastening the plates to the target in such a way as would enable the bolts to withstand the tremendous jar the whole of the rigid and unyielding fabric receives when struck by a 200-pounder in full flight. During last summer Mr. Fairbairn, sen., constructed an entirely iron target of small size; but the experiments at this proved the difficulties that would have to be overcome in securing the plate, as with the jar caused by every shot the bolts gave way, till most of the plates were brought to the ground, and the target virtually destroyed. On Tuesday another much larger target of Mr. Fairbairn's, constructed on a different plan, was again tried to determine whether the 18in. of wood between the armour and iron skin is necessary to prevent the bolts and rivets being destroyed by the vibration. This target, which was constructed by Messrs. Fairbairn and Co., of Manchester, was 20ft long by 10ft. high, with a porthole in the centre. The two large plates going the length of the target above and below the port were each 20ft. long, 3ft. 4in. wide, and 4½in. thick. The plates on each side of the narrow port were only 9ft. long, but of the same width and thickness. The two large upper and lower plates were each secured by fifteen 2-in. bolts, fastened with powerful screw nuts at the back, and the two centre plates by eight bolts of a similar description. These plates were fastened to 1-in. wrought iron plates, representing the skin of the ship, and behind each line of bolts were straps of wrought iron 10ft. long by 9in. wide and ¾in. thick. The entire mass was supported by ribs representing the sides of a ship, 18in. deep and 18in. apart made of ⅞in. plates secured by angle irons 4in. by 4in., and ¾in. thick; while the back of the ribs was still further strengthened by four horizontal strips of wrought-iron, 12in. wide by ⅞in. thick. The armour plates were not wrought, but rolled by Messrs. Brown and Co., of Sheffield, and the tonguing and grooving by which the Warrior's plates are dovetailed together was not resorted to in this instance, the plates being planed flat at their edges, and entirely dependent on the bolts for keeping their places. The whole target was an admirable piece of workmanship, and outwardly seemed strong enough to resist anything.

The experiment seemed to excite great interest, and the principal iron manufacturers and iron ship-builders were present from all parts of the kingdom. Among others were the Duke of Somerset, Lord Mountcharles, Lord De Grey, Lord Clarence Paget, Sir William Armstrong, Sir John Hay, Admiral Grey, Mr. Rolt, Captain Ford, Mr. Scott Russell, Mr. Laird, Mr Mare, Mr. Samuda, Mr. Fairbairn and Mr. Thomas Fairbairn, Mr. Langdon, &c. The target was placed close on the right of the Warrior target, which, all rusty and dinted here and there in rough deep holes, showed signs of the punishment it took so bravely last October. The guns, six in number, were placed at a distance of 200 yards from the target, and consisted of one 120 and three 100-pounder Armstrong guns with two 68-pounder guns for solid shot.

The first experiment made was with three 100-pounder Armstrongs with 12 lb. charges, and shells filled with sand, weighing 104 lb. each, and with two 68-pounder guns, with 16 lb. charge, and shells filled with sand weighing 50 lb. each. These five guns were fired at minute intervals, striking the target on the left-hand of the port, and sending the fragments of the broken missiles flying off with a terrific hum through the air. Not much interest was felt in this first attempt, as, judging by all previous experiments, it was thought almost certain that no damage could have been done. Yet it is not too much to say that, to those accustomed to witness the effect of sand shell on targets of such strength and magnitude, this first result was considered conclusive as to its weakness. An examination after these five shots were fired showed that no less than eight of the main boltheads which secured the plates had given way. This was such a series defection that it could only be accounted for by supposing that the screw nuts fastening the plates at the back of the target had been drawn up too tight. The nuts were accordingly slackened down, and a packing of laynard put between the armour plates and screw nuts of many of the chief bolts, to deaden the concussion, and the trial was proceeded with. The same guns were again fired with the same charges, but this time with live shell, the Armstrongs having a bursting charge of 8 lb., and the 68's a charge of 2 lb., with pillar and concussion fuses. Each shell exploded with a tremendous crash, and four more of the armour-plate bolts were broken at the back of the target, snapping off as short as if they were cast steel. The indent made by the shells was not very much, though apparently more than was made by the same missiles on the hammered plates of the Warrior target, and on both the blows of the 68-pounders had told with a severity in proportion to the increased initial velocity of the smooth-bore over the Armstrong guns. The latter have a slow velocity of 1,100ft. per second, and maintain this rate for a long time, while the former start at once at the rate of 1,650ft. per second, but, after the first 300 yards, lose their velocity with every 100 yards traversed beyond the point blank range. Under this experiment one of the plates, which had been previously struck by the sand-shell on the left of the port, had buckled out about an 1¼in., and the whole appearance of the target showed that it could not stand long. The firing was then continued with one 120-pounder Armstrong, with a 20 lb. charge and 140 lb. solid shot, three 100-pounders, with 14 lb. charge and 110 lb. solid shot, and one solid 68-pounder. The result of this trial was almost conclusive. The 140-pounder struck with a terrific blow between the edges of the top and middle plates, making a deep dint. The second struck on precisely the same spot, deepening still further the dint, breaking the fibre of the iron, and cracking the top and middle plates up to the nearest bolt-heads. The third shot struck in the middle plate, but the fourth hit again exactly in the same spot where the first and second had

gone before, and with a crushing noise went right through the target, leaving a rugged, large, irregular hole, which, if made in a vessel at or near the water line, would have caused a formidable leak. The shot penetrated not only the plate, but the strap of wrought-iron behind the bolts, 9in. wide and ¾in. thick, and beyond this again bent one of the main ribs outwards. The fracture of the iron showed that the iron itself was of excellent quality, but there was evidently not the same compactness that is produced by hammered plates, and the rust was distinctly visible between the layers of the iron. Eight more bolts, too, went at this trial, breaking as short as the former had done, but only one of the rivet heads started. It was an extraordinary piece of ill-luck for this target to get three shots in succession in its weakest part, but so it did actually happen, and the last went through. The next trial was made with three 100-pounders throwing solid cast iron shot of 200 lb., with 10 lb. of powder. These all hit in the left-hand side of the target, buckling out the plate they struck till the ends projected nearly a foot, and destroying all, or nearly all, of the remaining bolt-heads in the other plates. This ended the first portion of the experiments, which, when against targets, are always made at Shoeburyness with shots of increasing weight fired singly, and then the same charges fired in salvoes together. But it was seen, after the last trial, that it was useless to proceed with the salvoes; for, as nearly all the bolt-heads retaining the plates had been broken off, it was evident that the first salvo would bring the whole mass to the ground. The firing was, therefore, discontinued, and the target thus practically struck its flag at the conclusion of the first half of the experiments. The trial, on the whole, was considered unsatisfactory. It was admitted on all hands that the target as constructed had most undoubtedly failed. But the chief "iron men" attributed this failure partly to defects in the mode of fastening, and partly to the plates used being rolled instead of hammered. The supporters of the teak backing, on the other hand, attributed the failure wholly to the absence of timber between the armour and the skin, to distribute the force and deaden the jar upon the plates and their fastenings. These gentlemen seemed to have much reason on their side when they pointed to the Warrior target, which had gone through every ordeal during nearly two days' pounding, and was still, beyond all comparison, more perfect than the iron one, which had broken down in little more than an hour's firing. There is no doubt but that Mr. Fairbairn's target was disproportioned in the strength of its fastening. It was suggested that a "washer" between the screw heads of the bolts and the armour plating of a softer metal, such as lead or copper, might have saved the bolts themselves from breaking, and that a packing of tarred felt between the plates and the ribs would have deadened the concussion as much as timber. These may be worth trying, though we think, with all deference, that nothing cheaper and more effectual will be found than the timber backing. The chief value of these experiments, however, is not so much to ascertain the amount of iron required to resist the shot as to find out what description of fastenings will keep the plate in its position when repeatedly struck. The fastenings are, in fact, the only great difficulty in the way of making perfectly invulnerable iron frigates. We venture to think that bolts of iron wire rope might do the work. We don't say they would, but as every other description of bolt has been tried, and failed, it would be worth while experimenting to see what these could effect. They might be fastened at the back by driving an iron nail-shaped wedge into the centre of the rope, and then fusing and welding the wires into a rivet head over this again. During these experiments, as during every other at Shoeburyness, the much greater force of the blow inflicted by the old smooth-bore 68-pounder over the Armstrong shot of double its weight was strikingly evident. This is partly due to the much greater initial velocity of the smooth-bore guns, and partly to the fact that the conical point of the Armstrong shot in nearly all cases breaks off short on striking the target. Against iron targets or ships conical shot are about the worst that can be used, and, both to realise the full effect of the Armstrong gun and to test to the utmost the resistance of the target, it would be better if flat-headed shot were used on these occasions. It would also be as well if the Government were to test a target lined with only nine inches of teak, according to the plan on which the new iron frigates have been ordered. It would be rather a pity to find at the last moment that a mistake had been committed by reducing the teak at all, and nothing but actual practice at a target can ascertain this satisfactorily.

OBELISKS.

A CORRESPONDENT of the *Times* gives, with reference to the Prince Consort Memorial, the following particulars of large monoliths, including obelisks:—

"This idea of an obelisk naturally suggests three questions, viz., the material, the size, and the mode of transportation. As to material, the British Islands give us abundant specimens of the finest granite, a stone with which we are all familiar. London Bridge is a specimen of the blue-gray granite of Aberdeenshire. All the granite of the Royal Exchange is the granite of Devonshire, differing but little in quality and not at all in colour. Waterloo Bridge (at least all the upper part) is Cornish granite of a less compact texture and a somewhat lighter colour. The red granite of Peterhead, in Aberdeenshire, was, I believe, first introduced into London by the late John Rennie, the engineer, who directed that a slab of it should cover his grave. We are now very familiar with it, in the polished shafts of the Carlton Club, in all our cemeteries, and it is generally the material which we see polished in the drinking fountains. It is very compact and beautiful.

"The granite spoken of as the Ross of Mull is much coarser and of a brighter red. I have a polished specimen I brought from that neighbourhood, which is very beautiful in colour, but very coarse; but Nicol, in his *Geology of Scotland*, seems to suggest two sorts—viz., 'pale and high red.' He also says, 'It is the only granite to be found in the Western Islands.' It appears limited to the South-western extremity of the Island of Mull, and the formation is surrounded by the sea on three sides. I never visited the quarries at Peterhead, in Aberdeenshire; but the same writer says the granite of that locality is occasionally sienitic or porphyritic, which latter characteristic is often seen in the polished specimens. I am not aware whether these quarries can be approached from the sea, but I believe the stones at present are brought by land to Aberdeen, and then shipped. I recollect, some years since, when there was a desire to use polished granite shafts 40ft. or 50ft. long for the columns of a large public building in London, it was suggested that the road bridges in Aberdeenshire might prove unequal to the weight of such large stones though there was no difficulty whatever in obtaining them in the quarry itself. Leaving for the moment this part of the question, I now come to monolithic obelisks. They had their origin, as all your readers know, in Egypt, and notwithstanding all the learning of Zoega in his great work, *De Origine et Usu Obeliscorum*, their origin appears to be unknown, and no good reason has ever been given, in my judgment, for their introduction. Their use is well-known. They were set up in pairs before the great temples, and they were used to record the dedication of the temples and obelisks to various Deities, the names and titles of the Kings, with the fulsome additions that usually accompanied such dedication. Champollion gives a translation of the inscriptions on the four faces of the Paris obelisk, which shows they were erected by Ramses II. and his son, Ramses III., with their objects.

"The name given by the Greeks and Romans to these monuments is rather ignoble,—ὀβελὸς, as your readers know, is the Greek for a spit, and *obeliscus* is of course the diminutive. How many were set up in Egypt in the days of its greatness I have no means of knowing, but 48 of different sizes were removed to Rome. Augustus set the example, and it was followed by his successors down to Constantine. During that period of 340 years these 48 obelisks were set up in Rome, and were standing in the time of Valentinian and Valens, A.D. 364, for in the 'Regionary,' or catalogue, of the public buildings made at that time by Publius Victor, we read as follows:—'Obelisks (great), six, viz., two in the Circus Maximus, the greater of which is 132ft. high, the lesser 88ft.; one in the Vatican 82ft.; one in the Campus Martius 72ft.; two at the Mausoleum of Augustus, 42½ft. Obelisks (small) 42.'

"All these six great obelisks have survived the ravages of the Goth, the Christian, time, war, and flood, showing the enduring monumental power of a monolith. The largest of these stones—that before the church of St. John Lateran—was originally set up at Thebes, it is supposed 1,700 or 1,800 years before Christ. After remaining 2,000 years in its native city, it was floated down the Nile to Alexandria by Constantine; that emperor having intended it to decorate his newly-founded city on the Bosphorus; but, having died before this was accomplished, his son Constantine brought it to Rome. It was conveyed from Alexandria to Ostia, and up the Tiber, in a vessel of 300 oars; it was then removed by land and set up as the *spina* of the Circus Maximus. The land journey extended to three miles, which was performed on low-wheeled wagons. The date of its being raised was A.D. 357. It is not known when it was thrown down, but it was found by Sixtus V. broken in three pieces and buried twenty-four Roman palms in the ground. Its height is stated to be 148 palms. It was set up in its present place, as was also the obelisk, in front of St. Peter's, by the celebrated architect Fontana, who also removed and erected the great obelisk in front of St. Peter's. It is impossible to follow out this subject, but those who desire to do so may find all the circumstances of the Roman obelisks fully discussed in a very learned paper read by the Rev. Richard Burgess before the Institute of British Architects, May 31, 1858, and in the report of the discussion of June 14, which followed, by Sir Gardner Wilkinson and others. At this meeting Mr. Bell, the sculptor, also explained his ideas of the proper lines or forms of an obelisk, in which I agree. I am indebted to this paper by Mr. Burgess for many of the foregoing particulars. The Lateran Obelisk is red granite or sienite, and covered with hieroglyphics most beautifully cut. I believe all the Egyptian obelisks are red sienite, from the quarries of Syene (whence its name), and many travellers have noticed the fact that two unfinished obelisks of enormous size still remain in those quarries.

"This reference to the colour and material of the obelisks of antiquity leads me back to the first point of my remarks, and I have only to express a hope that the English monolith may be of red granite, and, if possible, of the granite of Peterhead, so similar in colour and quality to the Roman obelisks."

"The third point, to which I will shortly advert, is the means and cost of removing, working, and setting up large stones. In ancient times Herodotus speaks of a monolith temple of Latona removed 600 miles—of course principally down the Nile—and, if his dimensions are to be relied upon, its weight must have been 5,000 tons. The mode adopted by the Egyptians is shown, like everything else belonging to that remarkable people, in the paintings on the walls of the tombs. It was effected by mere brute force, and by thousands of men."

"In modern times we have exact details of the method pursued by three architects, viz., that of Fontana, in his book *Della Transportazione dell' Obelisco Vaticano*, published in 1590; next, the removal of the great stone on which the statue of Peter the Great stands, by Le Comte Caabary, or Lascary, Paris, 1777; and, lastly, the curious book of M. Lebas, the French architect, employed to bring the obelisk of Luxor to Paris and to set it up in the Place de la Concorde, Paris, 1839.

"The St. Petersburg monolith was found in the marshes of Finland, is of dark gray granite, and it weighed 1,450 tons, was moved four miles by land, and floated across the Gulf of Finland on a great raft towed by two ships. The expense, as far as I can make out, was 70,000 roubles.

"In the French instance the obelisk was lowered into a canal cut to the Nile, and received into a vessel (the Luxor) built on purpose, having an opening in the stern. This vessel crossed from Alexandria to Toulon, then to Havre, and finally ascended the Seine, where it was moored at the foot of the incline leading up to the Quai, and rolled on a platform to the middle of the Place de la Concorde, where it was set up. The cost of this work is stated variously at from £25,000 to £30,000.

"I will not intrude upon your space to refer further to monolithic shafts of columns than to state that the columns of the Pantheon are in one stone (the front row gray granite, the second row red granite), from the island of Sardinia; and also that at St. Petersburg there is an isolated column, "the Alexander column," 80ft. high, in one stone. This column was designed and executed by M. Montferrand, a French architect, who also built the Izaak Church; the shafts of the columns of the portico of that church are 60ft. high, in gray granite, each in one stone, and the masses of steps up to the portico are also in single stones and of enormous dimensions. I believe there is an account published of the mode adopted for moving these stones, but I have not been able to see it.

"In conclusion, I may add that a monolithic obelisk, of the exact proportions of the Luxor obelisk, and 100ft. high, would be 10ft. 6in. diameter at the base, and 6ft. 6in. under the pyramidion; and its weight, wrought and polished, of Peterhead granite, would be about 600 tons. To procure and raise such a stone in Hyde Park ought not to offer any particular difficulties to the architects of our own country."

Mr. Latimer Clark, writing from Cairo, also gives the following particulars of the obelisk at Alexandria.

"As the Alexandrian obelisk, which is the property of the British nation, has lately formed the subject of several letters in your columns, I have, through the assistance of the English Consul at Alexandria, obtained permission to excavate round it, and examine it, and the following account of its present condition may probably be interesting to your readers:—

"It lies on its side, imbedded in sand and shingle in the Western Harbour. Its under side is from 6ft. to 18ft. beneath the surface of the soil, and about 10ft. above the sea. Its base is about 12ft. and its apex 50ft. distant from the inner side of a rough rubble sea wall, which is 19ft. thick, and 24ft. high. The sea just washes the base of the wall, and the gravelly bottom deepens so gradually that a vessel drawing 20ft. of water could only approach within 400 yards. The obelisk is of granite, and is perfectly sound and unbroken, with the exception of its apex, 20in. of which have been broken away, but could be readily restored. Its present length is 66ft. 10in.; its breadth at the base is 7ft. 6in. by 7ft. 1in., and at the top where the apex commences 5ft. 1in. by 4ft. 10in.; the apex when complete is 7ft. 11in. high. The base is not flat, but roughly rounded as the stone left the quarry, and as 18in. of this would be necessarily built in its foundation, its height when erected as an obelisk would be 67ft. I believe the one at Paris is nearly 3ft. higher. Its weight is about 170 tons. Before describing its condition I will speak of that of the fellow monolith, so well known as "Cleopatra's needle," which stands erect a few yards to the eastward. This measures 7ft. 8in. by 7ft. 7in. at the base, and appears both in size and in its hieroglyphics to be almost a fac-simile of the fallen one. On the north side, facing the sea, the hieroglyphics appear nearly as perfect as when they left the sculptor's hand, and on the west side they are equally so, except near the bottom and at the extreme top. On the east side they are also perfect for one-third of the breadth throughout the whole height, but on the remaining two-thirds and on the south side they are nearly obliterated, and the granite is much decomposed, a few only of the deeper markings (originally 2in. or 3in. deep) being faintly discernible. It is evident that it has at some period lain on its side, partially imbedded in a soil which exerted a decomposing action upon it.

"The fallen obelisk is in this respect in a better condition, every hieroglyphic upon it being perfectly legible. On the two lateral faces they are very bold and perfect, and by mining under it in places I was able to ascertain that those on the under side are in the same condition. The upper face is the most imperfect, the surface being worn and injured, and the figures partially obliterated, though still very legible. The worse feature is, however, the state of its edges, all four of which have been broken away from top to bottom, usually to the extent of three or four inches, and near the base one of them has suffered a still more extensive injury. This greatly deteriorates from the beauty of the obelisk, and constitutes, I think, the only real ground for those who think it not worth the expense of its removal to England. It will be again covered with earth after the visit of his Royal Highness the Prince of Wales, to prevent the sale of fragments by the Arabs; but a model of it in its present state will be forwarded in a week or two to 1, Victoria-street, Westminster, to the care of Sir Charles Bright, who will, doubtless, have pleasure in showing it to any who are interested in the subject. There is no ground for the supposition that either obelisk is undergoing any decay or deterioration in its present position."

WOOD'S FERMENTING TUNS.

THIS invention, by Alfred Wood, of Lewes, Sussex, has reference more particularly to the fermenting tuns employed in brewing beer in which "covers" or "barm separators" are employed for separating the yeast from the beer as it is formed during the process of fermentation. Such covers have been variously constructed to act as attemperators or coolers to the fermenting mass in the tun by being formed of a hollow metal vessel through which cold water was made to flow, or they were formed of wood with a coil of metal pipes fixed to the under side, which was consequently immersed just under the surface of the fermenting worts, and through which cold water was made to flow; the yeast rising through small apertures in the cover was deposited upon the upper surface of the same. All these contrivances have, however, failed more or less to accomplish the object for which they were intended, because, in the first place, they were wrongfully made to act as attemperators or coolers to the surface of the fermenting mass where the yeast is forming, which carries with it particles of unconverted starch and gluten, and these particles on being thus cooled were precipitated into the warmer and consequently less dense mass of fermenting worts, instead of rising to the top of the cover, and being there brought into contact with the atmosphere.

Secondly, the attemperating action of the upper surface of the cover upon the yeast deposited upon it was not sufficient to act upon and separate liquid particles carried up with the yeast.

Thirdly, the openings through which the yeast rises on to the cover were too small, and consequently the liquid particles and gases were in a great measure squeezed out of the yeast before it arrived on the cover.

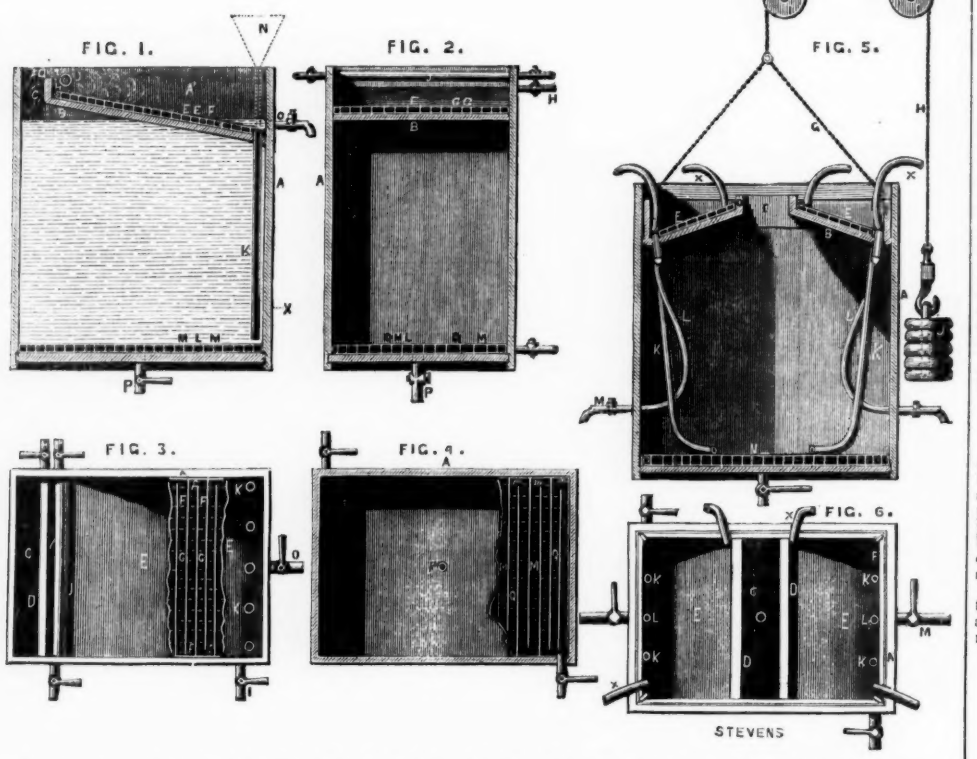
The object of this invention is to remedy these defects, and for this purpose a "cover" or "barm separator" is applied to the fermenting tun, of which the under side, which is in contact with the surface of the fermenting liquor, is formed of wood or other good non-conductor of heat, while the upper surface of the same, upon which the yeast is deposited as it rises from the fermenting liquor, is formed of a flat hollow metal vessel through which cold water is made to flow. The yeast, which rises freely through a large aperture formed in the cover at one end of the tun, is thus acted upon by the cold upper surface of the cover, whilst the surface of the fermenting liquor is effectually protected from any such cooling action by the intervening non-conductor of heat, and the precipitation of yeasty particles into the fermenting liquor is by this means prevented. It is preferred to fix this cover in an inclined position, and at the lowest side of the same are provided pipes for conducting the beer which is separated from the yeast on the cover back again to the bottom of the tun. On the bottom surface of the tun is formed another hollow metal casing through which, when the fermentation of the liquor is nearly completed, cold water is allowed to pass, by which the beer is cooled and acid fermentation prevented from setting in. In some cases where the fermentation of the liquor is sluggish it is accelerated at the commencement by passing hot water through the double bottom of the tun; or if the fermentation should proceed in too violent a manner it is checked to any required extent by passing more or less cold water through the double bottom during the process of fermentation.

Fig. 1 shows a longitudinal section through the fermenting tun; Fig. 2 shows a transverse section; Fig. 3 shows a plan; and Fig. 4 a sectional plan on line X, X.

Near the top of the fermenting tun A, which may be of any ordinary construction, is a cover B, formed of wood or other material which is a bad conductor of heat; this cover is fixed in a slanting position in the tun, as shown, and fits close to three of the sides of the tun, thus forming a yeast chamber A^1. At the fourth side where the cover is highest a space C is left between it and the tun. At this edge of the cover is fixed a vertical rim D, and upon the upper surface of the cover B is placed a shallow metal vessel or casing E, the top surface of which may either be plain or corrugated, and inside which a series of transverse partitions, F F, are fixed in such a manner that every following one has an aperture at the reverse end to that in the preceding one, as seen more clearly at *f f*, in Fig. 3, where a portion of the top plate of the casing is removed. Cold water is made to flow into this casing at H, and is caused by partitions F and G to flow backwards and forward over the entire area of the same, and eventually escapes through the pipe I. A short distance in front of the vertical rim D is a metal pipe J, through which also cold water is made to flow. By this arrangement, if the tun is filled with the fermenting liquor up to the under side of the cover B, the yeast as it is formed will rise up freely through the wide opening C, will fall over the edge of the rim D on to the cold surface of the metal casing E, coming in contact at the same time with the cooling surface of the metal pipe J, and then gradually descending upon the inclined surface of the attemperating metal casing in a thin layer, will thereby be thoroughly acted upon both by the cold surface of the casing and by the atmosphere. The yeast becomes by this means perfectly separated from the beer that is carried up along with it, and the latter, passing down to the lowest point of the cover, finds its exit through the small pipes K K, which conduct it back down to the bottom of the tun. On the bottom surface of the tun is another hollow metal casing L, constructed with partitions M M, having openings *m m*, similarly to the before-described yeast attemperator E, and through which, at a certain period of the process of fermentation, cold water is made to flow, the partitions M M serving both to cause the water to circulate over the whole surface of the casing, as also to strengthen the same so that it can bear the weight of a man when the tun is emptied for cleansing purposes.

The mode of operation in the fermenting tun is as follows:—The wort is pitched with yeast in the usual manner, and the tun is filled up to the under side of the cover to the height indicated by the dotted line in Fig. 1, so that a certain quantity of the worts lies upon the top of the cover, owing to the communication formed by the pipes K K. On the fermentation setting in the yeast as it is formed, accompanied by unconverted particles of starch and gluten, and containing at the commencement a large amount of essential oils of the hops, rises through the opening C and falls over the rim D on to the attemperator E, as already described; it passes down the surface of the same, and the liquid, becoming separated from it, finds its way in a cooled state through the pipes K K to the bottom of the tun. During the earlier stages of the fermentation it is best to rouse the thin yeast into the liquor upon the cover, and to pass the same down into the tun through the funnel N inserted in the openings of the pipes K. This is an important feature in this invention, as by this means the essential oil of the hops which passes up with the yeast becomes fixed in the liquor instead of being volatilised and lost as was heretofore the case, thus effecting a great saving in hops and improving the flavour of the beer. Should the fermentation proceed too sluggishly at first it may be accelerated by passing warm water through the bottom attemperator L. The circulation of the worts continues until the yeast which is formed becomes thick, when the openings in the cover leading to the pipes K K are closed, so as to prevent the yeasty beer from passing back into the tun; a funnel N is inserted into these apertures, through which clean beer from a previous brewing is poured in from time to time to make good the loss of the liquor resulting from the formation of the yeast. The beer as it settles from the yeast in the yeast chamber A^1 is drawn off through the cock O provided for that purpose, and is also poured back through the funnel N. When the beer has become sufficiently attenuated and the vinous fermentation

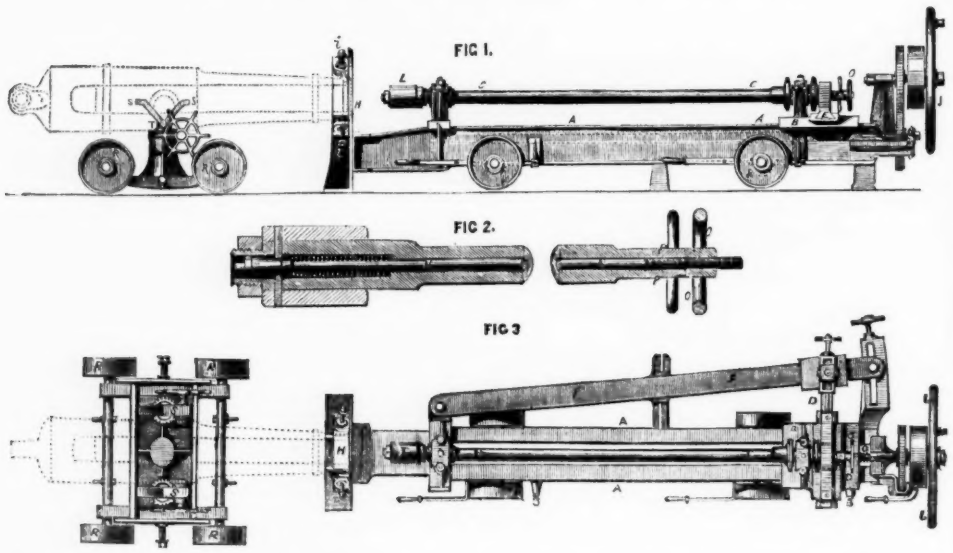
WOOD'S FERMENTING TUNS.



nearly ceases cold water is made to circulate through the bottom attemperator L, so as to cool the mass and check further fermentation, when the process will be completed and the beer fit for use.

In some cases the fermenting tun is employed for storing the beer after the fermentation is completed, by which a great economy in space, in waste, and in apparatus is effected. For this purpose the aperture C in the cover, as also the small holes leading to the pipes K K, are effectually closed up and the yeast chamber A^1 is filled with cold water, thus forming a perfectly air-tight vessel, which is effectually shielded from the heat of the atmosphere, and in which the ripeness of the beer may be hastened or retarded, by means of the attemperator L at the bottom of the tun, at the pleasure of the operator. The beer is drawn off from the tun when required through the cock P fixed in the bottom of the same. The "cover" or "yeast separator" to the tuns may be arranged in such a manner as to rise and fall in the tun according to the level of the worts in the same. For this purpose they may be constructed as shown in Figs. 5 and 6. Fig. 5 shows a longitudinal section, and Fig. 6 shows a plan of the apparatus. A is a fermenting tun of ordinary construction, provided with an attemperating vessel N at the bottom; B B is the wooden bottom to the cover, which is not fixed to the sides of the tun; and E E the attemperating vessels fixed on the top of the same, into and out of which the water is caused to flow through the flexible pipes *x x*. The aperture C which extends across the cover is in this case situated in the middle of the same, and the cover slopes up to it from either side. A rim, D D, is fixed at the edges of this opening, and round all four sides of the cover is fixed a rim F, forming the yeast chamber; to this rim are attached the chains G G, fixed to a central chain H, which passes over pulleys I I, and is also fixed to a balance weight J, by which the cover is kept suspended in the tun. As the level of the worts in the tun rises or falls, so this cover, floating on the surface of the same, is caused to rise and fall with it. The pipes K K for conducting the liquor back to the bottom of the tun are made flexible to allow of the motion of the cover, and other flexible pipes, L L, are provided, leading from the top of the cover to the cocks M M fixed in the sides of the tun for drawing off the beer from the yeast chamber when the pipes K K are closed. Mr. Wood sometimes forms such floating cover with an aperture at each end of the same, and then forms the cover so as to slope down toward the centre, and in some cases he provides only one aperture at one end of such floating covers, and makes them to slope down towards the other end, similar to the fixed cover shown in Figs. 1, 2, 3, or the cover is made flat instead of sloping.

VAVASSEUR'S MACHINE FOR RIFLING CANNON.



This invention for a "New or Improved Transportable Machine or Apparatus for Rifling Cannon," by Josiah Vavasseur, of 28, Gravel-lane, Southwark, consists in so constructing and arranging to be driven by manual power the machinery used for rifling cannon in combination with new or additional parts so as to produce a machine capable of being readily moved or transported from gun to gun, and place to place, in order that the operation of rifling may be carried on in the place where the guns are used, as, for example, in fortresses or ships, thereby avoiding the expense and inconvenience of removing the guns any distance from their position to the arsenal or other place where the rifling is usually done.

Fig. 1 is a longitudinal elevation of the improved transportable machine or apparatus, with the carriage for holding the gun in position for the purpose of rifling the same; Fig. 3 is a plan of the same machine and carriage; and Fig. 2 is a view, drawn to an enlarged scale, of the arrangement for rifling or cutting the grooves.

The machine for rifling consists of a bed A, similar to a lathe bed, fitted with a saddle B, travelling along the bed carrying the end of the rifling bar C, cross slide D, rack E, radius bar F, and screw G, for travelling saddle similar to an ordinary rifling machine. At one end of the machine is fitted a bracket and chuck H, with a hole large enough to receive the muzzle of the largest cannon the machine is designed to rifle. Four or more set screws *i, i, i, i*, are tapped through this chuck for the purpose of setting the gun or other piece of ordnance concentrically with the rifling bar, and securing it in its position when so set. At the other end of the machine may be mounted a fly-wheel J, so that the machine may be driven by manual power where, from position or other circumstances, other motive power is not available.

The bed of the machine is carried on four wheels, on the axles of which are fitted eccentrics K, K, by means of which the wheels may be raised or lowered so that the bed of the machine can rest upon suitable standards fixed to the machine, or can be lifted on to the wheels and transported from gun to gun as may be required.

The bar C used for rifling is hollow; on the end to which the cutters are attached a block L is fitted, which fits the bore of the gun, so as to slide up and down the barrel freely; the hole at this end of the bar is enlarged to admit of a cone M. On the surface of this cone, at right angles to the axis of the same, the cutters rest. The cone is fastened to the end of a small rod N, Fig. 3, which is continued right through the end of the bar carried by the travelling saddle B. This end of the rod is screwed, and a small hand-wheel O is tapped to fit the screwed end of the rod. Between the boss of the wheel and the end of the bar a cam P is placed; the object of this cam is that, previously to the bar being run back up to the breech of the gun or other piece of ordnance to be rifled, the cam P is to be so placed as to allow the cone M to recede back towards the breech of the gun, a spiral spring pressing against the cone for this purpose; this allows the cutters to fall in towards the centre of the bar, a small spring being used to press on them for that purpose. When the bar has arrived at the breech end of the cannon the cam P is turned so as to bring the cutters back to the same place exactly in which they were at the finish of the last cut: the necessary feed is then given by the small hand-wheel O. The block L at the end of the bar, through which the cams project, is made so as to be changed to suit the different sizes of guns or other pieces of ordnance it may be required to rifle.

The carriage on which the gun or other pieces of ordnance is to be placed during the operation of rifling is mounted on four wheels R, R, so as readily to be moved alongside the gun it is proposed to operate upon. The gun is lifted into the carriage, the trunnions resting on V-shaped carriers S, S, with a screwed piece T, T, beneath each, and a nut worked by a worm and whee similar to a screw jack. This arrangement allows the gun to be readily raised, if necessary, for the purpose of adjusting it for rifling. The carriages which carry the V-shaped carriers and screws can also be moved transversely by means of a screw; this, with the screws *i, i, i, i*, for the muzzle, allows the gun to be adjusted readily and accurately. With this machine the cannon may, in some instances, be rifled without even moving it from its carriage.

The machine may be also fitted with a bar for reboring the cannon previous to rifling, when necessary, through the cannon being old or badly bored.

MEYER'S SLIDE VALVES.

These improvements, by H. C. Meyer, of Hoxton, consist, firstly, of certain appliances to the ordinary slide valves now in use, and by means of which the friction on the face of the valve is reduced to a minimum, and consist of eccentric axles provided with wheels placed on the sliding part of the valve, and revolving in bearings placed on each side of the wheels, the bearing bracket or plummer block being fixed on the pressure side of the slide bearing, being close to the wheels in correspondence with rails fixed on the face side of the stationary frame of the valve.

Secondly, in this arrangements the axles are not eccentric as in the first plan, but will be fixed on to the body of the sliding valve, and the wheels will revolve in one and the same position on the rails of the stationary frame of the valve.

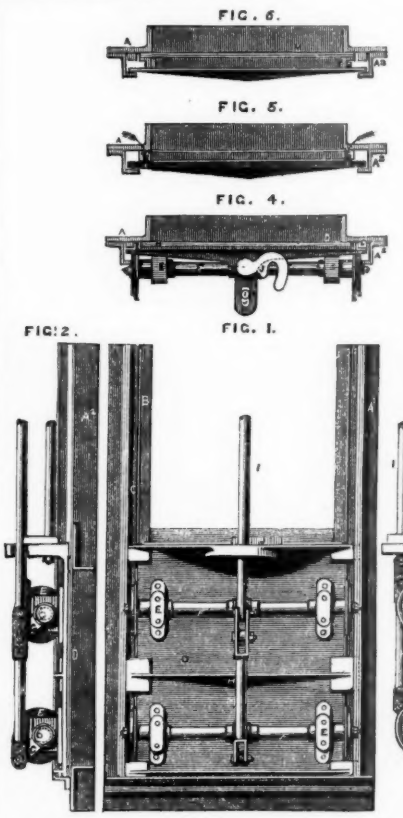
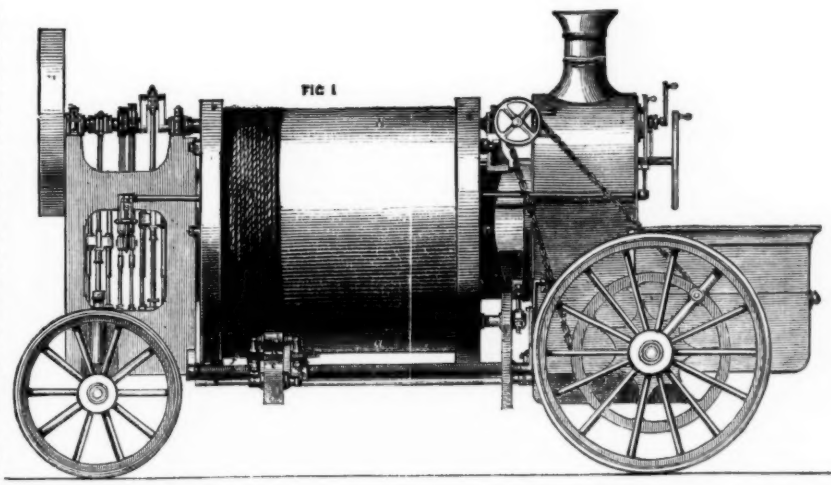


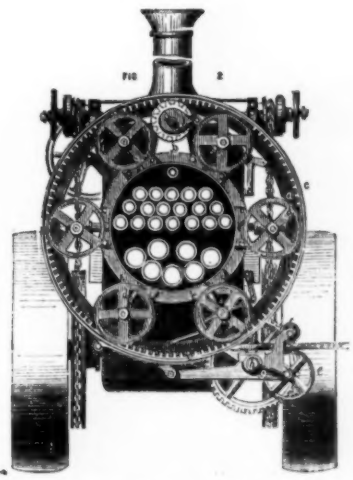
Fig. 1 is a front elevation; Fig. 2, vertical section, taken at A, B, of Fig. 1, showing slide pressed close to the face forming the watertight joint; Fig. 3 is a side elevation with the slide not closed or raised from the face; Fig. 4, a transverse section showing the application of the metallic double-joint face; Fig. 5, a plan or transverse section showing position of india-rubber packing, to assist in forming the joint. A denotes the stationary frame; B, the face which abuts against the face on the slide; C, the rail on which the flanged wheels attached to the slide travel when the slide is put in motion; A^2, upright guide for the slide, bolted or screwed to the stationary frame; D, the slide to which the plummer blocks E are secured, such plummer blocks forming the bearings for the axles F of the wheels: these axles are at the ends constructed so as to form axles of smaller diameter (see *f*, Figs. 2 and 3) for the wheels to turn upon, this smaller reduced axle being eccentric to the circle of the main portion F of the said axles, that is, close to its circumference and not at its centre. The axle F is at the middle provided with a lever arm G, keyed on to the axle, secured to another lever H, connecting the same to the other lever arm G of the other axle F, and to the connecting or working rod I. K is a square rod secured (free to turn) to the slide.

Supposing the valve to be shut, as shown in Figs. 1 and 2, and it is desired to open the same, the connecting or working rod I is moved, which, through the levers G and H, communicates motion to the axle F, *f*, giving the axle F, *f*, a quarter turn, thus forcing the wheels on the rails, and raising the slide from contact with the faces; then, by continuing to move the working rod I, the slide is moved from the valve opening, and when the valve is to be shut again the rod I^2 is turned a quarter turn, causing the hook J to embrace the working rod I, to insure the wheels being kept in contact with the rails while the slide is in progress of being shut, and when the slide is fairly over the valve opening the hook is to be reversed, and then, by continuing the motion, the axles will make a quarter of a revolution and bring the face to close contact.

Fig. 6 shows another arrangement with loose faces; L are loose angle irons brass-faced (cast) bolted to the valve (M), with vertical slots, to allow the angle irons brass-faced (L) being by the pressure of the water kept close to the brass faces, keeping the same watertight. For the eccentric motion wooden faces would be preferable to those of other materials. The loose metal faces may be used with advantage for steam engines

W. AND P. A. SAVORY'S WINDING APPARATUS.





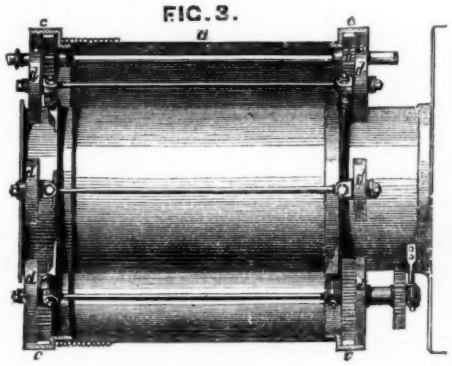
THIS invention, by Messrs. Savory, of Gloucester, consists in applying certain mechanism to the barrel or cylindrical part of the horizontal boiler of a stationary or portable engine, for the purpose of winding ropes or chains at pit's mouths, or for ploughing or other purposes.

It is proposed to place a drum round the horizontal boiler, which drum is caused to revolve by suitable wheels or gearing connected to the engine. The drum is to be made of wrought iron with a suitable cast iron head or ring at one or both ends; this ring is to have teeth cast inside, to gear into a pinion or pinions on the engine or other shaft; a part of the breadth of this ring is turned out true, to run on a number of friction rollers on the barrel of the boiler. When two drums are used they may be constructed with a cast iron head at one end and a wrought at the other with friction rollers, as before. The rope is to be guided on the drum in the following manner:—A pulley is fixed on a horizontal spindle in a suitable frame, to receive or bear the rope from the plough or other thing to be drawn; two other pulleys are fixed on the same frame on vertical studs or spindles, with grooves turned in each to fit the rope, and placed one on each side of the rope, so that the grooves of the guide wheel are opposite the periphery of the drum where the rope runs, and connected with suitable wheels to the internal gearing of the drum ring. The pitch of the screw is proportioned so as to move the frame during one revolution of the drum a distance corresponding with a little more than the thickness of the rope.

Fig. 1 is a side elevation of the apparatus; Fig. 2 is a transverse vertical section; and Fig. 3 a longitudinal vertical section.

a is a drum of metal placed around the horizontal boiler of the engine, and caused to revolve by pinions *b*, *b*, working within heads or rings *c*, *c*, placed or fixed on each end of the drum *a*, and having also teeth within them which correspond with those of the pinions *b*, *b*, these pinions being firmly secured to the engine shaft, as shown at Figs. 2 and 3. A series of friction wheels or rollers *d*, *d*, are secured by suitable bearings to the barrel of the boiler, for the purpose of supporting the drum *a* and maintaining it in position, or the friction wheels *d*, *d*, may in some cases be attached to the rim of the drum *a*, and revolve round the periphery of the boiler ends.

FIG. 3.



At Figs. 1 and 2 will be seen the method of guiding the rope round the drum *a*, to prevent its overlapping. A pulley *e* is fixed on a horizontal spindle in a suitably constructed frame, to receive or bear the rope from the plough or other thing being drawn; this pulley has another small pulley or roller e^1 immediately above it, to steady the rope in its passage through two horizontal grooved wheels *f*, *f*, fixed on studs or spindles attached to the before-mentioned frame; the edges of these grooved wheels touch each other, thus forming a circular opening for the rope to pass through; the frame is provided with suitable bosses *g*, *g*, having an internal screw thread cut therein to fit on a horizontal screw shaft *h*, secured by brackets or otherwise to the frame of engine or boiler. This screw shaft is so placed that the grooves of the guide wheels are opposite the lower periphery of the drum *a*, where the rope runs, and is connected with suitable wheels to the gearing inside the drum ring, as shown at Fig. 3. The pitch of the screw upon the shaft *a*, as also the number of teeth upon the wheels driving such shaft, are proportioned so as to move the frame during one revolution of the drum *a*, a distance corresponding with a little more than the thickness of the rope.

TRAFFIC RECEIPTS.—The traffic receipts of railways in the United Kingdom, amounted for the week ending the 1st of March, on 10,1⁰9½ miles, to £466,290, and for the corresponding week of last year, on 9,871¾ miles, to £483,92⁰, showing an increase of 237¼ miles and a decrease of £17,630. The gross receipts on the following fourteen railways amounted in the aggregate, on 6,601¼ miles, to £354,060; and for the corresponding week of 1861, on 6,445 miles, to £370,485, showing an increase of 156½ miles and a decrease of £16,425. The decrease on the Great Northern Railway amounted to £1,803; on the Great Southern and Western to £377; on the Lancashire and Yorkshire to £4,461; on the London and North-Western to £4,203; on the Manchester, Sheffield, and Lincolnshire to £1,658; on the Midland to £2,734; on the North-Eastern to £2,925; and on the South-Eastern to £1,159—total, £19,320. But from this must be deducted £975, the increase on the Caledonian; £180 on the Eastern Counties; £877 on the Great Western; £65 on the London, Brighton, and South Coast; £518 on the London and South-Western; and £280 on the North British—together, £2,895, leaving the decrease, as above, £16,425. The goods and mineral traffic on those lines amounted to £20!,813, and for the corresponding week of 1861 to £218,376, showing a decrease of £16,563. The receipts for passengers, parcels, &c., amounted to £152,247, against £152,109, showing an increase of £138. The receipts on sixty-six other lines amounted, on 3,507¾ miles, to £112,230, and for the corresponding week of last year, on 3,426¾ miles, to £113,435, showing an increase of 81 miles and a decrease of £1,205. The falling off in the traffic of the past week as compared with the corresponding period of 1861 is principally in the goods and mineral traffic of the great lines, and indicates the depression of trade in the manufacturing districts. The traffic receipts of the past week show an increase of £3,431, as compared with those of the preceding week ending the 22nd of February.

RICHMOND, CHANDLER, AND RITCHIE'S SACK HOLDER.

THE object of this invention, by Messrs. Richmond and Chandler, of Salford, and W. B. Ritchie, of Belfast, is to retain the orifice of sacks distended while they are being filled. The improved sack holder consists of a pillar or other fixing, to which is connected, by a set screw or other adjustable means, a bracket, in which are fixed the studs for two levers or arms furnished at their lower extremities with holders to which the sack is suspended. The levers are coupled by toothed segments, or other equivalent means, so that both are expanded or contracted simultaneously One of the levers is provided with a ratchet segment, into which a pall gears to hold the levers apart. By means of this improved holder sacks of any size may be held open.

FIG. 1. FIG. 2.

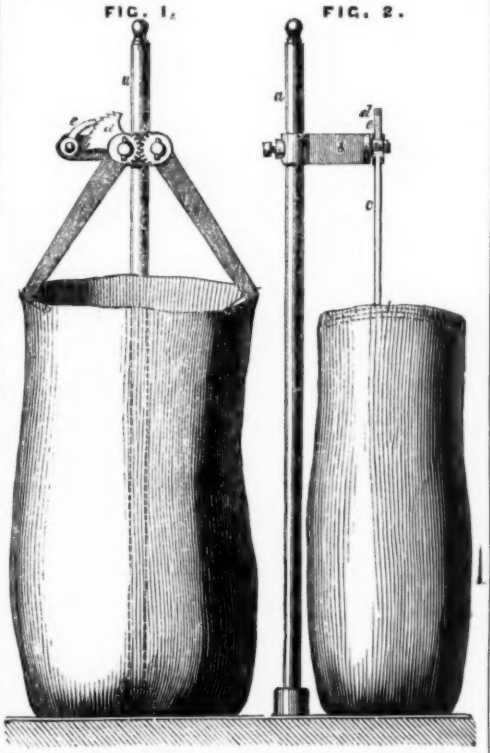


Fig. 1 is a front elevation of the sack holder; and Fig. 2 is a side elevation; *a* is the pillar or other fixture, to which is connected the adjustable bracket *b*, which can be set to any height from the floor, according to the length of the sack to be filled. To the bracket *b* are fixed two studs for the levers or arms *c*, *c*, the bosses of which are furnished with toothed segments gearing into each other. To one of the levers *c* is cast or forged a ratchet segment *d*, into which takes the pall *e*, which is hinged to a stud fixed in the bracket *b*. The extremities of the levers or arms *c*, *c*, are provided with spiked segments, on to which the mouth of the sack to be filled is suspended; the segments hold the orifice open. When the sack is full, or when it is required to remove it from the holder, the pall *e* is taken out of gear with the ratchet segment *d* to liberate the selvage of the sack. This pall and ratchet segment also render the holder suitable for sacks of various sizes.

THE MERSEY DOCKS.

THE Mersey Docks and Harbour Board have shown some prudence by withdrawing their application to Parliament—as will be seen on reference to the proceedings in the House of Commons on Monday—for an act authorising them to expend an additional £1,000,000 in dock accommodation. We have repeatedly expressed an opinion under this head that, in the present state of affairs, taking into account, also, the yet unfinished works on the Birkenhead side of the river, the course proposed to be adopted was rash and uncalled-for; and the members of the board seem at last to have come to a similar conclusion, although, in doing so, they have sorely offended the steam trade of the port, who threaten to take all kinds of steps on the subject. At the last meeting of the board the engineer submitted an interesting report on the condition of the dock works at the time of his entering on the duties of his office. The new works on the Liverpool side and adjoining the Canada Dock are nearly completed, and the foundation for the shed to be erected over the eastern extremity of the South Carrier Dock, for the use of the Bridgewater Trustees, is in a forward state. Nine cranes are fixed around the quays, and six more are in hand to complete that arrangement. The dock gates to the several entrances may be considered finished, and the bridges across the passages to the Carrier Docks are in hand, but nothing has as yet been done towards the construction of the ironwork of the bridge over the 80-ft. entrance into the Canada Dock, at which point a considerable amount of work will also have to be done before a "thorough" communication can be effected. The Woodside Landing-stage is in position. The kelsons have been continuously connected and the deck beams laid, so that now little remains to be done but the surface finishing. The report recommends that immediate provision be made for laying down some moorings extra to those originally proposed, for, with such a tide as this enormous floating mass is subject to, no precaution will be too great to guard against accident. Of the Morpeth Dock nearly two-thirds, or 420,165 cubic yards, of the excavations are complete, leaving 226,835 yards yet to be done. The outer sill of the lock, which will connect the Morpeth basin with the river, is completed, and 120ft. of the north wall carried up to the level of the old dock sill, leaving a gap between it and the river wall of about forty lineal yards. The low water basin, the most important point of the progressing works, is described in the report in the following terms: — "The foundations around its site are of the most treacherous character, being clay overlaying a wet and flowing sand, which, when bored into, 'spouts up' in a perfectly fluid state, the rock being at such a depth as to preclude the possibility of reaching it with solid foundations; and, were it possible to have done so, the danger of tapping the quicksand would appear to be so formidable as to have rendered such a course highly dangerous. The foundations, therefore, must have been a source of grave anxiety, and every precaution necessary to secure the safety of the work seems to have been adopted. The 50ft. entrances, the sluices, and large feeding tunnels which lead from the great float are built upon a forest of piles, and a similar course has been adopted wherever an indication of weakness has appeared in the substratum; yet, with all these costly but necessary precautions, slight settlements have here and there occurred in the walls, due to such enormous weights being laid on a bed of compressible material." Little doubt is entertained but that these sinkings (which are all vertical) will cease after the weight has fairly taken its bearings; but, in order to provide against the possibility of any disarrangements in the wall, a solid "toe" of masonry, in conjunction with piling of a most substantial character, has been laid. The masonry of the lock, main tunnels, and sluices may be considered in general terms as finished. The sluice gates and the inner gates of the lock are fixed in position, and the side walls are ready for coping. The engine-house is rapidly rising, and Messrs. Armstrong's people are fixing the hydraulic machinery. The return walls on each side of the lock, being the walls through which the sluices are carried, are completed and coped. The north wall, for its entire length of 1,461ft., with the exception of a gap of 129ft., which still severs it from the river wall, is complete and ready for coping. The report again points out the unreliable nature of the foundation, and alludes in pointed terms to the frequent interruptions occasioned by the breaking out of fresh water-springs from the substratum of quicksand before described, which seems to overlie the entire surface of the rock. To deal with these springs, as well as the enormous amount of leakage involved by the wetness of the bottom generally along this site, it has been found necessary to sink another well for pumping purposes: this is now in a forward state, and when the engine is fairly at work it is considered that it will effectually keep down the water. The completion of the coffer-dam for excluding the tide, for the purpose of enabling the contractor to complete his excavations, is mainly dependent on the masonry adjoining the river-wall, against which it will abut, so that, until this is done, a large portion of the excavations must remain untouched. The time prescribed for having this portion of the works completed is the 31st of March, 1862; but, owing to the many unavoidable adverse circumstances above stated, it must necessarily be extended for six or eight months beyond that period. In reference to the graving docks, it appears that there remains about 90,000 cubic yards yet to excavate, a quantity which will be required to make up the ground behind the masonry. They will not be ready for use in less than from fifteen to eighteen months, and this if no unforeseen contingencies occur. In regard to the execution of the masonry, the engineer says it is so good that he does not mean in any way to depart from the plans laid down by his predecessor. A summary of the report shows that in round numbers there are 500,000 cubic yards masonry, 1,212,63⁰ cubic yards excavation, and 272,574 superficial yards paving remaining to be done; a heavy lot of hydraulic machinery; no less than 38 shuttles for sluices, 24 pairs of gates, and two caissons to be built, besides an infinite variety of work which such appliances involve.

THE COAL TRADE.—The coal supply to the metropolis, both by rail and water, still continues depressed, and for the two months, January and February, the tonnage entered by railway was 240,081 tons 8 cwts., against 285,509 tons for the corresponding period, showing a decrease of 45,427 tons 12 cwt. Sea-borne coal shows a diminution of 1,786 tons, as also to the canals. The following quantities were brought up by the respective railways named during February:—London and North-Western, 49,542 tons 3 cwt.; Great Northern, 53,972 tons 17 cwt.; Eastern Counties, 12,582 tons 19 cwt.; Great Western, 6,964 tons; Midland, 5,912 tons; London, Tilbury, and Southend, 54 tons: total, 109,027 tons 17 cwt.; corresponding month last year, 148,608 tons 16 cwt.; decrease on the month, 39,580 tons 17 cwt. The sea-borne coal has been entered as follows:—From Newcastle, 119,728 tons; from Sunderland, 98,897 tons; from Hartlepool, 74,046 tons; from Wales, 10,995 tons; from Yorkshire, 3,176 tons; from Seaham, 12,966 tons; from other sources, 13,864 tons; total, 336,664 tons. The quantity entered from Hartlepool, as contrasted with last February's tonnage, shows an increase of 100 per cent.; but for this the sea-borne tonnage would have declined considerably more. The quantity of cannel, coal, coke, and patent fuel shipped at Liverpool in February was 49,794 tons, and in the corresponding month of last year 49,841 tons, showing a decrease last month of 47 tons.

EXPERIMENTS ON LOCOMOTIVE POWER AND RAILWAY RESISTANCE.

Mr. John Dixon, Chief Engineer of the Stockton and Darlington Railway, has completed a further series of experiments upon the resistance of trains and power of locomotives on that line, some of the results of which will be found in the subjoined tables. The performances on gradients of 1 in 44 are of especial interest:—

[Copy.] Experiments tried with No. 141 Engine "Excelsior" on Ormesby Bank (Gradient 1 in 44), Guisbro' Railway, on the 4th February, 1862.

Weight of engine, 29 tons 17 cwt.; tender, 16 tons 4 cwt.; cylinder, 18in. diameter, 24in. stroke; wheels, 5ft. diameter. The weather was mild, there was no wind, and the rails dry. The engine when starting, in every trip, ran for the first 30 yards with the reversing lever in full gear; for the remaining distance in 2nd notch from centre. Started in each trip at the 17½ mile post, and stopped at the 19¾ mile post.

The First Experiments were with running twelve Stockton and Darlington Railway trucks, laden with coke, three times up Ormesby Bank.

No. of trips.	Weight of train.	Weight of engine and tender.	Total gross weight moved.	Distance run.	Height of water in tank. When starting.	Height of water in tank. When stopped.	Water in boiler or fire-box. When starting.	Water in boiler or fire-box. When stopped.	Water used out of tank.	Water used out of boiler.	Total No. of gallons used.	Time in running trips.	Gallons of water used. Per mile.	Per hour.	Per ton per mile.	Per ton per mile per hour.	Coke used.	Speed per hour.
	tons. cwt.	tons. cwt.	tons. cwt.	miles.	ft. in.	ft. in.	inches.	inches.	gallons.	gallons.	gallons.	min. sec.					lb.	miles.
First trip	115 19	47 5	163 4	2¼	3 10	3 6	6	1⅛	121·8	114·5	236·3	10 10	105·92	1,393·29	0·644	3·797		12·27
Second trip	115 19	46 3	162 2	2¼	3 3½	2 10	6	3½	167·53	65·0	232·53	10 59	103·34	1,270·27	0·637	3·483		12·29
Third trip	115 19	44 14	160 13	2¼	2 6½	2 1	5½	3½	159·91	52·0	211·91	11 1	94·18	1,154·12	0·588	3·203		12·25
Average for three trips	115 19	46 1	162 0	2¼					149·74	77·16	226·90	10 43·3	100·16	1,272·58	0·623	3·494	1,528	12·60

The Second Experiments were with running six Stockton and Darlington Railway trucks, laden with coke, three times up Ormesby Bank.

	tons. cwt.	tons. cwt.	tons. cwt.	miles.	ft. in.	ft. in.	inches.	inches.	gallons.	gallons.	gallons.	min. sec.					*	
First trip	56 12	47 8	104 0	2¼	3 11	3 9	6	3½	60·92	65·0	125·92	5 52	55·96	1,287·8	0·538	5·503		23·01
Second trip	56 12	46 11	103 3	2¼	3 7	3 4½	5	2¾	76·15	61·25	137·40	5 27	61·06	1,512·6	0·592	6·517		24·77
Third trip	56 12	45 12	102 4	2¼	3 1	2 11	5	2¾	60·92	61·25	122·17	5 7	54·29	1,432·6	0·531	6·230		26·38
Average for three trips	56 12	46 10	103 2	2¼					65·99	62·50	128·49	5 28·7	57·10	1,411·0	0·553	6·083	928	24·72

Note.—The quantity of coke consumed includes the return journeys down the incline, which, of course, would be very little.

(Signed) Wm. Bouch, Locomotive Superintendent, Stockton and Darlington Railway.

Experiments tried with No. 141 Engine "Excelsior," on Ormesby Bank (Gradient 1 in 44), Guisbro' Railway, on the 4th February, 1862.

	Tons. cwt.	
Weight of engine	29 17	18in. cylinder, 24in. stroke, 5ft. wheels.
Ditto tender	16 4	
	46 1	
Load, 12 trucks, 4 tons 16 cwt.	= 57 12	Cylinder 18in. diameter = 254·46 sq. inches area.
Coke 12 × 4 tons 17·25 cwt.	= 58 7	Stroke 24in.
Gross load, exclusive of engine and tender	115 19	Diameter of wheel 5ft. = 15·7ft. circumference.

Gradient, 2¼ miles, 1 in 44 $\left(\frac{2,240}{44}\right)$ ... = 50·9 lb. per ton gravitation.

Speed 12·6 miles per hour ... ... = 1,108·8ft. per minute.

Engine	9·85 × 50·9 =	1,519·36	Gravitation of engine.
	29·85 × 18·0 =	537·30	Friction of engine.
Tender	16·2 × 50·6 =	824·5	Gravitation of tender.
	16·2 × 10·0 =	162·00	Friction of tender.
	Tons.	3,043·24	Resistance of engine and tender.
Load, say	116 × 50·9 =	5,904·40	Gravitation of load and wagons.
	116 × 9·0 =	1,044·00	Friction of load and wagons.
		9,991·64	

lb. ft.

And 9,991 × 1,108·8 = 11,078,020 foot pounds.

which ÷ 33,000 = 335-horse power.

254·46 × 2 = 508·92 area of two cylinders $\frac{9,991·64}{508·92}$ = 19·6lb. of equal velocity, but 19·6 × 3·92 ratio = 76·8 pressure per inch on the piston.

Water used per hour 1,272 gallons = 3·8 gallons per horse power per hour.

Same day and same engine, but load only 6 trucks = 56·6 tons, exclusive of engine and tender. Speed with this load 24·72 miles an hour, or 2,175·36ft. per minute.

Gravitation of engine and tender same as before	3,043·24lb.
Load 56·6 × 50·9 = ...	2,880·94lb. gravitation of load.
56·6 × 10·0 = ...	566·00lb. friction of load.
	6,490·18lb.

And 6,490lb. × 2,175·36ft. = 14,118,086 ÷ 33,000 = 427-horse power.

Water used per hour, 1,411 gallons = 3·3 gallons per horse power per hour $\frac{6490}{508·92}$ = 12·75lb. if velocity equal. But 3·92 increased velocity = 49·98lb. on the piston.

N.B. The *pro rata* pressure inversely as the speed would only be 39lb.

Observation on the above experiment:—

Load 162, including engine and tender, at	12·6 miles	= 2,041 tons	over one mile in an hour.
116, exclusive of ditto ditto	12·6 „	= 1,461	ditto ditto
58·7 paying or net load	12·6 „	= 739	ditto ditto

Next experiment at 24·72 miles an hour:—

103, including engine and tender ×	24·72 „	= 2,546	ditto ditto
56·6, exclusive of ditto ditto ×	24·72 „	= 1,399	ditto ditto
28·8 net or paying load ... ×	24·72 „	= 711	ditto ditto

The above shows that, as a mechanical result, the most work is done at the highest speed, viz., 2,546, as compared with 2,041. But the result, commercially, shows that the paying loads are 739 tons, as compared with 711 tons.

The difference, viz., 28 tons, is important in the earnings:—

viz., 28 tons, at ·22 of a penny for haulage = 6·16 pence for every mile the train runs.

[Copy.] Experiments tried with No. 141 Engine "Excelsior" between Barnard Castle and the Summit, on the 6th February, 1862.

Cylinder, 18in. diameter; stroke, 24in.; wheels, 5ft.; weight, 29 tons 17 cwt.; tender, 17 tons 12 cwt., at starting. The weather was good, there was no wind, and the rails were dry. The engine ran the whole distance with the reversing lever in the 2nd notch from the centre, except when running the second trip the lever was in 1st notch from centre for three miles after passing Bowes Station. The engine ran two trips, started at Barnard Castle Water Column, and stopped at the Summit Water Column when passing Bowes Station; the speed was reduced to ten miles an hour in each trip; when starting from Barnard Castle the water in the tender was heated to 130 deg.

No. of trips.	S. & D. trucks laden with coke.	Guard's van.	Weight of train.	Weight of engine and tender.	Total gross weight moved.	Distance run.	Height of water in tank. When starting.	Height of water in tank. When stopped.	Water in boiler on fire-box. When starting.	Water in boiler on fire-box. When stopped.	Water used out of tank.	Water in boiler.	Total quantity of water used.	Time in running trips.	Gallons of water used. Per mile.	Per hour.	Per ton per mile.	Per ton per mile per hour.	Coke consumed.	Speed per hour.
			tons. cwt.	tons. cwt.	tons. cwt.	miles.	ft. in.	ft. in.	inches.	inches.	gallons.	gallons.	gallons.	min. sec.					lbs.	miles.
First trip	18	1	181 3	47 9	228 12	13·75	4 1½	1 1½	3	1¾	1,026	35 less	1,061	61 0	77·16	1,043·61	0·337	0·332	1,232	13·52
Second do.	9	1	95 2	47 5	142 7	13·75	4 1½	2 2	3	3¼	716	7 more	709	31 30	51·56	1,350·47	0·362	0·689	784	26·19

(Signed) Wm. Bouch, Locomotive Superintendent, Stockton and Darlington Railway.

Experiments tried with No. 141 Engine "Excelsior" between Barnard Castle and the Summit, on the 6th February, 1862.

	Tons. cwt.		
Cylinder 18in. diameter = 254·46 square inch area	Weight	29 17	= 29·85 tons.
Stroke 24in.	Tender	17 12	= 17·60 „
Wheels 5ft. diameter = 15·7ft. circumference, 3·925 ratio ...	Load	181 3	= 181·15 „
Total		228 12	= 228·60 „

Distance run, Barnard Castle to the summit, 13·75 miles in 61 minutes. Speed per mile on the whole, 13·52 miles per hour = 1,189·76ft. per minute.

Elevation of summit	1,378
Ditto of Barnard Castle station	583
	795ft. rise.

Being 57·82ft. per mile, or 1 in 91·33, average gradient.

$\frac{2240}{91·33}$ = 24·52 lbs. per ton gravitation.

Engine 29·85 tons × 24·52 lb.	=	731·92 lb.	gravitation of engine.
29·85 „ × 18·00 „	=	537·30 „	friction of engine.
Tender 17·60 „ × 24·52 „	=	431·55 „	gravitation of tender
17·60 „ × 10·00 „	=	176·00 „	friction of tender.
		1,876·77 „	resistance of engine and tender.
Load 181·15 „ × 24·52 „	=	4,441·79 „	gravitation of load.
181·15 „ × 10·00 „	=	1,811·50 „	friction of load.
		8,130·06 „	total resistance.

Feet per min.

Then 8,130 lb. × 1,189·76 = 9,672,748 foot pounds, which ÷ 33,000 = 293-horse power nearly.

Water consumed per hour 1,043 gallons = 3·55 gallons per horse power per hour.

N.B. Pressure per inch on the piston = $\frac{8,130 × 392}{508·92}$ = 62·6 lb. per inch.

Second experiment:—Load 95·1 tons over same ground at 26·19 miles per hour with the same engine.

Resistance of engine and tender as above	1,876·77
Load 95·1 tons × 34·52 lb. F + G	3,282·85
	5,159·62 total resistance.

(26·19 miles an hour = 2,304·72ft. per minute.)

Then 5,159·62 × 2,304·72 = 11,891,479 foot pounds.

÷ 33,000 = 363-horse power. Water, 1,350 gallons = 3·72 gallons per horse power per hour.

$\frac{5,159·62 × 3·92}{508·92}$ = 39·7 lb. upon the piston.

N.B. Steam pressure *pro rata* inversely as the speed would only be 32·3 lb. per inch.

First experiment:—Load, including engine and tender, 228·6 tons × 13·52 miles per hour = 3,090 tons over one mile in an hour.

Second experiment:—Load, including engine and tender, 142·35 × 26·19 miles per hour = 3,754 tons over one mile per hour.

Showing that mechanically the engine is doing 21 per cent. more work at 26 miles an hour than at 13 miles, notwithstanding the popular notion about the "loss of power" at high speed.

But as the net or paying load is the important commercial question it will stand thus:—

First experiment	89·9 × 13·52 miles an hour =	1,215 tons 1 mile.
Second ditto	47·1 × 26·19 ditto =	1,232 ditto

Still showing 1·4 per cent. in favour of the higher speed, or, say, about the same.

The Machinery Department at the Exhibition.—The annexe for machinery in motion is fast advancing. The steam and exhaust pipes are conveyed under ground at the bottom of a square brick trough, along the top of the side walls of which is laid a tramway, by which all the heaviest machinery will be brought up the annexe to their stations. The engine-house and lofty chimney are nearly built. In the former will be six very large boilers, capable of supplying the machinery with from 60 lb. to 70 lb. of steam. The steam pipes are fitted at every length of 45ft. with hollow discs or drums of wrought iron, to allow of contraction and expansion, and the whole length of piping is laid, in gradually diminishing diameters, at an incline of 1 in 100. A simple but very ingenious self-acting drain provides for the escape of the water condensed at the lowest end of the pipes. The shafting for working all the machines is to be conveyed along each side of the annexe in handsome fluted cast iron columns 10ft. high and 10ft. apart. These rest on bed-plates bolted through slabs of stone to similar bed-plates placed beneath masses of concrete about four feet below the earth, so that each individual column will be as rigid and immovable as the building itself. Some of the groups of machinery in this annexe will be very large and powerful; two in particular, for which foundations are being excavated, are steam pumps of 40-horse power. One is for draining waste lands, and will be worked to show the body of water it can pump out, raising it to a low elevation; the other will be to show the mass of water it can discharge after raising it high. There are to be some powerful steam hammers here, and here also must be put the "stamper," or quartz-crushing machine, which has been sent from Australia with a cargo of gold quartz for its supply. Here, also, we believe, will be the steam hoists designed by Mr. Ashton, first used in this building, and which have lifted and lowered every ton of the materials used in its erection. It proves how nearly the building is done when, for the first time since the beginning of June, these hoists ceased work on Saturday last, and were removed from their old stations. It was intended to use them in lowering the dome scaffolds, but it was found that this could be accomplished more quickly by making slanting timber shoots from the summit to the ground, and sliding the beams down this on to a wadding of old sacks and rope yarn. In this way they are now thundering down at a great rate.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

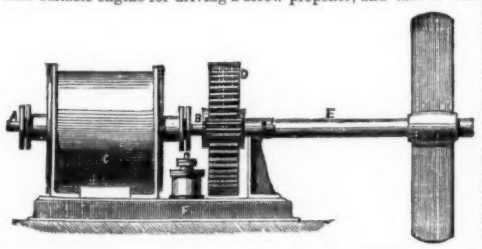
EXPANSIVE STEAM ENGINES.

SIR,—I have read with pleasure the able letter of your correspondent, "V. P.," in your impression of the 14th inst., on the practical use of steam expansively in marine engines; and, as he invites a discussion of the subject, I beg, with your permission, to say a few words about it and the marine engine generally.

From the general tone of "V. P."'s remarks I fancy that he holds a poor opinion of the steam engine as at present turned out by our manufacturers. I consider it at best as still in a state of barbarism, as any one must confess it is who reflects for a moment that, in order to utilise the force of a few cubic feet of steam in a cylinder, for the propulsion of a ship, it is necessary to carry about the world many tons of dead weight, besides the cylinder, and, in large engines, many tons of metal in constant motion. Without citing the ponderous old-fashioned side lever engines, with their infinity of moving parts, and whose use is still persisted in by some first-class companies, take as an example of modern practice for paddle-wheel steamers the Siamese twin engines. Here we have, in constant reciprocating motion, two pistons with their rods, a huge T crosshead, and an immensely heavy connecting rod, together with a lot of other gear. These engines work well, though when running before a heavy sea they sometimes perform the down stroke in a way calculated to frighten one. A cursory glance at these engines must convince any one that a considerable portion of the force of the steam is uselessly expended in tumbling these ponderous pieces about, though the object sought—a long connecting rod—is undoubtedly obtained. Expansion in the down stroke might be carried to any extent in this class of engine with success, but scarcely any use would it be in the up stroke. As an example of an engine for screw propulsion take the "crack engine," double trunks. Here we have a short stroke, almost as large an amount of cooling surface as can be obtained with a working cylinder, and a short slide, wasting at every revolution the amount of steam contained in the passages, in fact, just the necessary conditions for consuming fuel on a large scale. On the other hand, it offers great compactness, and it must be confessed that it is a first-rate working engine provided that its appetite for lubricating material be satisfied. Anything in the shape of economy is not to be looked for here; the short quick stroke and the loss of steam in the passages and clearance room in the cylinder ends effectually prevents anything of the sort being obtained. *Apropos* of this clearance "V. P." observes that in ordinary engines it is of so little importance as to be practically disregarded. He is, perhaps, not aware to what extent this disregard is sometimes carried. An instance lately came under my notice, where, in an engine of 13-in. cylinder and 12-in. stroke, a plate of 1¼in. thick was fixed in one end of its cylinder, and one of ¾in. in the other, leaving them the orthodox clearance, and this in an engine by a maker who would doubtless consider himself injured were he classed as less than first-rate. Nor is this by any means a solitary instance. "V. P." is fully alive to the necessity of reducing this clearance, and knows, doubtless, that it cannot be kept under ¾in. without risk of knocking the cylinder ends out. It is not consolatory to reflect that from this cause alone one-fifth of the steam supplied to the engine he cites is lost. It proves, though, the correctness of his argument in favour of a comparatively long stroke. In the principles he puts forth for a good engine, viz., high speed of piston, long stroke, and great expansion, together with the means by which he proposes to attain them, there is, in my opinion, some good engineering sense. The novelty of running the engines quicker than the screw, and reducing the speed, as proposed by you some time ago, is, I consider, a good innovation. With a pinion driving a wheel on the screw shaft the engine must necessarily have more command over the screw than when the reverse is the case. To obtain the all-important object of preventing condensation in the cylinder he gives four methods, and considers that of having a jacket round it, filled with heated air from the furnaces, as the best one. My opinion is that there is quite heat enough in the engine-room at present without taking any more, and that a better remedy has been applied, for whose invention there are several claimants amongst your correspondents—I mean that of placing the cylinder in the boiler or steam dome. This arrangement effectually prevents any radiation of heat from the cylinders at least, and renders felt and lagging unnecessary there. With regard to the details of his engine I have no comment to make, except that I think his pumps should all be rotatory ones, discharging their contents in a continuous stream.

Having thus taken a glance at "V. P."s letter, and feeling convinced that a discussion in the columns of THE ENGINEER, on marine engine economy, cannot fail to be highly useful to the world at large, I venture to propound, "also for discussion," my own views as to what an economical and tidy marine engine for screw propulsion should be, without entering into the subject of boilers. The arrangement I advocate is the following:—The boiler is placed athwart ships, with the furnaces forward, and through a stuffing box, fixed in the shell at the back, the engine shaft passes to the cylinder inside the boiler. This shaft may either drive the screw direct or by means of a pinion and wheel as proposed. The pumps—air, feed, and bilge—being fixed on the condenser, and driven by the screw shaft. Suppose for a moment that this arrangement can be carried out, let us see what benefits are to be derived from it.

First, perfect freedom from condensation of steam and radiation of heat from the cylinder. Secondly, by properly felting and covering the boiler, and from the entire absence of steam pipes in the engine room, "excepting a short exhaust pipe to the condenser," the radiation of heat may be considerably diminished as compared with present practice, and a ship might thus have an engine room in which engineers and firemen would have some prospect of living when out on a tropical station. Under the existing order of things a temperature of 120 Fah. is a common thing in the engine rooms of steamers in the tropics, as many naval engineers can testify. Thirdly, as the radiation of heat and condensation of steam would be diminished, so also would the consumption of fuel, while the comfort of the attendants would be wonderfully increased. The most suitable engine for occupying a position inside a boiler is undoubtedly a rotatory one, and though I shall pass for one more of the many "locos." who have knocked their heads against this philosopher's stone of engineering, I feel persuaded that it is the most suitable engine for driving a screw propeller, and that it will



ultimately drive the present reciprocating engine from the field. In making these remarks I have no crotchet of my own regarding this engine to obtrude upon your readers, my object is simply to call their attention to it, in order to elicit a discussion of its merits and some practical information respecting it. My own opinion is, that many of the rotatory engines already invented are capable of being improved by an addition of the equilibrium principle, so as to compete successfully with the ordinary engine in use, and even excel it.

enclose a sketch of the arrangement that some of the known rotatory engines would give for driving a screw propeller. On the shaft *a*, which passes through the cylinder *c*, a pinion B is fixed, which drives the large wheel D on the screw shaft *e*. The sole plate F being also the condenser, on which the pumps are fixed, and are driven by the screw shaft. If the cylinder be placed inside the boiler it would be supported on suitable brackets. The details for starting and stopping, &c., have already been invented and published, and the combination for simplicity, "the great merit in engineering," would contrast favourably with the best example extant of the common engine.

The problem to be solved in order to produce a good rotatory engine is simply that of fixing on a shaft passing through a plain cylinder a piston that shall utilise the power of the steam in turning round the shaft about its axis, at least as well as it is utilised in the common engine. When we read that, even under favourable circumstances, in an engine constructed expressly for the purpose, "of the dimensions cited by 'V. P.,'" expansion cannot be carried to $\frac{1}{15}$ of the stroke without losing $\frac{1}{5}$ of the steam, that is, wasting 20 per cent. of the fuel, from clearance alone, surely we may reasonably expect to get as good a result from a rotatory engine in which no clearance is required, and in which expansion can be carried to any extent. In addition to this clearance, in the common engine the passages from the slide case to the cylinder, be they long or short, have to be filled at every revolution with steam that gives no useful effect, another increase of waste in the fuel. If the coal represented by these two items could be saved in the engine, even were it pitched overboard at the commencement of a voyage, shipowners would gain by the loss. In the rotatory engine the steam enters by one port and goes out through another; therefore, the waste from filling passages is entirely avoided. In the common engine a mass of metal is being constantly driven about in opposite and ever-changing directions, which any engineer must know cannot be done without some expenditure of power. In the rotatory this loss of power must necessarily be considerably reduced: for, as all its parts may move in a continuous rotating motion round an axis, they partake of the nature of a fly-wheel, and give out again a considerable portion of the useful power administered to them, while their motion is uniform and steady. Any one who wishes to test the truth of this, let him take in his hand a weight of a few pounds, "a book, for instance," move it rapidly to and fro in a straight line for a few seconds, then change the motion to a circular sweeping one at the same speed, after which he can form his own conclusions as to the respective merits of reciprocating and rotating motions. In the common engine a considerable amount of power is expended in working the valves, and the engine's efficiency depends entirely upon their proper regulation and good order. If my memory does not deceive me, it was stated in THE ENGINEER some time ago that the valves of the Marlborough required 100-horse power to work them. All valve connections are a source of trouble and expense. In the rotatory engine no such valves are required, the piston admitting the steam to the cylinder, and providing for its egress without any other apparatus "excepting for expansion," thus obviating another loss of power, and favouring economy.

Take the rotatory engine in comparison with the common reciprocating one in a commercial point of view. Instead of having to transport constantly with the vessel, a large amount of metal in the shape of framing, plummer blocks, rods, &c. &c., occupying a considerable portion of the vessel, not only unproductive, but at a considerable expense for wear and tear, lubrication, &c., as is at present the case, we may with the rotatory reduce this space almost to boiler room and a screw alley, and the weight of engines considerably; for, as what little framing would be required would have no reciprocating motion to withstand, it might be considera ly lightened as compared with present practice. The space thus left for productive cargo would make a respectable figure in the year' accounts. With regard to repairs, in the engine I have sketched, a duplicate cylinder with its shaft, piston, and pinion being kept on hand, the vessel might be run under a crane, have her cylinder out, and the duplicate in and ready for work in at most a couple of hours. I may remark here that, until the portable system has been introduced into the marine engine, nothing like perfection will have been reached. With proper arrangements on this system nearly the whole of a vessel's machinery, boilers and all, might be taken out and replaced by duplicates "new or repaired" during the time she is discharging and re-loading, without detaining her a single hour. The marine engine of the present day bears about the same proportion of excellence to one in the state of efficiency to which I allude as does one of the old stationary engines, with its bearings built in the engine-house walls, to one of our best portables. The time now occupied in marine engine repairs necessarily keeps a large capital idle, a fact not at all creditable to the engineering skill of our country, since the remedy is simple and easy of application, for screw propulsion at least, nor is the introduction of the rotatory an indispensable requisite for this.

There is nothing, however, in mechanics, of which I am aware, that impedes the production of a good rotatory engine. Steam, the principal agent concerned in the matter, submits to be conducted through all sorts of intricate passages at the caprice of constructors, therefore there is no tenable argument to adduce in favour of its being compelled to perform its work at last moving exclusively in straight lines. The other agent concerned is the metal, which from experience we know works best and lasts longest, with the least amount of repairs, in machines where rotating motion is used. The only valid objection that can be urged against the rotatory is that up to the present time no inventor has been able to produce a proper piston for it. This, however, is no argument in proof of the impossibility of a good one being yet discovered, else what is the use of invention at all? Some time ago a correspondent of THE ENGINEER, "J. D.," in a discussion on portable engines, stated that in his opinion a good rotatory would after all be the best engine for the purpose. On this letter "V.P." in your number of January 10th, tells him that, if he desires it, he will send him a sketch of a rotary engine superior, in his opinion, to any yet invented; and adds that he thinks he knows them all, stating that, in his opinion, the rotatory is the very worst class of engine in existence. I cannot, of course, know whether this "V.P." and he whose excellent letter has called forth my present communication are one and the same person; but, be that as it may, I beg to disagree with "V.P." on this head *in toto;* and, *en passant*, I may mention that "J.D.'s" question in the same number, "Can a body, having a reciprocating motion, be balanced by another body having a rotatory motion?" appears to have staggered his opponents, as I have seen no answer to it. But to return. If "V.P." has a sketch of a rotatory engine superior to any yet invented, there must be something of considerable merit about it, and I would respectfully solicit him to make it known.

J. S.

Ferrol, February 25th, 1862.

AGRICULTURAL LOCOMOTIVES.

SIR.—In Mr. Romaine's letter, of the 28th ult., he states that he considers "it very dangerous for locomotives to travel about on town or country roads without first having some mechanical means of adjusting the boiler." He also speaks of having "suffered great annoyance by the melting of fusible plugs out of the crown plates of fire-boxes."

I have had several years' experience with road locomotives, and out of the forty engines fitted with my patent locomotive gear, now in constant work (many having travelled more than 3,000 miles each in the most hilly parts of this and other counties, frequently up and down inclines of one in six), in no one instance has a fusible plug melted out, or a crown plate been injured; a practical proof that the mechanical arrangement advocated by Mr. Romaine is an unnecessary complication.

THOMAS AVELING.

Rochester, March 12th, 1862.

STEAM PLOUGHING.

SIR,—Will you kindly allow me space in your valuable columns to correct some errors Mr. Howard stated in his paper on "Steam Cultivation," recently read before the Farmer's Club, regarding my digging maching travelling over the land. Mr. Howard states it takes fourfold the power to move an engine over the land to that taken by a stationary engine to transmit its power to the implement traversing the field. I think Mr. Howard has overlooked the important element of time, or the speed at which my machine travels when digging. This mistake has arisen, I presume, in calculating the speed to be the same as that of Boydell's traction engines when ploughing, viz., four miles per hour; whereas the digging machine exhibited at Leeds travelled at one-fifth that speed, viz., three-quarters of a mile per hour. I have often proved that it takes but 10 lb. of steam to propel my machines on a moderately level road and 15 lb. on the land, while to dig 7in. to 8in. deep, and 8ft. broad, 80 lb. to 90 lb. is required, showing, conclusively, that eighty per cent., at least, of the power is directly employed in the digging.

Mr. Howard is mistaken in supposing that I have abandoned the idea of a self-contained digging machine being practicable, but feel myself in the position of those inventors who were, as he says, in advance of the people, for I am still convinced that in countries with dry autumns, or in dry seasons here, it is the most economical mode of applying steam to the cultivation of the soil.

Devizes, Wilts, March 12th, 1862. ROBERT ROMAINE.

MISCELLANEA.

IT is understood that a medium-sized paddle yacht, intermediate between the Victoria and Albert and the Fairy, is about to be built for the use of the Queen.

SIR WILLIAM ARMSTRONG has presented to the officers of the Royal Artillery stationed at Shoeburyness for the time being a very useful library, valued at £500.

THE Scotia, which has just made so successful a trial trip, has the largest engines ever made on the Clyde, being 100in. cylinders, and 12ft. stroke, the Arabia's and La Plata's having 103in. cylinders and 9ft. stroke.

A LARGE quantity of metal fuzes, termed "pillar fuzes," which have been issued in vast numbers for the use of the Armstrong guns, have been proved in Woolwich marsh, and found defective. This, it is stated, will entail a serious loss on the War Department.

A PROSPECTUS has been issued of the South Essex Waterworks Company, with a capital of £80,000, in shares of £10. The object is to supply the district round Gray's, Essex, with water from extensive and pure supplies to be obtained from the chalk beds at that place.

THE wooden posts which support the roof of the eastern annex of the Exhibition building have got so far out of perpendicular that it has already been found necessary to restore them to their proper position. The posts under the roof of the western or machinery annex will, doubtless, require to be similarly treated.

ORDERS have been received at Chatham, from the Admiralty, directing Mr. Bernays, civil engineer, now employed at Pembroke Dockyard, to superintend the works in connection with the extension of the dockyard at Chatham. Mr. Bernays will be succeeded at Pembroke by Mr. M'Donnell, acting superintending civil engineer at Chatham.

PLUMBAGO, closely resembling the English, has been discovered in large quantities at Sonah, India, by Dr. Thompson, Civil Assistant Surgeon, Goorgaon. Its analysis gave:—In grains, 1,000; water, 43·54; salts soluble in water, 0·80; sulphates, 0·45; chlorides, 0·34; sesquioxide of iron, 32·94; carbonate of lime, 8·37; silica and alumina, 129·89; carbon, 784·52.

A WHARFINGER on the Surrey side publishes a formal notice in the papers that he shall oppose the construction of the Temple Bridge by all lawful means. He leases a wharf belonging to the Duchy of Cornwall; and he intimates that, if his own opposition fails, the bridge promoters will most likely be compelled to purchase the whole of the wharf.

THE advantage to be derived from the concession obtained by the South of Ireland Direct Telegraph Company for a telegraph station at Roche Point, at the entrance to Cork Harbour, where the pilots reside, and whence they board the steamers, was exemplified this week by the receipt of the news brought from New York by the Cunard steamer Asia some time before it could have been transmitted from Queenstown.

AMONG the number of Armstrong guns subjected to proof one day this week at the Royal Arsenal butt, Woolwich, three 100-pounder naval guns, to be denominated henceforth 110-pounders, were considerably damaged, and were returned to the forge. The defects were similar in each gun, namely, a separation of the coils forming the breech part, which yielded so as to disable the guns from further use in the present state.

IT is stated that Mr. Wilson has entered into an engagement with a company about to be brought out for laying down light rails, to be worked by locomotive power, on the road from Nulhatee to Moorshedabad, which has been conceded to him by the Government of India for that purpose. Mr. Wilson proceeds to India immediately to commence this work, and to complete negociations for other similar concessions from the Government.

THE pressure upon the departments of the Royal Arsenal at Woolwich has now subsided, and arrangements are being made for the reduction of the establishment by the discharge of a large number of mechanics and labourers, probably to the number of 3,000 men. Some of the men about to be dismissed have been employed as continuous hands on the establishment for seven, eight, and nine years, and are now entering into engagements to emigrate to British Columbia.

ON Saturday the officers and workmen of the London and North Western Company's locomotive department at Wolverton presented to Mr. J. E. M'Connell, C.E., a testimonial of their regard and esteem, and an address signed by 1,966 contributors, upon his retirement from office as locomotive superintendent of the southern division of the London and North-Western Railway. The presentation took place in the company's new pattern shop at Wolverton, about 1,500 officers and workmen being present. The testimonial consisted of three beautiful pieces of plate, of the value of £210.

IN addition to the fusible metal (cadmium, 1 or 2 parts; tin, 2 parts; lead, 4 parts; bismuth, 7 or 8 parts) already described by Dr. B. Wood, of Indianapolis, U.S., and which melts at 150 deg. to 160 deg. Fah., he has since discovered another alloy (cadmium, 1 part; lead, 6 parts; bismuth, 7 parts) which melts at about 180 deg. Fah., or about midway between the melting points of the old fusible metal and that first described by Dr. Wood. The principal feature to be noticed in Dr. Wood's alloys is the proof given of the fluidifying properties of cadmium.

THE railways of the United Kingdom are to receive from the Post Office £558,891 for carrying the letters this year; mail coaches only £13,509. Carts, stage coaches, and omnibuses, however, will get no less than £124,910. It will cost £700 to provide clothes for the mail guards, £16,150 to pay their wages and the wages of mail porters, £10,960 for the supply and repair of mail bags, £2,080 for apparatus for exchanging them on railroads. The whole cost of the conveyance of mails in the United Kingdom this year is taken at £755,980. But for the conveyance of mails abroad—the packet service—the country is to pay above £900,000.

THE following appointments of naval engineers have been made since our last:—Henry W. Blake, chief engineer, to the Indus, for the Buzzard; John Langlands, engineer, to the Indus, for the Shearwater; James Barlow, second-class assistant-engineer, confirmed in the Asia: William Jones, second-class assistant-engineer, confirmed in the Warrior; J. G. Sampson and W. F. Cole, acting second-class assistant-engineers, to the Indus, as supernumeraries; W. B. Stephens, engineer, to the Dart; Thomas Jeans, first-class assistant-engineer, to the Asia, for the Swinger; Robert H. Dobney, first-class assistant-engineer, to the Asia, for the Savage; W. H. Bambury, first-class assistant-engineer, to the Dart; Henry T. Smeddle, acting second-class assistant-engineer, to the Dart; Binch, first-class assistant-engineer, to the Hawke, for the Lark; H. William M'Lourin, acting first-class assistant-engineer, to the Euryalus.

W. AND J. GALLOWAY AND WILSON'S STEAM BOILERS.

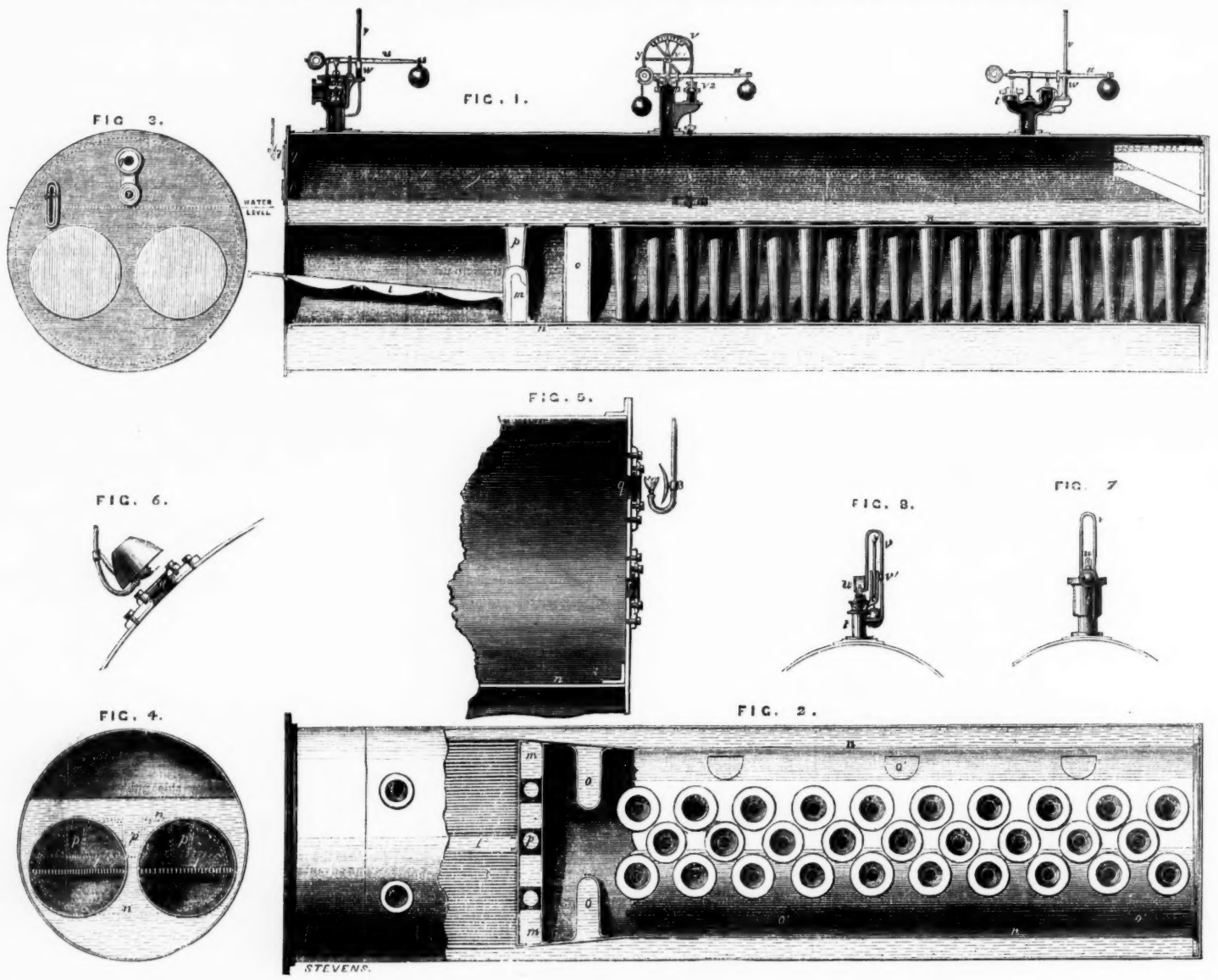


Fig. 1 is a section of a boiler to which improvements, by W. and J. Galloway, of Manchester, and J. W. Wilson of Barnsley, are applied. Fig. 2 is a plan partly in section, Fig. 3 is an end elevation, and Fig. 4 a transverse section of the same boiler. Figs. 5 and 6 are detached views of parts of the improvements, and Figs. 7 and 8 are detached views of the safety valves.

In Figs. 1 and 2 *l*, *l*, are two furnaces of the ordinary construction, separated by a mid-feather or water space l^0; *m*, the bridge, which may either be made of fire-brick as usual, or a water-chamber as shown; and *n* is the flue furnished with conical vertical tubes. Beyond and near the bridge are the two water chambers *o*, *o*, projecting from the sides of the flue; the object of which is to divert the currents of the products of combustion, and thus to increase the consumption of the smoke. To the upper part of the water bridge *m* are connected the lower ends of the vertical pipes *p*, shown also by dotted lines in Fig. 4. The upper parts of these pipes, which are tapered by preference, are connected to the flue *n*, thus insuring a circulation of water through the bridge.

The improvements in applying glasses to boilers are shown in Figs. 1, 2, 3, 5, and 6. On referring to these views the glass marked *q* is the one through which light is to be reflected by a jet of gas or otherwise, and the glass *r* is the one through which the interior of the boiler can be examined; both these glasses may be magnifying or plain, but they must be of considerable strength to resist the pressure of the steam in the boiler. By means of these two glasses the interior of the boiler can be seen while the boiler is at work. The glasses may either be placed in the end of the boiler as shown in Figs. 1, 3, and 5, or in the shell of the boiler as shown in Figs. 2 and 6.

The improvement in applying a glass plate to the end of the boiler through which the level of the water can be seen is shown in Fig. 3. On referring to which view it will be seen that a narrow strip of glass *s* of about the length of the usual glass water tube is applied to the end of the boiler. This narrow plate of glass is secured to the boiler in the manner shown in Fig. 5, or by any other convenient means, and it will indicate the level of the water in the same manner as the ordinary glass tube; while the fixings, taps, and detached glass tubes or plates are entirely dispensed with.

The improvements in safety valves are shown in reference to Figs. 1, 7, and 8. The safety valve shown in section at the left-hand side of Fig. 1 and in elevation in Fig. 7 is arranged in the following manner:—*t* is the valve box containing a duplex vavle of the usual construction. This valve is weighted by the lever *u*. The bent tube *v* is secured to the valve box *t*, or to the shell of the boiler, and the steam from the boiler has free access to the tube, the other end of which is connected to the under side of a ram, piston, or disc contained in the box *w*, the upper end of the ram, piston, or disc being in connection with the under side of the weighted lever *u*. When the pressure of steam in the boiler is sufficiently great to raise the ram, piston, or disc in the box *w*, the lever *u* raises the safety valve any required distance off its seatings, and holds it open until the pressure of steam is reduced to lower the ram, piston, or disc in the box *w*; thus allowing a free escape of steam from the valve. The safety valve shown near the right-hand end of the boiler is provided with two flat valves of the usual construction marked t^1 and t^2, the former opening inwards and latter outwards; both these valves are connected to the weighted lever *u*, which is acted upon by a ram, piston, or disc in the box *w*, to which the bent tube *v* is connected as before described; by this means when the lever *u* is raised the valve t^1 is lowered, and the valve t^2 raised off their seatings to allow the steam to escape.

The safety valve shown in section on the centre of the boiler Fig. 1 and in side elevation in Fig 8 is of the usual construction, and is combined with the water float to let off steam in case of deficiency of water. *x* is the water float, the rod of which, after passing through the shell of the boiler, is connected to a chain passing over the wheel *y*; the axle of this wheel forms the plug of a tap v^1 in the bent tube *v*. This bent tube conveys the steam to the under side of the disc or flexible diaphragm v^2, the upper side of which is in connection with the lever *u*; by this arrangement the safety valve is opened in the ordinary manner when the pressure of steam exceeds the desired limits, and it is held open by the descent of the float *x*, which opens the tap v^1 in the bent tube *v*, and admits the steam to the under side of the disc v^2, when the water descends below its proper working level.

The Scotia.—The new steamship Scotia, built under special survey expressly for the British and North American Royal Mail service, arrived in Liverpool from the Clyde on Thursday week, having made the run from the Cloch Lighthouse on the Clyde to the Bell Buoy at the mouth of the Mersey in 12 hours 4 minutes. The machinery worked admirably, and, in proof that the vessel is perfectly manageable, she was easily moved round in the Mersey within her own length. The trial trip on Wednesday before the Scotia left the Clyde for Liverpool was highly satisfactory, notwithstanding the unpropitious state of the weather. The distances were performed under the following conditions:—Against a strong flood tide, and also against a double-reefed topsail breeze of wind, from the Cloch to the Cumbræ Light in 59 minutes; after passing the little Cumbræ, the Scotia was brought round with great ease, and performed the upward run between the Cumbræ and Cloch Lights, but on this occasion with wind and tide in her favour, in 49 minutes; mean time, 54 minutes. The rate of speed will be understood by the following:—

59 minutes = 13·898 knots, or 16·010 miles per hour.
49 minutes = 16·734 knots, or 19·277 miles per hour.

30·632 — 35·287

Mean speed 15·316 knots, or 17·643 miles.

It is anticipated that under ordinary circumstances the maximum speed of the Scotia will be about 19 miles an hour. The trial referred to was made to test the efficiency and speed of the vessel for the mail service, which was done under the superintendence of Mr. John Dinnen, inspector of machinery, and Mr. James Luke, master shipwright of the Admiralty, Whitehall; the Board of Trade being locally represented by Mr. George Barber, shipwright surveyor, and Mr. H. R. Robson, inspector of machinery for the Clyde. The Scotia is to be under the command of Captain Judkins, the commodore of the Cunard fleet, who will now move his flag from the Persia, in which he has so long and so ably distinguished himself.

Foreign and Colonial Jottings.—As our readers will, no doubt, have inferred from the rise in the shares and bonds, there is hope in store for the hitherto luckless Grand Trunk of Canada. The receipts for the week ending February 15th were £17,674. Compared with those for the corresponding week of last year the increase is £8,997. On the first seven weeks of the half-year the increase in the receipts is £37,836.—A statement appeared in most of the London journals on Saturday, to the effect that the Indian Tramway Company had received an intimation that the Government of India had sanctioned the construction, by Mr. Wilson, an engineer recently returned to England, of the first tramway of 27 miles between Moorshedabad, the old capita of Bengal, and Nulhatee, a station on the East India Railway. As there are several gentlemen in the north of England interested in the concession referred to it is important to mention that it is not for a tramway at all, but for a railway, and that it has no connection whatever with the India Tramway Company.—A circular from the French Minister of the Interior cautions French shipowners against frauds practised in the ports of Cardiff and Swansea with respect to the loading of coal.—During the recent bombardment of Fort Donaldson by American gun-boats, in which the latter had to haul off greatly damaged, 1½in. iron plates backed with 15in. oak were found ineffectual to resist 32lb. shot.—The British screw steamer Stella has been chartered at New York to carry American contributions to the Great Exhibition.—A project has been set on foot to connect Singapore with the system of telegraphs in India at Rangoon. This line was promised to be executed by our Government when the Dutch Government laid a cable in 1859 between Singapore and Batavia; it being obvious that the utility of the latter line depends in great measure upon its extension to India, our Government accordingly shipped the cable that is now laid down between Malta and Alexandria in the autumn of 1860 for Rangoon and Singapore, and the line now proposed would have been then completed but for the wreck of the Indian steamer Victoria, with a portion of the cable on board. This caused a delay, which involved the loss of the season, and the destination of the cable was changed to Malta and Alexandria. The India and Singapore telegraph will save eight days between India and China, and the same time between England and China. Indeed, by a slight alteration in the dates of departure of the China mails an additional gain of two days, or ten days in all, would be secured—still leaving two days for telegraphing between Bombay and Singapore, for accidental delays on the voyage.

A numerously signed memorial and protest of owners and occupiers of wharves and other property on the Surrey side of the Thames has been presented to the commissioners, setting forth that between Lambeth Palace and Southwark bridge there are eighty wharves in separate occupations, carrying out a variety of extensive trades, besides factories, mills, granaries, and buildings rising directly from the waterside, with drawing docks and free landing-places, and for all of which the free use of the river shore is essential. While expressing their unwillingness to offer any opposition to public improvements, or to relieving the evils arising from the floodings of the river, the memorialists consider that their entire trades would be seriously damaged if any material impediment should be created in the river traffic by the interruption of the landing and loading of goods. They consider that any of the plans for an embanked roadway that have been laid before the public would materially impede such traffic, and that the present flooding of the river periodically may be prevented by causing the banks of the river to be raised and the wharf walls to be altered.

A contract has been entered into by the French Government with the Compagnie Générale Maritime for the establishment of a postal steam service monthly between France, the Island of Martinique, Santiago de Cuba, and Mexico. The speed at which this service is to be performed is nine knots per hour, and the subsidy granted is at the rate of 21s. 11d. per mile. This contrasts strikingly with the rates paid by the British Government to the contract packet companies generally. For example, the Royal Mail Steam Packet Company, which conveys the mails between this country and Mexico, although required to perform the service at a much higher rate of speed, is paid less than 10s. per mile.

TO CORRESPONDENTS.

ERRATUM.—*In the article on "The Paddle and the Screw," in our last number, first column and 15th line of the fifth paragraph, for "in proportion as the radius is to the cosine," read "in proportion as the cosecant to the radius." The words "assumed in this case to be 45 deg.," four lines above, or in the 10th line of the same paragraph, should have been omitted.*

L. O.—*In type, but crowded out this week.*

C. S.—*Bourne's quarto treatise on the steam engine, published by Messrs. Longmans, is undoubtedly the best extant.*

P. M.—*Leather and vulcanised rubber are destroyed by contact with steam. Even at low pressures they will soon become rotten.*

R. H. S. (Carr Bridge)—*We are unable to give you the address of the Association. Perhaps the Editor of the* Mining Journal *could inform you.*

J. B. M.—*The substance to which you allude is, we suppose,* papier maché. *We cannot say where you could most conveniently procure it.*

AN OLD SUBSCRIBER.—*We are not certain that the law which governs the action of steam in the curved tube of a Bourdon steam gauge has been demonstrated.*

E. B. M.—*The Taranaki Steel Iron Company's offices are at* 3, *Delahay-street, Westminster, where you can address the Secretary for the required information.*

W. T. (Thorney).—*Mr. Hall Dare,* 12, *Hanover-square, is the Secretary of the Royal Agricultural Society. You will probably find the card of a maker of pitch chains in our advertising columns.*

F. (Ferrol).—*It would not do to publish your invention in England previous to applying for provisional protection. There must be many such manufacturers as you ask for, but we are unable to refer you to one.*

J. S. L.—*It is generally held that the application of an old invention to a new purpose is not patentable. By sending, say* 1*s., in stamps to the Patent-office, and asking for Schiele's patent of November,* 1845, *it will be sent to you.*

MECHANICAL ENGINEER.—*You will find Mr. Weale's rudimentary treatises most useful. If, however, you are about entering upon a more extended course, you will probably require a teacher, and he could best advise you as to text books.*

T. B.—*Any steam gauge maker can doubtless furnish you with a gauge to indicate the pressure of water in mains, adding the graduations for the heads corresponding to the pressures per square inch. This is supposing that you have an air vessel.*

T. P.—*We really wish we could tell you what would prevent the formation of scale in boilers where bad water is used. So much quackery has been practised in treating scale disease, that we do not like to prescribe. Some of the remedies have been sal-ammoniac (once used on some of the railways) oak sawdust, gum catechu, or "cutch," &c. &c. In any case frequent blowing off must be practised.*

AN ENGINEER'S PUPIL.—*If you are what you describe yourself you ought not to come to us a second time with such a question. The problem is very simple, but we cannot undertake to work it out for you. Again we say, make the diagram, with any length of connecting rod you like, and find the thrust, at various parts of the stroke on the principle of the resolution of forces acting through jointed levers.*

A. Z. (C. M). *Steamers are very commonly tried in the way you describe. The Peninsular and Oriental Company's steamer Moollan had her engines tried last spring, alongside the quay at the Victoria Docks. With engines working up even to* 4,000 *horse power, the actual pressure exerted upon the hull, tending to drive it forward, would be but about* 40 *tons, and it would be a poor ship indeed which would be strained by such a pressure applied in the direction of her keel.*

J. D. (Uddingston).—*Like nine-tenths of our correspondents who ask us for dimensions of parts of engines, you neglect to give the pressure at which you intend to work. Supposing your* 10*-in. double-cylinders, with* 16*in. stroke, and making* 90 *revolutions per minute, to be worked by steam of* 60 *lb. pressure, we should employ a wrought iron crank shaft* 3¼ *in. in diameter. This is supposing that the fly wheel is between the two cylinders. If both connect on one side of the fly-wheel, let the shaft be* 4¼*in. diameter. The crank pins, if of the ordinary kind, may be* 2¼*in. in diameter, and* 2¼*in. long. If you employ your fly-wheel as a belt pulley, which we should advise you to do, its diameter will be governed by the speed at which you intend to drive your machinery. If it be* 5*ft. in diameter, let it weigh* 3,000 *lb. Although much less than this will answer, if great regularity of motion is not required.*

FANS.

(To the Editor of The Engineer).

SIR,—Will you kindly furnish me with a "practical rule" to calculate what air a fan of the following dimensions will discharge per minute, viz.:—6 blades, 20in. diameter outside of blades, each blade being 8¼in. long, 10in. wide at the butt, and 4¼in. at the tips, and making 180 revolutions per minute? The fan has an outer casement, revolving with the blades.

Todmorden, March 8th, 1862. W. T.

ROLLING STEEL TYRES.

(To the Editor of The Engineer.)

SIR,—In THE ENGINEER of the 1st instant you say you believe that Messrs. Brown, of this place, are the only parties who have machinery to enable them to roll cast steel tyres, and of course this statement will apply to all other tyres in the circle. I have been engaged for the last eight years or more in rolling that and other tyres in the circle, on a principle patented by me, and have, during that period, rolled upwards of sixty thousand tyres. I am sure you only require this information to cause you to insert the statement. W. OWEN.

Rotherham, 10th March, 1862.

THE HARTLEY ENGINE BEAM.

(To the Editor of The Engineer.)

SIR,—In answer to "A. C. H." I am not aware that any experiments have ever been made on "open sand castings." I should imagine, for this simple reason, that it was never supposed that such a material would ever be used where any particular strain was required. In the absence of any great authority perhaps the next best thing to do is to take the opinion of several experienced ironfounders, and I find that I have placed a high value upon "S." I agree with your correspondent "V.," who says they possess only two-thirds the strength of ordinary castings.

With regard to "Founder's" letter, it was stated at the inquest that it was "an open sand casting," and a representative of the makers was present at the time, and did not contradict it. It has also been discussed in these columns during the last six weeks unmistakeably as an open "sand casting." If it is not so why did not the makers say so long ago? I for one should like to see the original calculation of this beam. S.

Bermondsey, March 12th.

RAILWAY COLLISIONS.

(To the Editor of The Engineer).

SIR,—I shall feel obliged if you will give me a formula for the following:—A railway train 100 tons weight is running at a velocity of 8 miles an hour, and is run into by a following train of 200 tons weight, running at the rate of 16 miles an hour, what is the amount of force with which they come into contact? J. W. WILLIS.

[*The force of a blow cannot be rightly estimated as a steady pressure, although both may produce substantially the same result. The force of collision would be due to a difference of speed of* 8 *miles an hour, or* 12*ft. nearly per second. A body moving at this velocity would, if projected upwards, rise to a height of* 9*ft., and therefore in striking another object at rest the force would be that acquired by falling from a height of* 9*ft. The carriages which first came in contact would strike their buffers together with the same force as if one had fallen* 9*ft. upon the other, but the remaining carriages would receive a diminished shock owing to the elasticity of the buffers.*

SCREW SHAFT PACKING GLANDS.

(To the Editor of The Engineer.)

SIR,—Seeing by the newspapers that a screw steamer has had to put back owing to the packing coming out of the screw shaft stuffing box, the following plan has suggested itself to me as an easy means of getting over that difficulty in future.

Supposing the packing to be worn away, or to have come out in some manner, if a piece of rope or gasket was put outside of the gland, and the gland screwed tightly up, that would effectually prevent any water leaking through between the gland and tube.

To prevent the leakage between the shaft and gland I should take a few fathoms of rope of a suitable size, and having laid one end on the shaft, about 2ft. from the gland, commence winding it tightly round the shaft; this could be best done by starting the engine slowly, and by holding the rope tightly until it pressed against the gland, when, if there was room for it, a second coil might be run back over the first. The end of the rope must then be lashed to prevent its coming loose. This plan would, I think, be sufficiently secure to enable the vessel to proceed on her voyage.

N. C.

[*How long would the surface of the rope last where it rubbed against the stuffing box, and what would there be to keep it tight against the box?—Ed. E.*]

MEETINGS NEXT WEEK.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, March 18th, at Eight p.m., Discussion upon Mr. Hartley's paper "On the Lower Danube," and, if time permits, "Description of Works at the Ports of Swansea, Silloth, and Blyth." By Mr. J. Abernethy, M. Inst. C.E.

SOCIETY OF ARTS.—Wednesday, at 8 p.m. "On the Sewerage of Towns." By Robt. Rawlinson, C.E., Engineering Sanitary Commissioner in the Crimea. On this evening the Right Hon. Lord Stanley, M.P., will preside.

*** Plans, details, estimates, and cost of public sewers in Carlisle, Buxton, Worksop, and West Ham, will be given.

Advertisements cannot be guaranteed insertion unless delivered before eight o'clock on Thursday evening in each week. The charge for four lines and under is half-a-crown; each line afterwards, sixpence. The line averages nine words; blocks are charged the same rate for the space they fill. All single advertisements from the country must be accompanied by stamps in payment.

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Letters relating to the advertisement and publishing department of this paper are to be addressed to the publisher, MR. BERNARD LUXTON; *all other letters and communications to be addressed to the Editor of* THE ENGINEER, 163, *Strand, London, W.C.*

THE ENGINEER.

FRIDAY, MARCH 14, 1862.

DURABILITY OF IRON STRUCTURES.

No engineer pretends to assign a precise period for the duration of his structures. They will last for a very long time, for many centuries, perhaps,—at all events he professes to believe as much. In the case of masonry, we are able to refer to many works of the ancients—to a few of those of the Phœnicians, indeed, and to a long list of Roman structures, both cisalpine and transalpine, all of which prove the endurance of stone and mortar. Tiles, also, moulded by the ancient Romans, are still found in a sound state, and we have examples, in Hampton Court Palace and in the Lollard's tower of Lambeth Palace, of the endurance of exposed brick work for three or four centuries at least. Wood, too, when sheltered, as in the roof of Westminster Hall, or when immersed, as in the old piles of London bridge, or in the caissons of Westminster bridge, will last for centuries. But how is it with iron? The first iron bridge is believed to have been erected only ninety years ago, at Coalbrookdale, and we are not sure whether it is still standing. It was only about forty years ago that iron came into extensive use for engineering purposes, and but about thirty years since it was first used under the trying circumstances of railway traffic. And it is hardly fifteen years since wrought-iron bridges began to be used for railways. Now are they really to remain permanently? We are going on, apparently in the utmost confidence, as if these works were to last for ages,—and it may be that we cannot bring up anything to show that they will not last as long as their builders have anticipated. Yet we are forced to own that all our faith in the durability of iron structures is based upon *data* which are more inferential than absolute. Some wharfs and piers have been built, which appear to stand very well in sea and river water, and Mr. Mallet has come to some most encouraging conclusions from the results of some experiments which he has made upon the corrosion of cast-iron in the Liffey, and elsewhere. Mr. E. B. Webb has lately published considerable information upon the durability of cast iron piers and lock-gates, some of which information has been lately transcribed into our own columns. As far as it goes, this experience is calculated to inspire the engineer with renewed confidence in the applicability of iron to works of construction. But, at the same time, abundant instances can be adduced of the rapid corrosion of cast iron tubbing in coal pit shafts, even where no sulphur was to be detected. Cast iron pipes do not last for ever, either, in the ground, and iron troughs, and other castings, have been found to decay in a comparatively short time. As for wrought iron, there are abundant examples of its decay after some years' exposure. The lightning rods of old steeples are sometimes found to be eaten away by rust, and the iron dowels or clamps which have served to bind stones together in old masonry, are now and then found to be swollen to twice or thrice their orginal bulk with rust. Iron roofs on buildings are found to go rapidly, and galvanising has been found to be but a partial protection. Iron ships become eaten through in the plates, and boilers working with both "fresh" and distilled water become occasionally corroded in an unaccountable manner and after a few years' service. Wrought iron bridges, we must remember, are so recent in their use, that we cannot pretend to say with any certainty how far their durability is determinable from other experience. It has been said that wrought iron, after resting for many years in one position, becomes crystalline, and the case has been instanced of an anchor at Woolwich, which, having lain for nearly a century in one position, broke short off when finally removed. Iron becomes brittle, too, after long use. The old axles on the Liverpool and Manchester Railway lasted for from fifteen to twenty years, and at last began to break, promiscuously. The load which they carried had not been greatly increased, nor had they been run at a much higher speed, as they were under goods wagons, the speed of which had remained nearly the same from 1830 to 1850. Why, then, did they not hold out indefinitely? Their case appears to illustrate what Mr. Braithwaite calls the "fatigue of metals." They bore up for so many years and then broke down, just as a horse might have done. Now, as to this matter of fatigue of metals we know next to nothing. At the last meeting of the British Association Mr. Fairbairn related some experiments which he had made, and which showed, clearly enough, that a given load, repeated sufficiently often, at last broke the camel's, or rather the girder's back. He made a model of one of the girders of the Spey viaduct (about "passing" which Captain Tyler made such weighty objections), and loaded it with one-fourth of its calculated breaking load. By a simple contrivance this load was changed, or alternately applied and removed, one million times without apparent injury to the girder. The beam was then loaded to nearly one-half of its calculated breaking weight, and after the load had been changed 5,175 times, the beam broke down. It was then repaired, and a load equal to two-fifths of the calculated breaking strain was alternately applied and removed, 25,900 times, when, we believe, a second failure took place. Afterwards, with a load equal to one-third of the calculated breaking strain, nearly three million changes were made without perceptible injury. We are not to suppose, however, that the changes of load took place, in Mr. Fairbairn's experiment, in the manner in which 100 or 200 railway wheels deal out their blows upon a bridge at from 10 to 50 or 60 miles an hour. Indeed, it is impossible to say what is really going on in large iron girders, over which heavy trains are constantly flying. They were, most of them, built, too, for a live load of 1½ tons per lineal foot, some of them, indeed, for but one ton per foot. The present maximum load for moderate spans is nearer 2 tons per foot. So, too, different engineers have provided a strength varying from two to six times the maximum load, and no longer ago than last September Mr. Fairbairn was engaged in explaining to the British Association that, in calculating the strength of a bridge, its own weight was *first* to be deducted from its calculated breaking strength, and one-sixth of the *remainder* taken as the limit of safe load. Now, with tubular bridges a span would soon be reached where the work would break down under its own weight, yet Mr. Fairbairn would have engineers believe that, in all cases, a bridge will safely carry a live load equal to one-sixth of the difference between its own weight and its calculated breaking strain applied as a distributed load!

Is it generally known that, in the case of steel, a highly carbonised bar, too harsh for working, becomes, after long exposure out of doors, workable, showing a loss of carbon? If carbon in its solid form will escape invisibly from steel, as any experienced steel-maker can testify it does, what gradual changes may not be going on in iron? We do not suggest this question with any desire to excite alarm, but it may lead to more searching inquiries, of which, we think, it must be admitted, there is still some need.

STEAM ENGINE CONSTRUCTION.

GIVEN, a steam cylinder, a reciprocating piston, and a crank, and a constructing engineer will combine them in almost a hundred different ways. In the earlier steam engines the cylinder was always vertical, with the piston-rod working through the top cover, the vibrating beam being employed in the transmission of the power to the crank. In single-acting pumping engines, having no crank, Mr. Bull afterwards took the piston-rod out through the bottom of the cylinder, an arrangement which contained the idea of the steam hammer, and that, also, of Messrs. Thomson's inverted cylinder engine, as originally introduced by them in the Frankfort steamship, and since extensively adopted by other builders. Messrs. Boulton and Watt introduced the side lever engine for steam vessels—Mr. Fairbairn soon taking it up for factories. Another variety of beam engine is the "grasshopper." The greatest variety of arrangement, however, is among the direct-acting engines. With the upright cylinder the shaft is variously placed, according to the point at which it is required to take off the power. In the more usual plans, the connecting rod grasps a pin placed close to the end of the piston rod, the crank being above. With the shaft at a lower level, the cross head is sometimes bent down so as to work in guides on opposite sides of the cylinder, an arrangement at one time adopted by Mr. Bury for marine engines, and by Messrs. Robinson for sugar mill engines. With the shaft just over the cylinder cover the "steeple" plan is sometimes adopted, and at others, the piston rod is taken out through the bottom cylinder cover, and the connecting rod reversed so as to work upwards, the whole being an inversion of Maudslay's "table engine." The same attachment of parts is sometimes employed with horizontal cylinders, and Messrs. Maudslay's double piston rod engine is no more than the steeple engine laid horizontally. Then we have diagonal engines, sometimes with two cylinders placed at right angles to each other, both piston rods being connected to the same crank pin, according to the plan patented by Sir Marc Brunel in 1822, or having the cylinders separated at a less angle and having the drag-link interposed as in the Galway steamship Adriatic. Then there are oscillating engines and trunk engines, "Siamese" engines and pendulum engines, and there is an arrangement in which the cylinder turns completely around upon trunnions like those of an oscillating cylinder. In these diversities of position and connection there is seldom any thing which can be dignified as a mechanical principle. The variety may be interesting enough to ingenious draughtsmen, and may arouse the competitive spirit of a builder, here and there, just entering into business, but with the practical engineer simplicity and accessibility will generally determine his choice, although it is a fact that engines which are neither simple nor conveniently accessible appear best to meet certain exigencies of space and place on shipboard. It is only in this way that we can account for the favour still shown to trunk engines, for example, which work with much friction and considerable loss of steam by condensation. One important mechanical distinction, it is true, may be made with respect to the varieties of engines which we have enumerated. Some are self contained, while others are not. The beam and side lever engines require firm foundations to which they must be well tied down, the strain at the main centre of the beam being double the total pressure on the piston. Most of the direct acting engines, on the contrary, require no foundations beyond a surface sufficient to carry their weight. In the inverted cylinder engine, however, the lateral pressure on the guides is applied so far above the floor, and in the case of marine engines, the top weight of the cylinder is so great, and it has such a leverage when the ship is rolling, that the standards require to be of corresponding strength, and to be securely fastened down.

As with the position of the cylinder and the transmission of the pressure of the steam from the piston to the crank, so are all the other arrangements of the engine susceptible of a great variety of changes, all attaining much the same result with different degrees of simplicity. It is thus that we have a host of engines dissimilar in appearance and yet identical or nearly so in principle. The eminently practical man finds in these differences abundant scope for compari-

son and eclecticism, but is apt to look with distrust over those broader grounds of inquiry beyond which may arise fundamental changes in practice. The philosophical engineer, on the other hand, is impatient of details of engine-craft, and enters, instinctively, upon the pursuit of ideal perfection—an ounce or so of coal per horse-power per hour. The former will revel in the merits of a new piston or an improved valve gear, while the latter, disdaining such material littleness, poises the pinions of his imagination for a flight to the practice which shall dispense with nine-tenths of the present weight, bulk, and complication of steam engines. In regarding, therefore, the mere structure of engines, we may as well dismiss at once the consideration of maximum pressures, prolonged expansion, and, possibly, surface condensation. Mechanically, then, we may say, that modern practice is tending, visibly, towards smaller pistons running at higher speeds for a given power; to a unification instead of a multiplication of parts, and to the greatest possible directness of transmission of strains and pressure. With higher pressures and quicker speeds the most accurate workmanship is found indispensable; wearing surfaces of greater amplitude are necessary, and means for reducing the friction of valves and for counterweighting the disturbing weights of the engine acquire increased importance. On land, it is sought, as far as possible, to dispense with gearing and to work steam engines more nearly up to the speed of the machinery which they are employed to drive; in steam vessels, the increasing adoption of the screw has, except where gearing is still employed, led to the adoption of short-stroke engines running at high speed, a 3½-ft. stroke being repeated, in some cases, 200 times a minute. Wrought iron has been fighting its way for years into the place of cast iron, for framing, and even for beams where beams are still used. It was once thought a great step to substitute cast iron for wood in beams and connecting rods for land engines, but cast iron rods are hardly made now, and the case of the Hartley engine and that of the levers of the Scotia steamship are likely to decide the question of cast iron *v.* wrought iron engine beams. The cast iron main and end centres are, at last, going out of use too. For large engines, steam jackets are beginning to be considered as indispensable, both around the sides and upon the ends of the cylinders. With steam of higher pressure, pistons of greater simplicity and longer stuffing boxes are preferred, and care is being taken to relieve the back of the slide valve from a portion of the enormous pressure now resting upon it. We might thus pursue the details of steam engine construction, only to find that all are undergoing gradual change, and, as we hope, corresponding improvement.

RAILWAY ENGINEERING.

The late Mr. Stephenson once remarked that the construction of machine tools, although a subject of great importance, hardly afforded any field for discussion. This is now the case with railways. At the time when every thing connected with railway location, gauge, permanent way, locomotive power and working was undetermined, the field for inquiry and discrimination was almost boundless. There are many who can remember, and all have heard, with what energy the question of the substitution of locomotives for stationary engines and horses on railways was debated, thirty odd years ago. When the multitubular boiler and blast pipe had carried the day, wide differences of opinion arose as to the gradients and curves. Improvements in locomotive valve gear, and, almost at the same time, the relative merits of outside and inside cylinder engines, soon after occupied the attention of mechanical engineers. Then came the question of gauge, respecting which a deal of nonsense was emitted on both sides. Almost immediately followed the far more consequential discussion of the substitution of wrought for cast iron in bridges. More recently there has been a division on the question of iron permanent way, and, at the same time, much inquiry has been directed to the use of coal in locomotives. All, or nearly all, these questions have been argued, and the conclusions acted upon in a manner which would seem to leave little but to slowly accumulating experience in the future. Whatever of freshness may have attached to these subjects has certainly been exhausted. Railway engineers are *blasé* with all of them. Railway engineering has become a matter of *routine*, which almost any attentive young gentleman, with fair powers of apprehension, can readily master. (Not, by any means, that every knight of the level and drawing board can secure an appointment as chief engineer.) There is the survey, in which the Ordnance maps are of wonderful assistance, leaving, it is true, however, full scope for the study of the topographical and commercial features of the route. It is here indeed that the judgment and ability of the engineer are generally exerted to the best purpose. At all events, few engineering errors are more costly than errors of original location, as the practice of even our best masters has now and then testified. The nice determination of the line which shall best combine the more important requisites of directness, easy gradients and curves, facility of construction and general adaptation to the wants of the district, is a problem often worthy of the highest engineering talent, requiring, especially, the soundest professional judgment. The temptation to make a direct line, especially across country, is generally strong, and often, with works of considerable magnitude in the way, such a railway will prove actually cheaper in cost than a longer one entering upon the more valuable property along the watercourses. The question of gradients arises, however, involving much consideration of the working of the line, which also requires attention to the nature, probable extent, and prevailing direction of the traffic. Good judgment might sanction an incline of 1 in 50 in one case and refuse one so steep as 1 in 100 in another. An engineer might not be justified in one case in incurring more than a moderate expense to obtain curves no easier than of 10 or 12 chains radius, while, in another, a 20 chain curve would be the least admissible, and a large sum might, perhaps, be rightly expended in order to obtain a *minimum* of 30 or 40 chains. The value of property and the convenience of the inhabitants of the district traversed will also determine greatly the question of deviations. In respect of bridges, cuttings, and embankments, too, it is very often the case that much more favourable ground can be had by going a little out of the way. Indeed, the whole question of the selection of route requires, in many cases, the most comprehensive and careful consideration of a vast number of details, upon which the best professional experience, and the ripest judgment, may well be exercised. These once settled upon, however, and standing orders complied with, nearly all opportunity for the exercise of original qualities on the part of the engineer is past. To draw up the specifications is very much like drawing up a lease or an agreement, at least in so far as the introduction of the conventional clauses of both are concerned. The price of executing nearly all kinds of work is so well-known, too, that an engineer, with even a moderate circle of acquaintance, can hardly get far wrong in his own estimates of what his undertakings are to cost. When it comes to bridges there is not much chance of going astray. The omnipresent wrought iron girder—a capital superstructure, too, for a bridge—has but to be repeated, and the conditions which govern the choice of foundations and the width of spans are generally capable of such ready determination that but little room is left for doubt. As for the different kinds of bridge superstructure, almost all that can be said has become familiar to the engineer. For moderate spans the plate girder will generally be preferred, and when the span becomes so great that an economical arrangement of plates cannot be conveniently made in the sides of the girder, the lattice offers obvious advantages. As for cost, the leading contractors quote the same price per ton for both plate and lattice girders, so that there is very little room for choice in that respect. In many bridges, perhaps, indeed, the larger number, the cost of the superstructure is, after all, considerably less than that of the foundations, abutments, and piers, so that the question of superstructure, presuming that it is abundantly strong, is not of paramount consequence.

As for permanent way—such permanent way as is now put down on railways—its selection requires much the same kind of knowledge and care as would that of an ironmonger's stock of goods. Dilate as we may about form, weight, and quality of rails, weight and fastening of chairs, bearings of sleepers, &c., all these matters were practically settled years ago in the practice of the earlier railway engineers. We may modify a little here, and enlarge a little there, but we are, after all, following so nearly in the old track, that no "outside" observer could tell the difference. A rail is a rail, after all, and the best article in that line is, we fear, no better than, if as good as, the thoroughly worked and soundly welded bars turned out thirty years ago. We may own to more or less professional interest as to steel rails, improved rail-joints, &c. &c., but no one of us thinks of laying down a long line with steel rails, or of revolutionising rail joints. We leave those matters to patentees and the Permanent Way Company, an organisation perhaps less frequently heard of since the expiration of the fish-joint patent and the final decision *in re* Harwood *v* the Great Northern, but which, we believe, is still in existence.

And as for rolling stock, what has the engineer to do but to digest the quotations of the leading builders, for no engineer would think of specifying locomotives and carriages differing substantially from the recognised patterns. There is no engineer so isolated but that he can command the most complete plans and specifications of locomotives any day he requires them. He has only to take care that they are not much too large nor much too small, much as he would in buying a hat or a pair of gloves. Locomotives are manufactured now-a-days, and well it is that they are. Their value to the world is almost directly as the readiness and facility with which they can be procured. Some builders will turn out a better job than others, but few builders, even without the interposition of an inspector, would knowingly send out engines of conspicuous inferiority. So close, too, has competition been in locomotives these many years, that an engineer would be very safe who, having sent out his specifications, accepted the tender which represented a mean between the highest and the lowest. Some engineers cannot feel that they have discharged their proper functions until they have dictated something out of the common course with respect to a boiler, a safety valve, a piston, an axle, or a tyre, but, in the end, their pet preferences are resolved into the orthodox modes. In our own case we have had occasion to pay especial attention to locomotive practice, but we cannot point to any substantial improvement which has been made, within the last ten years, in that noble machine. A sheet iron shield has been intruded within the fire-box, and a hollow stay-bolt tapped in here and there, and the result is that coal is burnt with a moderate but indictable production of smoke. We have begun to use steel tyres, and, here and there, steel axles, and so we have begun to wear ventilating hats and to carry rotatory umbrellas, but in neither case is there a novelty in the essential construction.

We might go through every detail of railway construction and equipment and we should merely find that each was of much importance, but that with the conclusive arrangements which have already been made, no field was left open for extensive selection. It is well that this is so. The great principles of our practice being determined, our services to society are all the more comprehensible, and more likely, therefore, to be in request.

At a late meeting of the Archæological Institute Captain Windus, R.I.N., read an account of a great carrack, or man-of-war, built by the Knights of St. John, at Nice, in 1530. It was one of the fleet sent by the Emperor Charles V., in 1535, against Tunis. She was named the Santa Anna, and attracted much attention from her size, armament, and fittings. She had six decks; her crew was 300 men; she had a chapel, hall of reception, &c., and they served the crew with fresh bread daily. One remarkable fact of her construction was that she was sheathed in lead up to her bulwarks, and was impenetrable to the artillery of that day. The lead was attached with brass bolts. She was the La Gloire or the Warrior of her day. The account of her was to be seen in Bosio, and the huge carrack figures in the frescoes of the Palace of the Knights Hospitallers at Rome.

LITERATURE.

A Course of Elementary Mathematics. By John Radford Young, formerly Professor of Mathematics in Belfast College. London: W. H. Allen and Co., Leadenhall-street. 1861.

Those of our readers who have enjoyed the benefit of a comprehensive mathematical training—and there are but few branches of our profession in which such a training can be wisely dispensed with—will remember through how many difficult and often ponderous volumes he had to plod his weary way. Reverting for a moment to our own early years our memory recals a goodly library. "Euclid's Elements," Wood's "Algebra," Hymer's "Trigonometry," O'Brien's "Co-ordinate Geometry," Hymer's "Analytical Geometry of Three Dimensions," Woolley's "Descriptive Geometry," Snowball's "Mechanics," Whewell's "Dynamics," Webster's "Hydrostatics," Miller's "Hydrodynamics," Hall's "Differential and Integral Calculus," Moseley's "Engineering and Architecture," and Willis's "Principles of Mechanism," to say nothing of works on the steam engine, optics, and so forth, treated mathematically, or of others which we have probably forgotten in this hasty retrospect. Doubtless very many of our readers could at once recite a parallel list of treatises which formed part of their "first course" as students, and a few may be able to add largely to the number.

Now there are several evils associated with this distribution of one's study over so many different works. The first, and probably the least, of them is the unnecessary expense which has to be incurred. Another is the confusion produced in the student's mind by differences in the style, and often in the notation also, of the various authors. Then, again, it often happens that the various treatises overlap each other, so that time is wasted in extricating the thoughts from the books sufficiently to enable the mind to pursue a clear course of study steadily and progressively, and without loss of time. Finally, your studies are embarrassed throughout by the absence of that frequent reference to particular theorems and problems already studied, which is so serviceable to the student in a mathematical work whenever an author is wise enough to provide it. This last is a very important consideration. The mathematical sciences are so essentially progressive in themselves, and so intimately blended together, that it is impossible to pursue the study of them without keeping up a constant reference to doctrines or principles which have been previously established. The necessity of this is so obvious that we need not dwell upon it a single moment. It is manifest, however, that where you are driven from author to author every time you take up a new branch of study it is absolutely impossible to have the natural connection of subjects and parts of subjects kept up in the mind. We are quite aware, of course, that familiarity with the modes and views of different thinkers gives breadth to our knowledge. But this advantage should be sought after an elementary course of study has been completed; the young student is in no position to profit by discursiveness. His first business is to advance steadily along the highway of science; the time for exploring its byways will come afterwards.

In the work before us we have a course of mathematics, written by a single author, costing less than some of the treatises on single subjects mentioned above, preserving a consistent notation from one end to the other, avoiding repetition, and keeping up a continuous connection between subject and subject as they are successively developed. These, it will be acknowledged, are admirable characteristics to begin with. They create a strong *primâ facie* claim in favour of the work; but in this respect it is not, perhaps, altogether unexampled. It possesses other qualities, however, which fairly demand for it, in our judgment, a pre-eminent place among mathematical courses.

But before mentioning these it will be well to explain what the volume does and does not contain. It does not, of course, treat of many of the subjects named in the list of books given in our first paragraph. It is a purely mathematical treatise, and the author does not travel out of a strictly mathematical sphere. Common arithmetic and "Euclid's Elements of Geometry" are likewise excluded from it—the former, because it may be studied with all needful advantage from the ordinary manuals in popular use; the latter, because it is a distinct work of itself, "universally known and esteemed, and everywhere to be easily procured." The author has rightly judged that to insert either Euclid's treatise or one upon common arithmetic in the present volume could be of no possible benefit to the learner. It begins, therefore, with Algebra, which is followed by Plane and Spherical Trigonometry, Mensuration and Analytical Geometry; then come Statics, Dynamics, and Hydrostatics; then the Differential and Integral Calculus; and, finally, a series of applications of the Calculus to Mechanics.

Professor Young has long been known, and celebrated too, as a mathematical reformer, basing his reforms upon a fundamental belief with which we entirely and most heartily concur. He believes that the study of mathematical analysis should be prosecuted in the same spirit as the study of Euclid—that the reasonings of analysis equally with those of geometry should produce irresistible conviction, and that assent to every result of such reasoning should be compelled rather than yielded—"wrung from the reader, and not coaxed from him." He contends that every mathematical inquiry should be entered upon by the student in a sceptical spirit: "he should admit just so much as he is obliged to admit, and no more; and due watchfulness should always be exercised over the symbols he employs, lest, from his relaxation of the necessary constraint, they conduct him beyond the regions of common sense." The author anxiously—almost unnecessarily so, as it seems to us—asserts and re-asserts this view, and insists upon the necessity of bearing it in mind. If the reader should suppose that all our elementary works of repute provide against such errors (which but few readers who have been attentive students of mathematics are likely to do, we think), the author would refer him to many

instances of them. Even in so common-place a subject as the Binomial Theorem it is marvellously easy to go wrong. How many students of ordinary mathematical works are there, he asks, who would not unhesitatingly affirm that the following equation holds universally, for all values of x and a?—

$$(a+x)^{-2} = \frac{1}{a^2}\left(1 - \frac{2}{a}x + \frac{3}{a^2}x^2 - \frac{4}{a^3}x^3 + \frac{5}{a^4}x^4 - \frac{6}{a^5}x^5 + \ldots.\right)$$

Yet whoever affirms this must necessarily affirm also that—

$$(1+1)^{-2} = \tfrac{1}{4} = 1 - 2 + 3 - 4 + 5 - 6 + \ldots$$

which is a palpable absurdity!

Again, says the author: Take the subject of the Reversion of Series, which is sometimes applied to develope a root of an algebraic equation; how many are there—guided by their books—who, if required thus to develope x in terms of y from the equation $y = x + x^2 + 2$, or $y - 2 = x + x^2$, would hesitate to affirm that

$$x = (y-2) - (y-2)^2 + 2(y-2)^3 - 5(y-2)^4 + \ldots.?$$

But let $y = 1$: the statement then becomes

$$x = -1 - 1 - 2 - 5 - \ldots.$$

and yet x is known to be imaginary! "All such apparent discrepancies and contradictions may easily be reconciled. Algebra is not in the slightest degree chargeable with them, yet—there they are."

Nor is it by any means in algebraical works only that the due watchfulness over symbols, of which the author urges the necessity, is requisite. Every one who has studied Mechanics will have found himself stumbling at some time or other—pretty often, many of us—over the mysterious meanings which they sometimes assume in that department of study. No better illustration of this can be given than that which Professor Young adduces. Let a person tolerably familiar with algebra take up at random a modern treatise on dynamics. He may chance to light on one in which he will find such terms as Mass, and Weight, and Velocity, and Acceleration clearly and well defined. He is told that gravity produces an acceleration of velocity of 32ft. and a fraction per second in the latitude of London; that g is the recognised symbol for this quantity, that M stands for mass, and W for weight. Keeping all this in mind, he reads on a few pages, perhaps, smoothly enough, till he is suddenly arrested by the staggering statement that "$W = Mg$." If, as is no doubt often the case, the reader has been intent exclusively upon his symbols, this conclusion may come out naturally enough; but if he has connected them in his mind with the things signified, he must find it a serious perplexity.

The impediments which this slovenliness on the part of mathematical writers often throws into the path of the student are fearful. Professor de Morgan, in a sentence quoted by the author, speaks of the confusion created in his mind when a student by the definition of accelerating force which has become generally received. "Accelerating force, which any one would suppose to be the force which accelerates, is no such thing; it is the effect produced—the very acceleration itself." Well do we ourselves remember the trouble which this phrase at first occasioned us. So serious are the evils which this kind of thing produces that it is doubtful whether the great body of students ever altogether escape them. At any rate, many authors of works on science do not. We could name several treatises in which the most manifest incongruities are not only introduced, but paraded from one end of them to the other. A very common blunder indeed is to connect quantities of different dimensions, and not unfrequently of different natures, by plus or minus signs.

It is, therefore, in our judgment, a very gratifying circumstance to have put into our hands this comprehensive volume, by a most competent author, in which special care has been taken not to play fast and loose with the student, and not to stagger him with solecisms. There is, moreover, another feature in the present work which adds greatly to its value. The author has laboured throughout to relieve the student from the monotony of merely moving symbols about, and to show him, to some extent, the practical uses to which those symbols may be put from time to time as he advances. Where ordinary verbal matter can be made available in the elucidation of a subject, he does not scruple to employ it. He says many modern writers have a great aversion to put what is called "talk" into their mathematical books; but he has no such prejudice. The reason is plain and conclusive: "An ardent and intelligent student, who naturally expects, by devoting himself earnestly to the work, to gain something more from the study of analysis than a mere expertness in manipulating symbols, is apt to get weary of this unprofitable exercise; and knowing, as he must do, that *this is not mathematics*, becomes disheartened, from misgivings that his own mind is inadequate to the undertaking, that he has no talent for mathematics, nor sufficient acumen to penetrate its mysteries; whereas, in truth, there are no mysteries to penetrate."

This concluding phrase of Professor Young's—"*there are no mysteries to penetrate*"—if employed by a superficial writer would stamp him as unfit to instruct others; but employed by him, it is the best possible guarantee of his serviceableness as a teacher. It is because he has fathomed every part of his subject so thoroughly that he makes this declaration; and the man who has seen so-called mysteries through and through is the very best person to clear them up for us. It may be desirable to state, in this connection, that the author is not by any means a mere reviser of the labours of other men. Interspersed throughout this volume there are numerous new mathematical developments of a very high order which we owe entirely to him, and which it would be difficult to parallel, either for number or excellence, from the works of any other modern mathematician. This is saying a great deal, we know; but it is not more than we honestly believe to be due. We might illustrate the truth of it had we the necessary space at our disposal; but the extensions and improvements introduced are far too numerous to admit of that.

We must, however, direct the attention of such of our readers as may possess themselves of this admirable work to the highly satisfactory manner in which the Differential Calculus is here commenced and developed. Under the hands of the author this profound and all-important study is entirely stripped of its difficulties. All that (which may be properly called) "talk" about the ratios of nothing to nothing, and of infinitesimals to infinitesimals, with which so many writers have clouded the subject, he sweeps utterly away. It is to be regretted, he truly says, that in one of the most interesting and important branches of analysis, and one, too, the elements of which are far from difficult, the learner should be embarrassed at the very threshold by metaphysical subtleties repugnant to all his previously-acquired notions of mathematical accuracy and logical consistency. He asks for nothing more, therefore, when he comes to deal with differentials than the student has already become familiar with in vanishing fractions. The theory of vanishing fractions has, it is true, to be extended here, but it has not to be modified, still less has it to be overthrown. We cannot refrain from quoting the substance of the author's arguments upon this point, for they will be found full of interest to every one who has studied the Calculus, and will at the same time serve to justify the warmth of our admiration of the author's style:—

It is sometimes said, in reference to such equations as those marked [2]*, that if $d\,y$, $d\,x$, are each zero, we have divided 0 by 0, and have, therefore, no more right to put any one thing for the quotient than any other, for $\frac{0}{0}$ means anything. But the results [2] have not been obtained by any such division of 0 by 0: they have been arrived at, in each case, by dividing $F(x + \Delta x) - F(x)$ by Δx, and by this operation only. The result is a general expression, over the form of which—implying a law that all the particular cases of it must conform to—we have no control; but over the particular cases themselves, so far as their values depend on Δx, we have complete control, inasmuch as Δx is not fixed by any condition, but is free to take any value we may please to give it. Our aim has then been to select from the innumerable series of possible or admissible values—all conforming to one and the same law—that which would be the last or ultimate value in this series, if it were formed by first giving to Δx some finite value k, as small as we please, and then continuously diminishing k down to $k = 0$; the value of the ratio thus obtained terminates the entire series of values, and continuously unites with the individuals of that series in as strict obedience to the law of the general expression. It has been objected, however, that this is to change the original hypothesis: to make that (namely, Δx) 0 at the end of an operation, which at the beginning was a finite quantity. But there was no "original hypothesis" as to the value of Δx: this quantity Δx (or h) was designedly left free from *all* restriction as to value at the outset, *in order* that at any subsequent stage we might, without violating any previous restriction, give to it any value we chose, and with a view, of course, to its *ultimate* value, 0. It must not be overlooked that the fundamental operations of algebra—though called by arithmetical names—are quite free from arithmetical restrictions: $(x^2 + a\,x) \div x$ is $x + a$, and would still be $x + a$, though there were no such thing as arithmetic in existence; as it is thus universally true, it is true when the symbols stand for numbers—any whatever; so that when $x = 0$, $(x^2 + a\,x) \div x = a$, whatever number is put for a. We thus see that the differential coefficient $\frac{d\,y}{d\,x}$ derived from any function y of x, is not so derived by dividing 0 by 0; it is derived by dividing the algebraic quantity $\Delta\,y$ by the algebraic quantity $\Delta\,x$, and then giving to $\Delta\,x$ the arithmetical interpretation $\Delta\,x = 0$. Having thus found the true value (say $f(x)$) of the vanishing fraction $\frac{d\,y}{d\,x}$, we are justified *then* in writing $\frac{d\,y}{d\,x} = f(x)$, and consequently in writing $d\,y = f(x)\,d\,x$. This is more than stating the truism $0 = 0$—it is conveying the information that the zero $d\,y$ comes to be zero by multiplying the zero $d\,x$ by the factor $f(x)$, and in no other way. Those who object to regard $d\,y$, $d\,x$ as *zeros*, call them *infinitesimals*; which in reality is only using a long word for a short one: an infinitesimal has no finite value; and this is all that can be said of zero, which, however, is the preferable term, because it is more precise.

It remains for us to express our surprise that the author, whose avowed, and, for the most part, well-sustained design is to wring assent to his propositions from the reader, should have claimed for the three laws of motion all the force of self-evident truths. We know very well that D'Alembert put forward what he considered an *à priori* demonstration of the first law, and that Professor Playfair endeavoured to do the same thing in a more mathematical manner. But we know, also, on the other hand, that Poissin, who has seldom been surpassed as a mathematician, declared that "we cannot affirm *à priori* that the velocity communicated to a body will not become slower and slower of itself, and end by being entirely extinguished: it is only by experience and induction that this question can be decided." And this view of Poissin's is the accepted view of most modern philosophers. We should be sorry to go to the length to which Mr. John Stuart Mill proceeds, and assert that all science is of necessity inductively obtained in the first instance; but when we remember that from the time of Aristotle down to that of Galileo it was believed that all bodies in motion had, by their own nature, a constant tendency to move more and more slowly, so as to stop at last, from some inherent cause of fatigue—we say, remembering this, we find it impossible to go farther than Dr. Whewell when he says, "though the discovery of the first law of motion was made, historically speaking, by means of experiment, we have now attained a point of view in which we see that it might have been certainly known to be true, independently of experience." "This law," he adds, "in its ultimate form, when completely simplified, and steadily contemplated, assumes the character of a self-evident truth." It seems to us rather unlikely that a doctrine which it took men ages of existence and numerous refined experiments to find out, and which even now philosophers themselves cannot see to be evidently true without its being completely simplified and steadily contemplated, should wring a ready assent from every student of this elementary course of mathematics. We may be taking a harsh view of the matter, but this certainly seems to us a serious blemish in Professor Young's excellent, aye unrivalled, work.

* These equations need not be given. They merely express values of $\frac{d\,y}{d\,x}$ derived from certain equations, from which the reasoning of the author starts in expounding the nature of the differentialing process. The careful reader will have no difficulty in following the author's meaning through the passage quoted.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

2702. JOHN WATT, Lorrimore-street, Walworth, Surrey, and THOMAS SMAITH HAVISIDE, Cornhill, London, "Improvements in the manufacture of soap."—*Petition recorded 29th October*, 1861.

126. BARROW MOSS, Liverpool, "The application of steatite, either alone or in combination with other substances, to the manufacture of bricks, fire-bricks, the lining of furnaces, and other similar purposes."—*Petition recorded 17th January*, 1862.

356. WILLIAM WOOD, Monkhill, Pontefract, Yorkshire, "Improvements in the process of manufacturing pomfret or liquorice cakes."—*Petition recorded 11th February*, 1862.

384. THOMAS DAVISON, Belfast, Antrim, Ireland, "Improved means for preventing the corroding of steam boilers."—*Petition recorded 13th February*, 1862.

403. THOMAS RENISON, Glasgow, Lanarkshire, N.B., "Improvements in water closets."

404. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in electro-magnetic time-keepers."—A communication from John Henry Koosen, Dresden, Saxony.

407. JOSEPH WALL and THOMAS DODD, Liverpool, "Improvements in the construction and arrangement of apparatus for regulating the flow or passage of fluids."

409. THOMAS HORSLEY, Coney-street, York, "Improvements in apparatus for turning and closing the cartridges of breech-loading fire-arms."

410. JOHN COOKE, Willington, Durham, "Improvements in the method of propelling ships and other vessels."

411. DAVID DUNNE KYLE, Victoria-street, Westminster, "An improved method of communicating or signalling in and with railway trains."

413. JOHN CHATTERTON, Highbury, and WILLOUGHBY SMITH, Dalston, London, "Improvements in telegraph cables."

417. JONATHAN RUSSELL, Westbury Villa, Camberwell, Surrey, "Improvements in the method of raising sunken, submerged, or stranded vessels."—*Petition recorded 15th February*, 1862.

419. HUGH CRAWFORD, JAMES CRAWFORD, ROBERT CRAWFORD, and ROBERT TEMPLETON, Beith, Ayrshire, N.B., "Improvements in looms for weaving."

421. JOHN WHITAKER, Leigh, Lancashire, "Improvements in machinery or apparatus for pulping roots."

422. JAMES JOHN VAN DEN BERG, Hague, Netherlands, "A new fire lighter."

425. JAMES COMBE, Belfast, "Improvements in machinery for winding cops, and in the treatment of cops for warps and other purposes."—*Petitions recorded 17th February*, 1862.

427. JOHN HENRY HASTINGS and JAMES FREEZER, Holkham, and JOHN WOODS, jun., Wells, Norfolk, "Improvements in ploughs."

428. RICHARD WATKINS, Lower Belgrave-place, Pimlico, London, "Improvements in oil and spirit lamps, and in the means of producing light therein, parts of which improvements are applicable to lamps generally."

431. WILLIAM CLARK, Chancery-lane, London, "Improvements in gas apparatus used for lighting cigars and other tobacco."—A communication from Pierre Duchamp, Boulevart St. Martin, Paris.

432. MICHAEL HENRY, Fleet-street, London, "Improvements in cartridges."—A communication from Jules Lemoine, Rue Saint Paul, Paris.

433. WILLIAM BUSH, Tower Hill, London, "Improvements in omnibuses and other carriages."—*Petitions recorded 18th February*, 1862.

460. RICHARD HUME SKELLERN, South-terrace, Hatcham Park, Surrey, "An improved self-inking hand stamp or press."

462. JOHN STANDISH and JOHN GOODEN, Egerton, near Bolton, Lancashire, "Improvements in machinery or apparatus for stripping or cleaning the flats of carding engines."—*Petitions recorded 21st February*, 1862.

470. WILLIAM ASHTON, Manchester, "Certain improvements in machinery or apparatus employed in the manufacture of braids, and similar articles."

472. JAMES KIRKWOOD, Paisley, Renfrewshire, N.B., "Improvements in looms for weaving."

474. JOHN MILLINGTON, Oaken Gates, Shropshire, "A new or improved hearse or bier."

476. CHARLES HENRY JULIUS WILLIAM MAXIMILIAN LIEBMANN, Huddersfield, Yorkshire, "Improvements in felted fabrics suitable for carpets and other similar purposes, and in the apparatus employed therein."

480. GEORGE BLAKEY, SAMUEL BLAKEY, and JOHN BLAKEY, Liverpool, and BENJAMIN WHITE, Birkenhead, Cheshire, "Improvements in leggings or gaiters."

484. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improvements in burners for heating by gas."—A communication from Carsten Richard Meyn, Carlshütte, Rendsburg, Holstein.—*Petitions recorded 22nd February*, 1862.

486. GEORGE WEST, Chapel-place, Long-lane, Borough, Surrey, "Improvements in the construction of washing machines."

490. THOMAS BLAIR, Carlisle, "Improvements in machinery or apparatus for cutting, chopping, and breaking refined lump sugar and other substances."

492. THOMAS NESHAM KIRKHAM, West Brompton, and VERNON FRANCIS ESSON, Highgate, Middlesex, "Improvements in bleaching and dyeing yarn and thread when in the form of cops or otherwise wound."

498. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in the joints or chairs of the permanent way of railways."—A communication from Raymond French, Seymour, Connecticut, and William Goddard, Boston, Massachusetts, U.S.—*Petitions recorded 24th February*, 1862.

500. JEREMIAH WOODROW, Oldham, Lancashire, "A certain improvement in the manufacture of hats or coverings for the head."

502. JOHN PIDDINGTON, Gracechurch-street, London, "An improved machine for shelling or husking all kinds of grain.—A communication from Melchior Nolden, Frankfort on the Maine.

504. EDWIN BLISS, Percival-street, Clerkenwell, and HENRY LAMPLOUGH, Holborn-hill, London, "Improved means for viewing microscopic photographs and other minute objects."—*Petitions recorded 25th February*, 1862.

518. GEORGE DAVIES, Serle-street, Lincoln's-inn, London, "Improvements in emptying or draining the water from carcening docks in maritime ports."—A communication from Pierre Lucien Fontaine, Paris.

520. AGATHE DESIREE DUPARET, Paris, "Improvements in the ornamentation of tissues."

522. JAMES HENRY BENNETT, Blackburn, Lancashire, "Improvements in steam generators, and in engines to be worked by atmospheric pressure or steam and air combined."

524. JOHN CLIFF, Imperial Potteries, Lambeth, Surrey, "Improvements in glazing stoneware, red clayware, porcelain, and other kinds of earthenware."

526. CHARLES LOUIS KNOLL, Tottenham-court-road, London, "Improvements in pianofortes."

528. EDWIN GEORGE BRUZAUD, Pembroke-road, Kensington, Middlesex, "Improvements in pianofortes."

530. JOHN MEDHURST, Lower Queen-street, Rotherhithe, Surrey, "Improvements in apparatus for reefing and furling the top sails, courses, and other square sails of vessels."—*Petitions recorded 26th February*, 1862.

532. GEORGE TORR, Bucks-row, Whitechapel, London, "Improvements in, and an improved apparatus for, manufacturing and reburning animal charcoal."

534. CHARLES CLARK, City-road, London, "Improvements in tea and other trays for the table."

538. SIR CHARLES TILSTON BRIGHT, Victoria-street, Westminster, "Improvements in electric telegraphs, and in apparatus connected therewith, and employed in the manufacture thereof."

542. WILLIAM STUART WOOD, Larchfield Foundry, Leeds, Yorkshire, "Improvements in valves for regulating the flow of steam, water, or other fluids, and in means or apparatus for working or actuating them direct from the governor, or when worked by expansion cams in connection therewith."—*Petitions recorded 27th February*, 1862.

Invention Protected for Six Months by the Deposit of a Complete Specification.

573. PIERRE REMOND, Rue de l'Echiquier, Paris, "Improvements in double rein bridle bits."—*Deposited and recorded 3rd March*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

580. JOHN LEIGH, Manchester.—Dated 5th March, 1859.

584. WILLIAM PEACOCK SAVAGE, Roxham, Downham Market, Norfolk.—Dated 5th March, 1859.

601. ADAM BOOTH, sen., and ADAM BOOTH, jun., Manchester.—Dated 8th March, 1859.

642. ALFRED TYLOR, Warwick-lane, Newgate-street, London.—Dated 14th March, 1859.

598. JOHN PRETTY CLARKE, King's-street Mills, Leicester.—Dated 7th March, 1859.

647. THOMAS PATSTONE, Birmingham.—Dated 14th March, 1859.

610. JOHN ALLIN WILLIAMS, Baydon, Wiltshire.—Dated 9th March, 1859.

643. THOMAS LIGHTFOOT, Accrington, Lancashire.—Dated 14th March, 1859.

670. HENRY BESSEMER, Queen-street-place, New Cannon-street, London.—Dated 16th March, 1859.

655. JOHN DIXON and ROBERT CLAYTON, Bradford, Yorkshire.—Dated 16th March, 1859.

Patents on which the Stamp Duty of £100 has been paid.

505. WILLIAM WEILD, Manchester.—Dated 7th March, 1855.

504. JOSEPH COOPER, Birmingham.—Dated 7th March, 1855.

538. SAMUEL CUNLIFFE LISTER, Manningham, near Bradford, Yorkshire.—Dated 9th March, 1855.

618. William Smith, Little Woolstone, Fenny Stratford, Buckinghamshire. —Dated 19th March, 1855.

Notices to Proceed.

2691. William Taylor, Newport Pagnell, Buckinghamshire, "Improvements in joints or connections for metal and other pipes and tubes."—*Petition recorded 26th October*, 1861.

2702. John Watt, Lorrimore-street, Walworth, Surrey, and Thomas Snaith Haviside, Cornhill, London, "Improvements in the manufacture of soap."

2708. William Holland Furlonge, Mark-lane, London, "Improvements in the condensation of steam by surface contact."—*Petitions recorded 29th October*, 1861.

2726. Eugene De Bassano and Adolphe Brudenne, Brussels, Belgium, "Improvements in the manufacture of stearine."—*Petition recorded 31st October*, 1861.

2733. George Norman, St. Matthias-place, Stoke Newington-green, Middlesex, "Improvements in the mounting of 'cots or cradles.'"—*Petition recorded 31st October*, 1861.

2742. James Higgins and Thomas Schofield Whitworth, Salford, Lancashire, "Improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning."

2744. Robert Mushet, Coleford, Gloucestershire, "An improvement or improvements in the manufacture of cast steel, or homogeneous iron."—*Petitions recorded 1st November*, 1861.

2755. Thomas Walker, Robert-terrace, King's-road, Chelsea, London, "Certain improvements in the construction of cables or chains for telegraphic and other purposes, and for machinery connected therewith."

2757. John French, Manchester-road, Bradford, Yorkshire, "Improvements in machinery or apparatus for doubling or twisting yarns of worsted or other fibrous substances."

2759. Samuel Osborne, Bayswater, London, "Improvements in hooped skirts."

2763. Thomas Spencer, Prescot, and Thomas Robinson, St. Helen's, Lancashire, "Improvements in machinery or apparatus for making pipes and other articles of earthenware, and in the form of pipes for gas, sewage, and other purposes."—Partly a communication from Alfred Delafol, Paris. —*Petitions recorded 2nd November*, 1861.

2771. John Ashley, Grosvenor-place, Bath, "Improvements in apparatus for attaching horses to carriages."—*Petition recorded 4th November*, 1861.

2772. Robert Wilson, Patricroft, Manchester, "Certain improvements in steam hammers, and in valves applicable to the same, and to other steam engines."

2775. William Hall, Calais, France, "Improvements in the production of curved and other forms in articles of lace."

2777. Richard Fethney, Manchester, "Improvements in machinery or apparatus for preparing, spinning, or doubling cotton, silk, and other fibrous materials, parts of which improvements are applicable for winding and other purposes."—*Petitions recorded 5th November*, 1861.

2790. Frederick George Stuber, St. James'-road, Brixton, Surrey, "An improved hygrometer for measuring the humidity of the atmosphere, dampness of beds, garments, and for other similar purposes."—*Petition recorded 6th November*, 1861.

2801. John Barrow, Dalton Chemical Works, West Gorten, near Manchester, "Improvements in the manufacture of benzole, naphtha, naphthaline, aniline, and carbolic acid."—*Petition recorded 7th November*, 1861.

2804. Henry Montucci, Rue du Sentier, Paris, "Improvements in apparatus for goffering or embossing stuffs in high relief."—*Petition recorded 8th November*, 1861.

2814. Robert McNair, Glasgow, Lanarkshire, N.B., "Improvements in casings for stitching machines, and in adapting the same for writing."

2821. Edward Loysel, Cannon-street, London, "Improvements in match boxes or cases."—*Petitions recorded 9th November*, 1861.

2835. William John Hay, Southsea, Hampshire, "Improvements in protecting iron and wooden ships, caissons, dams, and other wooden or iron structures from decay, and from fouling by vegetable and animal matters, and in preparing the materials employed therein."

2837. George Davies, Serle-street, Lincoln's-inn, London, "Improvements in bleaching cotton and other textile fabrics or materials, and in the apparatus employed in such process."—A communication from Edouard Turpault, Paris.—*Petitions recorded 12th November*, 1861.

2852. Joseph Booth, Thomas William Chambers, and James Chambers, Bury, Lancashire, "Improvements in looms for weaving."—*Petition recorded 16th November*, 1861.

2996. Samuel Amphlet, Birmingham, "An improvement or improvements in ornamenting surfaces."—*Petition recorded 27th November*, 1861.

3015. Edward Tyer, Old Jewry Chambers, London, "Improvements in electric telegraphs."—*Petition recorded 29th November*, 1861.

3028. John Henry Glew, Howland-street, Fitzroy-square, London, "Improvements in machinery or apparatus for sewing or stitching."

3033. Watson Duchemin, Charlottetown, Prince Edward's Island, "Improvements in blocks for hoisting."—*Petitions recorded 3rd December*, 1861.

3220. John Francis Harvey, Strand, London, "Improvements in umbrellas and parasols."—*Petition recorded 24th December*, 1861.

3270. William Edward Newton, Chancery-lane, London, "Improved apparatus for obtaining motive power from explosive compounds."—A communication from Eugène Barsonti and Felix Matteucci, Florence, Italy.—*Petition recorded 31st December*, 1861.

99. James Garth Marshall, Leeds, Yorkshire, "Improvements in the preparation of flax, hemp, and other fibres, previous to being spun."—*Petition recorded 13th January*, 1862.

111. James Garth Marshall, Leeds, Yorkshire, "Improvements in the machinery and process for producing fibre from woven and other textile fabrics."—*Petition recorded 14th January*, 1862.

116. Henry Duncan Preston Cunningham, Bury, Gosport, Hampshire, "Improvements in means or apparatus for protecting screw propellers from entanglement, or being fouled by ropes or other bodies, also improvements in means or apparatus for closing up the screw aperture."—*Petition recorded 15th January*, 1862.

102. William Tozer, Gracechurch-street, London, and Archibald Read, Walworth, Surrey, "Improvements in boots and shoes."—*Petition recorded 21st January*, 1862.

226. William Edward Newton, Chancery-lane, London, "Improvements in engines to be employed for pumping or forcing air or water, or for other purposes where a rectilinear motion is required."—A communication from Wellington Lee, New York, U.S.—*Petition recorded 28th January*, 1862.

231. Francois Delamare De Boutteville, jun., Fontaine-le-Bourg, Seine Inférieure, France, "Improvements in machinery applicable to the spinning of fibrous substances."

233. John McKean and James Garbott, Walmer Bridge Mills, near Preston, Lancashire, "Improvements in sizeing or dressing yarns or textile materials."—*Petitions recorded 29th January*, 1862.

275. Friederich Wilhelm Daehne, Swansea, Glamorganshire, "Improvements in furnaces used in the manufacture of zinc"—*Petition recorded 1st February*, 1862.

327. Alexander McKenzie and Francis Pantuel, Glasgow, Lanarkshire, N.B., "Improvements in sewing machines."—*Petition recorded 7th February*, 1862.

355. William Lyall, Amiens, France, "Improvements in machinery for preparing flax, hemp, and other fibrous substances."—*Petition recorded 11th February*, 1862.

396. Samuel Benjamin Whitfield, Birmingham, "Improvements in the manufacture of iron bedsteads, and in the manufacture of ornamental iron tubes or columns for the construction and ornamentation of iron bedsteads."—*Petition recorded 14th February*, 1862.

427. John Henry Hastings and James Freezer, Holkham, and John Woods, Wells, Norfolk, "Improvements in ploughs."—*Petition recorded 18th February*, 1862.

460. Richard Hume Skellern, South-terrace, Hatcham Park, Surrey, "An improved self-inking hand stamp or press."—*Petition recorded 21st February*, 1862.

509. John Imray, Westminster Bridge-road, Lambeth, Surrey, "Improvements in hinges."—*Petition recorded 25th February*, 1862.

578. Sir Charles Tilston Bright, Victoria-street, Westminster, "Improvements in electric telegraphs, and in apparatus connected therewith, and employed in the manufacture thereof."—*Petition recorded 27th February*, 1862.

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 8th March, 1862.

1885, 10d.; 1886, 3d.; 1887, 1s. 4d.; 1888, 6d.; 1889, 3d.; 1890, 6d.; 1891, 10d.; 1892 3d.; 1893, 3d.; 1894, 1s. 1d.; 1895, 3d.; 1896, 3d.; 1897, 10d.; 1898, 1s.; 1899, 10d.; 1900, 3d.; 1901, 3d.; 1902, 3s. 8d.; 1903, 3d.; 1904, 1s. 5d.; 1905, 1s. 11d.; 1906, 10d.; 1907, 5d.; 1908, 3d.; 1909, 5d.; 1910, 3d.; 1911, 3d.; 1912, 5d.; 1913, 3d.; 1914, 7d.; 1915, 3d.; 1916, 10d.; 1917, 3d.; 1918, 7d.; 1919, 10d.; 1920, 3d.; 1921, 10d.; 1922, 7d.; 1923, 3d.; 1924, 3d.; 1925, 10d.; 1926, 5d.; 1927, 1s. 2d.; 1928, 1s.; 1929, 7d.; 1930, 3d.; 1932, 7d.; 1933, 7d.; 1934, 5d.; 1935, 3d.; 1936, 4s. 2d.; 1937, 6d.; 1938, 3d.; 1939, 7d.; 1940, 3d.; 1941, 6d.; 1942, 10d.; 1943, 1s. 1d.; 1944, 10d.; 1945, 6d.; 1946, 3d.; 1947, 3d.; 1948, 1s. 4d.; 1949, 3d.; 1950, 7d.; 1951, 3d.; 1952, 6d.; 1953, 7d.; 1954, 3d.; 1955, 7d.; 1956, 8d.; 1957, 7d.; 1958, 3d.; 1959, 7d.; 1960, 6d.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for The Engineer, *at the office of her Majesty's Commissioners of Patents.*

Class 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2091. T. Green, *Leeds, and* R. Mathers, *Stoke Newington-green*, "*Transmitting motion to machinery.*"—*Dated 21st August*, 1861.

This invention has for its object improvements in apparatus for transmitting motion to machinery. For this purpose, when transmitting motion from one grooved or plain pulley to another grooved or plain pulley, by an endless band or strap, an intermediate pulley on which is interposed in such manner that the opposite parts of its periphery are in contact with part of the periphery of the driving pulley, and part of the periphery of the pulley which is driven. When the driving and driven pulleys are grooved to receive the endless band the periphery of the intermediate pulley or wheel may be plain or grooved, and be in contact with corresponding plain or grooved parts of the peripheries of the driving and driven pulleys; but when the parts of the peripheries of the driving and driven pulleys, where the endless band acts, are plain, then those parts of the peripheries which are in contact with the opposite sides of the interposed pulley or wheel are to be grooved or suitably formed to work in a groove or grooves formed in the periphery of the interposed wheel or pulley.—*Not proceeded with.*

2108. S. Elson, *Oldham*, "*Apparatus for heating the feed-water of steam boilers, superheating steam, and surface condensation.*"—*Dated 23rd August*, 1861.

According to this invention the patentee proposes that the water to be supplied to the boiler shall first be heated by means of the exhaust steam of the engine, whence it is to be forced by pumps into suitable cylinders placed in the flues leading to the chimney, the water becoming further heated by the waste heat from the furnace of the boiler. A tube or pipe of small diameter, open at the lower end, conveys the water to the bottom of each cylinder, and is so arranged as to pass through their interior, whence the water continues its passage within the cylinders to the feed pipe which conveys it to the boiler. The cylinders are kept free from the accumulation of soot or dirt by means of chains or bands passing partly, entirely, or more than one turn round them from end to end, where their extremities are attached to wheels rotating at either or both ends of the cylinders by means of a shaft and cog wheels. These chains or bands thus scrape or rub off the soot or dirt as it lodges on the exterior of the cylinders, rendering them more capable of absorbing heat and conveying it to the water within. These cylinders, in like manner, serve for the purpose of superheating steam, in which case a syphon box is placed at their lower extremity, and an iron casing combining a lever, float, balance weight, and equilibrium valve is suitably arranged in order to carry off any water that might lodge in the cylinders, and also to retain the steam. The cylinders may also be made useful for surface condensation by arranging them in conjunction with an iron vessel or suitable receptacle, and exhausting steam inside or outside the cylinders, according as they are placed either in the interior or outside the said vessel.

2113. G. T. Bousfield, *Loughborough Park, Brixton*, "*Apparatus for feeding boilers.*"—*A communication.*—*Dated 23rd August*, 1861.

This invention consists, First, in combining a Giffard injector, and the suction pipe thereof, with a valve located in the said suction pipe in such a position that it prevents the reflux of the water from the suction pipe when the steam is shut off from the apparatus. The object of the Second part of this invention is to permit the suction pipe to be filled with water, or "primed," as the patentee terms it, up the end of the steam nozzle, so that, when the steam jet is put in operation, it shall begin to act immediately upon dense water. This part of the invention consists in combining the Giffard injector, the suction pipe thereof, and the reflux valve before mentioned, with a priming nozzle fitted with a cock or valve, the combination being such that the suction pipe can be primed through the priming nozzle, and that the latter can then be closed. The object of the Third part of this invention is to procure a supply of water for priming the suction pipe by the occupation of the injector, and it consists in combining the second part of this invention with a tank by means of a branch pipe leading from the discharge pipe of the injector, which branch pipe is fitted with a cock or valve, so that the tank may be replenished with water by the injector itself.

2130. H. Attwood, *Wapping-wall, London*, "*Improvements in cleansing and in feeding boilers.*"—*Dated 26th August*, 1861.

These improvements in cleaning boilers consist in placing one, two, or more conduits at about the water level; the conduits are dished on their upper surfaces, and are perforated at intervals, while curved flanges are adapted to the sides. Similar conduits are placed at the bottom of the boiler. The improvements in feeding boilers consist in supplying them from below through perforated pipes extending along the length, or nearly so, of the boilers. This arrangement is for keeping the sediment in a state of agitation, thereby causing the impurities contained in the water to rise to the surface, when it may be drawn off by the scum plate and cock. For some waters chemical agents are also used.

2131. Z. Colburn, *Tavistock-street, Bedford-square, London*, "*Arrangement and combination of high and low pressure steam engines.*"—*Dated 17th August*, 1861.

By the present invention a certain portion only, and not the whole, of the steam employed in working or driving a steam engine is to be previously worked at a higher average pressure per square inch above the atmosphere, either in another steam engine or in another separate and independent addition cylinder or cylinders of the same engine. Two facts are well known in connection with steam, to wit, that equal weights of fuel will generate nearly equal weights of either high or low pressure steam, and that steam on its discharge from the steam engine retains nearly the whole of the total heat or combined sensible and latent heat which it had on its admission to such engine. In cases, therefore, where steam engines are being worked at pressures ranging from 5 lb. to 60 lb. or 70 lb. per square inch above the atmosphere, and where more power is required with little or no sensible increase in the expenditure of fuel, or where it is desired to have the same power with a less expenditure of fuel, a part of the fuel may be applied under suitable boilers to raise steam of a pressure considerably higher than that already worked, and the high pressure steam so raised, and which may have a pressure of from 70 lb. to 250 lb. or more per square inch, is then to be worked either with or without expansion, or in a separate engine, or else in a separate cylinder or cylinders to be added to the existing engine; and this high pressure steam on its discharge from such separate engine, or such separate cylinder or cylinders, is to be allowed to mix with additional steam, by preference of a lower pressure, and the mixture is then to be admitted to and worked in the original or low pressure engine or engines in like manner as the steam ordinarily supplied to such engines. The steam may be exhausted from the high pressure engine either into the low pressure boiler, or into any vessel intermediate, between and in direct communication with the low pressure boiler and low pressure engine, or it may be exhausted into either the slide valve box, or the cylinder of the low pressure engine. The portion of steam to be worked twice over may bear any ratio desired to the whole of the steam worked in the low pressure engine, that is to say, an eighth, a half, or three-fourths, more or less, of all the steam worked in the low pressure engine may be previously made to pass at a higher pressure through the high pressure engine, or the high pressure cylinder or cylinders of the combined engine. The high pressure steam may be superheated if desired, either before its admission to the high pressure cylinder or after its escape therefrom, and while on its way to mix with the steam of lower pressure. If desired a portion only of the steam from the high pressure engine or high pressure cylinder may be permitted to mix with the low pressure steam, the rest of the high pressure steam being taken up in a small quantity of cold water, so as to heat it to a temperature equal to or greater than that at which the water is maintained in the low pressure boilers when at work. The water so heated is then to be admitted as feed water to the low pressure boilers. In this case the portion of high pressure steam to be condensed into water is to be made to pass through a condensing vessel, into which vessel is forced, by a pump or any other means, a regulated quantity of water of ordinary temperature, this quantity being sufficient only to take up as much of the steam as it is desired to condense into water, and so that the final temperature of the condensing water shall be equal to or above the temperature of the water in the low pressure boilers.—*Not proceeded with.*

Class 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2092. T. Graham, *Worthing*, "*The construction of boats, rafts, &c.*"—*Dated 21st August*, 1861.

The floating or under portion of these boats or rafts is to be formed in two, three, or more longitudinal sections, say ribbed troughs of iron, or any suitable material placed alongside, and apart from each other, and are to be so fitted as to receive and be firmly attached to and support a deck or floor projecting beyond the outside lines of these troughs, and this deck or floor is to be of a strength sufficient to support the cabins or coverings necessary for the protection of the passengers and cargo, and to protect these floating troughs from the effect of concussions at wharves, or in passing other floating bodies. The troughs are to be formed at stem and stern on the angle of exit and entry best fitted for progression through the water on which they are to navigate, and of a sufficient strength fully to resist the pressure to which they must be subjected, when submerged, by the weight of a full cargo placed on the deck or carrying platform of which they form the support; and, for further security, these troughs are to be divided from stem to stern, crossways or longitudinally, into such a number of water-tight divisions as to make submersion, without an almost total destruction of the troughs themselves, almost impossible.

2095. A. J. Mahon, *Dublin*, "*Screw or spiral propellers.*"—*Dated 22nd August*, 1861.

This invention consists in having the blade, of whatever form it may be (screw or otherwise), so constructed or arranged that it shall strike water while working at any angle that may be desired throughout its extent, and irrespective of its pitch, and also that, spaces being left next the parts of the blade placed angularly, water may pass freely through all parts of the said blade, and will be held within the perimeter of disc formed by the revolution of the blades.—*Not proceeded with.*

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2094. J. Kane, *Templemoyle, near Londonderry*, "*Treating flax, hemp, and other analogous substances which yield fibres, for the purpose of manufacturing from them fibres adapted to be spun into yarn and thread.*"—*Dated 21st August*, 1861.

For the purposes of this invention the flax-straw, hemp-straw, or other substances that yield fibre are, when being steeped in water, to be subjected to the action of certain ingredients which have for their object to induce or hasten the putrefaction of the nitrogenous and gummy matters which surround the fibres in their natural state. These ingredients, which may be used in a solid or liquid state, consists, essentially, of a nitrogenous substance or substances containing phosphoric acid or phosphates, or to which these latter are added, and which will produce ammonia by putrefaction, such as ground bones and guano, a solution of glue to which phosphates of soda or any soluble phosphate is added, or yeast. In some cases the patentee prefers using a solution of a soluble phosphate and carbonate, nitrate, or caustic ammonia, or other salt of ammonia only.

2110. R. A. Brooman, *Fleet-street, London*, "*Treating the hop plant to obtain a material resembling wool.*"—*A communication.*—*Dated 23rd August*, 1861.

The object of this invention is to produce from the hop plant a vegetable wool, or a material resembling wool. To accomplish this the plants are dried, put in trusses, and laid in sheds or barns, which must be dry and well ventilated. The plants are then sorted (for the branches and different parts produce different qualities of wool) and are passed through a crushing machine to break them up, and to crush the knots which are somewhat harder than the stalks, and contain a resinous gum more tenacious than that in the intermediate parts. The crushed plants are next submitted to the action of stamps or hammers, which beats out the resinous or gummy matter. The vegetable wool, with the waste still adhering to it, is submitted to the action of beaters, which free it from all foreign matters, and prepare it to be combed and carded previous to being spun or otherwise used in the arts or manufactures; or it may be used without being combed or carded. Among other uses it forms a valuable material for the manufacture of pulp and other purposes.—*Not proceeded with.*

2116. W. Clissold, *Dudbridge Works, near Stroud*, "*Apparatus for oiling wool.*"—*Dated 24th August*, 1861.

This invention relates to the operation of supplying oil or oleaginous mixtures to wool preparatory to its being submitted to the carding engine for the purpose of being worked into sliver, the object of this invention being to effect a uniform distribution of the liquid through the mass of the fibres under operation, and prevent the waste that is consequent on the ordinary mode of oiling wool. To this end the patentee employs a travelling brush or brushes, which, after receiving oil from a dipping plate, will transfer the same to a roller mounted above the feed apron of the carding engine, and pressing upon the wool supplied thereto. The contact, therefore, of this oiled roller with the wool that is passing under it will ensure the equal distribution of the oil over the whole surface of the wool.

2122. H. Nelson, *Manchester*, J. Carr, *Blackburn*, and G. Harrison, *Burnley*, "*Self acting mules.*"—*Dated 26th August*, 1861.

The documents relating to this invention are with the law officers under objection, and cannot at present be seen.

2126. F. Tolhausen, *Paris*, "*A new kind of artificial fur, to be made by means of the jacquard or other looms with silk or other textile material.*"—*A communication.*—*Dated 26th August*, 1861.

This invention relates to the manufacture of a kind of imitation fur resembling to all intents and purposes that called astrakan. The patentee produces this imitation fur either on the jacquard or on the common loom in the following manner:—The textile material intended for the weft, which is composed of several ends, is first sized or dressed in a gelatinous solution, then wound on tubular cops or spools which are exposed to a heat of about 150 deg. Fah., by which the fibres are curled. By using this weft, with the proper jacquard combinations, a piled or terry fabric is obtained, the weft forming the raised pile, which is then cut in the usual way. The pile or terry may also be obtained by means of the weft with what is termed a satin or satinade shed. The process is similar to that used for making velvet, and in order to cause the weft to curl the wires or knives are heated to a suitable degree, and they are also provided with a groove for guiding the knife while cutting the pile. The pile may also be cut on the under face of the fabric.

2133. L. M. J. Patureau, *Paris*, "*An improved thread protecting clew-box.*" *Dated 27th August*, 1861.

This invention relates to an improved mode of protecting sewing thread or other yarn when made up into a clew form becoming contaminated or soiled by continuous handling, dust, or other similar causes, whilst the invention at the same time prevents the thread or yarn of the clew from becoming entangled on being wound off, as often happens when unwinding the thread from a skein. For this purpose the patentee encloses each clew in a small capsule, box, or protecting case, by preference made of cardboard, fitting round the clew, and provided with a hole through which is left protruding that end of the yarn that is situated in the interior of the clew, thus allowing to wind off any suitable quantity of thread from the clew without fear of the thread becoming entangled. The box or protector he prefers making in two halves, hollow semi-spheres or shells, the rims or borders of which, being applied against each other exactly, fit together, so as fully to cover the clew inserted between them, the said rims being further glued or in any other suitable manner fixed together, but by preference by glueing all round the line of junction of the two semi-capsules or shells a small strip of paper bearing the manufacturer's trade mark, or any other suitable indication or ornament, whilst in order to allow of examining the yarn or thread of the clew whilst in the interior of the capsule or protector this latter is provided with one or more holes suitably situated for that purpose. He prefers making the clew boxes or thread protectors of cardboard, but stout paper, thin wood, sheet metal, gutta percha, leather, or other similar suitable materials, might be likewise made use of for that purpose.

2134. J. and W. Smith, *Keighley*, "*Spindles and flyers used in machinery for spinning and twisting fibrous substances.*"—*Dated 27th August*, 1861.

This improved method of attaching the flyer to the spindle consists in dispensing with screws, and forming in the top or upper part of the spindle a groove or bayonet slot, and in fixing or attaching a small pin or projection to the inside of the boss at the upper part of the flyer, which locks into the said groove or slot, and thus fixes the flyer at once without screwing.—*Not proceeded with.*

2138. R. A. Brooman, *Fleet-street, London*, "*Temples or stretching rollers for looms.*"—*A communication.*—*Dated 27th August*, 1861.

The main feature of this invention consists in effecting by one and the same temple or roller, carrying points or needles at or near each end, and extending across the loom, the regular and equal tension on the two selvages of the fabric under manufacture. The rotation of the temple roller is produced by the onward movement of the fabric, the selvages of which are seized by the points or needles, which are arranged spirally, and inclined outwards from the centre of the roller. A box for holding the temple or roller extends across the loom, and is furnished with bearings for it to revolve in. The box is held to the loom by springs secured to a cross bar, and the springs are slotted to enable the position of the temple to be adjusted. The outer ends of the temple are composed of segments made by preference of copper, tin, or other soft metal, and held on the roller by rings; the needles or points pass through the segments.—*Not proceeded with.*

Class 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

2097. B. Samuelson, *Banbury*, "*Harvesting machines.*"—*A communication.*—*Dated 22nd August*, 1861.

This invention relates to those harvesting machines in which the grain or grass, after having been severed by cutters which breast the crop, is intended to be removed out of the track by mechanical means, and is carried into effect as follows:—First, in those cases in which the cut grain or grass is allowed to fall on the ground, or on a fixed platform, the inventor places an upright shaft so that the step that carries it shall be in a line or thereabouts with the cutters on one side of them. This shaft he causes to revolve by means of any ordinary mechanical arrangements, deriving its first motion from a propelling wheel in contact with the ground; attached to this upright shaft, and revolving with it, he places arms furnished with rakes or sweepers. Around or partially around this upright shaft, but not revolving with it, he places one or more guides, so shaped that, by the contact therewith of the arms carrying the rakes or sweepers, these latter may be made to rise and fall as well as to revolve, thus enabling them to

enter the uncut crop at the proper inclination, to lay it upon the platform or the ground behind the cutters, to sweep the cut crop to one side, and to release themselves from it at the proper time. In many cases it is desirable that the rakes or sweepers should not all travel in the same path, for instance, one or more may simply bring the crop towards the cutters, but not remove it after it has fallen on the ground or platform. He effects this by so shaping the arms which carry some of the rakes or sleepers, or by attaching certain projections to them, that some may be guided into one path and others in another, in contact with one or more of the guides. Secondly, in those cases in which the cut grain or grass is allowed to fall on a travelling platform consisting of endless belts or similar contrivances which carry the cut crop to one side and deposit it; when this mode of delivery is adopted he places any convenient seat, saddle, or stand in advance, and on one side of the cutters, and at right angles, or at a less angle, with them, so that a person occupying it may be well placed for guiding or forcing the uncut crop by a rake, fork, or paddle towards the cutters and on to the travelling platforms leaving the removal of the crop, after it is cut, to be effected by such platform.—*Not proceeded with.*

2106. J. DUNN, *Alnwick*, "*Reaping machines.*"—*Dated* 23rd *August*, 1861.

This invention is carried out in practice as follows:—From a basket fixed on the side frame of the carriage is suspended a bent oscillating lever, the lower end of which is connected with the cutters; the said lever carries two pulleys placed at equal distances, one above and the other below the centre pin on which the lever moves and is suspended. To the spokes of the carriage wheels, on its inner side, is fixed a circular rack, into which the said pulleys gear. As the wheel revolves these pulleys traverse the teeth or projections on the said rack, and thus communicate to the said lever and the said teeth a reciprocating motion. By means of an ordinary slide-lever the said pulleys may be put out of gear when the knives are not required to be in use.—*Not proceeded with.*

2107. A. B. CHILDS, *New Oxford-street, London*, "*Dressing or cracking of millstones.*"—*A communication.*—*Dated* 23rd *August*, 1861.

This invention cannot be described without reference to the drawings.

CLASS 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

2120. R. W. JONES, *Cork*, "*Heating and ventilating, especially applicable to Turkish baths.*"—*Dated* 26th *August*, 1861.

By this invention the patentee proposes by flues, passages, or air chambers, peculiarly constructed and arranged between the heated floor immediately over the heating flues and under the upper floor of the sudatorium and tepidarium, to prevent accidents by burning, to which people are very liable in the hot air bath with horizontal flues constructed and covered in the ordinary way. The heating flues are connected with an ordinary furnace, over which are placed two boilers, one a circulating boiler for heating water, the other a steam boiler for generating steam or vapour, which is admitted into the hot rooms of the Turkish baths by a pipe which branches off into each room, and is regulated or controlled by separate cocks, to which again are attached perforated pipes which can be arranged in such a manner that the general and equal distribution of vapour is so completely under control that the vapour can never become disagreeable or oppressive, nor condense on the body of the bather. The hot air flues, passages, or chambers constructed between the two floors are also used to obtain an equal and even distribution of heat in every part of the hot room or sudatorium, and also in the tepidarium, and maintaining the required difference in the temperature of the two rooms, and, further, for lowering or increasing the temperature for the admission of pure oxygenised hot air for the purpose of ventilation, driving out impure air, so that the same air is not left in the room a minute, but is constantly changed, and which obviates the necessity of chilling the bather by the introduction of cold air; and this pure oxygenised hot air is also used for disposing of the vapour which is only allowed to pass over the surface of the body of the bather, to soften it, and to assist perspiration, which (the perspiration), to the great danger of the bather, is forced in the dry hot air bath. By the use of tiles of a peculiar make, which fit into each other where they join over the heating flues, the admission of gas, smoke, or any other injurious or deleterious matter is impossible, and the air is thereby preserved pure. For retaining heat fine sand is used.

2117. J. CRANSTON, *Birmingham*, "*Conservatories, orchard houses, and other horticultural erections.*"—*Dated* 24th *August*, 1861.

This invention applies to horticultural buildings to be constructed of wood and glass, and also to erections for any other purposes in which the same principle of construction is carried out, but with the use of iron, zinc, copper, tin, lead, or other suitable material in the place of glass, all the buildings being pinned and screwed together, and made to rest upon blocks of wood or butts of trees sunk in the ground, so that they can be erected with great ease, and are portable. For horticultural buildings the space to be covered is to be divided crossways by "principals" formed to the shape required, and of any ordinary kind. Upon the backs or outer surfaces of the "principals" pieces of timber are fixed edgeways to run horizontally from end to end of the buildings, and at any distances apart that may suit the lengths of the glass to be used in the roof. These timbers have been called "radical pieces," and to them grooved rafters are secured, the top end of each rafter to the bottom edge of the "radical piece," and the other end of each rafter to the top edge of the radical piece, and so on throughout the roof, dividing it into planes, the one plane rising above the other as much as the radical pieces are deep. Sheets of glass are fitted into the rafters, sliding into the grooves, where they are held by turn buttons screwed to the ends of the rafters, the turn buttons being long enough, when in horizontal positions, to catch and bear up the glass on each side of the rafters, and when turned to vertical positions they are sufficiently narrow in width to allow of the panes of glass being pulled out. The radical pieces have circles, trefoils, quarterfoils, or small openings of any shape pierced through them at equal or unequal distances, either all along or partly along their lengths, for the ventilation of the buildings, the insides of the radical pieces so pierced having valvular slides with friction rollers at the edges made to run in grooves, so that the ingress and egress of air is always under control, insuring perfect ventilation by numberless small openings in horizontal rows throughout the whole roof surface. The outlines of buildings so constructed can be varied to any extent by making the "principals" upon which the radical pieces rest either straight, canted, arched, or curved.

CLASS 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defences, Gun Carriages, &c.

2093. W. RICHARDS, *Birmingham*, "*Rifles and projectiles.*"—*Dated* 21st *August*, 1861.

In constructing breech-loading rifles (more especially, although not exclusively, double rifles), according to this invention, the patentee forms the stock in two parts, and hinges or joints the parts at a point a few inches in advance of the breech ends of the barrels, as is common in some breech-loading fowling-pieces. The front portion of the stock carries the barrels (if two are used), which, although connected, are not fixed to it, being capable of sliding freely a short distance. The butt portion of the stock has a plate fixed to it with projections or plungers upon it, which, when the piece is ready for firing, enter and close the breech ends of the barrels; this portion of the stock also carries, immediately behind the joint before mentioned, a vertical axis, which at its upper end terminates in a cam immediately under the barrels, and on the lower end of the axis is a lever by which it can be turned. On the under side of the barrels is a projection, which, when the barrels are brought up into a position for firing, comes just behind the cam, and then by turning the handle on the axis of the cam the barrels are forced back, the plungers on the breech-plate entering the barrels, and carrying forward the cartridges (which in loading the piece have previously been placed in the ends of the barrels) into their proper positions in the barrels. In constructing projectiles made in one piece of soft metal, and suitable for breech-loading fire-arms, he forms the body of the projectile cylindrical, and of such a diameter that it will just enter the bore of the piece, allowance being made for the thickness of the paper with which the projectile is enveloped when making it up into a cartridge. The projectile is by preference made without a hollow at its base, though it may, if desired, be hollow at that end. A short length of the projectile at the rear end is made of somewhat larger diameter than the bore of the piece, so that it will not enter the same. This enlargement, in loading a breech-loading fire-arm, stops the cartridge when it comes to the end of the chamber made to receive it at the breech-end of the barrel, thus preventing its being pushed too far forward. This enlarged portion, when forced forward by the explosion, takes the rifling of the barrel so completely as not to allow any escape or windage, and at the same time it ensures the rotation of the projectile as it leaves the barrel.

2104. J. WHITWORTH *and* W. HULSE, *Manchester*, "*Sights for small arms and ordnance.*"—*Dated* 23rd *August*, 1861.

This invention cannot be described without reference to the drawings.

2125. J. L. FIELD, *Colton Haverthwaite*, "*Improvements in the construction of armour-plates, and in their application to ships and batteries.*"—*Dated* 26th *August*, 1861.

In constructing armour-plates according to this invention the patentee rolls or forms them with ribs or projections at the back surfaces, in such manner that the ribs or projections may be the means, when used with suitable bolts or fastenings, of fixing the armour-plates to ships or batteries, thus avoiding the use of holes through the armour-plates for the passage of bolts through them and through the sides of the ships or batteries. In fixing the armour-plates to a ship or battery it is preferred to employ bolts the inner ends of which are tapped with screw threads to receive screw nuts, the outer ends of such bolts being made forked, so that the ribs or projections formed or fixed at the back surfaces of the armour-plates may be received between the forks and fixed thereto by rivets or other fastenings passed through the ribs or projections and the forks of the bolts; or the bolts or instruments used for fixing the armour-plates, when having ribs or projections at their back surfaces, may be otherwise formed.

2128. J. C. HADDEN, *Bessborough-gardens, Pimlico, and* C. MINASI, *Camden Town*, "*Projectiles and cartridges.*"—*Dated* 26th *August*, 1861.

Among the important features of this invention are the following:—Constructing projectiles with a hard metal body, and the soft metal belt so formed and so disposed with regard to each other as to present or leave a recess or channel around the projectile, and rearwards of the belt, that the direct force of the explosion may cause the belt the more readily to expand into and follow the rifling of the cannon from which such projectiles may be discharged. Also, manufacturing projectiles intended to centre themselves in the bore of the gun (as in several patents granted to the present inventors for inventions for forming them), with the swells or projections for receiving the twist situate at the rear of the projectile, and not at the front or forward portions. Also, with reference to shells intended to burst and break up into fragments, the following special mode of manufacturing the cast iron pieces intended for filling cases previously cast, as in the Armstrong shells, or for having cases cast on to or round them, as in the Britten shells, that is to say, the casting such pieces with thick parts and with thin or weak parts so shaped as that they may be fitted together in pairs or sets of pieces, the thick parts of the one fitting against the thin or weak parts of the other, and the thickness and form of such weak parts being such that fracture may readily and easily occur. And, further, the manufacturing elongated projectiles by so building within a case, or so casting a case on to such pieces, or other pieces intended to break up and separate, as to leave a chamber for the bursting powder to be used, principally situated at the rear end only of the projectile, and not extending throughout its length, except for purposes of ignition. And, as to the cartridges, the invention consists in so partially cutting, stamping, perforating, or acting upon thin cases, covers, or wrappers, that they will readily open, tear, separate, or part at a certain place or position, or places or positions, as required, either before being placed in the gun, or when pressed down to or near the breech. And in manufacturing cartridges as lastly described, or otherwise, with a stopple-cock or other equivalent contrivance for holding in the powder and keeping it dry, and which is removed when the twisted end is broken off or removed.—*Not proceeded with.*

CLASS 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

2099. R. TELFORD, *Birmingham, and* J. SANDERS, *Clifton*, "*A substitute for castors for furniture.*"—*Dated* 22nd *August*, 1861.

This invention consists of a kind of shoe with a smooth rounded bottom or bearing surface in substitution for ordinary castors with rollers or balls, such shoe being applied to furniture in a manner similar to that in which castors have ordinarily been applied thereto. The shoe consists of a socket, similar to the upper part of an ordinary castor, in which the leg of the piece of furniture is fixed, or a plate screwed thereto, and a solid piece of metal, earthenware, glass, or other material with a rounded smooth surface at the bottom, is inserted in the lower part thereof. The leg or portion of the furniture is thus made to rest on a solid, smooth, and rounded surface, instead of on the axis of a roller, or on a loose ball of an ordinary castor.

2124. A. LECHENE, *Stankope-street, Hampstead-road, and* C. NATHAN, *Westmoreland-street, Pimlico*, "*Ladies' collars, cuffs, &c.*"—*Dated* 26th *August*, 1861.

This invention consists in the application to the above-mentioned purposes of embossed and perforated paper, woven fabric, or other suitable material, stamped or cut out in varied designs by means of suitable dies or tools, such ornamental, embossed, and perforated designs being cemented or attached by some suitable adhesive material to a groundwork of net, tulle, tartatan, muslin, cambric, or other suitable fabric, by which the otherwise fragile ornamental design so applied is protected from being torn or injured when made up or applied to the several purposes of the invention.

2135. J. C. C. AZEMAR, *Mark lane, London*, "*An instrument to facilitate the practice of the drum.*"—*Dated* 27th *August*, 1861.

This invention cannot be described without reference to the drawings.

CLASS 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

2096. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*The preparation of pulp for paper.*"—*A communication.*—*Dated* 22nd *August*, 1861.

This invention relates to improvements in the preparation of pulp for paper, and consists in making subservient for this purpose and suitably treating hay (preferring, for the sake of economy, hay damaged by rain or damp, and which, consequently, may be obtained at a low price), the residuum or pulp of beet-root from sugar manufactories after the sugar has been extracted therefrom, and the wrack grass, either of which substances are first immersed for about two to twenty-four hours, more or less, in a lime bath, the strength of which must vary according to the nature of the above-mentioned substances to be treated, each of which will, by the present process, give rise to pulp which may be used separately or combined together, or with any other description of pulp hitherto made use of for the manufacture of paper. After this the substances are left to soak in an alkaline lye or liquid composed of lime, soda, potash, or ammonia, common sea salt, and nitric or hydrochloric acid and water. The proportions of the components of this liquid vary likewise according to the nature of the substance to be treated; the following composition may, however, be given as an example:—Lime, 20 per cent.; soda salt, 5 per cent.; nitric acid, 150 to 230 grains troy for every 200 lb. of the substance; sea salt, 5 per cent. The lye being once more made to act during eight to twelve hours, more or less, the thus lixiviated substances are boiled either in an open or a closed boiler, by preference, however, in a closed boiler under a pressure of about three to four atmospheres for about twelve hours. The substances are then washed either with phenic, or tri-nitrophenic, or carbuzotic acid, and finally well washed in water, after which they may be bleached by any of the known bleaching processes, by preference by means of chlorine or sulphurous acid. The pulp thus obtained from either of the above mentioned substances may then be used either of them alone or mixed together, or with any other pulp suitable for the manufacture of paper, and in any suitable proportions.

2103. T. RICHARDSON, *Newcastle-upon-Tyne, and* R. IRVINE, *Hurlet, Renfrewshire, N.B.*, "*The manufacture of paper.*"—*Dated* 22nd *August*, 1861.

This invention consists in applying in the manufacture of paper aluminous cakes obtained by acting on pit or alum shale or blues, either in a natural or roasted state, or on those ashes of bituminous minerals which consist chiefly of silicate of alumina with sulphuric acid, in substitution of the alum or aluminous cake heretofore employed, and which is extracted and manufactured from the compound of shale blues or ashes and acid above stated, at considerable cost.

CLASS 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

2127. F. TOLHAUSEN, *Paris*, "*A new and economical method of producing dynamical electricity, thereby obtaining useful chemical compounds.*"—*A communication.*—*Dated* 26th *August*, 1861.

This invention relates to a new arrangement of piles or batteries having constant and energetic currents, and yielding useful products at the poles of each element. The principle of this method is based on this theory, that the electro-motive power of a battery is proportional to the chemical action that takes place by the contact of a metal and an acid, which chemical action, on the other hand, is directly proportional to the caloric evolved. First, by the oxidation or decomposition of the metal by the acid; and, Secondly, by the combination of the metal or metallic oxide with the acid used, the said chemical action being inversely to the absorption of caloric produced by depolarisation. In order to form a battery by this method the inventor uses a metal or an alloy, and either a free acid or an acid that is combined with an electro-negative metal, so as to procure a very pure salt, which may be used in the arts directly or indirectly. In order to produce an energetic current he uses such metal and acid as will give rise to a rather powerful chemical action, and evolve much heat, *e.g.*, iron, zinc, lead, copper, and silver, nitric and hydrochloric acids, and clorhydrate, sulphuric, acetic, and chronic acids. Nitric acid being used as a depolariser at the positive pole, yields the best results, because it depolarises by absorbing the hydrogen with the least absorption of caloric. In order to absorb the nitrous vapours, which are given off as in Bunsen's pile, he uses the oleine or oleic acid from fatty bodies, or non-siccative oils, which are thus converted into concrete, elaidine, or elaidic acid, and may be used for making stearine candles.—*Not proceeded with.*

CLASS 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

1974. R. DE CLERCQ, *and* E. CHAZELLS, *Brussels*, "*Apparatus for raising water and other fluids.*"—*Dated* 8th *August*, 1861.

This invention consists in employing in a horizontal position a wheel having its boss or nave traversed by and fixed upon a vertical hollow shaft, terminating at the bottom in a solid spindle maintained between cross bars or webs to allow a passage, and working in a suitable bearing. The lower part of the shaft and spindle is placed in the water to be raised. The rim or circumference of the wheel is composed of a number of cylinders, closed at their ends, and placed near each other in the same directions as the arms. Above the boss or nave of the wheel there is a hollow truncated cone, traversed by the hollow shaft. In the interior of the cone there are partitions, so arranged as to leave spaces between them. Each of the hollow cylinders carries two pipes extending upwards. One of these pipes communicates with the truncated cone, and the other pipe is placed vertically at the other end of the cylinder; the length of this pipe is varied to correspond with the length of the hollow shaft between the nave and bottom spindle. Each of these vertical pipes has an elbow at the top directed to the exterior part of the machine. The shaft is hollow from the bottom spindle to the top of the truncated cone. The other part of the shaft is to be solid, or if not there must be means provided to prevent any communication with the lower part. The interior of the hollow part of the shaft communicates with the interior of the cone by apertures near the top. At the top of the shaft there is a spindle working in a suitable bearing, and having a pulley or other contrivance for giving rapid motion to the shaft and parts connected with it. The machine has to be filled with water, and rapid motion given to it, and the water contained in the truncated cone and horizontal cylinders is powerfully forced towards the circumference, and rises in the vertical pipes, from whence it is spirted out, but this water cannot flow to the circumference, nor rise in the pipes without leaving a vacuum in the truncated cone and in the horizontal cylinders. The water from the supply reservoir is then drawn through the hollow shaft and passes through the apertures near the top of the cone and fills the space from which the water has been forced. The water last supplied is in its turn forced outward, which causes another vacuum and aspiration, and so on. A continuous flow of water is thus obtained, the rapidity of which depends upon the speed given to the machine.—*Not proceeded with.*

1981. A. J. MOTT, *Liverpool*, "*Drawing beer and other liquids from casks, &c.*"—*Dated* 9th *August*, 1861.

The object of this invention is to prevent the air from coming in contact with fermented liquids when contained in vessels in limited quantities for domestic use, and consists in allowing the atmosphere to exercise a pressure on one side of a travelling medium interposed between such liquids and the air, which travelling medium will give or transmit the said atmospheric pressure to the liquids.

1982. C. P. MOODY, *Corton, Denham, Somerset*, "*Gates.*"—*Dated* 9th *August*, 1861.

This invention is for improvements upon a former invention for which letters patent were granted to the present patentee 12th December, 1860, (No. 3050), and consists in the means of securing and fastening the horizontal bars and uprights by hoops or straps of iron or steel which are carried outside the uprights on both sides of the gate, and tightened up by wedges or screws. He carries screws, bolts, or rivets through the straps or hoops, and into or through as many of the horizontal bars and uprights as may be found necessary to give solidity to the gate.

1983. J. HEMINGWAY, *Robert Town, York*, "*Apparatus for working coal, ironstone, &c.*"—*Dated* 9th *August*, 1861.

This invention consists in a series of revolving drills or augers, arranged in a suitable frame, and driven simultaneously by steam or other power, or by manual labour. These drills are to be furnished with cutters of various dimensions, and different shapes, to suit the particular material or mineral to be operated on, and are to be employed for the purpose of making either horizontal, oblique, or perpendicular cuttings, called "barings," or under cuttings, vertical or end cuttings, or any other cuttings required to facilitate the working of the material or mineral under operation. The drills may be applied and worked in any number which may be found expedient, and most convenient, and their action may be regulated at the pleasure of the person working the machine. The machine may be applied to the driving of headings or straight work, as well as to the working of coal or other material or minerals, by making suitable slight variations in the mode of application.

1985. J. *and* C. GRIFFIN, *Walsall*, "*Machinery for the manufacture or cutting of corks and bungs.*"—*Dated* 9th *August*, 1861.

According to this invention a knife supported horizontally has a rapid reciprocating motion given to it by the means hereinafter explained:—The piece of cork to be made into a cork or bung is supported between two centres, and is made to rotate slowly. The centres supporting the piece of cork are in a line parallel or nearly parallel to the edge of the knife, and at a distance from the said edge equal to one half the diameter of the cork or bung to be cut, and, while the said piece of cork slowly rotates, the rapidly revolving knife cuts the cork into a cylindrical or slightly conical figure. The knife and the centres carrying the piece of cork work independently of each other. The said knife is moved rapidly backwards and forwards by means of a connecting rod actuated by a crank made in or fixed on an axis situated at right angles to the line of the knife's motion. A rapid rotatory motion is communicated to the said cranked axis by hand or other power.—*Not proceeded with.*

1986. H. CHATWIN, *Birmingham*, "*Certain improvements in the manufacture of card, needle, pin, and other cases, and in the application to such articles of a new branch of ornamental art.*"—*Dated* 9th *August*, 1861.

The way in which the patentee proceeds to give effect to this invention is to prepare from pure deal lime tree, or other suitable wood or material, the sides of such cases, and on the one side he secures the edges and top and bottom parts with glue, the same being of a regular width for allowing the internal capacity to be uniform and regular, and over this he secures the other side, again using strong glue, as being the best and most convenient for uniting articles so composed. The case thus made is shaped on the outside either round square, or otherwise, as desired, by means of a rasp, file, or other suitable means and appliances well known to the workers or makers of such small goods. In this condition such cases are cut open, and around the division he places a lip or facing of thin bone, ivory, metal, or other suitable material, finishing this mounting around the same shape as the internal and external form of the case, with the exception that he allows the mounting, of whatever material it may be composed, to project according to the thickness of the material he purposes covering or applying to the outside of such cases. The parts thus prepared he unites when required with a suitable hinge-joint at the back, and with a spring snap in the front, in the ordinary way. In this condition he next applies (if so desired and arranged) the glass panel or panels containing the photographic picture and thus treated the case is fit for receiving the leather or other covering.

1987. A. V. NEWTON, *Chancery-lane, London*, "*Machinery for sewing.*"—*A communication.*—*Dated* 9th *August*, 1861.

This invention relates, Firstly, to the use of an adjustable needle bar guide box, by means of which the vertical needle of the sewing machine, whether it be coarse or fine, can be brought to any required proximity to the shuttle and shuttle race. Secondly, to the use of a needle guard by means of which the needle will be protected from being struck by the shuttle in its forward movement. Thirdly, to the throwing out of action of the presser foot. The invention cannot be described without reference to the drawings.

1990. R. A. GODWIN, *Newport-street, Lambeth*, "*Pumps.*"—*Dated* 9th *August* 1861.

For the purposes of this invention the patentee employs a cylinder mounted in a horizontal position, and having a piston fitted into it. Near each end of the cylinder a suction pipe enters in, passing through the side of the cylinder; each of these suction pipes is fitted with a valve opening into the cylinder, and the ends of the cylinder are closed, the piston rod working through a stuffing box in one of the ends; through the ends of the cylinders the exit passages are formed, and these are fitted with valves opening outward. These valves are kept as low down as possible to allow the whole of the water the cylinder contains to run out. In some cases he makes the whole of the ends or covers of the cylinder open as exit valves, in order to give free passage to the water; and in order that the piston rod may not interfere with the action of the end or valve through which it passes he causes the said rod to work through a stuffing box carried by a bar passing from side to side of the cylinder, and the end or valve has a circular hole cut in it large enough to pass the piston rod freely, and when the end closes the edges of the hole in the centre come against a ring around the stuffing box, and so make a tight joint.

1991. A. F. B. FALGAS, *Paris*, "*Construction of trusses and bandages for hernia, and of hypo-gastric girdles or belts.*"—*Dated* 9th *August*, 1861.

The object of this invention is to afford means whereby the wearer may place or adjust the pad or cushion of the truss, bandage, girdle, or belt, at any suitable inclination or position at which he or she finds the most comfort, ease, or relief, and after having adjusted it to such desired position may there retain it. For this purpose the patentee employs an arrangement or apparatus constituting a ball and socket adjustment or arrangement, in which a ball or a spherical or rounded knob or head fits in a socket cup or rounded recess (rotula or ball and socket fashion), and which is so combined with the pad or cushion of the truss, bandage, girdle, or belt, that the wearer can readily place or adjust such pad or cushion at the desired inclination or position, and retain it there by a screw.

1992. C. H. BIRKBECK, *Southampton-buildings, Chancery-lane*, "*Tents.*"—*A communication.*—*Dated* 10th *August*, 1861.

This invention has for its object improvements in the construction of military and other tents, whereby greater protection is afforded to the occupiers from the effects of bad weather on damp ground, together with additional ease and comfort whilst being occupied. For this purpose, when constructing a tent capable of accommodating four persons, three uprights are driven into the ground about two feet apart. These uprights may be in two parts formed with sockets or joints to connect them together, and are furnished with hooks near the centre for supporting the metal rods to which one end of the cloths or hammocks are attached. The upper ends of the uprights are connected by the rods, which also serve to support the outer covering of the tent. The other end of each cloth or hammock is attached to a metal rod formed with eyes or other connections at each end; this rod

when the hammock is to be used, is firmly screwed to the upper edge of the knapsack by straps or other fastenings, which thus forms a bearing or support for the foot or lower end of the cloth or hammock, so as to raise it above the ground. Ropes are attached to each end of the rod which fixes to the knapsack, the ends being tightly stretched up to a peg which is firmly driven into the ground. Two or more such cloths or hammocks may thus be stretched and supported side by side (according to the number of uprights employed), corresponding ones being stretched and supported from the central uprights in the opposite direction. Each cloth or hammock thus supported forms a dry and flexible bed or surface on which the soldier or other occupant of the tent can repose with ease and comfort, without being exposed to the weather, or the injurious effects of lying upon damp ground, while the space underneath the hammock forms a shelter for the arms, ammunition, provisions, or clothes of the occupants. The cloth or covering of the tent is cut in a rectangular form, so as to shut in the tent at the side by falling almost close to the side to protect the men against the heat of the sun, rain, or wind, and the parts thus forming the cover are furnished with buttons, hooks, eyelet holes, or other fastenings to connect them together; and the various parts can in case of need be employed as sacks or receptacles for the use of the commissariat or for luggage. The whole of the parts are capable of being rolled together to form a package of limited size, which may be carried on the knapsack. For the use of cavalry or travellers a light portable metal or other support may be substituted for the knapsack suitably constructed to fold up or attach to the hammock.

1996. T. Schneider, *Horseferry-road, Westminster, and* C. E. Crawley, *Gracechurch-street, London, "Inlaying wood, ivory, &c."—Dated 10th August*, 1861.

For the purposes of this invention the inventors take a veneer (which, to facilitate the description, they assume to be black) of the wood or other material, and they place it on a sheet of metal, from which portions have been cut, corresponding in form with the parts which are required to be removed from the veneer; the said sheet of metal being fixed on a suitable base to retain in their places any parts which may have been separated in producing the pattern. Over the veneer they place another sheet of metal, on the surface of which punches are fixed exactly corresponding in form and position with the parts to be removed from the veneer; this plate is put correctly in its position, so that the punches come correctly over the corresponding recesses in the first plate by means of guide pins. The plates are then pressed together until the veneer is cut, when they are again separated: the hollows in the first plate will be filled with portions of the veneer which have been forced with them by the punches, whilst on the upper plate, and clinging around the punches, will be the veneer to be inlayed, perforated in the manner required.—*Not proceeded with.*

1997. A. Barclay, *Kilmarnock, "Apparatus for raising, lowering, or moving heavy bodies."—Dated 10th August*, 1861.

Under one modification or arrangement of parts the improved crane consists of a main pillar or column, fitted in a footstep bearing, and movable or not about its axis. This pillar has jointed to it a jib extending upwards in an angular direction, and having jointed to its free extremity a secondary jib or beam, which sustains the load to be raised or otherwise moved. This secondary jib or beam is jointed to the main jib at about one third of its length from the upper extremity, which is connected to the main pillar by a connecting rod or radius bar. A pulley is fitted to the lower end of the secondary beam; over this the chain to which the load is attached is carried, and this chain is carried up over a pulley at the junction of the secondary beam and the radius bar, and down to an ordinary winding barrel, which is fitted to the main pillar, and may be actuated either by hand or steam power. The hoisting chain is wound round the front of the barrel, and there is a second chain for drawing in the main jib, which is wound on a duplex barrel in a direction contrary to that of the hoisting chain. The free end of this second chain is attached to the upper end of the jib where it is jointed to the secondry beam. The winding barrel on which the hoisting chain is wound is made with a second barrel, which runs loosely upon it, but is caused to rotate with the primary barrel by means of a clutch which is actuated by a hand lever. To raise the load the primary barrel is put in motion, then, if the second barrel is put into gear, the main jib is quickly drawn in, and the load moves inwards in a horizontal line, in readiness to be at once deposited on the truck, wagon, or other receptacle placed in readiness to receive it. The clutch which throws the secondary barrel into or out of gear with the primary barrel is arranged with an annular ratchet wheel and spring pall, as well as the ordinary external wheel and pall, so that, if the barrel should be inadvertently put in motion the wrong way, the pall slips over the ratchet teeth without doing any injury or causing breakage of the parts.

1998. M. Wiuzell, *Friars Green, Exeter, "Apparatus for twisting ordinary nails, and all other similar driving articles of a parallel or tapered form, and of a plain, fluted, grooved, or indented section throughout or in part."—Dated 10th August*, 1861.

This invention consists of a machine or apparatus, or arrangement of spur or other toothed wheels, and friction rollers of a parallel, conical, or other suitable form, for twisting screws with or without nuts or mandrils, or other shaped pieces, worked by a rack or racks or other gearing moving on suitable guides, and working in the necessary bearings, and arranged on suitable stands or beds, and driven by requisite driving wheels and pulleys, to which motion may be given by any known motive power. The machine may be made to twist the nails and other similar driving articles when in a horizontal, vertical, or oblique position. It may have any number of head pieces with rollers, segments, or other shaped pieces of steel, iron, metal, or metallic alloy) that may be thought desirable to follow up or suit the thickness, shape, or length of the nails or other similar driving articles to be twisted. The nails and other similar driving articles can be fed into the machine and removed therefrom when twisted by hand or machinery, and the machine may be made to twist any number of nails or other similar driving articles at any number of revolutions or parts of a revolution of its driving gear. The nails and other similar driving articles already made and required to be twisted are fed into the machine so as to rest in holes or slots, or between grippers or rollers, then twisted by traversing and revolving mandrils by means of screws, racks, toothed-wheels, segments or friction roller, having at one end, or both of their ends, rollers or other shaped pieces of steel, iron, metal, or metallic alloy of a form suited to the thickness, length, and shape of the nails.

1999. M. Wiozell, *Friars' Green, Exeter, "Improvements in machinery or apparatus for making plain twisted nails, spiral fluted nails, and other similar driving articles of a twisted or spiral fluted form throughout or in part."—Dated 10th August*, 1861.

This machine or apparatus is capable of making one or more nails at any number of revolutions or parts of a revolution of its driving gear, and when the bars, rods, strips, or wire of iron, steel, brass, copper, or other metal or metallic alloy, are placed in the machine, they are drawn into their required position between the grippers at intervals by machinery or by hand, then gripped and cut off into the required lengths, and held by jaws which are placed on the ends of traversing and rotating mandrils, then headed by hammers or press rods, and twisted by the traversing and revolving mandrils which draw the pieces of iron, when cut as herein described, through rollers in front of the grippers, so as to give them the required number of twists. The nails when thus made drop out of the jaws, which open when the mandrils have travelled their full distance. The machine is constructed as follows:—A driving shaft is arranged on a suitable framework or bed, and is driven by driving gear, to which motion can be given by any known motive power; from the said driving shaft, by means of cams or cranks, the mandrils are made to travel to and from the grippers, and upon the ends of the mandrils are self-acting jaws which hold the nails, and form dies for the heads of the nails, and in the centre of the mandrils are press rods, around which the mandrils are made to rotate by means of friction rollers, revolving cams, or conical clutches upon a shaft to which motion is given by the driving shaft. The grippers are worked by a cam fixed on the shaft, which rotates the friction rollers, and the feeding apparatus, composed of revoling cams and rollers, is geared by wheels and worked by the said shaft. The whole is arranged on requisite bearings and a frame or bed.

2001. A. Garzend, *Paris, "Apparatus for cutting up and reducing dye and other wood."—Dated 12th August*, 1861.

For the purpose of this invention the inventor employs a tool carrier or kind of cylinder having the form of an Archimedian screw, on the projections of which cutters are fixed in any suitable manner. By imparting a rapid rotary motion to the cutter cylinder the wood, as it is fed into the apparatus, will be instantly cut up.

2005. V. Jankowski, *Fitzroy-square, London, "Apparatus for sawing wood, &c."—Dated 12th August*, 1861.

In carrying out this invention one end of the saw is fixed in a holder passing through a guide connected to a spring, which the inventor prefers to be of vulcanised india-rubber. The saw thence passes through a suitable hole in a table adapted to support the material to be cut, and it is then at its other end retained in another holder passing through another guide, and connected by a link to a crank pin having a pulley upon its axis, with band operated by another pulley, by preference of larger diameter, upon the axis of which is placed another pulley still larger, and this pulley is caused to revolve by a band from another large pulley, the axis of which is formed with a crank operated by a treddle.—*Not proceeded with.*

2006. J. H. Elvans, *Lower Kennington-lane, "Steel busk or stay fastener."—Dated 13th August*, 1861.

This invention consists in constructing a steel busk or stay fastening, opening down the centre, and so arranged as to readily fasten and unfasten by means of three catches locking on to a spring slide.—*Not proceeded with.*

2009. J. Jacob Brunner, *Austria, "Producing on porcelain and other ceramic products, on glass, venetian enamels, and on metallic surfaces, designs in colours, and in gold, silver, and other metals."—A communication.—Dated 13th August*, 1861.

According to this invention such designs are first printed on paper in the thographic press, and thereupon drawn off or transferred upon the article or object to be ornamented. As usual in chromolithographic or colour printing the various colours and metals are printed on to the paper in succession, each from a separate stone, the paper used for this purpose being prepared to prevent shrinking during the operation of printing and transferring the design upon the object to be ornamented. The prepared metals and prepared colours as well as the vitreous mass or flux are in all cases reduced to the finest powder or dust before being used. On ceramic products and on enamels the ornamentation can be produced either upon the glaze or under the glaze.

2010. J. Lancaster, *Princes-street, Bedford-row, London, "Producing sand."—Dated 13th August*, 1861.

In carrying out this invention the inventor places the stone, ballast, or gravel in a suitable machine for crushing, pulverising, and washing the same, after which it is to be sifted through sieves of various sized meshes, according to the purpose for which sand thus produced may be required.—*Not proceeded with*

2012. J. G. Renny, *Brussels, "Improvements in the manufacture of articles of furniture by utilising certain parts of the cedar tree."—Dated 13th August*, 1861.

The Havannah cedar tree usually employed in the manufacture of cigar boxes has a portion of its trunk (called forks) knotty and rugged; these parts are rejected as unfit for any other use than fire-wood, for which purpose they are usually sold. Now the object and intention of this invention is to render these refuse parts useful in and for the manufacture of articles of furniture by preparing the said refuse parts in the following way, that is to say:—The patentee first saws the forks into veneers, and then glues them together for the purpose of giving to them consistency and hardness, which the said parts are naturally deficient in. The wood thus treated, when polished, presents a more brilliant appearance than the most costly mahogany, and has the advantage of neither degenerating in appearance, cracking, nor requiring to be repolished occasionally, which is the case with the finest specimens of knotted mahogany.

2013. C. Binks, *Gray's-inn, London, "Treating linseed and other oils and fats."—Dated 13th August*, 1861.

The specification of this invention is too voluminous to be quoted here in detail. The objects of the invention are as follows:—Firstly, to improve the drying properties of linseed oil, and other drying oils, but more especially of linseed oil. Secondly, to obtain such drying oils in certain cases free, or comparatively free, from colour, and especially from the deep or dark colour usually pertaining to linseed oil, which has been boiled or treated by the methods hitherto commonly resorted to in order to quicken its drying properties. Thirdly, to provide improved methods of obtaining dark coloured drying oils or drying oils similar in appearance and uses to those known as boiled oils. Fourthly, to impart to such drying oils at pleasure, and by improved methods of operating, different degrees of thickness or of "body." Fifthly, to provide improved methods of operating, and improved kinds of apparatus by which to carry on certain operations requisite for obtaining these or like effects or products, or for bleaching and refining linseeds and other oils and fats.—*Not proceeded with.*

2014. W. Common, *Brighton, "Apparatus applicable to water-closets and urinals."—Dated 13th August*, 1861.

In carrying out this invention the inventor uses an air-tight vessel in which water sufficient for one discharge is collected. As the water accumulates air contained in the vessel is compressed, so that, when the discharge takes place, the water will rush out with a force due to the degree of compression of the confined air. The air vessel is brought into communication by means of a pipe, with the reservoir or other water-supply apparatus, the vent of which pipe is capable of being closed by the rise of the spindle of the closet-supply valve. The spindle works through a stuffing-box in an elbow discharge pipe, and carries at its upper end a disc valve, which has its seat on the upper face of the elbow. In the head of the spindle a deep cross cut is made to form a passage for the water from the supply-pipe to the air vessel. The head of the spindle is capable of sliding in an elbow or lip of the supply-pipe, and when in its lowest position (which will be when the valve is on its seat) the small vent formed by the cross cut in the head of the spindle will allow of water flowing in a small stream into the air vessel. When, however, the valve is raised to discharge water into the closet pan this supply will be cut off. The spindle is jointed at its lower end to the ordinary lever of the closet, so that, when that lever is raised in the usual way, the valve will rise and discharge the water. To guide this discharge over the surface of the pan, and effectually to cleanse it, he proposes to form the pan with a hollow rim projecting inwards, which will guide round the water and allow it to escape close to the surface of the pan. When the lever is allowed to fall the spindle will also fall, this tendency being increased by the pressure of the supply water on the head of the vessel. The valve being now again brought to its seat the discharge of water will be effectually cut off, and the supply of the air chamber will recommence.—*Not proceeded with.*

2020. F. Durand, *Paris, "Metallic tubes."—Dated 14th August*, 1861.

This invention relates to a new mode of manufacturing any description of metallic tubes without brazing or soldering, and consists in casting the tube in a mould provided in the inside with a core arranged in such manner that, in running the molten metal in the mould, free escape is allowed to the air contained in this latter.—*Not proceeded with.*

2021. A. A. R. Damoiseau, *Paris, "Kilns."—Dated 14th August*, 1861.

This invention consists, principally, in arranging the kiln in such manner that all or a part of the feed air is properly heated on reaching the fuel, so as to obtain a better combustion of this latter, and whilst at the same time the construction of the kiln allows of the articles being more equally heated or fired than was the case in the kilns hitherto made use of.—*Not proceeded with.*

2023. R. A. Brooman, *Fleet-street, London, "Coating wire with copper, silver, gold, &c."—A communication.—Dated 14th August*, 1861.

The object of this invention is to prevent rust or oxidation of wire, and the invention consists in coating the wire with copper, silver, gold, brass, tin, or other suitable metal or alloy in manner hereafter described. The wire to be coated is first passed over a roller or pulley, which is in connection with the positive pole of a galvanic battery, then under one or more rollers or pulleys immersed in a suitable bath or solution, and in which a piece of copper or other metal which is to form the coat is suspended by a platinum wire; this piece of copper being connected with the negative pole of the battery the wire in passing through the bath or solution receives a deposit or coating of copper; it then passes over a wooden roller or pulley outside the bath and through a vessel containing water, on emerging from which it is cleaned and dried by a cloth or otherwise, and then wound on a roller to be used as required. The bath or solution before mentioned is prepared according to the metal or alloy with which the wire is to be coated.

2024. E. Edwards, *Beaufort-buildings, Strand, London, "Separating mineral ores, coal, and other substances from impurities."—Dated 14th August*, 1861.

The patentee claims, First, the novel combination of the several parts of the machines described, for the purpose of washing mineral and other substances or materials, as set forth; Secondly, the novel application of flexible discs, worked by revolving cams in the manner described for the purpose of producing sudden elevations and gradual depressions of water used for washing or purifying substances or materials, as aforesaid; Thirdly, the combination with such flexible discs and movable cams, when employed for the purposes before mentioned, of wheels or rollers carrying scrapers, in such a manner that the said scrapers can be turned up out of the way for the purpose of cleansing the screens without stopping the machine; Fourthly, the arrangement of such flexible discs, cams, and scrapers, so that the same water can be employed for a considerable time in performing the duty for which it is required, instead of permitting it to escape continuously.

2025. T. Silvester, *West Bromwich, Staffordshire, "Spring balances or weighing apparatus."—Dated 14th August*, 1861.

This invention consists in attaching the spring (in the description of balances known as "Salter's balances") to the bottom instead of the top or the middle piece or slide, by which the patentee saves about a-third of the material with the same size or weight of spring, and instead of employing varnish, as heretofore, to preserve the barrels from rust, he galvanises the barrels and also the middle pieces. In the ordinary balances the spring is always concealed, whether in use or not; but in this improved balance a short length of the spring is always to be seen protruding from the bottom of the barrel; and, when the whole weight is on, about half the length of the spring is in sight, so that the existence of rust or damage to the spring is very readily ascertained, and lubricating matter is easily applied.

2027. J. Billing, *Abingdon-street, Westminster, "Stoves."—Dated 14th August*, 1861.

The patentee claims, First, the construction of stoves wherein the smoke from the fire-box is caused to pass horizontally through an opening in the back of the stove into a central back flue, in which it descends, and then passes into two side flues, whence it ascends into the chimney, as described. Secondly, the construction of stoves having descending and ascending back flues, or simply one ascending back flue and a sliding valve to regulate the opening into the same, in combination with a throat valve or throat valves, and wherein the opening and closing of the throat valve or valves, and of the sliding valve regulating the opening into the back flue or flues, is effected by means of one and the same screw spindles and levers, as described. Thirdly, the application of a rising and falling "blower" to stoves actuated by an escutcheon or a rose, in conjunction with the knob that regulates the opening and closing of the valve or valves, as described. Fourthly, the construction of stoves, wherein a second movable grating is placed beneath, and is fitted in between the bars of the ordinary grating, for regulating the draught and clearing the bottom of the fire, as described. Fifthly, the construction of stoves provided with a back draught, wherein a fire-brick or metal back is employed, having a number of vertical or nearly vertical channels, through which air is made to pass, as described.

2029. S. Carey *and* W. M. Pierce, *East Ham, "Apparatus for re-burning animal charcoal."—Dated 15th August*, 1861.

This invention consists in making a revolving cylinder or retort for receiving the charcoal required to be re-burnt of an octagon or other many sided form, and casting or forming on each of the several longitudinal angles a bevelled fillet or rib, whereby the contents of the cylinder or retort, when in motion, may be readily agitated or spread, and more uniformly burnt than in the ordinary circular cylinder. The patentees also fit or hang the front end of the said cylinder or retort; or they sometimes hang or fit a door in or upon the front plate of the said cylinder or retort, so as to facilitate the charging or discharging the contents.

2031. J. Bethell, *King William-street, London, "Improvements in the manufacture from steatite of journals, axle-boxes, and bearings for machinery, axles, and spindles to work in smoking pipes, buttons, crucibles, and pots for chemical and smelting purposes, and also of a lubricating compound for railway and other carriages."—Dated 15th August*, 1861.

The patentee manufactures from steatite, journals, axle-boxes, and bearings for machinery axles and spindles to work in, by making bearings or linings to the bearings of blocks, sheets, or powder of steatite in its natural condition, or purified, as described, and on which the axle will rotate. He manufactures from steatite smoking pipes, buttons, crucibles, and pots for chemical and smelting purposes, by simply cutting them out of the steatite blocks to the forms desired, and either calcining them or not as is thought best, as for all these purposes, except buttons, they will answer equally well either burnt or not. He makes lubricating compounds for railway and other carriages by first grinding and reducing the steatite to a very fine powder, and then washing it to separate it from all gritty particles, and, if it is found to contain iron, he steeps the powder for some time in muriatic acid, stirring it often, and he keeps it there until all the iron is dissolved. He then takes out the powder, washes it again in clean pure water, and dries it, and after this is done it is what he calls purified steatite powder, and then it is only necessary to mix the powder with any of the oils, or fats, or soapy compounds now used for lubricating in any proportion that may be thought best.

2035. J. T. Hutchings, *Charlton, "Tennis and rackett bats."—Dated 15th August*, 1861.

This invention consists, principally, in the combination for such purposes of india-rubber, either by itself or in any of its various plastic compounds, or any other similar and suitable material. The inventor makes the india-rubber or compound material pulpy in the usual manner, and in such pulpy state places it in a mould of the required shape or form, where it remains until it has undergone the usual process of hardening, so as to give it the consistency and strength of what is known as ebonite, or otherwise known as vulcanite, and usually called hard rubber. He then removes them from the mould, and finishes off by burnishing. In some cases, such as when unusual lightness is desirable, he uses paper, and forms it in moulds, as before stated; and, when sufficiently dry and hard, he removes it from the mould, and finishes off in the ordinary way. The advantages of this invention is that, unlike the bats at present in use, they will retain their uniform shape for any length of time, are not liable to be effected by climate or temperature, and, consequently, the use of the presses, as heretofore, will not be required to force them into shape.—*Not proceeded with.*

2036. S. Desborough, *Noble-street, St. Martin's-le-Grand, London, "Umbrellas and parasols."—Dated 15th August*, 1861.

This invention relates to the form and construction of the metal ribs, stretchers, and joints of umbrella and parasol frames, and consists in forming the ribs and stretchers of metallic wire, the section of which is of T, triangular, bayonet, or other similar shape, in place of solid, tubular, or trough shape, as heretofore employed. Ribs and stretchers constructed according to this invention possess great strength and lightness, and, owing to their peculiar form, are very suitable for having the joints formed thereto which connect the stretchers to the ribs and runner, and the ribs to the top notch. Another part of the invention consists in forming the metal ribs and stretchers of umbrellas and parasols of a double trough or similar shape (⊓), or having two or more longitudinal channels.

2040. G. Fancherre, *Green-terrace, Middlesex, "Manufacturing gold dials."—Dated 15th August*, 1861.

In carrying out this invention the inventor first produces an engraved plate of the dial intended to be reproduced, and from this, by means of the electrotype process, he prepares a matrix of copper. In this matrix he deposits any desired thickness of gold by the electrotype process, and the gold copy so obtained he mounts upon a backing plate of brass, fitted at its back with pins suitable for fixing the dial to the watch or clock frame. The gold electrotype copy he secures to the backing plate by means of solder; and in order to facilitate the process of soldering the dial to the brass backing plate he first submits the gold dial face to ebullition in water, taking care to change the water frequently; and in order to remove any cyanide of potassium which may still remain in excess, and thoroughly to clear out the pores of the gold, he immerses the dial in fluoric acid, and afterwards washes it in boiling water. It is then ready to receive at its back a deposit of copper, which will facilitate the soldering of the brass plate thereto. When the soldering has been effected he covers the backing plate with a protecting coat of wax, and then immerses the whole in a bath of dilute nitric acid, by the action of which the copper matrix will be removed from the face of the gold dial plate. The dial may now be cleaned, cut, and finished in the ordinary way.—*Not proceeded with.*

2049. P. Walters, *Wolverhampton, "Machinery for cutting, sawing, and slicing or planing wood and other substances."—Dated 17th August*, 1861.

This invention is carried into effect as follows:—On a strong framework of wood or iron, fixed or mounted on standards, a bed-plate is arranged, on which a slide, having suitable grooves to correspond with the bed-plate, is caused to move with a reciprocating motion by means of a connecting-rod attached to the crank of a driving axle. The wood or other material to be operated upon is attached to the upper surface of the slide, above which a suitable plane, saw, or other cutting or sliding apparatus is secured by means of standards bolted to the framework. By these arrangements at each revolution of the crank a slice of wood or other substance is taken off of the desired thickness, and the cutter may be so regulated as to sheave or slice the wood of such thickness that it will curl or roll up, and form spills for the ordinary purposes of lighting, or a thicker slice may be obtained useful for many purposes.—*Not proceeded with.*

2057. E. S. Cathels, *Shrewsbury, "Compensating gas meters."—Dated 19th August*, 1861.

This invention relates to an improved mode of maintaining a constantly uniform water line or level in gas meters, by compensating for the loss of water in the meter by evaporation or otherwise, which is effected in the following manner:—The upper part of the front chamber of the meter is partitioned off by a horizontal partition, and is thereby converted into a space water supply tank or fountain. In the partition plate which forms the bottom of this supply tank or fountain there is a valve seat fixed perpendicularly under the gas inlet valve, the spindle of which passes through this valve seat, and on which spindle there is fixed a plug or valve that fits water-tight into the valve seat. The position of this water valve is so arranged that, when the water in the meter is at the correct line, and, consequently, the gas inlet valve is open, the buoyancy of the float (the float being common to both valves) keeps the valve in the bottom of the tank closed, and prevents any water descending therefrom. But when the water in the meter falls below the proper level the float descends, and slightly opens the water valve, and allows the water to flow gently into the meter until it has regained its proper height, when the float shuts the valve, and prevents any further descent of water. The gas inlet valve box has a horizontal partition, in which the valve seat is fixed, the valve spindle passing through a small hole in the bottom of the box, and the gas on entering through the valve is conveyed by a pipe down to the waste water box, from which it passes through the syphon pipe into the measuring wheel or drum. The top of this pipe (which is inside the front cover of the drum in the usual way) is at the correct water line, or, if made above the water line, a separate overflow pipe is employed, the top of which is at the correct water line or level.

2059. W. Gossage, *Widnes, Lancashire, "Soap."—Dated 19th August*, 1861.

The patenteee claims, First, the use of steam generated by the concentration of caustic alkaline liquors or soap lyes in close boilers for the manufacture of those kinds of soap in which the boiling is effected by the employment of steam. Secondly, the construction of apparatus to be used in the manufacture of those kinds of soap which are made by injection of steam amongst the materials employed, which apparatus provides for the steam employed being passed through a bed of filtering materials, and thereby causing the separation of particles of water therefrom previously to its being used for such manufacture.

2064. A. S. Rostaing, *Dresden, "Spectacles."—Dated 20th August*, 1861.

The patentee claims an arched spring lever or hinged bridge piece (when applied to spectacles of any shape or form), having for its purpose the raising of spectacles from before the eyes up to and before, but not on to, the forehead or hair.

2065. W. Fitkin, *Fleet-street, London, "Instruments for extracting teeth."—Dated 20th August*, 1861.

This apparatus consists of two separate portions, instruments, or appliances, which, when put to use, are employed in conjunction or combination. Each part has a handle or end conveniently formed for holding and using it, and one of these instruments or appliances, which the patentee calls the "fulcrum instrument," is constructed with a part or surface, hereinafter called the "rest piece" (intended to bear or rest against the gum or jaw of the patient), and also with a curved or bent arm, or what he calls a "bridge piece" or "arch," which is so shaped that, when the rest piece is applied against the gum, this bridge piece or arch passes over the tooth, and affords a fulcrum or bearing point for the second instrument or elevator to rest and work upon at the opposite side of the gum to that against which the rest piece is applied. The stem or body, the rest piece, and the bridge piece or arch of the first appliance, are in one piece, or in

rigid connection, or so contrived as to afford a firm and steady bearing, rest, or fulcrum for the second appliance. The second instrument, or "elevator," is serrated, or otherwise conveniently formed at one end for acting directly upon the tooth in the operation of extraction, and is also conveniently contrived for resting on the bridge piece or arch, for which he prefers to shape it with an orifice near the end, by which it is passed over the end of the bridge piece. The compound instrument is generally applied by so placing the first or fulcrum instrument that the rest piece may bear, rest, or press against the gum on one side or surface thereof, and the elevator is rested on the bridge piece or arch at the opposite side, and works thereon as a lever on its fulcrum, and thus acts upon the tooth; in fact both appliances or in-truments may be worked as levers, in some cases the handles being moved in antagonistic or opposite directions. The first or fulcrum instrument may be said to be formed with two fulcra, one being the rest piece, and the other the place of contact with the elevator or second appliance.

2066. H. EMES, *Adelaide-road, Haverstock-hill*, "*Dress fastenings.*"—*Dated 20th August*, 1861.

This invention cannot be described without reference to the drawings.

2071. J. SOMERVILLE, *Maidstone*, "*Improvements in apparatus for drilling and tapping gas and water mains and pipes, and in preventing leakage therefrom.*"—*Dated 20th August*, 1861.

According to this invention the patentee proposes to employ a peculiar apparatus, consisting of a bow or breech piece or bracket, secured to the main or pipe to be drilled by clips or straps, and having fitted to it at its centre, or in any other convenient position, a set screw, for the purpose of applying pressure to a combined drill and tap of a peculiar construction, which is actuated by an ordinary ratchet or other suitable contrivance. Immediately above, and attached to or forming part of, the drill or boring bit there is a cylindrical piece of metal, of the same diameter as the hole made by the drill, its object being to keep the drill steady after it has entered the main, and prevent it from breaking through too soon, or until the whole is ready to receive the tap; it is also serves to plug the hole whilst the drill is breaking through, and so prevents the escape of gas or water at that time. The tap is formed on the upper part of the stem of the drill, immediately above the cylindrical part hereinbefore referred to, and has two or more annular grooves or recesses made round it at proper intervals, into each of which is fitted a circular washer or collar of india-rubber, leather, or other suitable material. These washers or collars should be made of slightly larger diameter than the hole to be tapped, so that, as the tap penetrates into the main, and the washers or collars successively enter the hole, they will effectually plug the same, and prevent any escape of gas or water through the longitudinal grooves or slots made in the tap. The intervals or spaces between the washers or collars should not be less than the thickness of the metal being tapped, so that there may always at least one of such washers or collars in the hole. When the screw thread is sufficiently cut the tap is removed, and the service pipe is inserted in the usual manner.

2073. T. SUTTON, *King's-College, London*, "*An improved camera for taking photographic portraits and instantaneous pictures.*"—*Dated 20th August*, 1861.

This invention cannot be described without reference to the drawings.

2074. R. S. LAMBERT, *White-hall, Clevedon*, "*An improved skipping dipper or vessel for removing sugar and other liquids from boiling pans.*"—*Dated 20th August*, 1861.

The nature of this invention consists in the construction of a dipper provided, First, with external ribs or guards, so applied as to prevent the contact of the exterior surfaces of the vessel with the interior surfaces of the pans from which it is intended to dip up the contents, whereby the heated surfaces of these latter, even whilst the improved dipper is actually within them charged with a portion of their contents ready for removal, remain covered with liquid matter in quantity always sufficient to prevent injury from charring or scorching. Secondly, with a cover (by preference a dome or elevated cover) which enables the operator to "change over" or take into the pans in action, and before the improved dipper is in any degree lifted out or removed therefrom sufficient liquid to replace that taken into the improved dipper for removal, so that, when this vessel and its charge are actually lifted away, the pan is formed to be already replenished. By these means all possibility of injury from the destructive effects of large over heated surfaces acting on small quantities of highly inspissated substances is wholly avoided.

2075. F. GYE, *Royal Italian Opera, Covent-garden, London*, "*Gasometers and gasometer tanks.*"—*Dated 20th August*, 1861.

For the purposes of this invention the patentee constructs a gasometer tank in such manner as to render available much of the central space of land now covered or occupied by the tank of a gasometer. The tank for a gasometer according to this invention is made double at the outer circumference to receive the water or fluid employed, the interior space being left free for use when roofed or closed in air and gas-tight. He prefers to use the compartments in the centre of a tank to act as a second or interior tank to receive another but a smaller gasometer, though such space may be otherwise advantageously employed, and the central portion of the smaller tank may be similarly arranged to the outer one in order to admit of such space being used. The inner or smaller gasometer is arranged to act in the interior tank independently of the larger or outer gasometer, which works in the ring formed or outer tank. When thus employing the enclosed and roofed space interior of the tank of a gasometer to receive a smaller or inner gasometer the space between the roof of the enclosed compartment is in communication with the open atmosphere by suitable pipes or passages, so that the space may be at all times occupied by air; or such space may be so arranged as to receive gas when the inner gasometer is discharging its contents, and the gas received into the central compartment may be discharged into the mains when the inner gasometer is being charged with gas.

2077. G. F. MUNTZ, *French Halls, Birmingham*, "*Apparatus for melting nut-als.*"—*Dated 20th August*, 1861.

According to this invention the inventor places the metal in a vessel of brickwork or other material, suitably lined with fire clay, and through the bottom of this vessel are formed holes or passages (one or more) which are covered with tubes, similar to inverted crucibles, without bottoms, and made in a similar manner of fire-clay or other refractory material. Under the vessel containing the metal a furnace is formed, and the heat passes up into and is transmitted through the refractory tubes to the metal, the vessel, containing which is suitably covered. The refractory tubes may be arranged to pass horizontally, or in an inclined direction, through the metal containing vessel, but the arrangement described is preferred. It will be seen that, whereas when metal is melted in a crucible or pot, the weight tends to burst the sides of the vessel outwards; when the arrangement is as is above described, exterior of the refractory vessel, it tends to press its sides inwards, or crush it in, a strain which it is very much more capable of resisting than a tensile or bursting strain.—*Not proceeded with.*

2079. J. ELLIS, *Minories, London*, "*Sizing corks.*"—*Dated 20th August*, 1861.

The patentee claims the use of mechanism for gauging or separating the larger from the smaller sized corks, consisting of a worm or propelling shaft acting in conjunction with an open work or gauging cylinder or cylinders, so as to gauge or separate the larger from the smaller sized corks as required.

2083. W. CLARK, *Chancery-lane, London*, "*Optical and illuminating apparatus.*"—*A communication.*—*Dated 21st August*, 1861.

The patentee claims, First, the application of apparatus furnished with compartments of crystal or glass, composed of one or more hollow pieces, as substitutes for like or different forms to those in present use for optical purposes, whereby to reproduce in all scales of magnitude, of scientific or other experiments, by means of liquids contained in the spaces between the glass, for the purpose of producing the necessary refracting power. Secondly, the construction of lanterns with partitions of crystal or hollow glass filled with liquids, either coloured or limpid, as described, for the purpose of increasing the di-persive power of the candle, oil, gas, or electric light, according to the nature of the illuminating agent employed. He also claims all illuminating glasses, lanterns, or globular forms suitable as substitutes for the plain or solid forms ordinarily used, having hollow partitions, as described, for the introduction of white or coloured liquids for the production of infinitely varied and novel effects, by regulating the shades of the liquids and the containing sides. Thirdly, he adds that, by the word crystal, he includes flint and all other glass, and also that employed in optical experiments, the invention consisting of the application of all transparent matters, either coloured or uncoloured, and polished or unpolished, having hollow spaces or compartments filled with liquids, instead of the ordinary solid glass hitherto employed for general illuminating purposes, as also for the production of effects of white or coloured fire at public entertainments.

2086. N. SALAMON, *Ludgate-street, London*, "*Attachments or apparatus for sewing machines.*"—*A communication.*—*Dated 21st August*, 1861.

This invention consists, First, in contrivance which can be readily adapted and attached to any suitable sewing machine of the construction already well known and publicly used. By means of this contrivance two pieces of cloth (or material suitable for ruffling) are caused to be supplied to the ordinary feeding along apparatus of the sewing machine at different tensions while being sewn together. Secondly, in a contrivance for automatically creasing or marking, in regulated uniform distances in advance of the sewing, the next line of sewing to be followed, which is especially useful in folding and tucking by machine sewing, as by it the folds and tucks or plaits can be sewn at exact distances, in precisely the same repetition, without requiring the previous preparation by hand heretofore nece-sary, whereby it saves much labour and time. Lastly, in a modification of the last mentioned contrivance according to which the attachment is arranged so as to be applied to quilting and similar work, by marking with a piece of chalk or other suitable substance upon the material being sewn, so as to indicate precisely the next line of sewing to be followed, and thus secure more positive uniformity in the repetition of the work, and with less time and labour than heretofore.

2087. A. J. HENNART, *Tournay, Belgium*, "*Smoke consuming grates.*"—*Dated 21st August*, 1861.

This invention consists in the combined form or shape and arrangement of the grate bars of furnaces. These improved bars are composed of three pieces cast together so as to form a single one leaving many open spaces between each compound bar to give free passage to the atmospheric air.—*Not proceeded with.*

2089. J. M. MURAT, *Paris*, "*Apparatus for shearing military hat tufts, &c.*"—*Dated 21st August*, 1861.

The article to be sheared is, according to this invention, held in a tube at the end of a horizontal spindle caused to revolve slowly by means of cord and pulleys, so that the article to be sheared has only a rotatory motion round its horizontal axis. The tool carrier or holder is mounted on a horizontal shaft, and consists of a regular prism, having six sides or faces, on each of which is a blade or cutter. The tool carrier spindle, which is supported at two places, is caused to rotate rapidly by strap and pulley. The blades or cutters in rotating come nearly in contact with a fixed plate or counter-cam, which supports the thread or filaments of wool or other material to be cut. This plate or counter-cam is fixed on a carriage, and the tool holder is also placed on this same carriage, which is moved along by a screw; or it may be moved round the article to be cut by causing it to revolve (by a handle) in a circular path. The machine will sheave cylindrical, conical, and spherical articles.

2082. W. MASON, *Liverpool*, "*Soap.*"—*A communication.*—*Dated 21st August*, 1861.

The object of this invention is to dispense with hand washing in the cleansing of clothes and other articles. The improved soap consists of equal parts of any ordinary soap and kaolin, with about five per cent. of ammonia and five per cent. of soda; the whole mixed together and dried.—*Not proceeded with.*

2098. E. LANDSBERG, *Aine, Paris*, "*Porte-robes or buttons for holding up the skirts of ladies' gowns.*"—*Dated 22nd August*, 1861.

This invention has reference to a previous patent, dated 13th February, 1860 (No. 387). This porte-robe or button for holding up the skirts of ladies' gowns, instead of having only one end of the braid, tape, cord, string, or other tie fixed to and partly coiled round the barrel, in the inside of the button, has the same doubled, and both free ends fixed to the barrel, whilst the remainder forms a loop into which part of the skirt may be introduced and kept fixed by a runner or slide gilding along the braid, tape, or other tie, which runner or slide may serve likewise for regulating the length of tape, string, or other tie allowed to protrude beyond the button or stud.—*Not proceeded with.*

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

IRON TRADE AND THE PROSPECTS OF THE FOREIGN AND HOME TRADE: *Increased Demand from India and China: The Growth of the Trade with France*—COMPLAINTS OF THE LOW PRICES: *Commensurate Quality*—PIG IRON TRADE: *Reduced Make*—PRICE OF STONE—COAL TRADE: *Ruling Prices*—MR. S. GRIFFITHS AGAIN: *The Assumed Firm of E. B. Thorneycroft and Co.*—THE CINDERFORD IRON COMPANY: *Separation of Partnership*—GENERAL MANUFACTURING TRADES: *No Improvement: Shipments to the Southern States: The International Exhibition and the Jewellers*—BOARD OF TRADE RETURNS: *New Classification: Metals and Hardwares*—NEGLIGENT ENGINE TENTERS: *Eight Men Injured*—MR. H. L. FLETCHER CHARGED WITH FORGERY.

A SLIGHT shade of improvement characterises the reports which we receive this week from the different ironmaking firms of South Staffordshire. There is slightly more doing than there was last week at a few of the best houses, and some of the firms, who are not very careful as to the quality of the iron that they produce, are not worse off as a rule. This, however, does not say much, because, with the advance of the season, the orders were expected to increase very much faster than as yet had been perceptible, even although the American war should not assume appearances more favourable to a termination within a reasonable period than has been perceptible for some time past, and the condition of the trade, in the past six months in particular, has been almost unprecedentedly bad. Masters gather satisfaction from the slight encouragement held out by Earl Russell that the all-disturbing war may terminate within a reasonable period. But, while they give his lordship credit for better information than they themselves possess, they are not inclined, from their own reasoning, to share very warmly in his lordship's views. They are still of opinion that the Southerners are not be subdued; and that the attempt to subdue them, if much longer persisted in by the North, will bring temporary ruin upon the Federal States. Masters are not, therefore, full of expectation of good from the recent Federal victories.

The Board of Trade returns for January, which are noticed at some length below, are adverted to with satisfaction as showing the rapid growth of our trade with France in particular at a time when we so urgently needed new markets to compensate in some measure for the loss in the American trade direct. The continent, however, whence a greatly increased trade this year as compared with last was being looked forward to, is not this week in a condition less unsatisfactory than it was deemed to be at the time of our last report. As some set-off to this unfavourable feature of the prospects of the continental trade, India and China are announced to be ordering more freely than for some time past, and the future is anticipated with some satisfaction. Home will remain pretty good for iron of large sizes and fair quality, provided the political horizon of the continent should not portend storms of more than ordinary ruthlessness. Before the revival of trade prices will be as they now are accepted, for some descriptions, at very low figures. At Wolverhampton, on Wednesday, the complaints were very loud of the rates that were being accepted by South Staffordshire houses for iron delivered in Liverpool in particular. They are almost incredibly low; but the fact of invoices showing the precise figures having been seen removes all room for doubt. Sheets are being sent hence to Liverpool on terms which would make them £6 15s. a ton in South Staffordshire. The quality, however, is proportionate with the price; and what such iron can be used for is a problem which no one here can solve.

Pig-iron continues inanimate; and the make of the district is about to be reduced by the blowing out of two more furnaces at Bilston—those of Messrs. Jones and Murcott.

The quantity of hematite iron stone is small as compared with a short time ago, and the prices of native stone are for white and gubbin from 13s. to 15s. per ton.

The coal trade is, in the Dudley district, in a somewhat better state than it was a fortnight ago. The qualities in demand are principally those used for domestic consumption, and are chiefly exported. Best thick coal is realising 11s.; common, 8s.; lumps, 7s.; and fine slack 2s. 6d. per ton. Heathen coal, 10s.; lumps, 7s.; brooch, all one way, 9s.; Kibbles, 5s.; at the wharfs west of Dudley. On the cast side prices range from 6d. to 1s. per ton higher.

Mr. Samuel Griffiths has received his "letter of license" from his creditors; and his "deed of inspection" has been duly published in the *Gazette*. In the reference to this matter last week, some confusion arises from the omission of Mr. E. B. Thorneycroft's name in the statement that the deed contained a recital setting forth that he (Mr. E. Bagnall Thorneycroft) was never a partner in Mr. Griffiths' so-called firm of Messrs. E. B. Thorneycroft. Notwithstanding this recital we find that Mr. Griffiths, in this week addressing the men who were in his employ while the "Staffordshire works" were open, still referring to Mr. E. B. Thorneycroft as his past and present partner. Mr. Griffiths has been entertaining those workmen this week with a plentiful supply of good fare. His election expenses for contesting the borough of Wolverhampton at the last election are just published. They amount to £980.

The following is a copy of a circular which has been issued by Mr. William Crawshay, announcing a dissolution in the partnership which formed the Cinderford Iron Company:—

"I beg to inform you that the partnerships heretofore subsisting between my father, Mr. William Crawshay, and the late Mr. William Allaway, and subsequently between my father and Mr. Stephen Allaway, and since between Mr. Stephen Allaway and myself, are all now at an end, and that the business of the late Cinderford Iron Company will, for the future, be carried on by me alone, in the name, or under the title of 'The Cinderford Ironworks.'"

The Birmingham general trades continue without noticeable alteration. The cases in which there is scarcely any alteration are an exception.

A Birmingham paper announces that some vessels have sailed from Liverpool with heavy goods—articles regarded simply as necessaries—for the Southern States, intending to run the blockade, and we understand that some members of Lloyd's have taken the insurance at such an easy rate that, after deducting freight, risk of capture, danger of the seas, &c., there remains a margin for profit which bears favourable contrast with that under the high protective duties of the North. Several special branches of Birmingham manufacture have profited by these transactions, and some surplus stock has thus unexpectedly been got rid of. The experiment seems likely to be repeated as opportunity offers.

At one time great dissatisfaction was felt among the fine art houses in Birmingham—such, for instance, as the manufacturers of jewellery, chains, &c.—with respect to the accommodation for those branches in the New Exhibition Building, and it was indeed probable that many firms would not be represented at all. There has, however, been an entire re-arrangement of the position assigned them, and we now find that Birmingham will stand very well. The representative of a local firm writes from the International Exhibition office:—"The whole affair is re-arranged. The Birmingham jewellery department is an entire square by itself—four frontages; and we shall do very nicely."

By the Board of Trade returns just issued we find that the total value of the British manufactures and produce exported in January was small, amounting only to £8,439,055, but it is rather more than that of the exports of the corresponding month of last year; and the increase is participated in by most of the important manufacturers of the Midlands, the chief exceptions being hardwares and cutlery, machinery, railway iron, and silk manufactures. These branches of the national industry are now entered in the tables in such a manner as to show in which of the numerous sub-divisions into which modern arrangements have cast them the increase or diminution has taken place, by which separation the utility of the returns is very much enhanced. Small arms appear in these accounts for the first time in the January return, which shows that £43,356 were exported in that month, against 16,908 in the corresponding month of last year, and 10,381 in that of 1860. Earthenware and porcelain are now separated, and we learn that the value of the exports of the former was £66,221, and that of the latter £2,999, against £53,010 for both, last year, and £98,938 in 1860. The increase upon last year was general, but was most conspicuous in the exports to France, which from £249 in value in 1860, and £499 last year, rose to £3,938. Glass shows a decline from £42,738 in 1860, and £34,777 last year, to £33,310, owing to a falling off in the exports of window glass and common bottles. Hardwares and cutlery are also separated, as they ought long ago to have been, and the exports of the former are shown to have amounted in value to £24,968, as those of the latter to £17,107; but the last amount represents only a portion of the goods formerly classed under this head, being limited to manufactures of steel, or of steel and iron combined (anvils, vices, saws, files, edge tools, cranks, slide-bars, &c.), and tools or implements of industry, otherwise than agricultural, not wholly composed of iron or of steel. The value of the exports of all articles previously entered under the denomination of hardwares and cutlery was £161,773, against £230,973 last year, and £243,105 in 1860. Manufacturers of leather are now entered so as to distinguish the value of the boots and shoes exported, which amounted to £120,710, more than five-sixths of the whole being shipped to Australia. Machinery, as already mentioned, shows, on the whole, a decline, as though the value of the steam engines exported rose from £44,081 to £53,962, as compared with the corresponding period of last year, the exports of other machines declined in value from £170,436 to £144,920. The increased production of steam engines for India and Brazil was sufficient to more than compensate for the diminished shipments to Spain, but such was not the case with regard to the increased production of other machines for France, Spain, Holland, the Hanse Towns, and Russia, as against the diminished shipments to India and Australia. The improved classification of metals gives the following results:—

MONTH ENDED JANUARY 31ST.

	1860.	1861.	1862.
Iron, Pig and Puddled	£43,379	£46,517	£64,991
,, Bar, Angle, Bolt, and Rod ..	140,360	98,099	126,920
,, Railway	152,415	183,269	107,670
,, Wire	20,771	13,441	11,351
,, Cast	40,199	32,252	42,082
,, Hoop, Sheet, and Plate	58,752	36,038	44,957
,, Wrought	103,209	138,969	148,529
Steel, Unwrought	71,841	30,076	50,324
Copper, Unwrought	99,070	52,714	34,230
,, Bar, Rod, Bottoms, Pans, Sheets, Nails, and Plates (including Yellow Metal)	114,507	67,922	91,046
,, Wrought, Other Sorts ..	19,801	14,253	14,785
Brass	11,770	11,881	18,008
Lead	38,405	24,119	21,543
Tin, Unwrought	25,402	20,311	22,492
,, Plates	100,996	36,596	64,283
Zinc	6,063	2,802	3,069

The great increase in the exports of pig and puddled iron took place in the exports to France and Holland; while that of the second description was general, except as regards the United States. There was a diminution in the shipments of railway iron to India, Australia, and the United States; but the exports to other railway-making countries show an increase, especially to France and Spain. The increase in cast iron was general, except as regards the United States and Brazil. In hoops, sheets, and boiler plates the exceptions were the Hanse Towns, Australia, and the United States, the increase being greatest in the trade with Holland, Spain and India. The falling off in unwrought copper was general, while the increase in wrought copper and yellow metal extended to all countries except Holland, Italy, and Turkey. Australia was the only market which diminished its demand for tin plates. The value of the plate, plated wares, jewellery, and watches exported was £40,480, against £34,327 in the corresponding period of last year. In the import account clocks and watches show a falling off, the former from 9,338 to 4,514, and the latter from 6,867 to 5,030. There was a largely increased importation of copper, chiefly from Chili, and also of copper ore and regulus tin and zinc; but iron and lead show a diminution. Silver ore is an item in the metallic imports which appears for the first time, the value imported being £32,170 against £780 in the corresponding month of last year.

Two cases of gross and serious negligence by engine-tenters at collieries have come under our observation since last week. On Monday the magistrates at Willenhall sent an engine-tenter, who had been in the service of Mr. Phillip Williams, the chairman of the Ironmasters' Association, of South Staffordshire, to prison for six weeks, and ordered the wages that were due to him to be confiscated, for his having drawn a skip over the pulley, and for being drunk while he was at his work. On the same afternoon eight men received serious personal injury, seven of them by being drawn over the pulley at a pit at Tividale, two miles from Dudley. The doggy of the pit was on the bank when the men were nearing the top of the shaft. On perceiving that the engine was working faster than was compatible with safety, and being further alarmed by observing that the engine tenter was out of the engine-house, thrust the "wagon," or movable platform, over the pit's mouth. He had scarcely done so before the skip was over the pulley, and the men were out. Immediately that he had performed the timely act, which saved at least a majority of his fellow-workmen from certain death, he sustained very severe injuries himself, for some of the men, and probably portions of the skip and the massive weights which are hung above it, fell upon him. It is further to be regretted that the son-in-law of this man, who was one of the party in the skip, cannot survive. All the injured men are married and have children.

Mr. H. L. Fletcher, one of the partners in the late firm of Pitt and Fletcher, iron merchants, of Willenhall, and who is the eldest son of the notorious Bilston incumbent of that name, was, on Wednes-

day, charged before the magistrates at Wolverhampton with forging the acceptance to, and then uttering a bill of exchange for, £80. The bill was drawn by Fletcher upon the firm of "Pitt and Fletcher," two months after the dissolution, and he wrote the name of "Jacob Groves," of Willenhall, as the acceptor. The bill was discounted by a broker, and, when disavowed by Groves, tendered to the firm. Pitt was then a clerk, and he paid the money to the bill broker. Pitt and Fletcher having, however, through the discovery of the defalcations of the Rev. H. S. Fletcher, to go into the Birmingham Bankruptcy Court, an explantion of the payment had to be made. Hence these proceedings. Fletcher was remanded for a week, and the bench refused to accept bail. The affair gave rise to much conversation among the iron trade in Birmingham yesterday (Thursday), and on the day before in Wolverhampton.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

NORTHERN MATTERS: *Depression on Tyneside: Trade of the North East Ports: The Elswick Works: The Steam Collieries: Cleveland Iron Trade: River Tyne Commission: Miner's Relief Fund*—FATAL ACCIDENT ON THE BORDER UNION RAILWAY—BIRKENHEAD FERRIES—MANCHESTER, SHEFFIELD, AND LINCOLNSHIRE RAILWAY: *New Station at Liverpool*—IRONWORK CAPABILITIES OF LIVERPOOL: *Messrs. Vernon and Son's Works*—INSTITUTION OF ENGINEERS IN SCOTLAND—FENCING OF FLY-WHEELS: *Important Judgment by Sir A. Alison*—SUGAR MILL MACHINERY FOR THE INTERNATIONAL EXHIBITION—STATE OF TRADE: *Manchester: Sheffield: Derbyshire*—EASTERN COUNTIES RAILWAY.

WE commence with the north. The state of commercial affairs on Tyneside is still gloomy. In the exports of general merchandise from north-eastern ports there was last month a considerable falling off, the decline in the shipments from Newcastle having been upwards of £18,000, from Sunderland upwards of £5,000, and from the Hartlepools upwards of £40,000. Most of the large establishments in the northern district have rather circumscribed their operations, but the great Elswick Works are an exception to the rule, and the large space of ground which the Ordnance Company purchased a short time since to the east of their existing buildings is being covered with large workshops. It is stated that several of the largest steam collieries are working only four days to the fortnight; and only those collieries which have large contracts, and are, therefore, but little affected by market fluctuations, are working eleven days to the fortnight. The Cleveland iron trade participates in the general depression, and in the Rosedale district there is some want of employment. The members of the Tynemouth Chamber of Commerce have a bone to pick with the Tyne Improvement Commission. They held a special meeting on Friday evening, at which the great source of complaint against the river conservators, who have now had a separate corporate existence of nearly twelve years, seemed to lie in their postponement of the construction of the Low-Lights Dock, for which Parliamentary powers were obtained last year; and petitions were adopted for presentation to both Houses of Parliament, and to the Admiralty and Board of Trade, with a view to amend and extend the present constitution of the commission. At the same meeting, a petition, praying Parliament to withhold its sanction from the Tyne Ferry Bill in the form in which it is proposed, was likewise agreed to. The chamber seems to ignore the fact that great commercial depression prevails, and that the commissioners with prudent caution decline to embark in works involving a large outlay in the present state of affairs. The miners of Northumberland and Durham propose to establish a permanent relief fund to include only fatal accidents and those by which miners may be permanently disabled. It is recommended that all men should contribute 1d. weekly and boys ½d. weekly towards the object in view. An interesting letter has been addressed by Mr. J. W. Pease, of Darlington, to Mr. Hugh Taylor, as president of the coal trade. The subject of which the writer treats is the relief fund proposed to be established, and he submits a plan of insurance, by which the object may be carried into effect, to the highest advantage of those whose interests are concerned. He calls attention to the single cases of accident which are of so frequent occurrence, and the miners in the comparatively new iron district in Cleveland he also intends to include in the scheme. Mr. Pease suggests that each year should provide a fund equal to the cases arising in it, and the term of insurance he would limit to five years, a longer period being easily provided for by a larger weekly payment. Care, he says, should be taken that the premium payment should be so regulated year by year, after the experience of a year or two, that the Hartley fund should not be infringed upon, save in the case of any casual circumstance which might arise; and he thinks that the surplus money might be invested in the names of seven trustees, to be selected by a majority of the coalowners, who subscribed to the insurance fund.

Yesterday week a fatal accident occurred on the Border Union Railway. Heavy rain caused an accumulation of waters at Flash Burn, in Liddesdale, where the stream passes under a high embankment of the railway, through a culvert 8ft. in diameter. The bank had slid down and stopped the end of the tunnel, and the accumulation of water, 20ft. deep, threatened to sweep away the embankment. Mr. J. F. Tone, the engineer of the company, entered the tunnel from the other end, accompanied by Mr. Thomas Ridley, the cousin of the contractor, and a labourer. Mr. Tone took a shovel, intending to pierce the mass of clay and let through a small quantity of water which might gradually enlarge the opening. In an instant the mass of clay gave way, and all the three were swept by the water through the tunnel. The labourer was washed on to dry land. Mr. Tone, though stunned and bruised, struggled to land, but Mr. Ridley was swept into the Liddell, swollen by the rain, and lost his life. The unfortunate gentleman leaves a widow and four children. But for the precautions taken by Mr. Tone a much more serious loss of life might have taken place. The workmen expressed their readiness to go up the culvert, but Mr. Tone refused to allow them in the face of such imminent danger before he had examined the state of matters in the culvert, and satisfied himself that the remedial works could be undertaken with safety.

The Birkenhead ferries continue extremely prosperous, and are yielding a gradually increasing revenue. New steamers are about to be provided in connection with the Woodside Ferry, and at the last sitting of the Birkenhead Commissioners a report was read from Mr. G. Harrison and Mr. J. Laird, M.P., as to the best description of boats which could be selected. The report stated that the passenger steamers should not be less than 150ft., or more than 160ft. long, and not less than 27ft. beam; draft of water, with 50 tons on board, not to exceed 7ft.; the power not more than 100 horses, each wheel to be worked by a pair of engines, say four engines in all, and the engines to be capable of working up to four times their nominal horse-power; the vessels to be built of iron, and steered from each end; to be provided with separate accommodation for ladies and children if practicable; to have water-tight bulkheads, to render the vessel safe in case of collision under all ordinary circumstances; and the steamer's deck to be level with the new Landing-stage at Woodside, which is 6ft. from the water's edge. The luggage-boat should not be less than 150ft., or more than 180ft. long; not less than 30ft., or more than 35ft. beam; and draft of water, with 100 tons dead weight on board, not to exceed 8ft.; the horse-power of engines not to be less than 120, or more than 180 (nominal), and to be on the same powerful principle named for the passenger steamer; the vessel to be built of iron, and steered from both ends.

The Manchester, Sheffield, and Lincolnshire Railway Company solicit powers for establishing a station in Liverpool in connection with their gradually extending system. It is proposed to construct a railway 1 mile and 53 chains in length from a junction with the authorised line of the Garston or Liverpool Railway at Egerton-street, Toxteth Park, to or near the junction of Lawton-street, and Ranelagh-street, Liverpool. The proposed new line and station are to be completed, if authorised, in five years.

The *Liverpool Albion* has not yet quite exhausted its stores of information on the ironwork capabilities of Liverpool. This week it gossips very agreeably about the works of Messrs. Vernon and Son, eminent local iron shipbuilders. Mr. Thomas Vernon, now deceased, was the founder of the firm, and, as a practical operator in plates and other descriptions of malleable iron, was one of the first to perceive the advantages to be derived from the application of iron to shipbuilding. No less than 30 years since Mr. Vernon, under the approving superintendence of Mr. C. Wye Williams, so well and so honourably known in the steam shipping world, constructed some 30 iron barges for the Shannon navigation, many of them being still in use. Between 1831 and 1844 Mr. Vernon built and launched some 37 ships almost entirely constructed of iron, several of them being steamships of considerable power and tonnage, and he also devoted his attention to many other kinds and branches of iron manufacture. At the commencement of 1844 Mr. Vernon was joined by his son Mr. John Vernon, who became a partner in the business; and since that year the firm has kept a regular record of the ships which it has built. It appears from this journal that from 1844 to the end of 1861 they built no fewer than 108 ships, with an aggregate measured burden capacity of about 46,000 tons, besides a very large extent of other important works, in the shape of girder bridges, floating wharves, and similar constructions of manipulative skill. Of the now celebrated iron-screw colliers trading between the Tyne and London, and having double iron bottoms, the first were constructed by Messrs. Vernon and Son. They fully solved the problem—"Can a vessel be made to carry a full ore-cargo on her voyage, and return in a seaworthy condition without the cost of loading ballast?" These vessels are made to a certain extent with double bottoms, and with such hydrostatic apparatus that, under perfectly regulated arrangements, water can be admitted to or excluded from the space between the two bottoms or skins of the ship. Thus, when the vessel is loaded, and she requires no ballast, the water is excluded from the vacant space; but when her cargo has been discharged, and she has to return with an empty hold, the turning of a tap admits the water between the inner and outer skins of the ship till she is sufficiently loaded with water-ballast, and is thus expeditiously and cheaply made ready for sea. Besides the important improvement above referred to it may be mentioned that Mr. Vernon, sen., along with Mr. James Kennedy, were the inventors of the bulb deck beam iron, which is now universally employed in the construction of all iron ships. Other improvements have also been made or sedulously worked out at this establishment, till now the deck and inside ceiling are nearly all the wood-work required in the formation and completion of iron-built ships. A continued increase of business led to a gradual extension of Messrs. Vernon's premises, and the building yard and its appurtenances are now of large dimensions. From south to north the yard stretches along the river margin 486ft.; and from east to west it extends 323ft. In the central portion of the east side are situated a range of writing and drawing offices; and contiguous to these is the large drafting room in which the ribs and framing of the different vessels are drawn out of the full size. The southern margin of the building yard is occupied by the smiths' shop—230ft. long by 40ft. wide, which is employed in making the general smith work of the establishment, and has twenty blast hearths. It is amply furnished with all the varied tools required in the preparation of heavy ironwork, including the making of stern and rudder-posts, and the scarfing of keels, and has a steam hammer of considerable dimensions. Just beyond the shop referred to, still more to the south, is the shop and yard for bending the ribs and other portions of the framing of first-class iron ships. This shop is furnished with the requisite amount of perforated iron floor, and there are two sets of large rollers for bending or flattening rod or plate iron, besides punching, drilling, and trimming machines. The building yard is conveniently situated, and commands a good stretch of river front, with a well-regulated launching elevation. Since the commencement of the present year Messrs. Vernon have launched, or have now on hand, eleven iron vessels, having an aggregate of 10,000 tons measurement; all these are sailing ships. Conspicuous in a complete list of Messrs. Vernon's miscellaneous works would necessarily stand the stupendous landing-stages on the shores of the Mersey. They constructed all the girders for the high-level railway at the north end of the town, and restored the screw-steamship Great Britain, after she had been stranded in Dundrum Bay. They constructed the two first of Mr. Bourne's steam-trains of barges for the navigation of the Indus, each train being 700ft. in length, and connected by joints to accommodate it to the tortuous channels of the Indian rivers. They also constructed barges for the navigation of the Ganges and of the Danube, and built the iron steamer Assam, about twenty-five years ago, for navigating the Ganges. This vessel, after having worn out one pair of engines, is being, or has been, fitted with new engines, her hull being still in perfectly good order. Last, not least, may be mentioned a caisson of very peculiar construction, recently executed for the Government Dockyard at Malta. The floating principle of this caisson is an air-chamber, so placed in the fabric as to be completely submerged, the buoyancy or sinking of the whole apparatus being effected in the simplest way, and with the utmost nicety, by a very small weight of water introduced into a chamber placed above the air-chamber first alluded to.

At last week's meeting of the Institution of Engineers in Scotland discussions took place on papers "On the Expansive Working of Steam" (read by Professor Rankine), and "On Surface Condensers" (read by Mr. Spencer). The meeting was presided over by Mr. W. Johnstone.

In the Sheriff's Court at Glasgow Sir A. Alison has disposed of the case of "Mrs. Sarah Docherty and children *v.* James Alexander, calenderer, of Glasgow." The pursuer's husband, the defender's engine-keeper, was killed by the fly-wheel of the engine. It was held by Sir A. Alison, reversing the judgment of the sheriff-substitute, that the defender was liable, as the fly-wheel was not boxed or railed in; and the sum of £50 was ordered to be paid to the pursuer in respect of "damages and solatium." Sir Archibald Alison, in the course of a long note appended to his judgment, observed:—"The necessity for boxing fly-wheels has been so strongly experienced that, in some trades where young persons are generally employed, it is declared imperative by Act of Parliament, specially made for that matter. The defender here is a calenderer, which is not one of the trades where it is by statute declared that boxing is indispensable; but the reason of the thing applies to all factories where fly-wheels are in use. The deceased had been for fourteen years about engines, in one employment for four years and a half as an engine-keeper, and no special unskilfulness can be proved against him. The sheriff does not go so far as to assert that a master is bound to guard his workmen against the consequences of any probable recklessness on their part; but he apprehends that he is bound to guard against the probable dangers of the employment at which they are engaged, if it can be done at a reasonable expense and without any extraordinary trouble. In the present case, the risk to the engine-keeper was obvious, and such as must have endangered the life of the most careful workman, for how was it possible for a person in charge of the fly-wheel, and requiring to oil it occasionally, to go round the engine in a little space of from 2ft. to 2½ft. broad, when revolving with extreme velocity, without incurring some danger? And although, in some cases, the danger might be removed by stopping the engine when the same was being oiled, yet sometimes this was not possible, and under no circumstances could it be done without stopping the engine, and thereby throwing all the persons in the works dependent on its motions for a time out of their duties."

Messrs. W. and A. M'Onie, of Scotland-street, Glasgow, have completed a powerful steam engine, with sugar-cane mill, which they will show at the International Exhibition. The steam engine is highly finished and of 30-horse power nominal, the sugar mill being of corresponding size. The weight of the whole exceeds 70 tons. More sugar mill work is stated to be shipped from the Clyde than from all the other parts of the empire; and Messrs. M'Onie have now large orders on hand for Asia, Africa, and the West Indies.

Captain Palin reports thus as to the state of employment among the machinists and foundries of Manchester:—Of forty-seven machinists, sixteen are working full time with all hands, twenty-one full time with a portion of their hands, nine are on short time, and one has stopped altogether. Of twenty-four foundries, six are working full time with all hands, fourteen are working full time with a portion of their hands, and four are on short time. At Sheffield there is not much change. Several houses in the engineers' and machinists' tool trade report that they are in receipt of good orders, while others state that they are not doing much. The coal and iron trades of Derbyshire are depressed.

The Eastern Counties Railway Company has been foiled again in an absurd attempt to obtain powers to establish lines of steamers from the minor eastern ports to various points on the continent. The project was strenuously opposed by the steam shipping interest, who contended that the funds of the company could not properly be applied to such an object. The Parliamentary Committee, before whom the matter came, took a similar view of the matter, and, in doing so, probably saved the company itself from considerable loss. The Bill for amalgamating the Eastern Counties, Norfolk, &c., companies, will pass, in all probability, so that 650 miles will be placed under one general management, and fused in one common interest.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£	s.	d.	Dis. p. ct.
IRON, English Bar and Bolt:—					
in London	pr tn	5	15	0	2
in Wales	"	5	0	0	"
in Liverpool	"	5	10	0	"
Deliv. into boats at wrks: Staffordshire Bars	"	7	0	0	1½
Sheet, Sngl. (Nom. rates last qr. day for favourite brands)	"	8	10	0	"
Dbl.	"	10	0	0	"
Hoop	"	8	0	0	"
Rod, round	"	7	0	0	"
Nail Rod, sq	"	7	5	0	"
SHIPPING IRON, Staffordsh. Bars (Delivered in Liverpool 10s. per ton less)	"	7	0	0	2
Sheet, Single	"	8	15	0	"
Double	"	10	5	0	"
Hoop	"	8	5	0	"
Rod, Round	"	7	0	0	"
Nail Rod, Square	"	7	5	0	"
IRON, Rails, in Wales, cash	"	5	7	6	nett
" " 6 months	"	5	10	0	"
Old, to cut up	"	0	0	0	"
Railway Chairs, in Wales	"	4	0	0	"
" in Clyde	"	3	15	0	"
Pig No. 1, in Clyde	"	2	6	0	"
3-5ths No. 1 & 2-5ths No. 3		2	9	0	"
No. 1, in Wales	"	3	10	0	"
No. 1, in Tyne and Tees	"	2	12	0	"
Ditto, Forge	"		9	0	"
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	"	3	10	0	"
Welsh Forge Pig (all Mine), at the Port	"	3	5	0	"
Acadian Pig, Charcoal	"	7	10	0	"
Scotch Pig, No. 1, in London	"	0	0	0	"

		£	s.	d.	Dis. p. ct.
IRON, Swedish, Indian assortments	pr tn	11	5	0	2
Russian C C N D to arrive	"	16	0	0	"
STEEL, Swedish Keg, ham.	"	15	10	0	2½
Ditto, rolled	"	15	0	0	"
Fagot		17	0	0	"
SPELTER, on the spot	"	17	15	0	nett
To arrive	"	18	0	0	"
Hard, remelted	"	17	0	0	"
ZINC, in sheets	"	23	0	0	"
COPPER, Tile, 14 to 28 lb.	"	98	0	0	2
Tough Cake	"	98	0	0	"
Sheathing and Bolts	pr lb.	0	0	11	"
Sheet	"	0	0	11	"
Bottoms	"	0	0	11½	"
Old	"	0	0	9	"
Yellow Metal	"	0	0	9	"
Burra	"	97	0	0	"
Russian do.	"	0	0	0	"
LEAD, British Pig	"	20	15	0	"
Spanish	"	19	10	0	"
W. B.	"	21	0	0	"
Sheet	"	21	15	0	"
TIN, English Block, nom.	"	120	0	0	"
Bar "	"	121	0	0	"
Refined "	"	122	0	0	"
Foreign Banca	"	126	0	0	"
Straits	"	118	0	0	"
TIN PLATES, Char. coal, IC	pr bx	1	9	0	"
Ditto IX	"	1	15	0	"
Coke, IC	"	1	3	0	"
Ditto IX	"	1	9		"
Do. at Newport, 1s. pr bx less		—			"
Do. at L'pool, 6d. "		—			
CANADA, Plates	pr tn	12	0	0	2
QUICKSILVER	pr bt		0		

LEAD in fair demand.

RAILS.—There has been a good many inquiries this week, and the market is somewhat firmer in consequence.

SCOTCH PIG IRON has been a little firmer this week, and a fair amount of business done. The market closed firm at 49s. 6d. cash for Mixed Nos. Warrants f.o.b. in Glasgow.

SPELTER continues unaltered, and but little doing in it at £17 15s. on the spot.

COPPER in moderate request, at the reduction reported last week.

LEAD tolerably firm.

TIN.—English in fair demand. Banca cannot be had here under £126, while the price in Holland is much higher. Not much doing in Strait which is quoted £118.

TIN PLATES in good demand.

March 13th, 1862. MOATE AND CO., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861 £	s.	£	s.	1862 £	s.	£	s.
Teak	15	10	17	0	15	0	16	0
Quebec, red pine	3	10	4	10	3	5	4	0
yellow pine	3	0	4	0	3	0	3	15
St. John, N.B., yel.	5	0	5	10	5	0	5	10
Quebec, oak, white	5	0	5	10	5	0	5	10
birch	3	10	4	0	4	10	0	0
Memel	0	0	0	0	0	0	0	0
elm	3	10	4	15	3	10	4	15
Dantzic, oak	3	10	6	0	3	10	6	0
fir	2	15	3	10	3	0	4	0
Memel, fir	3	10	4	0	3	10	4	0
Riga	3	5	3	10	3	10	3	15
Swedish	2	15	3	0	2	15	3	0
Masts, Queb. rd pine	5	0	6	0	5	0	6	0
yl. pine	5	0	6	0	5	0	6	0
rd pine	0	0	0	0	0	0	0	0
Lathwood, Dantz, fm	6	0	6	10	6	0	7	0
St. Peters.	8	0	8	10	9	0	9	10
Deals, per C., 12 ft. by 3 by 9 in.								
Quebec, wht. spruce	13	0	18	0	15	0	19	0
St. John, wht. spruce	13	0	16	0	15	0	17	10

Per load—	1861 £	s.	£	s.	1862 £	s.	£	s.
Yel. pine, per reduced C.								
Canada, 1st quality	17	0	18	10	17	10	19	0
2nd do.	12	0	12	10	12	0	13	0
Archangel, yellow	13	0	13	10	14	0	15	0
St. Petersbg. yel.	12	0	12	10	12	10	13	10
Finland	9	0	10	0	9	10	10	10
Memel	10	0	15	0	10	0	15	0
Gothenburg, yel.	10	0	11	10	10	0	12	1
white	9	10	10	0	9	10	11	0
Gefle, yellow	10	0	11	0	11	0	12	10
Soderhamn	10	0	10	10	11	0	12	10
Christiania, per C 12 ft. by 3 by 9 in. yellow	22	0	25	0	22	0	24	0
Deck plank, Dntz per 40 ft. 3 in.	0	14	1	4	0	14	1	4
Staves, per standard M								
Quebec, pipe	70	0	75	0	50	0	55	0
puncheon	16	0	18	0	16	0	15	0
Baltic, crown pipe	160	0	170	0	170	0	180	

SCOTCH PIG IRON REPORT.

		s.	d.		
No. 1	Gartsherrie	55	3	f.o.b	Glasgow.
" 1	G.M.B.	49	0	"	do.
" 3	Do.	48	0	"	do.
M. Nos.	Do.	48	6	"	do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths " 3 .. G.M.B.	Cash prompt	49	3	per ton.
	1 mo. open	49	6	do.
	2 mos. "	49	9	do.
	3 " "	50	0	do.

MANUFACTURED IRON.

	£	s.	d.	
Bars, Govan	7	0	0	
" Common	6	17	6	
Drumpeller, Common	6	17	6	
Do. Best	7	17	6	
Plates and Sheets	9	0	0	to £10.
Rails	7	5	0	
Pipes	4	15	0	
Chairs	3	10	0	

GLASGOW, 12th March, 1862.

The market, as regards speculation, is almost lifeless. The shipping demand is good, and promises to continue so throughout the spring months. The home demand is slack both among malleable iron makers and founders. These are not quite so busy as they were at this time last year.

Exports last week were 9,042 tons, against 7,117 tons in the corresponding week last year. SHAW, THOMSON, and MOORE, Metal Brokers.

ENAMELLED TABLETS.—The Patent Glass Enamel Company, of Birmingham, represented by Messrs. James Hunt and Co., of 36, High Holborn, are producing great numbers of enamelled tablets, chiefly lettered signs, in which the letters are burnt on in the most indestructible materials. The glaze resists a considerable concussion, and is in no danger of cracking with ordinary care. A great improvement has been lately made by the Glass Enamel Company in fixing gold upon the enamelled surfaces, so that gilt letters may be produced at will.

THE EXHIBITION.—The Great Western and Vale of Neath Railways will exhibit five or six broad gauge locomotives in the approaching Exhibition. Locomotives will soon arrive, also, from Prussia, intended for exhibition. All these engines are to be drawn through the streets to South Kensington, by Bray's traction engines. A block of Krupp's steel, weighing upwards of 30 tons, is also to be taken to South Kensington by the same means. Among the heavy weights lately moved by one of these engines was a steam cylinder weighing nearly 21 tons, being one of a pair made by Messrs. Penn and Son for a pair of 1,000-horse engines for the Spanish Government. During a la trial, with a heavy load over swampy ground, one of Bray's engines exerted a measured tractive force of 9,000 lb., the wheels sinking but two or three inches into the soft ground

THE GASWORKS OF LONDON.

The metropolis, including a number of its suburbs, is supplied with gas by thirteen companies owning nineteen works, all but two of which are within four miles from Charing-cross. The retorts, both single-end and double-end, are equal to almost exactly 5,000 double retorts, averaging about 19ft. in length, or to 10,000 mouth-pieces. It has been estimated that these works carbonise 850,000 tons of coal annually, and from which about 8,000,000,000 (eight thousand million, or, in the ordinary terms of gas measurement, eight million thousand) cubic feet of gas is made. Of this, upwards of one million thousand feet is lost by leaking from the mains and in other ways, while the rest is sold for about £1,600,000. Other estimates give 1,000,000 tons as the amount of coal carbonised yearly, the sale of gas amounting to £2,000,000, equal to 14s. 6d. for every man, woman, and child in the metropolis.

The first gas company in London, as it was the first in the world for the production of gas commercially, was the "Chartered," originally empowered as "*The* Gas Light and Coke Company," and which commenced business in 1812. This company has, for many years, carried on three separate works, one in the Horseferry-road and Great Peter-street, Westminster, one in Goswell-street and Brick-lane, and a third in the Curtain-road. The City of London Gas Light and Coke Company built extensive works, in 1812 also, at the foot of Dorset-street, just below the Temple, and upon ground originally occupied by the New River Company. The Phœnix Company was the first to make gas on the south side of the Thames, their first retort house, at Bankside, and now occupied as a boiler shop by Messrs. Rennie, having been built in 1816. The present retort house at Bankside was erected in 1840, and in 1848 the same company, already carrying on a branch works at Greenwich, established a third and extensive station at the south-eastern end of Vauxhall bridge, with large gas holders at Kennington-oval. The next London gas company was the Imperial, whose operations have always been by far the most extensive of any in the metropolis, if not in the kingdom. The Imperial has three gasworks, the Pancras station, at Battle bridge, near King's-cross, the Hackney-road works, Great Cambridge-street, and a third establishment at Fulham. Then we have the London Gasworks, in Vauxhall, near the bridge, the Ratcliff, near the Wapping end of the Thames Tunnel, the South Metropolitan in the Old Kent-road, the Commercial in Stepney, near the Mile End-road, the Equitable in Pimlico, a short distance above Vauxhall bridge, the Independent in Albert-street, Haggerstone, the Surrey Consumers' in Rotherhithe, near the Thames Tunnel, the Great Central Consumers' at Bow-common, and the Western at Kensall-green. It will not be necessary for our purpose to give the boundaries of the districts supplied by the various companies. In most cases the position of the works themselves is within the district supplied, although in other instances the whole delivery of gas is at a considerable distance from the works. Thus, the Great Central Consumers' Company, whose works are at Bow-common, are not allowed by their Act to supply gas elsewhere than in the City of London, the neighbourhood about their own works being lighted by the Commercial Company.

Three gasworks, the Ratcliff, the Surrey Consumers', and the Greenwich branch of the Phœnix, are on or close to the Thames, below London bridge, and are thus enabled to receive their coal directly from the Newcastle colliers. Five works, the Bankside and Vauxhall stations of the Phœnix Company, the City, the London, and the Equitable, are on the river side, above bridge. Five works, the Commercial, the Independent, the Pancras and Hackney-road stations of the Imperial, and the Western, are on the Regent's Canal. The Fulham station of the Imperial Company is on the Kensington Canal, the South Metropolitan works are on the Grand Surrey Canal, and the Great Central Consumers', is close to the North London Railway, from which branches extend directly into each side of the retort house. Neither of the three stations of the Chartered Gas Company are on a line of water or railway communication, the whole of their coal having to be sacked at the nearest wharf, thence carted to the works, where the men carry it in on their backs. The City extension of the North London Railway will run close to the Curtain-road works, which will thus receive their coal directly from the railway wagons, the level of the rails being 16ft. above the floor of the retort house.

Illuminating gas is produced by the decomposition of organic substances, of which coal is among the cheapest and most convenient. Under a destructive distillation at a high heat, wood, resins, fats and oils, peat, and many other substances yield lighting gas. In some of the towns in America, as at Wilmington, North Carolina, the whole supply of gas has been made from pine wood, which does not, however, afford a gas of high illuminating power. Works for the production of gas from resins, fats, and oils, were at one time common, but have been generally abandoned on account of the greater cost of the gas produced as compared with that obtained from coal in the ordinary manner. Some interest has been aroused by the gas-producing properties of peat, and one or two of the London companies are now experimenting with peat from the estates of the Earl of Caithness in the North of Scotland. Thus far the results have been encouraging, and it may be that peat gas will by and by come into extensive use.

Purified coal gas consists almost entirely of carbon and hydrogen in two different proportions of mixture. Hydrogen, which is the more inflammable constituent, gives but a very feeble light when burnt in the air or in pure oxygen. When two atoms of hydrogen have united themselves to one of carbon, forming carburetted hydrogen or marsh gas (the "fire damp" of the miners), light is afforded, as, in burning, the inflammation of the hydrogen precipitates the carbon atoms, raising them to incandescence, in which state they are highly luminous. When the two atoms of hydrogen take up a second atom of carbon, forming bi-carburetted hydrogen, or olefiant gas, the illuminating power is greatly increased. Purified coal gas is a mixture, in variable proportions, of pure hydrogen and carburetted and bi-carburetted hydrogen, the whole having, as in the average of London gas, a specific gravity of about ·400 or ·412, air being 1·000.

Coal is, practically, a compound of carbon and hydrogen in the solid state. A good gas coal may contain 85 per cent. of carbon, and from 5 to 7 per cent. of hydrogen, the remainder being fixed oxygen, &c., besides mineral matter. The coal once decomposed at a high heat, the hydrogen immediately takes the gaseous state, carrying with it also from twice to three or four times its own weight of carbon vapour in combination. The remaining carbon, generally from 60 to 70 per cent. of the original weight of the coal, is known as coke, its porous structure being due to the formation of highly expansive gas throughout its whole mass. At a low heat, the chief products of the distillation of gas-bearing coal are liquid hydro-carbons, as oil and tar. Paraffine oil is distilled at a moderate heat from the highly hydrogenous Boghead coal, and it is probable that the vast subterranean collections of oil in and near the American coal fields have been formed by the action of internal heat upon the beds of coal themselves. At various places not far from the oil wells, natural gas is obtained in abundance from the ground, the town of Fredonia, in the State of New York, being lighted throughout by natural gas, which is also employed for illuminating one of the lighthouses on the southern shore of Lake Erie. This gas, we may suppose, has been generated at a higher heat from either the coal or coal-oil, from near deposits of which the gas is obtained.

We may observe here that the lights given out by torches, oil and spirit lamps, and candles, are true gas-lights, as much so as that which blazes from the burner of a gas-pipe. In burning any inflammable substance, it is gradually decomposed by the heat communicated from the original ignition, and the gaseous products thus formed, and to which the brilliancy of the light is due, are practically identical with coal gas. The superior brilliancy of the latter is due to its being less diffused, and to being burnt at a more rapid rate; at least a dozen sperm candles being required to give as much light as an Argand gas-burner burning 5 cubic feet per hour. A gas-burner burning but 1½ cubic feet per hour gives a light only equal to that from a single candle, while by doubling the discharge from the burner a light equal to that of from 8 or 10 candles is obtained.

With this hasty glance at the nature and properties of coal gas, we may follow up the details of its production in the great gasworks of the metropolis. At many of these works two qualities of gas are made, ordinary gas and cannel gas, the latter having two-thirds more illuminating power than the former, the usual price of ordinary gas being 4s. 6d. per thousand cubic feet, while cannel gas is sold at 6s. The Western Gas Company make only cannel gas. For the ordinary gas the coal used comes from the neighbourhood of Newcastle. A good house coal is not, as a rule, the best gas coal, as the latter would be too smoky and "crusty." Hence it is that the coal from the Pelton, Haswell, Lambton's, Levison's, and Pelaw pits, being especially rich in hydrogen, and therefore preferable for gas-making, ranks in price considerably below that of Walls-end. Thus North Pelton gas coal has been quoted lately as low as 12s., and perhaps 14s. is a fair average price for gas coals in the Pool, where the Surrey Consumers' Company unship them at their own doors. Cannel gas is either made directly from Lancashire, Scotch, or Welsh cannel coal, or it is made by mixing the gas from Newcastle coal with that made from Boghead coal. The latter now brings 56s. a ton, and its price is likely to rise to where gas companies can no longer afford to use it. Some of the Newcastle coals contain a certain proportion of cannel in combination. From the Levison coal, for instance, more or less cannel may be picked out. At present, for making cannel gas up to the parliamentary requirement, the proportion of Boghead to Newcastle coal is about as 3 to 7, 30 per cent. of the whole amount of coal carbonised being of the former, and 70 per cent. of the latter variety; the different kinds of coal being carbonised in separate retorts, so set that the gases may meet and intermingle in the "hydraulic main" over the retorts.

Good gas coal is more liable than other coals to spontaneous ignition. The presence of "fire-damp" in the mines of richly bituminous coal proves the readiness with which hydrogen separates from solid carbon, and if the coal be reduced to "slack," which is the state in which a great deal of gas coal comes to London, some attention to ventilation is necessary to prevent the accumulation of gas in the vessels and stores in which the coal is kept. Occasionally we hear of a gas explosion, blowing up the decks and "starting" the planking of a collier. If the coal be allowed to get damp, decomposition of both the coal and water goes on, and there is every chance that the former may ignite spontaneously unless thoroughly ventilated. At the different London gasworks, from 20,000 to 100,000 tons of coal are carbonised yearly, and large stocks, often from 5,000 to 20,000 or 30,000 tons of coal are occasionally stored together. Unless care is taken to keep the coal well out of the weather, and to secure good ventilation, both by large openings in the upper part of the walls of the coal sheds, and, generally, by air-pipes penetrating and ramifying throughout the coal itself, there is more or less danger of fire.

The coal wheeled to the floor of the retort-house, the business of gas-making commences. Gas retorts are close vessels, once made almost exclusively of cast iron, but in all the London gasworks they are now almost as exclusively made of fire-clay or built up of fire-bricks. The old iron retorts were generally 9ft. or 10ft. long, with one end cast in, the other being closed by a removable lid or cover. More than nineteen-twentieths, however, of all the gas retorts now in use in London are from 18ft. to 20ft. long, and provided with lids at both ends. In cross section the retorts are either circular, elliptical, or ⌂ shaped, a very large, if not the largest, proportion of those now used in London being of a circular section. An internal diameter of 15in. is a common size, the fire-clay sides being from 2in. to 3in. thick all round. Considerably larger retorts are used however, the Chartered Company having a number of ⌂ retorts at their Goswell-street works, measuring 26in. inside. The retorts are always placed horizontally, a number varying from five to fourteen being set together within a sort of oven of fire-brick, which is heated throughout, generally by a fire in a single furnace at each end, although occasionally two fires are employed at each end of a set of retorts. Each set, or oven of retorts, is technically called a "bench," and these are placed, side by side, in a long row, the length of which governs the length of the retort-house.

At the great Pancras station of the Imperial Company, there are nearly 600 retorts, 20ft. long, or nearly 1,200 "mouth-pieces," the retorts being worked from both ends. These are generally set 10 in a bench, although in some of the benches there are but 6 retorts. At the Hackney-road station of the same company there are, we believe, 386 retorts 19ft. 6in. long, a large number being set 10 in a bench. At the Fulham station of the same company are 380 long retorts, 240 of which are set 6 in a bench, while 140 more are set 10 in a bench. It is to be borne in mind that 6 is the number now adopted in setting new retorts.

At the Horseferry-road station of the Chartered Gasworks there are equal to 340 long ⌂ retorts, or 680 mouth-pieces. Some are set 11 in a bench, although a smaller number appears to be preferred. At the Goswell-street works, some of the retorts are but 9ft. long, and worked from only one end. There are 545 mouth pieces, equal to 272½ full-length retorts. All are set 5 in a bench. At the Curtain-road works only single-end retorts, 9ft. long, are used, and of these there are 155, equal to 77½ retorts 18ft. long.

The Vauxhall station of the Phœnix Company has 357 retorts, 20ft. long, mostly cylindrical, and all set 7 in a bench. At Bankside there are 140 retorts, of the same length and shape, and set 7 in a bench At Greenwich a smaller number is used.

The City of London Gasworks, Dorset-street, have single and double retorts, mostly cylindrical, equal to 940 of the former, or 470 of the latter. There are but few single retorts. A small number also of old retorts are of iron. The usual number placed in a bench is 7, although some are set 5 together.

The London Gasworks, Vauxhall, have about 250 retorts, mostly cylindrical, 16in. in diameter, and say 19ft. long. They are usually set 9 in a bench, with one fire grate at each end of each bench, although a number are set 12 in a bench, with two fire grates at each end.

The Equitable Gasworks have, we believe, 30 benches of long retorts, some with 7 and some with 9 in a bench.

The Commercial Gasworks have 270 long retorts set, mostly 7 in a bench.

The Ratcliff Gasworks have 105 long retorts, set 7 in a bench.

The South Metropolitan works have 195 long ⌂ retorts, all but one bench containg 7 in a bench.

The Great Central Gas Consumers' works have 279 long retorts, 11 being the number generally set in a bench. The benches are very high, and the retort-house is divided into two storeys, 7 retorts opening upon the upper stage and 4 below, where the fire is made. The retorts are all of clay. Originally, Mr. Croll, the former engineer, and afterwards the contractor for carrying on the works, made the fires on a level with the upper stage, where the heat first acted upon 6 clay retorts, afterwards descending and acting upon 7 iron retorts below.

The Surrey Gas Consumers' works, until lately worked by Mr. Croll, have 16 benches of long elliptical retorts, the retort-house being divided into two storeys. The fires are made upon the upper stage, where the fire from each grate acts first upon 6 clay retorts 15in. in diameter, afterwards descending to 8 cast-iron retorts below, there being 14 in a bench.

At the Western Gasworks there are 165 ⌂ retorts, 20ft. long, set generally 7 in a bench. We may here notice a peculiarity of the retort-house at these works. As originally designed by Mr. G. H. Palmer, it is a 12-sided building, forming a dodecagon in plan. The retorts were originally placed around the building against the sides. When long retorts afterwards came to be used, all the benches were taken down and others set up so as to form ranges radiating from the centre of the house outwardly.

We cannot at this moment give the number of retorts at the Independent Gasworks.

At the various works of the Chartered Gas Company, and at the South Metropolitan works, the retorts are built on the spot of fire-bricks. At all the other works we believe that retorts moulded in fire-clay are exclusively used, with the exception only of the small number of iron retorts already mentioned. Mr. Grafton, of Cambridge, patented the clay retort in 1820, and it soon after came into extensive use in Scotland; so soon, indeed, that Mr. J. B. Neilson, the patentee of the hot blast, and who was originally engineer to the Glasgow Gasworks, has had the credit of the first application of clay to gas retorts. It was many years, however, before clay retorts came into extensive use in England. An iron retort 20ft. long, and of medium diameter, weighs about 2 tons, costs, say £12, and is worn out after having distilled about 1,500,000 cubic feet of gas (750,000 feet, if the retort be a single one, 9ft. or 10ft. long), which is equal to about an average year's work. A clay retort of the same size, costing 6s. per foot, or £6, will generally be in good condition after three years' use, and some are said to have been worked for from five to eight years. Rather more fuel is required for heating clay retorts than is necessary with iron, but the former can be worked at a higher heat, which gas engineers generally consider an advantage. In America, where the cheapest gas (made at Pittsburgh from coal dug almost at the doors of the works) costs 6s. 3d. per 1000ft., the price in New York being 10s. 6d., and in Philadelphia 9s. 6d. per 1000ft.; clay retorts are only beginning to be used, notwithstanding, too, that the old single-end iron retorts have sold there for nearly £14 a ton.

Fire-clay retorts are made in the neighbourhood of Newcastle and elsewhere, and we are not sure that the London gas companies do not import them occasionally from Belgium, where also they are extensively manufactured. A good fire-clay should be, as nearly as possible, pure silica

and alumina, combined as a silicate of alumina. The presence of lime and iron, which makes almost the whole of the difference between fire-bricks and ordinary bricks, renders the clay fusible in proportion to the extent to which these impurities are present. The Dynas clay, from Wales, is in high repute among gas engineers, and the Stourbridge and Newcastle fire-clays divide the suffrages of many experienced men. We have even heard Cowan's Newcastle fire-bricks pronounced superior to Stourbridge, notwithstanding that the former cost but about 60s. a thousand, the latter fetching, say 90s., and Dynas bricks somewhere about 110s. Some clays expand under the action of fire, others shrink, and there are others still, among which we believe, are the three varieties named, whose bulk is hardly affected by any degree of heat.

The fire-clay retorts are moulded about 2½in. thick, and generally in lengths of from 4ft. to 6ft. The lengths intended to form the outer ends of the retort are thickened to rather more than 3in., and holes are formed in the clay to receive five or six bolts for holding on the mouth-pieces, which are short extensions of the retort, and which are always of cast iron. To fasten the several lengths of the retort, end to end, together, so as to form a single retort, is easily accomplished by introducing at the joints, and in a plastic state, a little fire-clay, as nearly as possible of the same quality as that of which the retort itself is made. With this clay in the joints, precisely as mortar is interposed between ordinary bricks, the retort is "set" or got into place in the "bench," where a high heat is applied, and the separate lengths burnt into one continuous tube, complete and ready for use. Of course all the retorts in a bench, whether there be 5, 7, or a dozen or more, are thus burnt together at the same time. It is usual to make a narrow shallow grove in each abutting end of the several lengths, the fire-clay for jointing thus having a better hold while soft. Many gas engineers, however, now order retorts without this groove, the abutting ends being left as smooth as the other surfaces of the retort.

Clay retorts, unless encircled by frequent thicknesses of brick-work, would crack, and probably break down altogether. We have, it is true, heard something about clay retorts being set and worked in some of the French gasworks, while supported only at the ends, but nothing of the kind is attempted in London. Clay retorts crackle upon the surface, even when, as in all London gasworks, fire-brick partitions or bonds are built completely around them at distances of from a foot to 15in. from centre to centre for the whole length of the retort. Through these walls, 4in. thick, and a dozen or fifteen in number, a 20ft. retort passes much as a boiler-tube might extend through a succession of tube-plates, only there is, perhaps, no necessity for absolutely tight joints in the brickwork outside of gas retorts, at least the brickwork within the walls of the bench in which they are set. We have referred to the bond-walls before commencing to describe the setting of retorts, and for the reason that these walls do not particularly affect the distribution and action of the heat, but are provided chiefly to secure the integrity of the retorts themselves, and may thus be regarded as part of their own structure. Clay retorts, however protected, must be very gradually heated, and as gradually let down, else they will be very apt to crack.

Retorts built up of separate fire-bricks have been used for many years, and Mr. Spinney has made them, in this manner, of the size of large ovens, say 5ft. wide, or thereabouts, at the bottom. Of the fire-brick retorts now made in the London gasworks, few, however, are over 20in. wide at the bottom. The advocates of fire-brick retorts declare that they will neither crack nor leak. Inasmuch as they cost but little, if any, more than moulded clay retorts, last at least as long, require no more fuel for heating, and involve no especial difficulties or inconveniences, one would suppose that, if they possessed any merits, they would be in general use. These negative virtues are insufficient, however, to commend them to gas engineers generally. We suspect the chief reason to be that, as they must be constructed and burnt together at the gasworks, men who have had no experience with them (and here we include nine-tenths of all gas engineers) are disinclined to incur the care and possible chances of failure of making them, and, therefore, with the retort-maker's commercial travellers omnipresent, prefer buying outright that which is known to answer, and which, if it fail, can be returned to a responsible tradesman who undertakes to make good all defects. For our own part, we are inclined to believe that the brick retorts are the cheapest in the end; but it is, perhaps, too much to expect men to enter upon a business in which there is nothing to protect them from themselves, whereas, by giving out a contract, they can transfer the whole responsibility to other shoulders, whose owner is glad enough—for the sake of profit—to take all the risk.

At the Horseferry-road station of the Chartered Gasworks the bricks intended for retorts are made of Dynas (Welsh) clay, and are 15in. long, about 2½in. thick, and moulded to the curve of the sides and top of the retort. The floor of the retort is made of successive lengths of fire-clay tiles, or slabs, about 3in. thick, except on the two edges corresponding to the sides of the retort, where the tile is rabbetted to receive the lower edge of the side bricks. All the bricks are laid upon a wooden centre and made to break joint with each other. The cementing material is plastic fire-clay, of the same quality as the bricks themselves, and applied just as ordinary mortar would be applied. The retorts being thus successively built up within the bench, a strong heat is put upon them and the joints baked together, just as the several lengths of fire-clay retorts are made to unite in one continuous whole.

At the Goswell-street station of the Chartered Gas Company, Mr. Upward, the engineer, employs Cowen's Newcastle bricks in building retorts. At the South Metropolitan, Mr. Livesey also uses Cowen's bricks, each brick being made to lap for half its thickness, at each end, upon those contiguous to it, while grooves, made to secure a better hold of the fire-clay used in jointing, are scored in the longitudinal edges. The tiles are made from the Ewell fire-clay, which, although containing sufficient iron to give it a bright red colour, and although of a friable nature, almost as much so, indeed, as Bath brick, is scarcely affected by heat. Mr. Livesey adopts a thickness of 3in. for his retort bricks, and 3½in. for the tiles forming the bottoms. At the Crystal Palace District Gasworks, at Sydenham, Mr. Christie adopts Stourbridge in preference to Newcastle bricks for retorts, although, thus far, as in the Commercial works, of which Mr. Christie formerly had charge, he has generally employed clay retorts of the common kind. There is a decided and distinguishing difference in the colour of the Stourbridge and Newcastle fire-bricks, the former having a flesh colour, while the latter, when new, are of an almost milky whiteness. It is curious to note that after the lightest coloured bricks have been subjected to long service in a gas retort, they are found to have acquired a reddish, and often a dark red colour. When broken up, ground under edge runners, and the powder again tempered and moulded into bricks, old fire-clay retorts will come out a deep red. This can result only from the acquisition of iron from the coal carbonised in the retorts.

The setting of retorts is a matter of much importance, the objects being to secure a high and uniform heat upon all the retorts in a bench with the least expenditure of coke in firing. A Mr. Rackhouse is said to have been the first, and as long ago as 1815, to introduce the plan of setting each nest of retorts in an oven, the plan now invariably adopted in all the gasworks of London. With the long retorts now used, these ovens may be described as tunnels about 18ft. long, 6ft. or 7ft. wide, and of a height corresponding to the number of retorts to be enclosed. The arch or crown of the oven is semi-circular, or semi-elliptical, and is turned in firebricks, of which, also, all the surfaces exposed to the heat are formed. The floor is laid over ordinary brickwork, beneath which a coke pit is formed in many works, as at the Chartered, Phœnix, and several others. In the newer works, however, and generally, indeed, where the value of space is not excessive, none of the brickwork extends further below the floor of the retort house than is necessary to secure a good foundation. The furnace for firing the retorts is made at each end of the oven or tunnel, the grate being proportioned to the work to be done, a width of 15in. and a length of fire-bars, in each furnace, of about 2ft. or 30in. being a common allowance for a bench of seven retorts. Over the fire-bars is generally turned a small arch of fire-bricks, the heat being led off on each side to act upon the retorts, around which it circulates in rising between the numerous partition walls previously described. The upper and lower retorts are separated from each other, for their whole length, by firebricks or tiles, the heat being seldom allowed to act directly upon the bottom of a retort, but more generally upon the sides and upon the top, where the heat is reverberated from the underside of the crown of the oven. After the retorts are in their places, the ovens are closed at both ends by brickwork built in and around the retorts, and out to the sides and top of the oven. The heat from the furnace, after rising on one side of a vertical tier of retorts, generally descends down the other side, what is left escaping into a flue below, which is in communication with the chimney stalk. With clay retorts the heat is generally such that an iron damper in the main flue would be melted in a short time, and hence fire-clay dampers are employed. Even the chimneys, where built of common bricks, are generally cracked by the heat, and in one of the most recent gasworks in the neighbourhood of London—that of the Crystal Palace District Company—the chimney has been made of firebrick throughout; the circular shaft, 14in. in thickness all around, being formed of radial bricks, bonded together at intervals of the height of the shaft, by rings of large firebrick segments 4in. thick.

The side walls and arches of the furnaces (not those of the ovens) are frequently burnt out in from three to six months, although they may last for a year. The setting is generally such that they can be renewed without disturbing the retorts. The durability of the retorts has already been touched upon. Three years is perhaps a fair lifetime for clay retorts worked at a high heat. The inner walls of the ovens should last for a number of years, say eight or ten. Whenever they require rebuilding everything set up within the oven must, of course, come out.

It is customary to tie the brickwork of the retort benches together, both in the direction of the retorts and along the length of the retort house, by tie bolts, taking hold of "buck staves" or clamps. With iron retorts there is, of course, considerable expansion on their first being heated, and it is well known that, under the action of heat, cast iron dilates permanently—a cast iron fire-bar, for example, gradually extending half an inch or more in length, although its elongation under any one heat may not amount to nearly as much. A 20ft. cast iron retort becomes, in this way, permanently elongated by from 3in. to 5in., and its outward thrust in this expansion must of necessity be great. With clay retorts, however, especially if the clay be of a kind which does not increase in bulk on being heated (most clays contract by heat), there is little or no disruptive strain upon the brickwork, and at the Crystal Palace District and other gasworks, Mr. Christie has entirely dispensed with tie bolts and buck staves.

The cast iron mouth-pieces, upon which the sockets for the ascension pipes for conducting away the gas are cast, are generally fastened to the ends of clay retorts by bolts, which project from the clay through holes left for that purpose when the retort is moulded. Mr. Hughes, in his little work on gas-making, says:—"In preparing the "end of the retort to have the mouth-piece attached, the "end surface is chipped and notched with grooves like the "surface of a millstone, in order to retain more firmly the "cement filled in between the retort and the flange of the "mouth-piece. The cement used is the ordinary iron "cement, compounded without sulphur, and mixed with an "equal quantity of fire-clay. This mixture, made into the "consistence of mortar, is spread evenly over the joint; "the mouth-piece is then attached and screwed up, the "recesses in which the bolts are sunk being filled with the "same mixture."

For fire-brick retorts, socket mouth-pieces enclosing the end of the retort are used at the Chartered Gas Company's works, and at those of the South Metropolitan—that is to say, the end of the retort extends into a socket 4in. or 5in. in depth, cast upon the back of the mouth-piece, and generally three or more mouth-pieces with these sockets are cast together upon a single plate, which is held, by tie bolts, against the brickwork. At some other gasworks, where brick retorts are used, the mouth-pieces are made without sockets. The sockets would, perhaps, be found advantageous, even with ordinary clay retorts. Cases have been known where the expansion of the ascension pipes (through which the gas rises from the retort) has been such as to lift the hydraulic main off its supports. In such cases a great strain must necessarily be thrown upon the mouth-piece joints, where a socket would afford great resistance against starting the bolts.

The mouth-pieces, and thus the ends of the retorts, are closed by iron lids, either cast or wrought, the latter being preferable and in extensive use. Through a couple of ears, one on each side of the mouth-piece, two studs project outward, and through two slots, one in the outer end of each stud, a cross-bar is so placed as to be capable of ready removal. By a stout screw passing through the cross-bar and pressing against the centre of the lid, the latter, previously luted with wet lime, is made gas tight.

We may now stop to examine the working of the retorts. Presuming that everything is in readiness, they are first very gradually heated for a number of hours, this process sometimes lasting for a whole day. The coal having been wheeled into the retort house, on both sides of the great main range of benches, so that the men can charge simultaneously at both ends of the retorts, the charging scoops are first filled. The scoop is of sheet iron, not far from 16ft. long, and of a size convenient for being run into and turned over in the retort, by means of an iron stalk with cross handles at the outer end of the scoop. About half of the coal intended to be charged at one mouth-piece is shovelled into the scoop, which is then lifted, run into the retort, there turned over and immediately withdrawn, leaving the coal behind. A second scoopful being charged, the lid, previously served around the edges with wet lime, is applied—the cross-bar having been previously slipped into its place—and, by means of the tightening screw, a close joint is quickly made. The other end of the retort being similarly and simultaneously charged, the coal, already in course of decomposition, sends off its gas into the hydraulic main above.

The amount of coal charged at a time, at one mouth-piece, varies in the different London gasworks from 170lb. to 280lb., or from 340lb. to a quarter of a ton to one long retort. From 196lb. (1¾ cwt.) to 224lb. is the more usual charge for 16in. retorts. Thus, when charged every six hours, the carbonising power of the 340 long retorts at the Horseferry-road station is about 300 tons, or possibly 320 tons a day, and the 350 retorts (700 mouth-pieces) at the Goswell-street and Curtain-road works will get through 300 tons a day. With nearly 600 long retorts at the Pancras station of the Imperial Company, about 500 tons can be carbonised daily, and we believe that, at the Hackney-road station of the same company, upwards of 425 tons of coal have gone through 386 retorts in a day of 24 hours. At the London Gasworks, too, we understand that about 300 tons of coal have been carbonised in one day, in 250 retorts. At the City Gasworks, and at the Commercial works, 1,700 tons a week is about the maximum carbonising power of each, although the former has 940 and the latter but 540 mouth-pieces. At the Vauxhall station of the Phœnix Company, at the Great Central, and at the Equitable works, the maximum is about 1,100 tons each every week. In every case the retorts are charged every six hours. At the Western Gasworks, however, where only cannel gas is made, a considerable number of the retorts are worked on four-hour charges.

For working the retorts it is customary to divide the men into gangs of five each. Three of these, who attend the retorts, are called carbonisers or stokers, a fourth keeps up the fires in the furnaces, and the remaining man wheels the coal and coke on a barrow. To one of these gangs from 42 to 56 mouthpieces are allotted, 50 being the number at the Goswell-street works, and 56 at the Crystal Palace District works. This allotment of mouth-pieces is not always in the same range of benches, and it sometimes happens that the men have to go from one retort house to another to serve their full number of retorts. The men work 12 hours at a shift, for seven days in the week, with the exception of one, and sometimes two, Sundays in the month. The work is trying, especially when "drawing" or raking out the retorts, but this severe work is not continuous, the men having more than half of the whole time for rest. Thus, for every bench of 7 retorts, or, rather 7 mouthpieces, at least three-quarters of an hour are allowed for charging and drawing, whereas it is not unusual for the work to be over in from 15 to 20 minutes. In the hottest of the work the men frequently strip to the waist, and many will, while reeking with perspiration, stand under the open louvres in the roof, no matter how strong the draught. At many of the works the men are provided with an unlimited supply of a drink composed of oatmeal and water "skilly," and of which the carbonisers at the Chartered Gas works (Horseferry-road) are found to consume an average of seven quarts each a day, so great is the thirst occasioned by their work. One of the men at these works while incautiously drinking freely, not long since, of cold water when overheated, dropped dead to the ground.

The pay of the head stoker of each gang of men is generally about 33s. a week (of 7 days), the other two stokers working under him receiving, say 30s., although the pay is not always as high as this. The firemen and coal-wheelers are usually paid about 24s. In the winter time, when the daily production of gas is nearly or quite fourfold what it is in summer, a gasworks with 300 long retorts would give employment in all to about 300 men, one-half working by day and the other by night. In the winter, therefore, between 4,000 and 5,000 men are employed in the nineteen gasworks of London. In the spring, when the

demand for and consequent production of gas begins to fall off, a large proportion of the stokers seek employment in the neighbourhood of London and in the country, generally in brickmaking. At this trade they will work all the summer, returning in the fall to their former place of employment. Many of the managers of the London gas-works can point out men who have worked for them in this manner, or "off and on," for ten or a dozen years. At some of the works, as at the several stations of the Phœnix Company, rooms are fitted up for the use of the workmen in the intervals between "charging" and "drawing." At the Bankside station of the Phœnix Company there is a library of a few hundred volumes, and a daily newspaper, as well as several weeklies, are taken in for the use of the men. Good baths are also fitted up for their free use, after working hours. The library and the baths were also set up at the extensive Vauxhall station of the same company, but it appears that all the books, lead-pipe, and brass cocks gradually disappeared, until nothing was left. At the Hackney-road works of the Imperial Company, Mr. Clark has recently fitted up eight baths hardly inferior in any respect to those of a first-class hotel, and we sincerely hope, for the welfare, as well as the credit of the men, that the fittings will be better respected than they were at Vauxhall.

(*To be continued.*)

THE PATENT LAWS.

THE Manchester Patent Law Reform Association had an interesting committee meeting on Friday. The meeting was convened to consider the report of a sub-committee to which the resolutions proposed by a committee of the British Association for a reform of patent laws had been referred. The sub-committee, after considering what defects in the working of the present law require amendment, and after examining carefully the resolutions of the British Association, had resolved to recommend certain alterations which they were of opinion would not interfere with the rights of inventors, and at the same by preventing a number of useless patents being granted, would be an additional security to the public. These alterations, as subsequently amended by the general meeting, were as follow:—1. That a Court of Commissioners or examiners shall be appointed, to consist of three members, eminent for their scientific acquirements, one to be conversant with mechanical engineering, the second with chemistry, and the third a barrister, or law officer, with a sufficient staff of assistants, who shall devote the whole of their time to the patent office, and be paid liberal salaries out of the funds arising from the fees paid for letters patent; 2. That the said commissioners shall grant provisional protection for inventions on application as heretofore; 3. That the commissioners shall carefully examine each invention so provisionally protected, as to the novelty thereof; 4. That the commissioners shall, within two months from the date of the provisional protection, either authorise the grant of the patent, or inform the applicant that they have doubts about the novelty of the invention, stating their reasons, and referring him to the authorities they depend upon for proving the want of novelty, or, if necessary, to require further particulars than are contained in the provisional specification; in such case the applicant shall furnish additional descriptions within one month after receiving such notice, or such longer time as the commissioners, in their discretion, may deem necessary; 5. That the applicant shall have one month to file his specification, after receiving the decision of the commissioners; 6. That any person interested in opposing the grant of any patent shall give notice of his objections to the commissioners previous to the expiration of two months from the date of provisional protection; 7. That when the commissioners report against the novelty of any invention the applicant shall have the privilege of asking for a re-examination, at which he shall produce either *viva voce* evidence before the commissioners, or give them additional particulars in writing; 8. That the applicant shall pay reasonable fees for such re-examination, the fees to be regulated by the commissioners; 9. That all cases of infringement shall be tried in the first instance in any of the ordinary courts of law, before a special jury of gentlemen conversant with the subject matter of dispute; 10. That either party shall have the power of appealing against the decision of such jury to the Judges sitting in Banco, and that, if they confirm the judgment already given, their decision shall be final; but if they differ an appeal to the Privy Council shall be allowed, but whose decision shall be final. 11. That if the patentee shall find that he has claimed something in his provisional specification which is not new or useful he shall be allowed to disclaim the same in his final specification. 12. That the £50 tax now payable at the expiration of the third year, and also the £100 payable at the expiration of the seventh year, be abolished, but £50, payable at the expiration of the fifth year, be substituted therefor. The chairman, Mr. W. Fairbairn, said that the charges for patents under the existing law were £25 for the first year; £50 for the third year; and £100 for the seventh year. The sub-committee proposed to take away the £50 on the third year and substitute £50 on the fifth year, which concluded the patent. The committee of the British Association had recently met in London to consider the subject; but their business was merely formal, as they were waiting to hear the decision of the Manchester Local Committee. Mr. E. J. Hughes said that Mr. Ricardo this evening would move for a Committee of the House of Commons to inquire into the subject of patents; and Mr. Ricardo was in favour of the abolition of patents, as was also Sir William Armstrong. The sub-committee had had to consider how they could best remove the objections entertained by these gentlemen. The only valid reason they urged was the multiplicity of useless patents. The sub-committee recommended a provisional examination as to the novelty merely of the invention proposed to be patented; and they believed that this would have the effect of striking off, at the least, one-half of the applications which were now made. The plan recommended was the same as was pursued in America. They thought it would have the effect of lowering the tax, which was imposed not so much for the purposes of revenue as to prevent many useless patents being placed on the statute book. After some discussion, a discretionary clause was added to the fourth resolution. The report of the sub-committee included a resolution to the following effect:—"That a patentee shall not be compelled to grant licenses for the use of his invention until after the expiration of five years from the date of his patent." After considerable discussion on compulsory licenses, which it was said were sought for by the "abolitionists," Mr. Clayton moved that the resolution be struck out. The chairman thought the resolution of the sub-committee would only lead to vexation and trouble, and the meeting agreed that it should be expunged. The resolutions in their amended form were then approved of, and ordered to be submitted for confirmation to a public meeting.

RAILWAY SUSPENSION BRIDGES.—Mr. George Turnbull, resident engineer of the East Indian Railway is arranging for the construction of a suspension bridge across the Hooghly at Barrackpore.

VENTILATION OF RAILWAY AND OTHER CARRIAGES.—No one who has travelled much can have failed to feel the want of some more efficient mode of supplying fresh and extracting the foul air from our public conveyances. To do this without being a cause of annoyance to the most susceptible appeared a matter of some little difficulty, but Mr. Montague Wigzell, of Topsham, Devon, has solved the problem in a way which is self-acting, and does not necessitate any alteration in the make of the present carriages. Several engineers of eminence speak highly of the thought which has been exercised in perfecting the method, and it is already being placed upon some of the lines in the south of England.

THE MALAHIDE VIADUCT.

AT an ordinary general meeting of the Institution of Civil Engineers of Ireland, held on Wednesday, March 12th, in the new lecture theatre, Trinity College, Dublin—Professor S. Downing, C.E., in the chair— Mr. William Anderson, member, read the following paper "On the construction of Malahide viaduct.

A few hundred yards from Malahide station, the Dublin and Drogheda Railway crosses an estuary or bay, partly on an embankment, and partly by means of a viaduct 577ft. long. At the original construction of the line this viaduct was built of timber, in eleven spans of 52ft. each. The general arrangement of this structure is illustrated above.

The obstruction to the free flow of the tide presented by the embankment caused a very powerful current to rush through the bridge, and it was very soon found that the soil into which the piles were driven was rapidly washing away, and the bridge settling down in consequence. To arrest this evil, large quantities of stones were from time to time shot into the stream, till a bank was formed averaging 130ft. broad by 30ft. high, extending in continuation of the embankment right across the tideway. By this means, and by constantly packing up the rails, in some places to nearly 3ft., the viaduct was made to do its duty till the year 1859, when serious signs of decay becoming apparent, the directors ordered their engineer, Mr. Marcus Harty, to prepare plans for the reconstruction of the bridge. As this was a work presenting some engineering difficulties, and involving a large outlay, designs were also obtained from some English engineers of note; but, none of them having been adopted, it is unnecessary to notice them any further. In arranging the design for a new viaduct three things had to be mainly considered, viz:—

1. The maintenance of the traffic during the execution of the works. 2. The widest possible tideway; and 3. The most durable material. The first and second considerations, together with the relative cost of the superstructure and piers, decided the number and length of spans, for these had to be so arranged that the piers might be constructed and the new girders laid without endangering the old foundations; while the order in which the new structure should be erected was determined with reference to the least obstruction of waterway.

It would appear, at first sight, that the easiest plan would have been to take down one-half of the old bridge first, build the new piers on the site of the old ones, and complete the superstructure of one line. By this means much complication in arranging the traffic and all danger of obstructing the water-way would be avoided. But it was feared that the old piers could not be disturbed with safety; that the hold of the piles in the ground was so uncertain that any disturbance of the stones might loosen the piles to a dangerous extent, and consequently any works performed on one half the pier would seriously endanger the other. The new piers were therefore placed in the water-ways. The first three spans of the bridge were to be completed—first for the down and then for the up road; all the old work taken down and the new water-ways cleared and levelled. The increased facility for the flow of tide thus obtained would enable four more piers to be built, the down line over them completed, then the up line, the old work again removed, and, finally, the remaining piers and superstructure laid in. As regards materials, Mr. Harty proposed two plans—one, stone piers supporting cast iron girders 26ft. span, with brick arches turned between them, and the road laid in ballast; and the second, stone piers supporting wrought iron beams 52ft. span, with the road-way laid on the top of them, on timber sheeting in the usual manner. The very much greater liability of wrought over cast iron to corrosion from the effects of sea water was very strikingly exhibited in the old bridge, where the bolts and straps securing the woodwork were deeply eaten away, even when the surface showed a good coat of paint, while the cast iron sockets and shoes, though unpainted, were almost free from rust. This fact induced Mr. Harty to recommend the first plan, but the strong prejudice which exists against the use of cast iron in situations where failure might lead to most disastrous consequences, swayed the directors to adopt the wrought iron superstructure. The first thing done was to prepare nine light travelling cranes. They were very ingeniously and cheaply extemporised by converting pairs of old engine wheels into turntables, fixing them on the body of an ordinary ballast wagon, and arranging on them a wooden framework and jib carrying an ordinary contractor's crab. At the same time stones for the piers were being delivered at the Dublin terminus, and, as the season was advancing towards spring, and no time was to be lost, six or seven quarries were laid under contribution. 1,705 tons of stone in all were worked up—calp for the rubble masonry and limestone for copings. The dressing of the stones was all done at the Dublin terminus, the piers being actually built up dry, the stones marked, transported to the bridge, and the piers again built up dry, but turned bottom up, alongside the line on the embankment, close to the viaduct.

The working drawings of the ironwork were also got out, tenders were invited from a few firms in Ireland and England, and the contract ultimately given to Messrs. Courtney, Stephens, and Co., of this city, the firm with which the author is connected. There was no contractor for any other part of the work, it was all executed under Mr. Harty's personal superintendence; a great portion, however, was done by piecework, as will presently appear.

As soon as the various preparations were sufficiently advanced the works on the bridge commenced in March, 1860, by carefully straightening and levelling the roads to the exact lines they were to occupy in the new structure. Switches were laid in at both ends of the bridge to turn the traffic at pleasure to either line; signals were erected near the point levers for the guidance of the trains, the approach of which was notified as soon as they came in sight by the ringing of a bell fixed on the middle of the bridge. Over the site of each new pier a cross road was laid, projecting sufficiently far over the water on each side to admit of a crane standing clear of passing trains. The rails of the main line were nicked out, to allow the flanges of crane wheels to clear, and as the sheeting over the new piers had to be removed the main line rails, where they happened not to be over the wooden beams of the old bridge, were strengthened by bolting short pieces of rail under them. Seven workmen's huts were extemporised out of third-class carriages, while the engineer took good care of himself in a snug office built on the north abutment in the castellated style, tastefully decorated with coal tar.

A siding was laid on the north embankment for the pilot engine, which remained in attendance throughout the work. Two boats and a boatman were provided, the latter stationed so as to be in readiness to render assistance in case of accident to the men, and life buoys were placed on the bridge for the same purpose. In spite of every precaution, however, the author grieves to record that one of the men fell into the tideway, was swept away by the resistless current, and drowned; his body was not recovered for a fortnight. The rush of water under the bridge was at times awful. Some idea of its force may be formed when it is stated that a dam, composed of about 4 tons of 80 lb. rails, bolted together to form a boom, with stones and sods among them, was washed away on the night of May 4th; the ends of some of the rails may even now be seen, so tightly jammed among the stones and rocks as to resist every available means of recovering them.

Before describing the method of constructing the piers it is necessary to mention that the bank of stones thrown in to support the old bridge was assumed to be ample support for the new work, nothing more being required than to consolidate and level the base of the pier. A reference to Diagram 1, and to the stereoscopic views on the table, will show that the pitching thrown in to support the old bridge had been piled round the base of the piers, forming thus two sides of a dam; the tide fell away very rapidly from the east side of the bridge, which, therefore, required no protection, and it remained only to arrest the shallow but rapid stream which was caused by the discharge of the pent-up waters of the estuary. This was done at first by a dam of sods kept down by rails and stones, but after the accident already described the following plan was adopted:—On the west side of the tideway to be dammed a curved track was cleared at low water, the ends resting on the pitching round the old piers, and the convex side turned against the pressure of the bay. A wall of sods was then built up in the track, and securely pitched with stones on both faces, the form of the sides and top being such as to impede the flow of the water as little as possible when once the tide rose too high for continuing the works.

This dam was, after all, only a very imperfect protection, as the water found its way through the loose stones in every direction, so that all the foundations had to be laid under water.

In preparing the site of the piers two plans were adopted. At first, the loose stones were removed to form a level bed at the proper depth, some 15in. below the general surface, and the edges of the hole thus formed were built round with stones set on edge without cement, the work being all under water. The space was then filled in with shivers mixed with iron turnings to concrete them, the whole being rammed down, as long as any yielding could be perceived, by means of a five cut block of iron. To prevent the ram splashing into the water a layer of stones was laid on the top of the real formations, and removed after the ramming was complete. Later on, however, this method was modified in favour of large flags laid in some 7in. below the bottom, of ashlar, and rammed down, as before, through stones temporarily filled in on them. The building of the edges with pitching was also discontinued until after the first courses had been set. As soon as a firm and level base was obtained a framework of old rails, being the contour of the base of the pier, was laid down, and after being adjusted at the proper level on a few blocks of stone, the intermediate spaces were carefully packed with flat stones all along under the rails, and the interior space filled in level with their upper faces; a grouting of cement being sometimes poured in, if the state of the water permitted it. On this foundation the first course of ashlar was laid, and the pier carried up very rapidly, the stones being taken down from their places in the pier on the bank, run on to the bridge in a hand lurry, and lowered very rapidly by two cranes, one working on the cross road, and one on the blocked up main line. Lewises were at first tried for slinging the stones, but subsequently abandoned for common chain hooks, which answered equally well. Medina cement (Nine Elms) was used for the work set in water, or where it would be very quickl covered by the tide, and Roman or Portland for the rest. The pier are remarkable for having no plumbing quoins of any kind. They were built from centre lines stretched from a vertical post erected few et beyond the cut-waters of each pier. As the batter was in from every side templates were made for each course; the correct position of each in the length of pier being given by a standard length from the guide poles. Stone pitching was carefully packed all round the new pier to guard it as much as possible from the violence of the current. After the old bridge had been removed the water-ways were carefully levelled, the gain in tideway being about 35 per cent.

The first stone of the first pier was laid April 14, 1860, that of the eleventh on September 19, 1860, about twelve days elapsing between the commencement of each pier. During this time, however, a great deal of the old bridge was removed; and some casualties occurred, as, for instance, the dam of No. 2 pier failed on May 4, as already described; and on the 8th of the same month the increased rush of water occasioned by obstructing the first three waterways, caused a breach in the fifth, which took seventy tons of stones to repair; and on September 17 the dam of No. 11 pier gave way. There was also delay of about a month from the inability of the contractors to get the ironwork for the first three spans ready in time; so that, on the whole, it will be admitted that the work was done with very creditable rapidity, mainly due to Mr. Harty's admirable arrangement, great forethought, and unwearied personal exertion. It should also be remembered that all the works had to be arrested for the passage of every train, and that a great deal of the laborious work could only be done during the two hours or so of low water.

The abutments were originally built of stone, and very little alteration in them was necessary.

The cost of the rock ashlar, dressed at the terminus ready for building into the piers, was 14½d. per cubic foot; the same stone delivered dressed from the quarry 13½d. per foot cubic, and it was found that 10·7 cubic feet of dressed stone was procured from a ton of rough, the real weight of the stone being 13½ cube feet to the ton. The cost of transporting stone, building piers dry twice over, and finally setting the work in its place, could not be kept separately, as, from the nature of the case, it was performed in broken time.

The watermen did their work by the piece, the following being the cost of founding each pier:—

Removing dam from last pier, damming west end of old arch and maintaining same, filling and discharging stones and sods for dam from quarry, sinking old waterway for foundations of new pier, setting flags to near the proper level and guide post stones, covering flags with stone shivers, and gravel mixed with iron turnings, ramming down flags with five cwt. ram, removing shivers and stones, and helping to set up guide posts, getting down rails, levelling and centreing them accurately, flagging among them in shivers, and iron turnings to level of rails, attending to masons to the completion of first course of ashlar on rails, packing under outer edge of ashlar base, packing round pier and cast apron, loading bottom to pitching and slope of apron, loading and discharging all stone required from quarry—£15.

Bending rails to form of cut-water, and securing them to form of foundation; drilling and rivetting to plates at ends, and four fish rails, and two cross rails near centre—each, £3.

Cutting rails for a cross crane road over each new pier, crossing square the up and down main lines, cutting flange gaps in main lines, and eight plates to go under them, including drilling—£1 10s.

When the rails of main line were unsupported and made beams of —per rail, 2s. 6d.

The two upper courses of the piers were of cut limestone, into which the cast iron wall plates for the beams were sunk.

As the new piers had to be built in the water ways, it follows that if the regular spaces were preserved the end spans would have to be either a half or one and half times the old ones, but as so great a difference would have been inconvenient the first and last piers were placed so as to divide a span and a half into two, the new viaduct consequently consists of eight spans 52ft. and four spans 40ft. 2½in. (Diagram 2). The depth of the longer beams is 3ft. 1½in. between the intersection of centre lines of lattice bars and flanges, or nearly one-fourteenth of the clear span, the piers being 3ft. thick at top. The shorter beams are reduced in depth in proportion to their length, so that in both the number of lattice bars is the same. Each span is composed of six beams, connected together by horizontal and vertical cross bracing, four beams being immediately under the rails of the two roads, and two beams under the hand-rails. Longitudinally the beams are connected rigidly on every alternate pier, resting immovably upon it, while the remaining piers are provided with expansion rollers, the upper flanges of the beams being merely held in position laterally by a joggle secured to one beam only. In order to avoid exposing a large surface to the action of the spray and sea air, the flanges of the beams are made as narrow and thick as possible, while the lattice bars, in compression for the same reason, are made of thick bar iron instead of the more advantageous section of T, L, or [iron. In addition to the amount of material necessary to meet the strains, ½in. thickness all over is added to the roadway beams to compensate for corrosion; the outer beams under handrails are in other respects of the same strength, in order to secure protection to carriages getting off the rails. The load on one of the larger road beams is thus estimated:—

	tons.	cwt.
Pitch pine planking 4in. thick	1	10
Gravel strewed over same	2	0
Rails and sleepers	1	10
Diagonal cross bracing	1	0
Beam	6	0
Passing load half a ton per foot	25	0
Total	37	0

THE MALAHIDE VIADUCT.

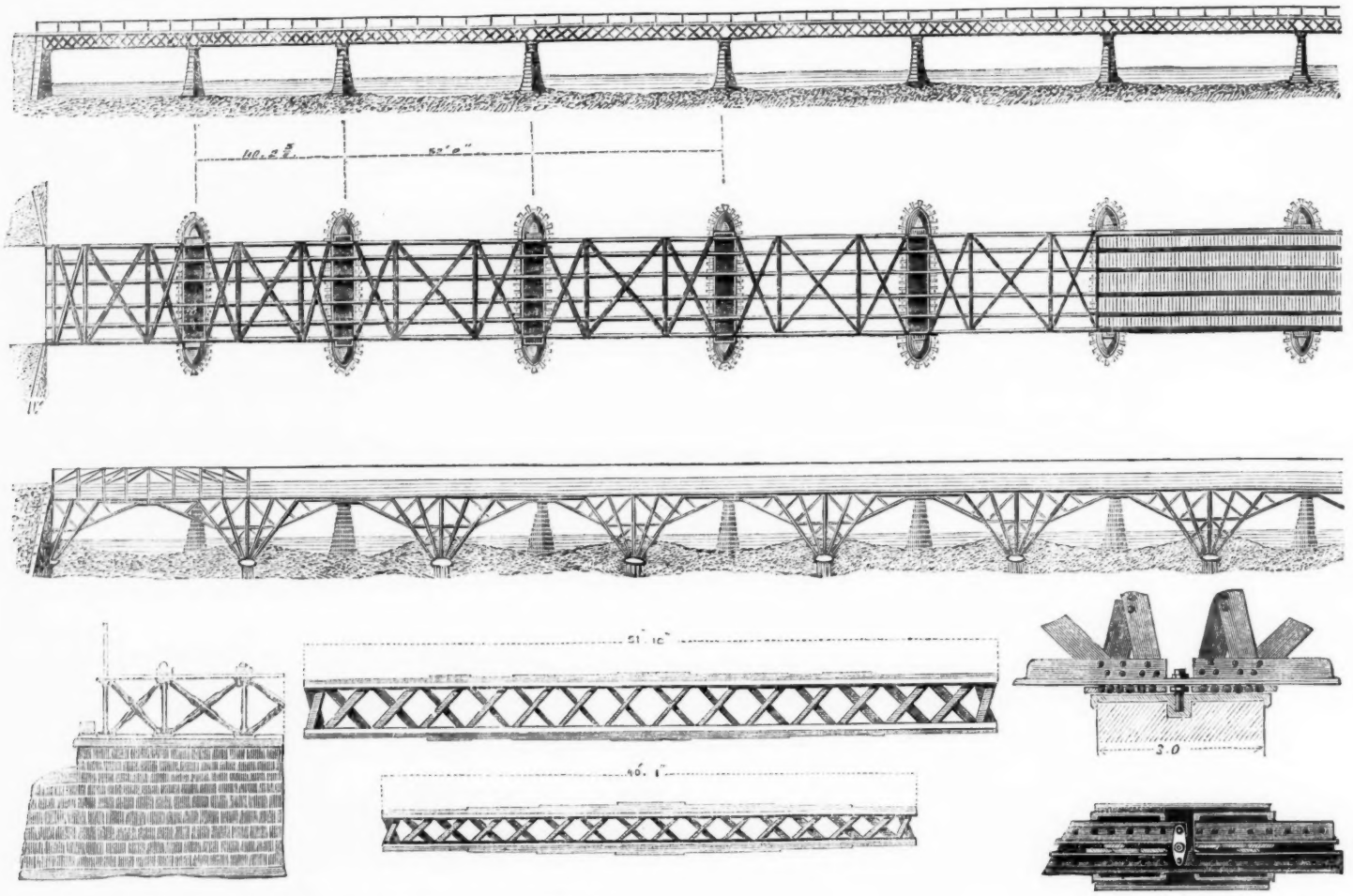
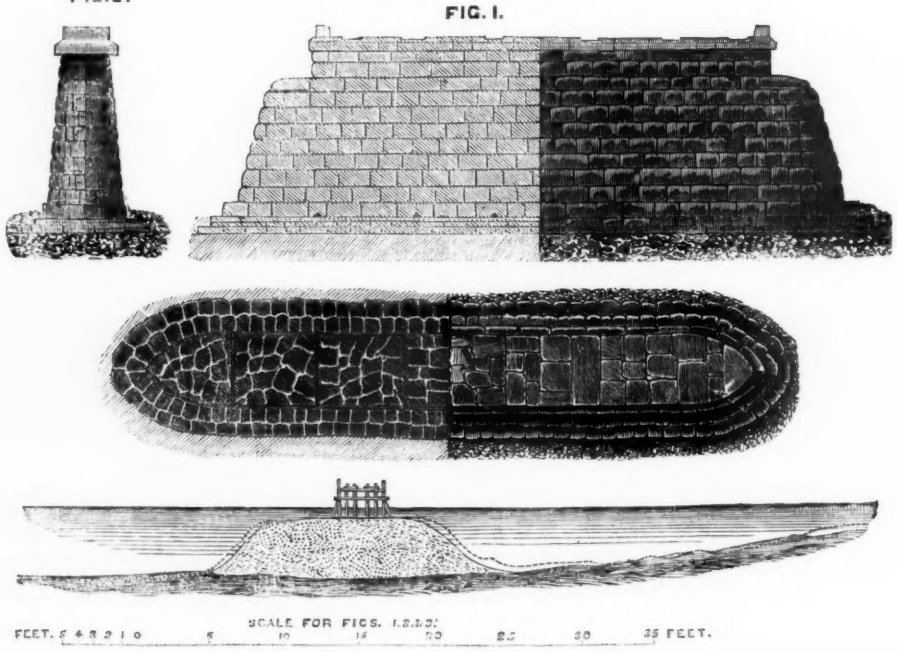
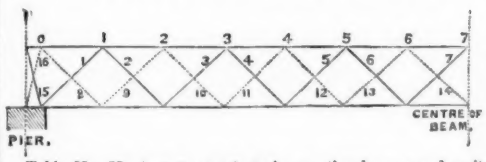


FIG. 2.

FIG. 1.





37 tons uniformly distributed, being rather more than $\frac{3}{4}$ ton to the foot run, and for this load the strength of the flanges is adjusted; while, to meet the contingency of an engine running on a very narrow base with unduly loaded driving-wheels, the diagonal bracing is further strengthened to sustain a concentrated load of 5 tons travelling over the beam.

The shorter beams are similarly calculated to carry 28 tons each, with a concentrated load on lattices of 4 tons additional. The flanges of the beams are composed of pairs of unequal sided angle-irons with their deep sides, between which the lattice-bars are secured vertical, the necessary sectional area being made up by piles of plates, decreasing in number from the centre towards the piers. The webs consist of double systems of diagonal bracing, presenting fifteen points of intersection with the flanges.

Table No. I indicates the total strain in tons, the sectional area in inches, and the unit strain in tons on each bar of the bracing, calculated for the present paper by those most useful formulæ for which the profession is indebted to Mr. B. B. Stoney, and which may be found in the "Quarterly Journal of Science" for October, 1859.

Table I.

Strain in diagonal bracing due to 2·64 tons on each apex, and 5 tons moving over beam.

No. of Bar.	Maximum compressive strain.			Available sectional area.	Unit strain.	Maximum tensile strain.			Available sectional area.	Unit strain.
	Due to uniform load.	Due to 5 tons passing.	Total.			Due to uniform load.	Due to 5 tons passing.	Total.		
	tons.	tons.	tons.	sq. in.	tons.	tons.	tons.	tons.	sq. in.	tons.
1	13·034	6·5	19·534	5·25	3·72	0·000	0·0	0·000		
2	0·266	0·5	0·766	3·93	0·19	9·576	5·5	15·076	3·1	4·8
3	9·576	5·5	15·076	4·25	3·55	0·226	0·5	0·726	3·2	0·23
4	1·064	1·5	2·564	3·19	0·8	6·650	4·5	11·150	2·4	4·65
5	6·650	4·5	11·150	3·75	2·95	1·064	1·5	2·564	2·7	0·95
6	2·394	2·5	4·894	1·69	2·53	4·256	3·5	7·756	1·1	7·0
7	4·256	3·5	7·756	2·25	3·44	2·394	2·5	4·894	1·5	3·26
8	0·000	0·0	0·000	4·31	0·00	11·172	6·0	17·172	3·7	4·09
9	11·172	6·0	17·172	4·75	3·61	0·000	0·0	0·000	3·6	0·00
10	0·532	1·0	1·532	3·56	0·43	7·980	5·0	12·980	2·8	4·64
11	7·980	5·0	12·980	4·0	3·24	0·532	1·0	1·532	3·	0·51
12	1·596	2·0	3·596	2·81	1·28	5·320	4·0	9·320	2·1	4·44
13	5·320	4·0	9·320	3·25	2·86	1·596	2·0	3·596	2·2	1·63
14	3·192	3·0	6·192	1·31	4·65	3·192	3·0	6·192	0·75	8·25
15	0·65	5·08	5·73	4·31	1·33	0·00	0·0	0·00	0·0	0·0
16	9·64	5·08	14·72	5·25	2·80	0·000	0·00	0·00	0·00	0·00

Table II.

Strain in flanges due to a uniform load of 37 tons.

No. of space.	Top flange.			Bottom flange.		
	Maximum strain.	Available area.	Unit strain.	Maximum strain.	Available area.	Unit strain.
	tons.	sq. in.	tons.	tons.	sq. in.	tons.
0—1	7·32	9·50	0·83	9·24	5·44	1·7
1—2	23·76	9·50	2·5	25·08	5·34	4·53
2—3	36·36	15·37	2·45	38·28	10·12	3·64
3—4	47·52	15·37	3·22	48·84	10·62	4·6
4—5	55·44	21·24	2·61	56·66	15·34	3·61
5—6	60·72	21·24	2·86	61·94	15·38	4·03
6—7	63·36	21·24	2·98	64·58	15·78	4·09

If W represent the load on each apex of a system of bracing inclined at an angle ϕ with the vertical, and U be the number of loaded apices between any given diagonal and the abutment, and l be the length of beam, then the strain in that diagonal will be $= (1 \times u) u \frac{W \sec. \phi}{2 l}$ when the first apex is distant one whole bay from the pier, and $\frac{u^2 w \sec. \phi}{2 l}$ where the first apex is only one-half bay distant from the pier. That portion of the formula $\frac{w \sec. \phi}{2 l}$ is a constant for every individual beam, so that the process of finding the pressure on each diagonal is simply multiplication by $(1 \times 4) u$ or u^2 as the case may be.

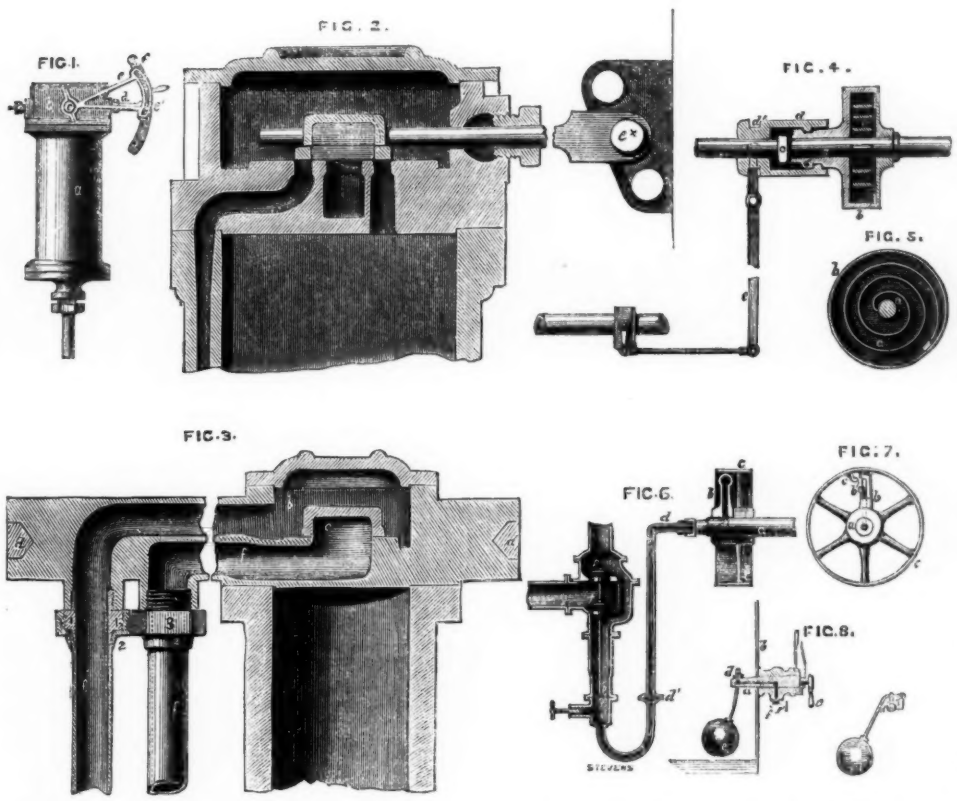
Table No. II gives the total strains, sectional areas, and unit strains in every portion of the flanges. In estimating the sectional areas available for duty, a deduction of $\frac{1}{8}$in. of surface all over the beam has been made to allow for corrosion, which, as has already been stated, is extremely rapid. In the top flange and compression lattices no deduction has been made for rivet holes. In the bottom flange, in which all the holes are punched, the cross section of the holes augmented by $\frac{1}{8}$ has been deducted, while from the tension lattice bars in which the holes were drilled, their actual cross section has alone been taken. As regards the necessity of considering a punched hole as somewhat larger than its measured diameter, it is necessary to explain that from several experiments recently made, there can be no doubt that the material immediately surrounding a punched hole is sensibly injured by the violent straining it undergoes. The author hopes that before the close of this session, he will be able to complete the experiments referred to and lay the results before the Institution, for which reason he will not now enter more deeply into this interesting subject.

The cross-bracing connecting the six girders of each span gives rigid lateral support to the top flanges at four points, leaving, in the larger beams, a length of 22ft. in the centre to act as a column with fixed ends. The breadth of the flange is 12in. or $\frac{1}{12}$ of the length, at which proportion Eaton Hodgkinson's experiments have shown that wrought iron will bear very nearly a crushing strain without lateral deviation. The lattice bars in compression are all $1\frac{1}{4}$in. thick in the layer, and 1in. thick in the smaller beams, the breadth only being varied according to the strain. The sectional area of these is determined by the law that the power of flat bars to resist a compressive strain varies directly as the cube of the thickness, as the breadth, and inversely as the square of the length. This law, which has been thoroughly investigated and experimentally demonstrated by Eaton Hodgkinson, will be found very clearly set forth in that mine of practical information, "E. Clark on the Britannia Bridge," vol. i., p. 318. From an average of eight experiments there recorded on bars of various proportions, the author has calculated a constant for wrought iron which gives very nearly the strength of any bar whose length exceeds thirty times its least dimension. Let l = length in feet, t = thickness in inches, b = breadth in inches, then the breaking load in tons, $w = 215 \frac{t^3 \times 6}{l^2}$. It is hardly necessary to remark that, in consequence of the difficulty of getting bars perfectly straight, perfectly uniform in texture, and in making the direction of crushing strain to coincide accurately with the centre of the bar, very great accuracy is not to be expected in such calculations.

(To be continued.)

The Brighton artesian well now yields a good supply of water. At a depth of 1,285ft. the green sand was reached, and a rush of water amounting to 650ft., with a continuous flow, took place. The diameter of the well, which has been dug throughout, is, we believe, between three and four feet.

KINSEY'S STEAM ENGINES.



This invention, by Henry Kinsey, of Nottingham, relates to steam engines. In constructing oscillating steam engines the slide valve is to be arranged to work in a plane at right angles to the length of the cylinder, in place of in the direction of the length, as is usual, and the valve face is formed at one end of the cylinder; the trunnions are placed at the same end of the cylinder, their centre line being in the plane of the valve face. The valve rod, projecting from the valve box at one or both ends, will then, as the cylinder rocks, move with it, its outer end or ends, supposing the valve to be stationary on its face, describing an arc of a circle. The valve rod, as its end is carried to and fro with the cylinder, is governed by a curved course, which pushes the valve to and fro over its seat, as required, to drive the engine. The curved course is stationary where the engine is at work, but it is capable of pivotting about a point in the centre line of the trunnions; this motion brings up another portion of the curved course, which is of such a form as to cause the engine to work backwards in place of forwards.

Fig. 1 is a side view of a cylinder of an oscillating engine with valve box and parts connected therewith arranged in the manner above described.

a is the cylinder; *b*, the valve box at the lower end thereof; *c*, one of the trunnions on which the cylinder oscillates; *d*, the valve rod, at the end of which is a pin entering a slot in the lever *e*, this lever is centred on the trunnion, and when the engine is at work it is locked to the fixed arc *f*. The slot in the lever *e* is divided into two parts e^1 and e^2, each of these parts is equal in length to the distance passed over by the pin at the end of the valve rod at each oscillation of the cylinder, and, by moving the lever *e*, it may be set so that the pin above mentioned may traverse as the engine works in either one or other of the parts of the slot. To the parts of the slot such curves are given that when the pin works in the one part the valve will be suitably traversed to cause the engine to move forward, and when it works in the other part it will be suitably traversed to cause the engine to turn backwards. The method in which the passages and valve are arranged is shown at Fig. 2, which also illustrates a slight modification of the above described method of working the valve, and which will be again referred to.

In the modification shown in Fig. 2, the pin at the end of the valve rod is made to work in a curved course equal only in length to the space passed over by the pin at each oscillation of the cylinder; this curved course is capable of turning about a centre c^3, and by thus moving it the engine may be reversed, the curve when inclined in one direction being suitable for driving the engine forward, and when inclined in the opposite direction for driving it backwards.

Another arrangement is shown at Fig. 3, which is a vertical section of the lower part of the cylinder of an engine. *a* is the cylinder; *b*, the valve box; *c*, the valve; *d*, *d*, the trunnions; *e*, the steam, and *f*, the exhaust pipes; e^1, f^1, are the corresponding passages. The pipes *e* and *f* are made of vulcanised india-rubber and canvas, they are connected with the trunnion by couplings *g*; the portion 1 of the coupling screws into the end of the passage, and is made with a conical nozzle, over which the end of the flexible pipe is stretched; 2 is a ring of metal tapering internally to correspond with the taper of the nozzle; this ring fits over the pipe, and has a flange at its lower end; 3 is a nut which screws under the ring 1; it has a flange within it, which comes in contact with the flange on the ring 2, when it is screwed up, and it thus forces the ring 2 downwards, so as to nip the pipe between it and the nozzle on the piece 1, and thus a tight joint is made. When steam engines are used to work with machinery which has frequently to be thrown off and on it is difficult to regulate the speed of the engine, as when relieved of the work it runs away before the ordinary governor is able to act. To obviate this the driving pulley of the engine is connected to its shaft by a spiral or other spring of suitable strength, so that the pulley will lag more or less behind the shaft, according to the strain on the driving strap. On the boss of the pulley a worm is cut, and working on this worm there is a nut connected with a block capable of sliding but not of turning on the shaft, so that the motion of the pulley independently of the shaft causes this block to traverse, and in so doing it actuates a throttle valve, opening it when the strain on the pulley is heavy, and closing it when the reverse is the case, and when the strain is taken off suddenly the steam is cut off as quickly as the spring can act.

Fig. 4 is a longitudinal section of apparatus thus arranged. *a* is a shaft; *b*, a pulley thereon, which would be capable of revolving freely were it not connected with the shaft by a spiral spring *c*, as is clearly shown at Fig. 5, which is a section through the pulley *b*. On the boss of the pulley is an inclined groove or short screw b^1, and *d* is a nut working therewith. This nut fits the shaft, on which it is capable of sliding, but it is prevented from turning independently of the shaft by a pin on the one entering a groove in the other. On the exterior of the nut a groove d^1 is formed, and this the forked end of the lever *e* enters, so that when the nut moves lengthways on the shaft it actuates the lever *e*; this turns on a centre at e^1, and is connected by a rod to the throttle valve *f* in the steam pipe of the engine. When gear is employed a similar arrangement may be made.

The same principle of so connecting the driving pulley to the shaft that it can lag behind to a greater or less extent according to the strain upon it, and applying the motion so obtained to actuate a valve in the steam pipe of the engine, is also applied in Fig. 6. *a* is the shaft; *b*, a driver or projection thereon, which is made hollow and filled with mercury, and closed at the end by the spring diaphragm b^1, as is more clearly shown in Fig. 7, which is an end view, partly in section, of the shaft and parts connected therewith. *c* is a pulley on the shaft *a*. It would be capable of turning freely thereon were it not for the protection c^1 upon it, which bears against the flexible diaphragm b^1, this yields more or less according to the pressure upon it, and forces the mercury down the hollow driver *b* and a pipe *d* in connection therewith, which terminates in a chamber, in which is another diaphragm *e*, resting on the surface of the mercury. The centre of this diaphragm, which rises and falls with the mercury in the chamber, is directly connected with the expansion valve *f* in the steam pipe, so that when, by the pressure on the driver, more mercury is forced into the diaphragm chamber, the diaphragm raises the valve *f*, and allows more steam to pass; in a similar manner, when the pressure on the driver is lessened, the supply of steam is more or less cut off. Diaphragms may be introduced into the pipe *d*, as at d^1, if the length of this pipe is such that otherwise the mercury would fall, leaving a vacuum above it.

In order to ascertain the height of water in a boiler a stuffing box is made in the side of the boiler above the water line. Through this a metal tube is passed; this tube is closed at the end within the boiler, but has a hole cut in its side to which a valve is fitted; this is connected with a lever with a float at its end. The outer end of the tube is fitted with a handle. To ascertain the height of the water the tube is turned gradually round by this handle, and as soon as the float touches the water the valve will open and allow steam to blow out through the tube; the inclination of the handle at this time will indicate the amount of water in the boiler.

This arrangement is shown at Fig. 8. *a* is a tube passing through the side of the boiler *b*; it may be made tight by packing; it is shown, however, ground into a seat like an ordinary cock. *c* is a handle on this tube by which it can be turned round; *d* is a valve pressed on its seat by the weight of the ball float *e*, to the arm of which it is connected by a link. To ascertain the depth of water in the boiler the cock *f* is opened, and the tube *a* slowly turned by its handle until the ball float touches the water, and is raised by it, then immediately the steam passes along the tube, and escapes at the cock *f*; the inclination of the handle at the time this takes place indicates the level of the water.

Institution of Naval Architects. — The meeting of the Institution of Naval Architects, of which the Right Hon. Sir J. S. Pakington, Bart., G.C.B., is the President, is appointed to be held this year at the Hall of the Society of Arts on Thursday, Friday, and Saturday, the 27th, 28th, and 29th of March. The business will commence with a report from the council, after which the first day will be devoted to the discussion of the steering and sailing qualities of ships of war, the construction and armour of iron-plated ships, and the preservation of the bottoms of iron ships from fouling. The following gentlemen are expected to take part in the day's proceedings, viz.:—The Right Hon. President, Capt. Sir J. C. Dalrymple Hay, Bart., R.N., M.P. for Wakefield, Rear-Admiral George Elliot, Rear-Admiral Woodford J. Williams, Capt. E. Pellew Halsted, R.N., Capt. Cowper Phipps Coles, R.N., Mr. W. Fairbairn, Capt. Ford, of the Thames Ironworks, Mr. J. Scott Russell, Mr. Charles W. Lancaster, Mr. J. Brown, of Sheffield, and Mr. H. D. P. Cunningham, R.N., whose improved sails are being applied to the Defence and Resistance. On the following day the morning will be devoted to the consideration of the rolling motions of ships, and of the propulsion of steamers; the discussion being opened by the Rev. Joseph Woolley, LL.D., late Principal of the School of Naval Construction at Portsmouth. In the evening the very important subject of the derangement of the compass in iron ships generally, and especially in iron-cased ships, will be explained and experimentally illustrated by Mr. Archibald Smith, F.R.S., Mr. Evans, Superintendent of Admiralty Compasses, and Mr. Rundell, the Secretary to the Liverpool Compass Committee. On Saturday a number of miscellaneous papers will be read, on the American Stevens' Battery, the Construction of Marine Steam Boilers, the Ventilation of Steamers, Submarine Explosive Shells, &c.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

Thursday, March 13, 1862.

Mr. F. Campin, President, in the Chair.

ON BUILDING STONES.

By James B. Walton, V.P.

The author commenced by observing that he had decided to treat his subject geologically, dividing it into two parts, viz., stratified and unstratified rocks, or, in other words, aqueous and igneous stones.

He first directed attention to the former of these divisions, which was arranged in the three classes of arenaceous, argillaceous, and calcareous rocks.

Arenaceous or siliceous rocks are generally composed of grains of sand, which are rounded as if by the action of running water, and bound together by some calcareous or siliceous cement. These rocks, which are termed sandstones, are sometimes found with the grains of sand extremely coarse, and, again, delicately fine. This coarseness or fineness is, however, of trifling importance in comparison with the nature of the materials by which the particles are cemented. Many sandstones have their parts so loosely united as to be totally unfit for building purposes, this being the nature of the rock which underlies the town and castle of Nottingham. Purely siliceous sandstone are admirably adapted to withstand the influences of wind and weather; but where there is an admixture of silex with other materials, great skill is required to select a durable building stone.

Argillaceous rocks scarcely admit of a general description, but most of them emit a peculiar earthy odour when breathed upon, and consist of silica and alumina, with small proportions of lime and magnesia.

Cretaceous rocks, or limestones, are composed of lime and carbonic acid. Many of these stones consist of fragments of shells and corals, which are united by means of a calcareous cement. Those belonging to the Oolitic group, are found to consist of small egg-like grains, each of which has a particle of sand for a nucleus, around which are formed concentric layers of calcareous matter.

Limestones and sandstones of the same specific gravity are found to exhibit the following relations:—As regards the resistance to a compressive force, the sandstone has a superiority over the limestone nearly in the proportion of three to two; the absorbing power of the sandstone is less than that of the limestone, as the former absorbs ·097 of its bulk, while the latter absorbs ·114. The sandstone will be composed of silica with a small per centage of carbonate of lime, and the limestone will consist chiefly of carbonate of lime with small quantities of silica and magnesia.

The author then reviewed the building materials of the Pliocene, Eocene, and Wealden deposits, describing more particularly the Kentish Rag of the lower greensand series, and the Sussex and Purbeck marbles of the Wealden formation. The latter were stated to have been much employed in the embellishment of our ecclesiastical edifices in the middle ages.

The Oolitic rocks were next described, and full particulars were given of the Portland, Ancaster, Bath, and Ketton limestones. It was remarked as a singular fact, that with reference to the Oolitic rocks, the top beds are invariably the hardest, while the lower are extremely liable to decay. Portland stone was stated to be far superior to the Bath and other stones of this formation, and also to be decidedly the best material to withstand the trying influences of the London atmosphere. The average weight of Portland stone is 135½ lb. to a cubic foot, its specific gravity 2·145, and its absorbing power 0·206. The analysis of this stone as given by the commissioners in their report of 1838 is as follows: —

Silica	1·20
Carbonate of lime	95·16
Carbonate of magnesia	1·20
Iron and alumina	·50
Water and loss	1·94
	100·00

The analyses of the Ancaster, Bath, and Ketton stones, according to the same eminent authorities, is as follows:—

	Ancaster.	Bath.	Ketton.
Carbonate of lime	93·59	94·32	92·17
Carbonate of magnesia	2·90	2·50	4·10
Iron and alumina	·80	1.20	·16
Water and loss	2·71	1·78	2·13
	100·00	100·00	100·0

The Oolitic stones of Oxford and Northampton were next referred to, particular notice being directed to the yellowish and rusty appearance of the buildings in these vicinities, and to the lamentable symptoms of decay which many of them exhibit.

The lias and new red sandstone districts were described, and the building materials were treated at some length.

The Permian or magnesian limestone series was next introduced, and interesting particulars were given with reference to the selection from these deposits of the material for the construction of the New Houses of Parliament. It appeared that the commissioners first recommended the Bolsover quarries, from having observed that the Norman porch of Southwell Minster, which was supposed to have been executed in this stone, was as free from decay as when it was erected eight hundred years back. These quarries were, however, abandoned in consequence of the stone being small in bed and difficult to remove from the earth. The Anston beds, in Yorkshire, belonging to the Duke of Leeds, situated about five or six miles from Bolsover, were then examined, and found to fulfil the requirements of the commissioners, so this stone was adopted, and delivered in London at the rate of 200,000 cubic feet per annum for several years.

Numbers of buildings have been executed in this material, both in London and the country, and instances were given in which the stonework is already suffering much from decay.

The analysis of the Anston stone is as follows:—

Carbonate of lime	54·89
Carbonate of magnesia	42·07
Protoxide of iron	0·49
Peroxide of iron	0·56
Silica	0·51
Water	0·24

The magnesian limestones of this district were stated to be very numerous, and to vary but slightly in their chemical constituents; that quarried at Mansfield Woodhouse, in Nottinghamshire, was described as being more durable than the Anston stone, but so expensive to work that it is but seldom employed. It was used by Mr Gilbert Scott, in the construction of the Martyrs memorial at Oxford, in 1840, and is found to stand remarkably well.

The Cragleith and Bramley Fall sandstones of the carboniferous system were described at some length, and were stated to be admirably adapted to resist a great compressive force, and to withstand the varied influences of weather, wind, and water. The average weight of a cubic foot of Cragleith is 146, and of Bramley Fall, 142½ lb. The latter is capable of withstanding a pressure of 109,000 lb. to a cubic foot, which is nearly the amount safely sustained by Portland. The piers of the railway bridge at Pimlico and Fulham are constructed with this material.

The Silurian, Cambrian, and Devonian systems all furnish excellent materials for building, and were described at some length by the author.

A review was then given of the igneous or unstratified rocks, particular mention being made of granite, syenite, and greenstone. The decay of granite was briefly noticed, and accounts were given of the strength of several varieties of this material, including the Aberdeen, Peterhead, and Cornish granites. The Aberdeen granite is considerably lighter than that quarried in Cornwall, but possesses nearly double the resisting power to a compressive strain.

Particulars were given with reference to the expansion of stones, and an account of some experiments recorded in the "Transactions of the Royal Society of Edinburgh" was related, from which it

appeared that the building stones in common use expanded nearly in the same proportion as cast iron.

The author concluded his paper with some observations on the decay of stone, and made especial reference to the decomposition of the materials employed in the construction of the Houses of Parliament. An analysis of the evidence taken before the committee appointed to inquire into the decay was given. It appeared, from the evidence of Mr. C. H. Smith, one of the commissioners of 1838, that the stone was all taken indiscriminately from the quarry, and that the selection was left to persons who had little knowledge of the subject. The decay was stated to be most apparent in all damp and sheltered situations, the stone being in good preservation in many places where it was exposed to the full action of wind and weather.

ON THE FRICTION OF RAILWAY CARRIAGES.

By John Dixon, C.E., Chief Engineer of the Stockton and Darlington Railway.

The earliest account I can obtain of experiments respecting the friction of railway wagons was that by John Grimshaw, the inventor of continuous ropemaking, above forty years ago, and published in Mr. Wood's "Treatise on Railways," in or about 1824, and in his third edition, 1831, page 197. Here the friction of an ordinary Newcastle chaldron wagon is stated to be $\frac{1}{170}$th of the gross weight of wagon and load, and an empty wagon at $\frac{1}{3}\frac{1}{8}$th part of the load. The former being 13·17 lb. per ton and the latter 8·75 lb. per ton. [N.B Weight of laden wagon, 8,522 lb. Weight of empty wagon, 2,586 lb.]

Mr. Wood then states, page 197, that, in conjunction with the late George Stephenson, in October, 1818, several experiments were tried by a dynamometer, but, owing to the oscillations of the pendulum, no satisfactory result could be read off. Mr. Wood then tried several more experiments on the Hetton Colliery Railway with the ordinary chaldron wagons, in December, 1824 (see page 205, third edition). Length of plane, 1,164ft. straight line; uniform gradient of 1 in 104·24, or 11ft. 2in. in the whole distance. The wagons were allowed to descend freely by their gravitating force. Four laden wagons, each weighing 9,408 lb. = 37,632 lb., or 16·8 tons; wheels, case-hardened cast iron, 2ft. 11in. diameter; axles, 3in. diameter; bearings, cast iron, 4in. broad; space described, 1,164ft.; time of descent, 120 seconds. This Mr. Wood works out to be equal to a friction of 157·4 lb., or 39·35 lb. per carriage, or 9·36 lb. per ton.

The next trial was with seven laden carriages, exactly confirming the preceding experiment, or 9·36 lb. per ton, being $\frac{1}{3}\frac{1}{5}$th of the weight. Three more runs give confirmatory results.

Page 211 contains a table of several experiments with carriages running down an inclined plane.

The average of 12 trials with loaded wagon gives 9·87 lb. per ton.
" 12 more ditto 10·05 ditto.
" 12 " with empty wagon 8·22 ditto.

The wind slightly interfered with these.

In pages 213 and 214, more examples are given, showing a variation from $\frac{1}{3}\frac{1}{3}$ of the weight, or 8·028 lb. per ton.

Ditto $\frac{1}{1}\frac{1}{3}\frac{1}{5}$ ditto 12·1 ditto,

giving an average of about 10 lb. per ton, or $\frac{1}{2}\frac{1}{2}\frac{1}{4}$ of the weight.

The foregoing were with common Newcastle chaldron wagons, without springs or buffers, and very plainly fitted up axle bearings, &c.

Pages 343 to 358.—Mr. Wood gives the result of experiments tried on the Liverpool and Manchester Railway, about 1829. At that time much was expected from the adoption of friction rollers to the axles by certain parties. Mr. Winans, from America, patented an apparatus to reduce the rubbing or axle friction; likewise Mr. Brandreth, a Liverpool barrister, patented another, slightly differing in application, but, nevertheless, depending upon the same principle.

Mr. Rastrick and Mr. Hartley were appointed to conduct these experiments (see table, page 246.) Mr. Winans' carriage ran with from 8·32 lb. to 11·65 lb. per ton. Average of ten experiments, 9·43 per ton. Mr. Brandreth's, from 9·92 to 11·58, or for eight experiments the average is shown to have been 10·62 per ton.

Mr. Stephenson competed before the same referees with a carriage fitted up with good workmanship and material, but with plain axles and no antifriction apparatus at all. The result was that this plain carriage gave less friction than either of the other two, viz., from 7·67 lb. to 9·17 lb. per ton; the average of nine runs being 8·65 lb. per ton. Of course antifriction rollers were not adopted on the Liverpool Railway, neither does it appear that they have made progress on other railways; but, in The Engineer of February 21st, 1862, I observed that a revival has taken place on the Eastern Counties Railway, showing more favourable results, viz., a reduction from 11 lb. to 7 lb. per ton. But nothing short of a year or two's time will be satisfactory as to whether they can be kept in good working order without considerable trouble and expense.

The circumstance of antifriction apparatus not being generally adopted in mill work would tend to show that great saving had not been obtained by its adoption.

I ought to have borne in mind that the 8 lb., 9 lb., or 10 lb. per ton herein recorded as the friction, consist partly of the rubbing friction of the axle in the bearing, partly of the friction from the rolling of the wheel on the rail and pressure of the flanges against the rail, especially in curves and uneven rails, and partly from atmospheric resistance.

Now without going into great detail, we may call the mere axle friction 6 lb. per ton, and it is upon this only the antifriction apparatus can be brought to bear in reducing it. All other resistances remain undiminished thereby.

I need scarcely add that no reduction of the resistance from gravitation can be effected by any contrivance whatever, but the weight of the antifriction apparatus will tell in a contrary direction, more or less according to the gradients.

The next authenticated experiments on the friction of railway wagons that I am acquainted with are those detailed by Mons. Pambour in his excellent and early treatise on railways, published in 1836, viz., six years after the Liverpool and Manchester Railway was opened, and in making these experiments I accompanied and assisted him in most of them.

Page 92.—Mons. Pambour first tried his experiments with a spring dynamometer, but owing to the oscillations of the index or pointer, they were by no means satisfactory, but appeared to average nearly 8 lb. per ton. He then adopted the angle of friction by allowing wagons to run by the force of gravitation down inclined planes, and thence to deduce the friction by mathematical calculations.

Page 102-3.—On July 29th, 1834, five wagons, laden with bricks weighing 31·31 tons. This ran a total distance of 9,933ft., the difference of level between the stopping and starting being 38·55ft. This gives the rate of inclination $\frac{1}{2}\frac{1}{5}\frac{1}{7}$, and, consequently, 1 ton is 2,240 ÷ 258 = 8·69 lb. per ton. This, of course, included the resistance of the air and some extra retardation from their having to run over several switches and crossings.

Another experiment with the same five wagons, at the same place, on the same day, gave the friction 9·17 lb. per ton.

Page 104.—The wagons were run separately instead of five in a train, and the result was as follows:—

$\frac{1}{1}\frac{1}{9}\frac{1}{7}$ or 11·36 lb. per ton.
$\frac{1}{1}\frac{1}{8}\frac{1}{0}$ or 12·42 lb. "
$\frac{1}{2}\frac{1}{0}\frac{1}{0}$ or 11·17 lb. "
An empty wagon $\frac{1}{1}\frac{1}{6}\frac{1}{5}$ or 13·28 lb. "

It will be seen that the friction was less when all five wagons run together than when run one at a time, which M. Pambour attributes to the atmospheric resistance being less in proportion to the weight of the train when run altogether than when run separately, owing to their exposing only one front for five, instead of each presenting a similar frontage.

Page 105.—Another experiment with the ordinary merchandise wagons, viz., 19 wagons = 92 tons. This gave $\frac{1}{2}\frac{1}{6}\frac{1}{6}$ inclination = 8·11 lb. per ton. On the 31st July, 1834, in the presence of Hardman Earl, one of the directors, Joseph Locke, C.E., and Mr. King, engineer of the Liverpool Gasworks, the tender of the "Atlas" engine, weighing $5\frac{1}{2}$ tons, gave $\frac{1}{2}\frac{1}{1}\frac{1}{7}$, or 10·13 lb. per ton.

On the same day fourteen wagons, = 61·35 tons, ran over a space of 9,579ft., having a descent of 35·32ft., which gives for the friction $\frac{1}{2}\frac{1}{7}\frac{1}{1}$, or 8·26 lb. per ton.

Page 107.—Another trial with 43·72 tons gave $\frac{1}{2}\frac{1}{5}\frac{1}{9}$, or 8·64 lb. per ton, and another trial with 104·59 tons gave $\frac{1}{2}\frac{1}{7}\frac{1}{9}$, or 8·15 lb. per ton.

Then complete trains were run, including engine and tender, the result being 7·78 lb. per ton.

Page 108.—Another being 7·96 lb. per ton, and more with similar results.

The speed is not generally given, but from Table, page 108, it appears to have been about 10 or 11 miles an hour.

From these last trials it appears that the engine must have run with less friction than the ordinary wagons.

And page 116, it is there shown that the addition of springs did not reduce the friction much, if any.

Page 136.—M. Pambour does not think it prudent to reckon the friction of engines at less than 15 lb. per ton, but that is treating the engine merely as a carriage when not drawing the load, but inasmuch as the strain upon the brasses of connecting rods, slide valves, axles, &c., must be considerably increased when full steam is on drawing a load, he (M. Pambour) writes an entire chapter, which is beyond the purpose of the present essay. I will merely quote that the results do not show less than 18 lb. to 20 lb. per ton.

To scientific professional men the foregoing recapitulations may appear unnecessary, and truly are "nothing new," but it may be observed that there are great numbers of valuable practical men now-a-days entrusted as foremen, &c., with the supervision of engines and carriages, who have meritoriously risen from workmen, and who perhaps never read, nor even heard, of the authors I have been quoting who were the pioneers in the diffusion of railway knowledge twenty-five or thirty years ago.

I now propose to follow up the subject, and to trace what advancement has been made of late, and see how the matter stands at present.

From the date of Mons. Pambour's book, in 1836, I am not aware of any treatise of a popular character until Mr. D. K. Clark published his scientific work in 1855; but this is too costly for many, and too learned or abstruse for the class of men I have mentioned. Not that I undervalue science or mathematical notation, but those who have not had the advantage of such instruction in their youth will find it hard work to acquire, especially when every day brings its share of arduous duties.

My aim is to state my information as plainly as possible, even by a "roundabout" redundancy of words and figures.

A great deal of information is doubtless scattered through such publications as the Gauge Commissioners' Reports in 1848, and several Mechanics' Magazines or periodicals, but not in a collated form, so as to be referred to by the class of men I have named.

Referring to D. K. Clark's work above named, I observe a set of experiments made by Mr. Wyndham Harding, showing the friction

at 16 miles an hour to have been 8·5 lb. per ton.
20 " " 8·5 "
26 " " 12·6 "
32 " " 22·5 "
59 " " 32·9 "

A table of Mr. Daniel Gooch's experiments, on the broad gauge, gives—

at 13 miles an hour " 8·03 lb. per ton.
19·4 " " 8·05 "
21·1 " " 8·43 "
45·6 " " 13·79 "
61·3 " " 19·20 "

and several more cases with similar results.

Also experiments on the Caledonian Railway, page 295, No. 95. First with coal and goods wagons at

20·0 miles an hour .. .. 11·28 lb. per ton.
12·00 " .. .. 7·66 "
10·00 " .. .. 23·00 "
24·00 " .. .. 9·07 "
32·00 " .. .. 12·3 "

and with passenger carriages at

32·7 miles an hour .. .. .. 25 lb. per ton with express train.
45 " .. .. .. 28 "
28 " .. .. .. 24 "
40 " .. .. .. 25·4 "
32 " .. .. .. 24·6 lb. per ton with mail train.
18 " .. .. .. 19· " parliamentary train.
20 " .. .. .. 23·2 "

Page 299.—In order to account for the friction being less with coal wagons than with superior carriages or coaches, it is stated, "that the advantages are, we believe, chiefly due to the lateral play of the journals in the bearings, which enabled the wheels to adjust themselves without effort to the rails, swaying towards either side, as the conical tyres and unlevel rails might bias them.

"In one case the want of end play prevented the wheels so adjusting themselves laterally, without carrying with them the superincumbent loads.

"For moderate speeds, say, fifteen to twenty miles an hour, some lateral play in the bearings is undoubtedly beneficial. But, at high speeds, lateral play becomes dangerous, and is inadmissible."

Mr. Clark gives many tables and rules for calculating atmospheric and other resistances; how they increase with high speeds, &c., but I consider these beyond the limits of the present paper.

Having thus briefly given an outline of our information on friction (for the better understanding of what is to follow), from the result of my own experiments, I will state that the Stockton and Darlington Railway, being the oldest public railway in England, and whose traffic was chiefly in coals, commenced in 1825 with the same kind of wagons as were in general use amongst the collieries of the Tyne and Wear, called chaldron wagons; weighing then about 1 ton 10 cwt., and carrying 2 tons 13 cwt. of coals, of which kind of wagons the same railway have now about 15,000, but rather larger, say, weighing 1 ton 12 cwt., and carrying 3 tons of coals or ironstone.

It will hardly be expected that I can give any *bonâ fide* experiments made to ascertain the friction of these wagons: nevertheless, we have, what I am pleased to consider, an excellent mode of ascertaining the friction on the original rails and with the original wagon. For although the Stockton and Darlington Railway commenced with two locomotive engines, the traffic in coals soon exceeded their capabilities, and a great amount of traffic was hauled by horse power.

The coal field being situated fully 320ft. above the level of the tidal river, where the coals are put on board ship, necessarily gives a descending line of railway, and, for several miles, the inclination is such that the laden wagons will run of themselves, or, more scientifically speaking, by the force of gravitation. But, although the laden wagons require no power on such parts to take the coals to the place of shipment, the empty wagons must be hauled back, and, for this purpose, the horses had to trot down to be ready to begin their work; and, inasmuch as the laden wagons were suffered to run down at a rate of six or eight miles an hour, heavy work horses were soon fatigued by the down journey. Some one ingeniously suggested that it would be a great saving of horse labour to let them ride down those portions of the line where the descending gradient was sufficient to make the wagons run without any dragging or hauling. For each horse a homely wagon with low wheels, railed on all sides but at one end, ironically called a "dandy cart," was constructed: and, although the poor brute might question why he was, through coaxing and whipping, made to mount himself into such a novel situation, yet, such is the sagacity of the horse, that the species very soon discovered that it was easier and more pleasant to ride than to walk, and in some instances became very expert in getting into the dandy carriages, even when in motion, having been taught that if they did not display some alacrity in mounting, that they would have to run on foot several miles.

On a part of the railway, near "Fighting Cocks station," the gradient descends 1 in 209½, then 1 in 285½, then 1 in 236¼, averaging 1 in 236, for 1½ mile.

Now, the $\frac{1}{2}\frac{1}{3}\frac{1}{6}$ of a ton is very little over 9 lb.

Down this gradient the wagons regularly ran, and the horse rode in the dandy cart.

Although this system was pursued on several parts of the line, extending over many miles, the above is about the flattest part on which the horses could ride; of course the wagon men who found horses and drivers at a tonnage price had to be careful to keep the axles well oiled, and to cry out if the wagons were not in good repair.

In my recent experiments I was disappointed in finding that the common chaldron wagons would not run all through this part, as formerly, stopping on 1 in 285; but on being taken to 1 in 211, they did run by themselves. Now this is equal to 10·6 lb. per ton, but further details will be given.

The extension of the Stockton and Darlington Railway system, being, by the year 1861, extended by the making of various branches, and a union with the South Durham and Lancashire line, to join the Lancaster and Carlisle line, at Tebay, in Westmoreland, making together 160 miles, a great increase of rolling stock was required, and as the South Durham and Lancashire line had very severe gradients, viz., 1 in 70 to 1 in 60, for several miles, it was deemed advisable to get the mineral wagons for conveyance of coal, coke, and ironstone of a better character than the original coal or "chaldron wagons," and as much stress was laid by the commercial officers of the company upon the great saving that would arise from the reduction of friction by the use of what we call the trucks, as distinguished from wagons, I felt myself called upon to try a few experiments.

These trucks weigh 4 tons 16 cwt. each, and will carry about 8 tons of coal, but only 4¾ to 5 tons of coke. They have wrought iron wheels, springs, and buffer apparatus, and cost about £90 each.

On July 28, 1860, one of these improved trucks, weighing, with the load of coke, 9 tons 11 cwt. 2qr., ran down an incline 118·6 chains in length, having an average descent of 1 in 255, consequently I call the friction ($\frac{2}{2}\frac{8}{5}\frac{4}{5}\frac{9}{5}$), 8·78 lb. per ton.

I have to explain that they were set off upon a gradient of 1 in 76, and after reaching the bottom of this incline were suffered to expend the acquired velocity by running on a level or nearly level portion until they stopped of their own accord. The exact difference of level between the starting and stopping point was measured, and the length accurately taken, which gave the average gradient, which I have taken, as the measure of the friction, as sanctioned by Wood and Pambour.

Similar experiments were repeated, and the result was 8·50 lb., 8·33 lb., and 8·56 lb. per ton. These were with single trucks, over the same ground; average, 8·43 lb. per ton. Then twenty laden trucks, weighing, including the load, 191 tons 6 cwt. 3 qr., gave 8·44 lb. per ton, or $\frac{1}{2}\frac{3}{7}\frac{5}{5}$ part of the weight. This was repeated, and gave 7·99 lb. per ton.

Several great railway authorities object to this method of obtaining the friction. Mr. Bidder says "that when the wagons are running by gravity down an incline they press on one another, so as to give rise to cross pressures, causing much additional friction between the wheel flanges and the sides of the rails." And a similar objection is made by Mr. Clark, p. 291-2.

No doubt it would be so if the leading wagons in the train ran worse than the rest, but this does not appear to be so, according to the above experiments, for the amount of friction by the twenty wagon train is less than by running the wagons separately.

On this same portion of railway thirty-three chaldron wagons, weighing 10 tons 9 cwt., were run four different times. The result was 12·62 lb., 12 59 lb., 13·16 lb., and 10·98 lb. per ton. Averaging 12·33 lb. per ton.

Fifty-eight laden chaldron wagons = 201 tons 16 cwt., were then run down the same plane, and gave 13·75 lb. per ton, being in excess of the experiment with only three wagons at a time.

A passenger carriage was then tried, and the result was 15·64 lb., but, being an old carriage, this must not be relied on.

When I wrote the article you did me the honour to insert in your numbers of The Engineer for January 31st and February 7th, 1862, I adopted 9 lb. as the friction of the best wagons with springs, &c., called trucks, and 12 lb. as the friction of the chaldron wagons, as being, in my opinion, about a fair medium.

We have had several trials by another method, similar to that adopted by Mr. Wood, that is by running wagons down an incline, noting the speed and difference of level during a given time, and comparing the time in running down an incline, having a certain number of feet fall, with the time that a heavy body would require to fall from the said height, thereby to deduce the friction.

Three empty chaldron wagons, weight 4 tons 16 cwt., run down a plane 457ft. long with 6ft. fall in 1min. 4secs. this was worked out by one of my assistants to give 11·17 lb. per ton.

	T.	C.	Q.		
1 full wagon =	4	6	0	run down in 62 seconds =	9·89 lb. per ton.
3 full wagons =	13	0	0	run down in 109 seconds =	11·16 lb. per ton.
3 laden trucks =	14	7	2	run down in 63½ seconds =	10·84 lb. per ton.
1 laden truck =	5	18	2	run down in 60 seconds =	8·62 lb. per ton.
3 passenger carriages and guards van				76 seconds =	14·97 lb. per ton.
An engine and tender 40 tons run in				63 seconds =	10.52 lb. per ton.

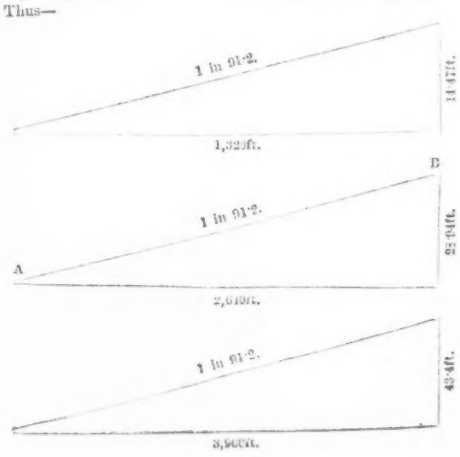
But I fear the distance was too short to give very reliable results I was rather surprised at the small friction of the engine and tender, considering the multiplicity of parts and rubbing surfaces, but it tends to show the benefit or advantage of superior workmanship and lubrication.

Further experiments were made on a part of the Barnard Castle branch, a sample of which I shall here give in full details.

Experiments made March 29th, 1861, on the Barnard Castle Branch of the Stockton and Darlington Railway.

22 laden trucks and 1 brake-van = 389 tons 16 cwt.,
ran down an incline of a ¼ of a mile ... ... } 1 in 91·2, in 120 secs. = 7·5 miles per hour.
Ran down ½ a mile in 163 " = 11· " "
" ¾ " 208 " = 12·9 " "

Thus—



For the first quarter mile:—

$\sqrt{\frac{14{\cdot}47}{16{\cdot}095}}$ $\sqrt{\cdot 899} = 0{\cdot}948$ seconds to fall perpendicularly through 14·47ft.

$0{\cdot}948 \times 91{\cdot}2 = 86{\cdot}45$ theoretical time down the plane.

$\frac{2240}{91{\cdot}2} = 24{\cdot}56$ lb. gravitation per ton.

$120 \times 24{\cdot}56 = 34{\cdot}092$

Theoret. time 86·45

and 34·092 minus 24·56 = 9·53 lb. the friction per ton.

For the half-mile, run in 163 seconds:—

$\sqrt{\frac{28{\cdot}94}{16{\cdot}095}} = \sqrt{1{\cdot}798} = 1{\cdot}34$ seconds time to fall through 28·94ft. perpendicularly.

$1{\cdot}34 \times 91{\cdot}2 = 122{\cdot}2$ theoretical time of running down B to A.

Gravitation per ton as before = 24·56 lb. per ton.

$\frac{163 \times 24{\cdot}56}{122{\cdot}2} = 32{\cdot}76$ lb.

and 32·76 minus 24·56 = 8·20 lb. the friction per ton.

For the three-quarters of a mile, run in 208 seconds:—

$\sqrt{\frac{43{\cdot}4}{16{\cdot}095}} = \sqrt{2{\cdot}69} = 1{\cdot}64$ seconds to fall 43·4ft. perpendicularly.

$1{\cdot}64 \times 91{\cdot}2 = 149{\cdot}568$ theoretical time in running from B to A.

$\frac{2240}{91{\cdot}2} = 24{\cdot}56$ lb. gravitation per ton.

$\left.\begin{array}{l} 208 \text{ actual time} \\ 149{\cdot}568 \text{ theor. time} \end{array}\right\} \times 24{\cdot}56 = 34{\cdot}15$

and 34·15 minus 24·56 = 9·59 lb. the friction per ton.

Firstly, for a quarter of a mile, 9·53 lb.
Secondly, for half a mile, 8·20 „
Thirdly, for three-quarters, 9·59 „

3 [27·32

9·10 lb. average friction per ton.

The result of these various experiments leads me to remark, in conclusion, that we have not effected much if any reduction in the friction of our common chaldron coal wagons having case-hardened cast iron wheels without springs; but, on the contrary, I was disappointed in finding that they generally would not run by their gravitation on parts of the line where they formerly did so, as described by the paragraph on the horses riding in dandy carts. This I cannot attribute to any other cause, than that when drawn at slow speed by horses, the wagons, as I before explained, were allowed more side play, and more care taken in the oiling of the axle bearings; and instead of being then run in sets of 3 or 4, they are now run in trains of 40, 60, and even 80 wagons; and in these large trains they are more liable to be knocked out of square by concussions, and a stiffer kind of grease is used, &c., and bad bearings and shorn axles more likely to escape detection.

The newer or improved class of wagons which we have recently introduced, called herein trucks, by way of distinction, carry between two and three times the load of the old chaldron wagons, and are fitted up with brass bearings, wrought iron axles, malleable iron wheels, bearing and buffer springs, and, in fact, as well fitted up as any carriages in the kingdom. These, it will be seen, run with 20 to 30 per cent. less friction than the chaldron wagons; but it is only fair to bear in mind that those of which we have, say, 600, are all nearly new, and of course will run better than when they have worn tyres, &c. All the same as these only show 8½ lb. to 8½ lb. per ton. I adopt 9 lb. in all my calculations, as will be seen in your print of my article on resistances, on inclines, &c., published in The Engineer of January 31st and February 7th, 1862.

Then comes the experiments with passenger trains (see table herewith), dated January 14, 1862, where eleven experiments average fully 12 lb. per ton.

In this I was greatly disappointed, for we have the credit of having our passenger carriages in a state to challenge comparison with all other railways. No expense is spared. They are not built by contract, and I can only suppose that they are too stiffly and closely fit in the journals, very little side play being given.

Very tight screwing up of the connections between carriage and carriage and connected brakes must, more or less, operate against free running, especially round curves; but it will be seen that my experiments first consisted of separate carriages, and then seven of them united in one train; but the united seven did not show any increase, but, on the contrary, somewhat less. Probably the less atmospheric resistance, in proportion to the weight, may account for that.

Experiments made near Fighting Cocks, January 20th, 1862.

A train of ten passenger carriages consisting of four second-class, five third-class carriages, and one van started of themselves upon a gradient of 1 in 209·3, and ran 600 yards at a speed of three miles an hour, and stopped when they came upon a gradient of 1 in 285·87. This shows that the friction would be 10·7 lb. per ton.

The same train was next tried upon the gradient of 1 in 285·87, but would not run although repeatedly put in motion. It was then tried upon a gradient of 1 in 211, and when gently put in motion ran 100 yards, making the friction 10·6 lb. per ton.

These experiments were made upon a curve of 120 chains radius.

The carriages were then taken to a straight part of the line near Oak Tree, and allowed to start of themselves upon a gradient of 1 in 211, upon which they ran two chains and then came upon a gradient of 1 in 262·48, and stopped after having run, altogether, 374 yards at a speed of from 1 mile to 1½ miles per hour. This gives a friction of 8·5 lb. per ton.

It may be inferred from these experiments that about 2 lb. per ton is due to the friction of the wheels against the rail on a curve of 1½ miles radius.

From the first day's experiments with single carriages the friction appears to be rather high; the average being 11·9 lb. per ton, but this is accounted for by the fact of the greater portion of the line upon which the experiments were made being curved. Out of 120 chains only about 55 chains were straight.

Table of Experiments made with Passenger Carriages on the Gunsbro' Railway, for ascertaining the friction per ton, on the 14th Jan., 1862.

No. of exp.	Description of train.	No. of compartments per car.	Weight of train in tons cwt.	Distance run over in chains.	Fall in feet.	Gradient 1 inch.	Highest velocity in miles p. h. ur.	Average velocity in miles p. hour	Friction p. ton lbs.
1	1 3rd class car.	4	5 0	111·0	40·46	181·0	16·07	9·10	12·37
2	1 2nd do.	3	4 5	123·6	39·83	204·8	18 00	10·09	10·93
	1 3rd do.	4	5 0	109·7	40·26	179·4	16·07	7·89	12·70
4	1 do. do.	4	5 0	108·5	40·39	177 3	15·00	7·72	12·63
5	1 do. do.	4	5 0	108·3	40 39	177·0	14·07	7 30	12·65
	1 2nd do.	4	5 0	123·6	39·83	204·8	17·30	10 4	10 90
7	1 van.	1	5 12	119·8	40 41	195·7	17·30	10 30	11 44
8	1 2nd class car.	3	4 5	124·4	39 81	206·1	18 00	10·07	10 80
9	1 do. do.	5	7 1	101·2	40·21	165·8	16·07	7·22	13·48
10	1 do. do.	5	7 1	98·7	39·91	162 1	16 07	5·19	13·72
11	4 3rd class, 2 2nd class, & 1 van.*		35 17	121·4	40·00	200·3	18·00	10·60	11,13

* Same carriages as were run separately.

The gradients are the average, but the carriages were set off down 1 in 80 for about 25 chains, then flattening down to a level.

It may be objected that none of these were first-class carriages; I, therefore, observe that the important parts, such as framing, axles, wheels, springs, buffers, couplings, &c., are of equal quality and workmanship; differing only in cushions, linings, and decorative fitting up

MISCELLANEOUS.

Those taking an interest in the "smoke nuisance" question may now, almost any day, see the principal chimney of the Houses of Parliament belching forth dense volumes of smoke.

A verdict of "Manslaughter" has been returned by the coroner's jury against John Moody, the viewer of Cethin Colliery, where nearly fifty men and boys were lately killed by a gas explosion.

The following goods have been sent to the International Exhibition in London from Manchester, New Hampshire, in the United States:—A steam fire-engine, cotton, delaine, and hose goods, seamless bags, a washing machine, and some ploughs.

The manufacture of postage labels, and of the envelopes provided at the Post-office, is estimated to cost £27,916 this year. The poundage allowed to distributors amounts to £4,600. The sum of £1,000 a year is now allowed in the estimate as the additional expenditure entailed by increasing business. This sub-department employs forty persons. The whole Post-office Department employs more than 25,000 persons in the United Kingdom.

The new Royal Artillery Hospital, on Kidbrook Common, near Woolwich, has been commenced. Its length will be 900ft. The infirmary grounds will extend over an enclosed area of eight acres. The difficulties of forming a solid stratum for the foundation walls have been found greater than was anticipated, from the boggy state of the subsoil, which in some places has required a layer of concrete 8ft. in depth. The materials for this were carted from the gravel quarries at Plumstead, a distance of about three miles. The establishment intended for washing the hospital linen by means of steam machinery, commenced last year on Woolwich Common, is partly roofed in.

The *Times*, under the head of "Not far from the truth," published the following letter on Tuesday last:—Sir,—I am told to understand that you go to ask our Emperor to open your exhibition. I hope in charity you will bring him into the building blindfoold, and so he shall save the miserable indignation we have suffered from looking at your horrid building. Hi! Hi! we mock ourselves at you when we see from the park the big Dome built on boards and half hid by the big shed. Oh the ugly brik and the frightful shed to call al Europe to see! Why you host so much? If you only say we build the shed then no one laugh. Even the little boy the guide he say "dam ugly." I have, &c., Jules Pirer. Leicester-square, Hotel Sablonière.

The Royalist, with engines of 150-horse power, made by the Greenock Foundry Company, has been tried at Plymouth. The engines are horizontal direct acting; cylinders, 38in.; stroke, 2ft.; and can be worked up to about 650 horses. The shaft is 65ft. long, and the propeller, Griffiths', is of 10ft. diameter, with a pitch of 13ft. The trial was superintended by Commander Risk, Mr. Steil, of the Steam Reserve, and Mr. Ward, from Keyham Steamyard. The Royalist, which is not masted, draws 9ft. 8in. forward, and 12ft. 4in. aft. The wind was strong from the eastward. Six runs at the measured mile, under full power, produced an average speed of a little more than 11 knots; revolutions per minute, 106; pressure, over 20 lb; vacuum, 26½in. There were no hot bearings, and the trial seemed to give entire satisfaction to the Government officers.

The following appointments of naval engineers have been made since our last:—Benjamin Barber, chief engineer, John Fox, acting engineer, Reed Ockenden, first-class assistant-engineer, and Joshua Smith, acting second-class assisting-engineer, to the Tribune, commissioned. J. Ashley, promoted to chief engineer; J. Conolly confirmed as second-class assistant-engineer, supernumerary, in the Indus; James Imrie, confirmed as second-class assistant-engineer in the Simoon; James Radford and George J. Maybury, acting second-class assistant-engineers to the Cumberland as supernumeries; John C. Gruchy promoted to chief-engineer; R. J Wilson, chief-engineer, to the Magicienne; Thomas E. Buckle, engineer, to the Cumberland, for the Mullet; J. T. Harris, engineer, to the Magicienne; James A. Wilson, engineer, to the Lee; C. H. Pillar, first-class assistant-engineer, to the Magicienne; Henry Peters, first-class assistant-engineer, to the Lee; J. Baillie, acting second-class assistant-engineer, to the Magicienne; R Macaulay, acting second-class assistant-engineer, to the Lee; Daniel M'Farlane, engineer, supernumerary, to the Indus, confirmed; William Fedarb, first-class assistant-engineer, supernumerary, to the Indus, confirmed; and John Dows, confirmed second-class assistant-engineer, in the Virago

The Defence was again tried on Thursday week. The weather was favourable for the trial, but at times very thick. The wind was light, at west-north-west. The ship's draught of water was nearly the same as on her former trial—being 25ft. 5in. aft, and 24ft. 3in. forward. She was complete in her stores, and had 440 tons of coal on board. After completing the first mile to the westward the weather became thick, and the ship was taken off the trial ground for a short time: but the weather again cleared up, and the runs at full power showed a mean speed of 11·612 knots an hour. This completed the trials at the measured mile, thick weather again setting in and preventing the half-boiler trials being carried out. The ship was then taken off into deep water, and tested in going round the circle, which she completed in 8 minutes and 10 seconds. In testing the engines they were stopped, from the time of moving the telegraph on the bridge, in 12 seconds, started ahead in 15 seconds, and astern in 11 seconds. The temperatures on deck and below were as follows:—On deck, from 45 to 49 deg.; in the middle of the engine-room, from 90 to 100 deg.; and in the stokeholes, from 88 to 96 deg. The speed made on the first trial was 11·357, and that made on the present occasion, 11·612—a quarter knot less than had been anticipated. The steering qualities of the ship were found to be as uncertain as on the former trial.

The traffic receipts of railways in the United Kingdom amounted for the week ending the 8th of March, on 10,109½ miles, to £462,838, and for the corresponding week of last year, on 9,871¾ miles, to £485,272, showing an increase of 237½ miles, and a decrease of £22,434. The gross receipts on the following fourteen railways amounted in the aggregate, on 6,691½ miles, to £352,756; and for the corresponding week of 1861, on 6,445 miles, to £372,304, showing an increase of 156½ miles and a decrease of £19,548. The decrease on the Eastern Counties Railway amounted to £405; on the Great Northern to £1,929; on the Great Western to £751; on the Lancashire and Yorkshire to £4,423; on the London and North-Western to £4,163; on the London and Brighton to £235; on the Manchester, Sheffield, and Lincolnshire to £1,930; on the Midland to £3,209; on the North-Eastern to £2,777; and on the South-Eastern to £1,379—total £21,201. But from this must be deducted £801, the increase on the Caledonian; £35 on the Great Southern and Western; £409 on the London and South-Western; and £408 on the North British—together £1,653; leaving the decrease, as above, £19,548. The goods and mineral traffic on those lines amounted to £265,910, and for the corresponding week of 1861 to £218,866, showing a decrease of £12,956. The receipts for passengers, parcels, &c., amounted to £146,846, against £153,438, showing a decrease of £6,592. The traffic receipts on sixty-six other lines amounted on 3,507¾ miles to £110,082, and for the corresponding week of last year, on 3,426¾ miles, to £112,968, showing an increase of eighty-one miles and a decrease of £2,886. The falling off in the traffic of the past week as compared with the corresponding period of 1861 is about twice as much in the goods and mineral traffic as in the passenger traffic of the great lines, caused by the depression of trade in the manufacturing districts. The traffic receipts of the past week show a decrease of £3,452, as compared with those of the preceding week ending the 1st instant.

BRAY'S TRACTION ENGINES.

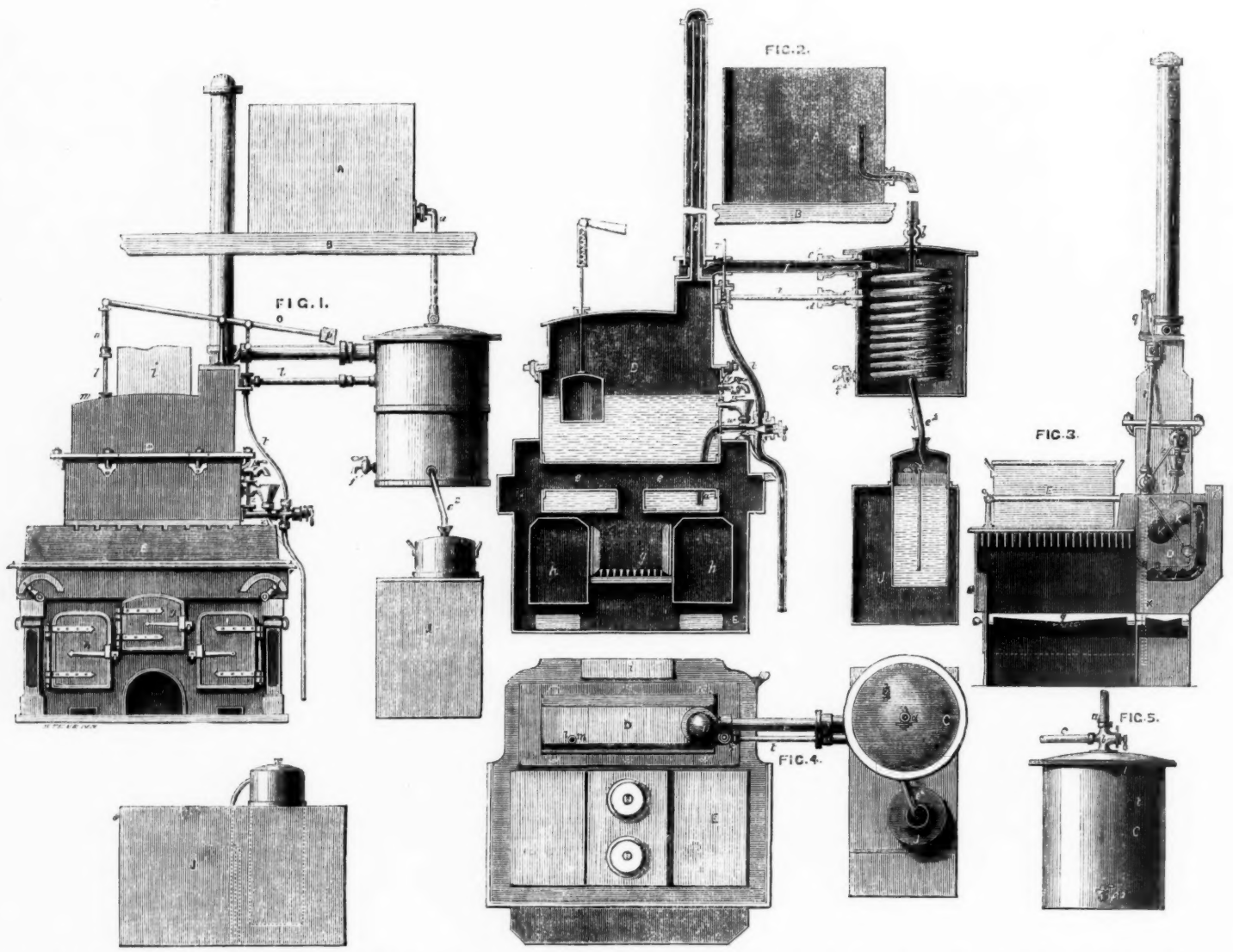
The third ordinary general meeting of the Bray's Traction Engine Company took place on Friday last at the offices, Pall-mall East; Mr. H. D. Davies in the chair.

Mr. Louttit, the secretary, read a report, from which it appeared that the experience gained by the directors during the past year, with regard to the working of the engines and the conduct of the business of the company, had been so entirely satisfactory, that they had now the fullest confidence in the ultimate success of the system of steam traction. A new engine, No. 16, built at the company's factory, was finished a few months since. In its construction every desirable adaptation was tried, and as some of these were necessarily experimental, its completion was considerably delayed by the modifications and alterations suggested as the construction proceeded. The results obtained, however, when the engine was brought out, left no doubt that it was the best traction engine ever built. Several eligible contracts at a distance were at once offered for the employment of this improved engine, but having no other to supply its place, the directors were obliged, in the interests of the company, to decline those offers, and confine its services to special work in the neighbourhood of London. It had removed for Messrs. John Penn and Son—for whom it was now working—some immense loads of machinery for the large engines they manufacture, with far more ease, and occupied much less time, than two of the old engines under similar circumstances. Engineers, and other persons whose opinion is valuable in connection with traction engines, expressed their approval of its superior arrangement and construction, and at its satisfactory working. The directors were, therefore, much gratified at being able to state that they had gained the support and co-operation of a number of influential noblemen interested in the subject, who, after being personally satisfied of the utility and advantages of Bray's traction engines, had associated themselves with the company as honorary directors, with a view to promote the general adoption of these engines, and to record their opinion of the important position this agent for economising horse labour would take in the development of commercial and agricultural enterprise both at home and abroad. They had also obtained as their consulting engineer Mr. D. K. Clark, C.E., a gentleman well known from his great experience and works in locomotive engines, as well as from his connection with the International Exhibition. Mr Clark was accordingly now engaged in arranging for the introduction, in a new engine, of all the improvements not fully attained in No. 16, and at the same time so modifying and simplifying the details as to reduce the construction of traction engines to a principle. Her Majesty's Government had ordered an engine similar in design to No. 16, with the addition of various appliances for transmitting power to other machinery, to be built for permanent service in Woolwich Dockyard, where the directors hoped to deliver it about the beginning of May. Arrangements had been made for the employment of the company's engines, in removing heavy machinery into the International Exhibition. Amongst other work, No. 16 would be engaged to transport thither from the docks some ingots of steel, locomotive engines, and other large masses of machinery, sent by various foreign manufacturers, and also to remove some engines for the Great Western Railway Company. Numerous applications, with regard to the purchase of engines, continue to be received from every quarter of the world; and now that the directors saw their way to having engines built on thoroughly scientific principles, from Mr. Clark's designs, in which wear and tear, involving maintenance and repair, would be reduced to the minimum of cost, construction be greatly simplified, and reliance on the efficiency of the engine be undoubted, it only remained for the necessary capital to be forthcoming, to admit of operations being commenced on an extended and profitable scale. The amount of the present capital, which, with all debts and liabilities, was less than £30,000, had been subscribed from time to time, as it became necessary, by a few individuals interested in the development of the question. For this sum the directors had purchased the original and supplementary patents, with all the plant, fixtures, and rolling stock, and had been enabled to carry on business since the company's formation until the present time, during which period they had gained much valuable experience. A further limited amount of capital was under offer to the company, the deposits in respect of which were in the hands of the company's bankers; but this amount not being adequate to the purposes of the company, the question had been postponed until the present meeting, and it was therefore hoped that sufficient additional capital would now be subscribed.

The engineer's report, which was appended, stated that the distinguishing principle of the engine—the feathering wheel, as it might be called—was of great practical value, and he had endeavoured, in the new design, to embody it in the form best adapted to the purpose. He was confident in the merits of this system o steam traction on common roads as a sound investment capable o being indefinitely extended.

The chairman, in moving the adoption of the report, observed that the directors had at length attained a point for which they had been labouring for years, and which during the course of their operations appeared almost incapable of being realised, not only because great obstacles were thrown in their way, but because it was difficult to make the public understand the full importance of their work. They had now, however, overcome every mechanical difficulty, and they were in a position to employ their traction engines with such facilities and to such advantage as they never anticipated. With reference to the question of investment he would direct attention to the report of Mr. Clark, the engineer, who stated that "he was confident in the merits of this system of steam traction as a sound investment, capable of being indefinitely extended." There was no doubt that, in arriving at this conclusion, Mr. Clark had been guided by great practical experience and by a perfect knowledge of the subject under his notice; and on the general question, the obvious result of the use of these engines was that, whereas the cost of conveying goods according to the ordinary means of transport was 8d. per ton per mile over an average road, the present company were in a position to carry the same goods at the rate of 4d. per ton per mile, and with considerable advantage to those who were interested in the undertaking. Moreover, there were many things that could not be removed by any other means than the use of the traction engine, for it was well known than when a large number of horses were employed to draw an unusually heavy burden it was extremely difficult to get them to pull together. In proof of the fact that the project was to be regarded as a good and profitable investment, he might state that, supposing they had twenty engines working at the most moderate rate, they would yield an income to the company of something like £10,000 a year. The demand for the engines was increasing daily both at home and abroad, and there was a large amount of property in mineral districts that was not worked at all for the want of such means of transport as Mr. Bray's invention afforded. Now came the question whether the engines could not be worked without any detriment to the public convenience; and on this point he would remind the meeting that the same difficulties were presented when the railway system first came into existence that were started in reference to these engines. In regard to the comparative results of the two modes of travelling, viz., the railway system and the ordinary roadway, he had some documentary evidence which was interesting and instructive. There were no complete government returns upon the subject, but the police were instructed to make returns of all road accidents in the City and metropolitan districts that came within their knowledge; and the result in the year 1859 was that during that period 70 persons were killed by accidents and 878 injured, making a total of 948 persons killed and injured. In the same year the number of passengers killed and injured on railways, between the months of July and December (which was the period when, as was well known, there was more travelling than at any other), was 383. He had not been able to obtain the return for the previous six months, but if it were put as double the above figures, it would give 766 deaths and injuries sustained on railways throughout the kingdom against 948 persons killed and injured to the knowledge of the police in the streets of the metropolis; and during that

BROWN'S FRESH WATER APPARATUS.



year, according to the returns, 164 millions of passengers travelled over 102 millions of miles. The comparison was much the same in France, in which country it appeared there were more deaths by accidents from ordinary carriages in one year than by casualties on all the railways in ten years. As regarded the traction engines belonging to this company, it was a gratifying circumstance that not a single accident had ever occurred through them, except in one instance, and that arose from the fact that one child pushed another child under the wheels. There was a further merit which belonged to these engines in their improved form, viz., that their motion made little or no noise, and the sound which the employment of steam generally produced was skilfully obviated. It was quite clear, under all these circumstances, that the time had now come when all prejudices should be removed, and when the question as to traction engines should be regarded as of great national importance. The directors of this company were in a condition to offer a good investment to the public, and they required only an adequate amount of capital to enable them to achieve the results desired. The subject was scarcely less important than that of the railway system itself; and he sincerely hoped that the present undertaking would ere long attain to that position in the public estimation wh.ch its importance ought to command.

The report was adopted, and a resolution was passed authorising the directors to take the necessary steps for increasing the capital of the company. A gentlemen present stated that he contemplated using the engines extensively abroad in connection with a rail system of agriculture which he explained to the meeting. The directors had kindly placed No. 16 engine at his disposal, for the purpose of making experiments by means of a spiral spring dynamometer to register up to 8 tons—the accuracy of which he had tested by means of hydraulics—to ascertain the draught power it exerted. It had three wagons attached loaded with 9,000 bricks, the weight being with wagons about 30 tons, with which it went to Clapham-common. On the hard road the draught indicated was about 1,800 lb., increasing in some cases where it was very muddy, there having been about 48 hours' previous rain, to as much as 2,200 lb. The engine went on the grass, which was very soft and slippery from the rain, and drew the load along without difficulty, the draught being about 3,000 lb. The wheels of the engine left an impression in the ground about the depth of half an inch, while the wagon wheels made tracks as deep as 2in. For the purpose of experiment the train went to a very boggy piece of turf; after moving over it for a short time the wagon wheels sunk to the depth of 6in. in a bad place, while those of the engine were scarcely 2in. deep. The draught power exerted increased to 4,500 lb., when the wheels of the engine slipped round without moving the train. The driver, having gone so far on the plain surface of the wheel, then brought the auxiliary power to bear and threw out the spades a short distance, which exactly doubled the power of the engine, since the dynamometer registered 9,000 lb., and the engine drew on the load without further difficulty. These figures were quite independent of the power exerted by the engine to move herself. This result was considered entirely satisfactory, since no traction engine had hitherto been found capable of exerting a greater draught power than 4,500 lb. It was, therefore, calculated that on increasing the width of the tyre of the wheel and putting on slow gearing, by the use of his rail system to guide the implements, one of these engines could draw at least 30 ploughs after it, ploughing 5in. deep, at a speed of about 1½ miles per hour, or plough 60 acres per day; and as he could employ it for every purpose of cultivation in large tracts of land in foreign countries, after reckoning cost of outlay and maintenance at a high rate, he would be able to raise wheat, &c., at the cost of 1s. per bushel.

The retiring directors and auditor were then re-elected, and Mr. Bray offered a few practical remarks in regard to his continued endeavours for the advancement of his invention, and its application to agricultural purposes. A vote of thanks to the chairman and directors terminated the proceedings.

BROWN'S APPARATUS FOR DISTILLING SALT WATER.

This is the invention of Andrew Brown, of Liverpool. Its special feature consists in making the "feed" self-acting.

Fig. 1 is a front elevation of the apparatus combined with a cooking stove; Fig. 2 is a vertical section, with the exception of the condenser worm, which is shown in elevation; Fig. 3, a side elevation of the evaporating boiler and cooking stove; Fig. 4, a plan view of part of Fig. 3, and of the condenser and filter; Fig. 5, a side elevation of the condenser, and Fig. 6, a longitudinal elevation of the filter.

A represents the supply cistern in ordinary use, placed on the top of the deck-house B, and usually filled by a force pump on board the ship; C, the condenser or condensing worm chamber, made of metal, and bolted quite air-tight; it communicates with cistern A by two pipes, *a*, *a*, one as uptake for hot water, and any steam generated, the other for supply of the colder water, a circulation being maintained as is well known. These pipes may either be connected to a three-way cock *b*, as shown in Figs. 1, 2, and 5, where the third way *c* is for running off the waste water and steam generated in the condensing worm chamber immediately after commencing to distil, and before the circulation hereinbefore mentioned is allowed, or they may have separate cocks, *d*, *d*, as shown in Fig. 4, in which latter case one of the cocks will have two ways (or the three-way cock might be used), so as to carry off the waste water and steam above referred to. D, the evaporating boiler, the bottom of which may be made of malleable iron, with a T flue or tube *e* passing through the same, and the top of cast iron, and fasten them together by bolts or otherwise; *f*, tubes secured and open to the said evaporating boiler, to cause a circulation from the bottom of the water upwards, to or about the water line; these tubes, by being placed in the fire flue, transmit considerable heat to the water. When the boilers are large, two or more flues or tubes might be used; E, the cooking stove, the effectiveness of which remains unimpaired, as the heat required for the evaporating boiler is simply that which hitherto has passed off into the chimney. *g*, fire-place; *h*, ovens; *i*, chimney; *j*, pieces of perforated angle iron, rivetted to the bottom of the boiler to prevent sudden egress of the combustible gases; *k*, dampers placed at the ends of the T flue to allow the cooking stove to be used when the distilling apparatus is not at work; F, the float made of copper, porcelain, or other durable metal or material; *l*, the float spindle, moving through a stuffing gland *m* in the boiler cover; *n*, the regulating nut and spring, the former of which determines the "lift" of the float, and consequently the opening allowed for passage of "feed" water, and the latter counteracts the surging of the water in the boiler, through the rolling and pitching of the ship, by yielding and returning without opening the "feed" valve at every slight motion; *o*, the lever, with balance weight *p*; *q*, bracket supporting the said lever *o*, to which is jointed the spindle *r* of the feed controlling valve or tap *s*, placed in the supply pipe *t*, communicating between the condenser and boiler; *u*, a stuffing gland, to allow for the working of the ship; *v*, a two-way cock through which the boiler is supplied at *w*, but which is also suitable for emptying the boiler by the passage or pipe *x*; *y*, y^1, surface, blow-off, and sediment cocks fitted with a water level gauge *z* and waste pipe z^1; I, steam passage to the condenser. The upward pipe a^2 is carried a sufficient height to prevent flooding of the boiler, and the downward annular passage b^2, formed by encircling the upward pipe with another of larger diameter, acts also as a condenser by the action of the atmosphere thereon; c^2, a stuffing gland to yield to the working of the ship, d^2, the condensing worm. This is surrounded at the top with an annular ring, so that the hottest water in the condenser shall be drawn off for feeding the boiler; e^2, the condensed fresh water exit to the filter J.

The Aurora's Feathering Screw Propeller.—The official trial of her Majesty's frigate Aurora took place at Plymouth on Friday, the 14th instant. The trial of this ship was looked forward to with some interest in consequence of her being the first large vessel of war fitted with the feathering screw propeller as invented by the late Mr. Joseph Maudslay. The Aurora is a 51-gun frigate of 2,558 tons, her length between perpendiculars is 227ft., and her breadth of beam 50ft. She is fitted with horizontal double piston-rod engines, of 400 horses nominal power, manufactured by Maudslay, Sons, and Field, with cylinders of 64in. diameter, with a stroke of 3ft. The trial took place at the measured mile outside Plymouth Breakwater, under the superintendence of Captain Key, of the Steam Reserve, Messrs. Steel and Ward attending on behalf of the Admiralty. The vessel not being rigged, or having her guns and stores on board, was at her light draft of 16·9 forward and 19·7 aft. The wind was of the force of 4 to 5 from the eastward. The trial was considered highly satisfactory, the speed the vessel attained being 11·33 knots, 61 being the mean number of revolutions of the engines, with a pressure of steam of 20 lb. After six runs had been made at the measured mile with the engines working at their full power, two runs were made at half boiler power, when a speed of 8·216 knots was obtained, the engines making 45 revolutions per minute. The diameter of the screw is 17ft., and it may be set at a minimum pitch of 17ft. 6in., from which position the angle of the blades can be varied till they are set in a fore and aft position. On the trial the blades were set at a pitch of 22ft. 6in. The alteration of the angle of the blades is effected from the quarterdeck of the vessel, and may be readily done while the screw is in motion at full speed; this was tested during the trial, when it was found that two men had perfect control over it. The advantages of this description of propeller are, first, that it enables a vessel to proceed under canvas alone, without the necessity of lifting the screw out of the water, thus avoiding the trouble, risk, and loss of time usually attending that operation when performed in a seaway. This is accomplished by placing the blades fore and aft in a line with the keel, in which position they offer little or no resistance to the progress of the vessel, while at the same time they in a great measure fill up the aperture in the dead wood, which is found of the greatest advantage to the steering of the vessel when under sail alone, as it prevents the water rushing through the opening, and causes it to impinge upon the rudder. The second advantage is, that by altering the angle of the blades the pitch of the screw may be easily varied at pleasure to suit the different circumstances under which the vessel may be proceeding, which is of advantage on long voyages when sailing and steaming are combined, and admits of a great saving of fuel and a high speed of vessel being maintained The whole of the apparatus for effecting these alterations is combined with the ordinary lifting frame, so that it may be easily examined at any time. Screws of this principle, with some difference of detail, were fitted amongst others, some years since, to the fine fleet of vessels built for the General Screw Steam Shipping Company, and were used with considerable success on the voyages to Calcutta and back, and were the means of effecting a great saving of fuel.

TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

STUDENS.—*Received.*

G. J. H.—*Nothing will prevent incrustation if you use hard water and do not blow off often.*

R. J.—*Tallow is put into low pressure boilers to prevent priming, but it will cause violent priming if used in high-pressure locomotive boilers.*

M.—*How could you guarantee such a saving of fuel by your invention, when, as you say, you have no capital? We cannot advise you otherwise than to ask some friend, among your own acquaintance, who would join you in carrying out the invention.*

C. O. C.—*We really do not know which forge in England has turned out the heaviest forging, but we suspect that it is the Mersey Steel and Iron Company's forge at Liverpool. If you include Scotland we believe the Lancefield forge has done the heaviest work of all.*

G. H.—*We are unable, just now, to give you the length of the rudders of the Great Eastern and the Warrior. We believe that the Great Eastern's rudder was made considerably shorter, in proportion to the length of keel, than is customary in other ships.*

P. Z.—*For an engineer's berth in the navy you must apply by letter to the Secretary of the Admiralty, Whitehall, stating your age and qualifications, and enclosing certificates of servitude in an engine factory, and of good character. If required, you will be notified to report at Woolwich.*

STEFKEY.—*Supposing the pressures to be measured from the bottom of a vacuum, and the steam to be worked throughout the stroke, there should be but little difference. Steam of a pressure of 100 lb. per square inch above the atmosphere would expand, provided there were no heat imparted to or from the cylinder during expansion, about eight-fold before falling to the pressure of the atmosphere.*

W. H.—*We understand you that your lever vibrates around a point 4in. from one end and 5ft. from the other. A ½in. piston has an area of ·19135 square inches, and at the rate of 3 tons per square inch would support 1,286 lb., to balance which, at the other end of your lever, would require 85¾ lb. With your lever suspended so as turn freely on its joint, attach a steelyard or a spring balance at the distant end (where the ball is to go on), and whatever is the weight shown, deduct it from the 85¾ lb. already ascertained, the remainder being the proper weight of the ball.*

STEAM ENGINE CONSTRUCTION.

(To the Editor of The Engineer.)

SIR,—In your able article on the above subject in THE ENGINEER of the 14th inst. I notice the following:—"In single-acting pumping engines, having no crank, Mr. Bull afterwards took the piston rod out through the bottom of the cylinder." I do not know the year in which Mr. Bull first carried this out, nor where he put up his first engine; but the engine now known as the "Bull" engine was patented in 1801, by William Symington, the introducer of steam navigation, and he erected one soon after with a 70-in. cylinder at Lord Rosslyn's Colliery, at Dysart, in Scotland.

A drawing and description of this engine will be found in the *Mechanics' Magazine* for 1833, No. 536.

Possibly some of your readers may be able to tell us whether "Bull" was before Symington in this arrangement? A. B.

THE HARTLEY BEAM.

(To the Editor of The Engineer).

SIR,—In reply to the remarks by your correspondent "S," regarding the casting of the Hartley beam, he says the statement made by a witness at the inquest that it was an "open sand casting" was not contradicted by the representative of the firm who made it.

If "S" will take the trouble to read over the evidence at the inquest *in extenso*, as reported in the *Newcastle Chronicle*, he will find that Mr. Charles Carr, an owner and viewer of the colliery, who was present when the beam was cast, at once contradicted the said statement, and said it was a covered casting. Mr. Kenyon Blackwell, the special commissioner sent down by Government, also remarked, "So, after all, it was not an open sand casting."

With respect to the breaking strain of the beam, I cannot do better than refer "S," and your numerous readers, who doubtless take great interest in the subject, to the very able article in the *Mining Journal* of Saturday, March 15th, containing the calculations and remarks made by Mr. J. J. Atkinson, of Durham, the Government Inspector of Mines for the county, as well as the practical observations of Mr. Thomas Clark, the most skilful founder in the north, upon the construction of the beam. FOUNDER.

Walker Ironworks, Newcastle-on-Tyne,
19th March, 1862.

AGRICULTURAL LOCOMOTIVES.

(To the Editor of The Engineer.)

SIR,—I do not think Mr. Aveling's own very fortunate experience in travelling his engines down inclines 1 in 6, mentioned in your last issue, is any conclusive argument or practical proof that there is no danger arising from the roof of the internal fire-box being left bare of water. It is the old excuse, given in answer to almost every objection in almost every trade, that "*we have never found it to be so*," and this very fortunate experience will go on until some day we shall hear of a blow up. I could quote half a dozen makers of traction engines, in opposition to Mr. Aveling's individual experience, who do not think the adjusting apparatus to the horizontal boilers an unnecessary complication, but then we would be as far as ever from solving the question, and, therefore, we ought to look at it from a point of well established engineering practice. Why have marine boilers been constructed for these last fifty years so as to have a deep body of water over the roof of the internal fire-box if it was not necessary? and can Mr. Aveling deny there is any difference between his boilers travelling 1 in 6, and a marine boiler tipped to and fro at sea, as regards the level of the water?

I think, sir, this is a question the Royal Agricultural Society ought to take into their consideration, as it affects the great body of the farmers of this country, now that these engines are being made locomotive for steam cultivation and other purposes. ROBT. ROMAINE.

Devizes, Wilts.

THE PROPERTIES OF STEEL.

(To the Editor of The Engineer.)

SIR,—In your interesting article on the durability of constructions in wrought and cast iron, last week, you conclude with a question which assumes a chemical fact that has hitherto not been established, and as it is on a most important subject, and liable to mislead intending investigators, may I be allowed to state the position we are in as regards our knowledge of the change iron and steel undergo by long exposure to atmospheric influences. It appears to be a well established fact that steel ingots, which are at first unworkable, may become workable by long exposure to air or in running water. This fact, I believe, is daily acted upon in this town. But that the cause of this change is the elimination of carbon from the steel is not by any means proved; and, indeed, it is difficult to imagine that loss of carbon could take place at the common temperature. Analysis of a piece of steel before and after exposure would readily settle this point, and it would be a valuable addition to our knowledge of the subject, even if yielding only negative results. I venture to suggest that the cause may be sought for in the molecular changes induced in the mass of metal by vibration, or by the electric and magnetic currents of the earth. The first, we know, materially influences the molecular condition of iron (*e.g.*, the change of railway axles from fibrous to crystalline structure), the latter causes require investigation; but, in my humble opinion, offer a more probable theory than that of the removal of carbon by oxidation or vaporisation at the normal temperature. WILLIAM BAKER, F.C.S.

Lead Works, Sheffield, 19th March, 1862.

MEETINGS NEXT WEEK.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, March 25th, at 8 p.m., "Description of Works at the Ports of Swansea, Silloth, and Blyth." Part II. By Mr. James Abernethy, M. Inst. C.E.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.—Thursday, at 7.30 p.m. "On Retaining Walls." By Mr. William Rutt.

SOCIETY OF ARTS.—Wednesday, at 8 p.m., "On the Commerce of our Colonies and their Cost." By Henry Ashworth.

Advertisements cannot be guaranteed insertion unless delivered before eight o'clock on Thursday evening in each week. The charge for four lines and under is half-a-crown; each line afterwards, sixpence. The line averages nine words; blocks are charged the same rate for the space they fill. All single advertisements from the country must be accompanied by stamps in payment.

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Letters relating to the advertisement and publishing department of this paper are to be addressed to the publisher, MR. EERNARD LUXTON; *all other letters and communications to be addressed to the Editor of* THE ENGINEER, *163, Strand, London, W.C*

THE ENGINEER.

FRIDAY, MARCH 21, 1862.

ENGINEERS AND ENGINEERING.

THERE are agricultural interests and commercial "interests;" and these are almost infinitely divided into subsidiary "interests;" law, medicine, and divinity are embodied in influential organisations, each making itself not only heard but felt upon numberless occasions, but we believe there is no such thing as an engineering interest in a commercial or political sense. The engineers neither hold public meetings, nor send deputations to Downing-street or the Admiralty; they do not come out in the newspapers, nor do they, in any corporate character, appear before the world. Unlike the learned professions, engineering, at least in this country, has no great schools nor professorships, no degrees nor diplomas. Unlike every trade and almost every branch of industry, engineering has no committees, no "benevolent associations," no agents, no spokesmen in Parliament, on 'Change, in the clubs or in the street. Any one may write "Engineer," or "C. E.," or "M. E.," after his name as he may happen to choose. True, the engineers have an Institution duly chartered, but for what the charter was ever asked or obtained, we are unable to say. The Institution, as such, is not a Power, no more than is Dr. Cumming's congregation. True, the former can, like a club, or a mutual improvement society, elect or reject applicants for membership, but this is, we believe, the extent. It has a president, a number of vice-presidents and a council, a treasurer, a secretary, and an honorary secretary, an auditor or so, and an honorary architect. There are members, associates, graduates, and honorary members. No organisation of the kind could be more formidable, and it must have seemed a pity to some of the more ambitious engineers that it could not be turned to some political account. The late president of the Institution did attempt something in this direction, and the members were asked to speak up upon the National Defences. Few, however, cared to speak, being content to call on Tuesday evenings to listen to naval and army officers and military amateurs, who, not being members, had been brought to Great George-street to infuse life into the proceedings. The time does not appear to have yet arrived, therefore, when the public will hesitate upon great national questions to ask, anxiously, "What do the engineers say?" When railways and steam navigation were in course of development, engineers gained a good deal of influence, but we fear this influence has greatly fallen off since the untimely death of Mr. Stephenson. The title of engineer can be so easily assumed that the public, we think, are beginning to suppose there cannot be a great deal behind it. How often do engineers find non-professional men—landlords, merchants, barristers and others—discussing harbours, railways, docks, bridges, and like works, with a confidence which shows that they are not unfamiliar with their general construction and a great many of their details. In mechanical engineering especially, there is a vast amount of popular knowledge of the steam engine and the more important machines. The multiplication of farm engines and portable engines generally, added to the almost constant familiarity of all classes with the general appearance of railway locomotives and steamboat engines, has led a vast number of men in various positions in life to study the steam engine, and in this great numbers of excellent descriptive books, of which many thousands have been printed, have served an important purpose of instruction. There is nothing exclusive or concealed in even the very highest branches of engineering knowledge. Every principle, rule, and fact which can be imparted at all, can be readily mastered by any person of moderate education, and those (there are always many) who have a natural aptitude for comprehending the general properties of materials, and the circumstances governing their application, will always make fair progress in the acquisition of such information as depends chiefly upon observation.

With no checks upon the assumption of the title of "Engineer," the profession is being daily invaded; and it is notorious that professional engagements are gradually becoming less lucrative. This must continue as the public learn that engineering knowledge and skill is by no means the exclusive property of a few. We cannot say that we regret the present tendency, yet we almost wonder why the Institution does not attempt, in some way, to obtain a definition, and if possible a recognition of the initials "C. E." Here there is an engineering interest at stake, and its treatment might be invested with a great deal of public importance. The other professions take good care to define and preserve their privileges, and why should not ours? Will not this subject at last occupy the attention of the authorities in Great George-street?

RAILWAY RESISTANCE.

WHEN George Stephenson, turning the knowledge of the workshop, in his time, against the knowledge of bookmen, told them that the friction of railway carriages was constant at all velocities, he was not only contradicted but energetically opposed. He had not made the mistake of asserting that the mechanical power required to overcome a given frictional resistance was the same in equal times, at whatever velocity the work was performed. A shaft may turn in its bearings with a friction of 3 lb. for every ton of the weight in motion, and this resistance will be practically the same at 200 as at 20 revolutions, yet in an hour's work ten times more mechanical power will be consumed at the former than at the latter speed, and, necessarily, ten times as much work will be done. All this Mr. Stephenson and the millwrights of his day well knew. With facts on their side it was not long, therefore, before they convinced the mathematicians.

Railway friction, or rather railway resistance, has been the subject of many experiments, and it would be supposed that, by this time, its extent was well known. So it would be were it an invariable quantity. On the contrary, however, hardly any two railway trains run with exactly the same resistance. The late Mr. Windham Harding's experiments and those by Mr. Gooch were doubtless very carefully made, yet they showed widely different results. Mr. Harding experimented on the narrow and Mr. Gooch on the broad gauge. This, however, goes for little. Extensive practice affords no evidence that the broad gauge has any superiority in draught over the narrow gauge. The broad gauge works the heaviest engines, burning the most fuel and costing the most for repairs, and that, too, over very favourable gradients, and yet there is no advantage in load drawn to show for the additional cost of power. The difference must have been in the condition of the carriages and permanent way experimented upon, and their condition is always variable. Only practical men know within what wide limits they occasionally do vary. There is, we think, a disposition among engineers to under-estimate the average resistance of rolling stock on ordinary lines, and we believe there is more than one engineer, in large practice, and more than one locomotive builder, who is satisfied with assuming a friction of 10 lb. per ton at the speeds common with goods trains. Very few, even if engaged in working railways, can find opportunities for making experiments for themselves. The interruption to traffic, and, above all, the increased chances of accident, to say nothing of the cost and care of conducting suitable experiments on railway traction, lead many practical men to avoid them altogether. It is for this reason that the result of all recent experiments, carefully conducted to determine the amount of railway friction, are especially useful. There are many practical men who have never had an opportunity of consulting the results of Wood's, Stephenson's, and Pambour's experiments, and who will, for this reason, be pleased to know that extensive experiments for the same purpose have lately been made upon the Stockton and Darlington Railway—the first line in the world regularly worked by steam. Mr. John Dixon, a veteran engineer, whose practice dates from a period before the Liverpool and Manchester Railway, and who, under George Stephenson, conducted the works at Chat Moss, on that line, has lately gathered a large amount of important information applicable to the present class and condition of rolling stock and permanent way. We have given, in previous numbers, a considerable share of this information, and are enabled to add more to-day. Mr. Dixon's experiments on friction have been made in a manner more satisfactory, in our opinion, than with the dynamometer. He has adopted the mode preferred by Pambour whenever the features of the line enabled him to carry it out, viz.:—to run his carriages down a gradient of considerable steepness and along a nearly level line at the foot. The difference in elevation and in distance gives the ratio of friction to load, while, with the time and average speed of descent, a very close approach can be made to the determination of the exact resistance at like speeds.

THE HOP TRADE.—Notwithstanding bad times, the returns show that the acreage under hops slightly increases. In 1859 there were 45,665 acres under hop cultivation; in 1860, 46,271; in 1861, 47,941. In 1859 the duty charged was £599,346; in 1860, only 69,767; in 1861 but £149,700. On the 1st of February the duty for 1861 had all been paid except £12,338.

LORD PALMERSTON ON COAST DEFENCES.—Lord Palmerston, in giving evidence before a parliamentary railway committee last week, stated that he had turned his attention very much lately to the defences of the country, and that it was most important that all the arsenals should be connected by railway, and of similar gauge. His lordship also stated that it was in contemplation to make some defences on an island in the British Channel, and that it was advisable that Portsmouth and other arsenals should be connected with Bristol by a railway without break of gauge. His lordship also stated that he was in favour of connecting all towns on the south coast by rail.

STATISTICS OF HUMAN LIFE.—The total number of human beings on earth is now computed in round numbers at 1,000,000,000. They speak 3,064 now known tongues, and in which upwards of 1,100 religions or creeds are preached. The average age of life is 33½ years. One-fourth of the born die before they reach the age of 7 years, and the half before the 17th year. Out of 100 persons only six reach the age of 60 years and upwards, while only one in 1,000 reaches the age of 100 years. Out of 500 only one attains 80 years. Out of the thousand million living persons 330,000,000 die annually, 91,000 daily, 3,730 every hour, 60 every minute, consequently one every second. The loss is, however, balanced by the gain in new births. Tall men are supposed to live longer than short ones. Women are generally stronger than men until their 50th year, afterwards less so. Marriages are in proportion to single life (bachelors and spinsters) as 100:75. Both births and deaths are more frequent in the night than in the day. One fourth of men are capable of bearing arms, but not one out of 1,000 is by nature inclined for the profession The more civilised a country is the more full of vigour, life, and health are the people. The notion that education enfeebles and degenerates the human frame is not borne out by fact.—*Once a Week.*

THE AMERICAN ERICSSON BATTERY.—The *New York Times* says:—"The iron-clad steamer Monitor went on another trial trip yesterday, to test the steering qualities, &c. A naval commission, composed of Commodore Gregory, Chief Engineer Garvin, and Naval Constructor Hart, was appointed to accompany her. She left the navy yard at half-past ten o'clock in the morning, and proceeded down the bay about five miles beyond Fort Lafayette, returning to her anchorage off the navy yard at five p.m. The commission report that her steering qualities are all that could be desired. One man steers her with perfect facility. She makes a complete revolution, in either direction, within three times her own length, and within five minutes of time. The guns were fired to test the question which had been mooted, of whether the concussion within the turret would not be so as to injure seriously the ears of the men. First a blank cartridge was fired with the hatches in the roof open. Then a charge of canister, weighing 135 lb., with 15 lb. of powder, with the hatches still open, and finally the same charge with the hatches closed, as they will be under the fire of the enemy. It was found that, in every case, the concussion in every part of the interior of the turret was considerably less than when standing near such a gun fired in the open air. The sailors stationed at the guns, and who expect to handle them shortly against the enemy, all expressed themselves as much delighted at the success of the trial. The speed of the vessel by the log was 16¼ knots, the engines making sixty-five revolutions. It is expected that after the grease gets out of the boilers, so that they will not foam, a considerable increase in the speed will be attained. The engineer of the vessel, Mr. Isaac Newton, reports that the engines work beautifully. The compass in the iron pilot-house did not work altogether satisfactorily, but no difficulty is apprehended with regard to being able to adjust it.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

FLOW OF WATER AND GOVERNORS.

Sir,—Having seen that nobody has answered your correspondent "T. B——n," who asked a question in The Engineer of 17th January, 1862, I beg to offer the following formulæ and calculations, which I hope will be satisfactory:—

Calling L = length of pipe in feet,
q = quantity of water required in cubic feet per second,
d = diameter of pipe in feet,
h = head of water in feet,
v = velocity in feet per second.

Then $h = \frac{(L + 50\,d)\,q^2}{1542{\cdot}133\,d^5}$

$$q = \sqrt{\frac{1542{\cdot}133\,d^5\,h}{L + 50\,d}} = 39{\cdot}27\,d^2\sqrt{\frac{d\,h}{L + 50\,d}}$$

when q = quantity of water required in cubic feet per minute.

Then $q = 2356{\cdot}2\,d^2\sqrt{\frac{d\,h}{L + 50\,d}}$

$$v = 50\sqrt{\frac{d\,h}{L + 50\,d}}$$

Your correspondent asks further the question—Required a "head" of water in feet necessary to produce 280 gallons per minute, through pipes 7in. diameter and 1,000 yards long, having a total rise of 52ft.?

Applying the above formula, we get—

$$h = \frac{(3000 + 50 \times {\cdot}583)\,{\cdot}746^2}{1542{\cdot}133 \times {\cdot}583^5} = \frac{3029{\cdot}15 \times {\cdot}557}{1542{\cdot}133 \times {\cdot}0673} = \frac{1687{\cdot}237}{103{\cdot}786} = 16{\cdot}26 \text{ feet.}$$

Having likewise noticed that your correspondents "G. C. P." and "A. T." are still in want of formulæ for the calculation of governors, I will, with your permission give them the following rules, which I know from experience are correct and reliable:—

Calling h = the vertical distance between the point of suspension and plane of revolution of centre of balls in inches,
r = revolutions per minute,
l = length of arms in inches from point of suspension to centre of ball,
d = diameter in inches of circle in which the centre of balls revolve,
$s = \frac{d}{2}$ = radius in inches of the same circle,
39·1393 in. = length of pendulum, vibrating seconds in London.

$\sqrt{39{\cdot}1393 \times 60} = 375{\cdot}36$
$375{\cdot}36 \div 2 = 187{\cdot}68$

Then we get—

$$r = \frac{187{\cdot}68}{\sqrt{h}}$$

$$h = \left(\frac{187{\cdot}68}{r}\right)^2$$

$$d = 2\sqrt{l^2 - h^2}$$

$$s = \sqrt{l^2 - h^2}$$

$$l = \sqrt{h^2 + s^2}$$

Hoping that the above formulæ may be useful to your correspondents, I beg to add I shall be happy to furnish them with any further information they may wish for concerning the above subjects.

Brixton, 10th March, 1862. L. O.

SURFACE CONDENSERS.

Sir,—In your report of Mr. J. F. Spencer's valuable paper, on "Surface Condensation," in your impression of the 7th March, I note the following paragraph:—

"Practical men cannot be expected to endorse many of the extreme statements published in favour of surface condensation such as these: 'that land boilers last seven times as long as marine, and that boilers working with distilled water last three times as long as those working with salt water.'"

As this paragraph is taken from a paper read by me before the Society of Engineers in November last, it calls for some explanation from me. With regard to the first statement, I know of several land boilers which have been in use more than twenty-seven years, and have been, at the end of that time, in fair working order. This, I think it will be admitted by Mr. Spencer, is at least seven times the age at which marine boilers are reduced to such a state of infirmity, that if they are not entirely removed to be replaced by new, they require, or have received, almost as much repair as would bring them into the state of the Scotchman's knife, which, as you have doubtless heard, had been supplied with two new blades and one new handle. These will be taken, probably, by Mr. Spencer, as extreme cases, but, in my opinion, are only fair cases for comparison, as they are low-pressure boilers which have had the advantage of the supervision of an experienced engineer, and, therefore, stand on the same footing as marine boilers. It would be absurd to compare a low-pressure marine boiler, under the charge of an experienced staff of engineers, with a high-pressure land boiler tended (as is the case with nine boilers out of ten) by a man having no knowledge, theoretical or practical, of its construction.

With regard to the statement that the life of a marine boiler using distilled water is extended in the proportion of three to one as compared with a boiler using salt water. This I know to have been the case in a vessel fitted with surface condensers under Hall's patent, and that under no peculiarly advantageous circumstances; and, having been the case in at least one instance, there appears to be no reason why it should not follow in others.

I am aware (and so stated in reading my paper) that this is an exceptional case, and in the discussion which followed the paper I alluded to several instances which had come to my knowledge, or under my own observation, in which the boilers had worn even more rapidly with than without the use of surface condensers. But, as I do not attribute this wear to the principle of surface condensation, but to some defect in construction of the condensers, I hardly think it fair to use it as an argument against the system. That this peculiar honey-combing wear is not due to the use of pure water, I am convinced from the fact of its not being experienced at all in a boiler which has come under my observation, in which rain water only is used, and in which there is of course no scale. On the other hand, I know of a case where this peculiar wear was found in a boiler which had been recently supplied from a surface condenser, which was of course blamed, although the other boiler in the same vessel, and supplied from the same condenser, did not show any unusual wear. The corrosion in the first instance was ultimately found to proceed from some brass filings having, by some means, found their way into the boiler, probably from some part of the condenser. This should be a warning to all makers of surface condensers to be very careful to remove all filings or loose particles of brass or copper which may adhere to the tubes during the process of cutting, &c.

If this and other improvements which practice may point out are attended to, I have no doubt that Mr. Spencer will shortly be able to endorse my statement—that surface condensers are capable of prolonging the life of marine boilers in the ratio of at least three to one.

John Louch.

March 18th, 1862.

HYDRAULIC PRESSES.

Sir,—I observe, in your impression of the 28th February, under the head "Miscellanea," a statement relative to hydraulic presses, wherein it is stated that the largest hydraulic presses ever made were those of Mr. McArthur, of Johnstone, who has also made presses for Woolwich Arsenal. I beg to inform you that the above is incorrect, as it was I who contracted with the Government for two of my patent machines for squirting lead rods, and I erected them at the Royal Arsenal, Woolwich. They produce at the rate of 20 tons of rods per ten hours, and the water rams are 20in. diameter. Amongst the numerous machines I have erected is one with a ram 25½in. diameter, for the manufacture of metallic pipes for Messrs. Alexander Ferguson and Co., lead merchants, Glasgow.

The largest press ever made, so far as I am aware, has been erected by me, and is the property of Messrs. Weems and Stark, pipe manufacturers here, the ram being 31in. diameter. It was put up for the purpose of making solid brass tubes by pressure, and our experiments proved that the copper and zinc is only mechanically arranged and not chemically combined, from the fact that the zinc oozed out and formed a pipe, while the copper remained in the bottom of the cylinder. I have also several of these presses in operation, making block tin pipe from solid blocks, the ¼-in. bore weighing only about 3 oz. per yard.

Mr. McArthur was in my employment, and this may account for the introduction of his name in connection with these presses.

Johnstone, near Glasgow. John Weems.

18th March, 1862.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

72. Robert Johnson, Liverpool, "An improved composition for coating the bottoms of iron ships to prevent their fouling, and which composition may be used as a protective coating for wood, iron, or other substances exposed to the action of sea-water."—*Petition recorded 10th January*, 1862.

128. Julius Cæsar Dickey, Saratoga Springs, Saratoga, New York, U.S., "An improved quartz crusher."—*Petition recorded 17th January*, 1862.

227. William Irlam, Gibraltar Ironworks, Newton-heath, Manchester, "Improvements in the construction of railway crossings and turntables."—*Petition recorded 28th January*, 1862.

237. Richard Archibald Brooman, Fleet-street, London, "Improvements in machinery for puddling metals."—A communication from François Dumeny and Firmin Lemut, Closmortier, near St. Dizier, France.—*Petition recorded 2 th January*, 1862.

281. Alexandre César Barnabe Malois, Boulevart St. Martin, Paris, "Improvements in the manufacture of boot and shoe heels, and in machinery to be used therein."—*Petition recorded 20th January*, 1862.

350. William Henry Weaver, Edington, Bridgenorth, and Charles Gall, Bridgenorth, Shropshire, "Improvements in machinery for cultivating, ploughing, harrowing, or scarifying the land."

351. Thomas Fyfe, Leicester-square, London, "Improvements in knapsacks, and in apparatus for supporting them or other similar burdens upon the shoulders."

359. Richard Johnson, Manchester, "Improvements in welded wires used for telegraphic and other purposes."—*Petitions recorded 11th February*, 1862.

375. William Edward Newton, Chancery-lane, London, "Improvements in projectiles."—A communication from James Woodbury and Solomon Gray, Boston, Suffolk, Massachusetts, U.S.

377. John Peters, Ulverston, Lancashire, "Improvements in portable steam engines applicable to locomotive, stationary, and marine engines."

379. William Williams, Bath, Somerset-shire, "Improvements in pianofortes."

381. Charles Alfred Ebrutt, Blackman-street, Southwark, "Improvements in reclining, easy, and other chairs."

385. Francis Falconer, Glasgow, Lanarkshire, N.B., "Improvements in glasses for lamps."—*Petitions recorded 13th February*, 1862.

405. William Avery, Birmingham, "Improvements in machinery for the manufacture of screws, a part or parts of which improvements may also be used in the manufacture of pins, rivets, and nails."—*Petition recorded 15th February*, 1862.

423. Edward Thomas Hughes, Chancery-lane, London, "An improved method of, and apparatus for, collecting the gases given off from furnaces."—A communication from Emil Langen, Siegburg, Prussia.

424. Thomas Birdsall and James Birdsall, Leeds, Yorkshire, "Improvements in preparing hides or skins for tanning."—*Petitions recorded 17th February*, 1862.

429. Charles Denis Segoufin, South-street, Finsbury, London, "An improved apparatus for the purpose of viewing photographs on cards."—*Petition recorded 18th February*, 1862.

437. Henry Bernoulli Barlow, Manchester, "Improvements in carding or otherwise preparing cotton and other fibrous materials, and in machinery employed therein."—A communication from Sixte Pierre Villain, Paris.

438. James Nasmyth, Rue de l'Etoile, Brussels, "Improvements in apparatus for obtaining a circular motive power."

442. James Turner, Upper Thames street, London, "Improved machinery for mixing, mincing, and pounding materials to be used in the preparation of food."

443. William Hinton, Greville-street, Holborn, London, "Improvements in barometers."

445. James Paterson, Middle Temple, London, "Improvements in means or apparatus for reburning animal charcoal."—A communication from George Alexander Drummond, Montreal, Canada East.

447. George Tomlinson Bousfield, Loughborough Park, Brixton, Surrey, "Improved modes of protecting iron boilers, tanks, and vats from wear arising from galvanic action."—A communication from John Welton Wilcox, West Roxbury, Norfolk, Massachusetts, U.S.—*Petitions recorded 19th February*, 1862.

449. George Frederick Lee, New Bridge-street, London, "An improvement in torniquets."—A communication from Thomas Scott Lambert, New York, U.S.

453. Joseph Bleasdale and Frederick William Borland, Accrington, Lancashire, "Improvements in fluted rollers for preparing and spinning fibrous materials, and in the mode of manufacturing the same."

455. James Paterson, Middle Temple, London, "Improvements in the use of animal charcoal."—A communication from George Alexander Drummond, Montreal, Canada East.

457. Charles Wood, Bramford, Suffolk, "Improvements in horse-rakes."—*Petitions recorded 20th February*, 1862.

461. Henry Ward, Castle Bromwich, Warwickshire, "An improvement or improvements in ladies' saddles."

463. William Hamer, Little Lever, near Bolton, Lancashire, "Improvements in apparatus employed in the preparation of cotton and other fibrous materials."

464. Edward Smith Crease, Gracechurch-street, London, "Improved machinery for drilling, boring, or excavating rock or other earthy substances."

466. Joseph Krasuski, Boulevart St. Martin, Paris, "An improved apparatus for controlling fiery horses."—*Petitions recorded 21st February*, 1862.

473. Augustus Eornemann, Monmouth-street, Bath, "Improvements in the mode of constructing fountains."

477. James Townend, Bradford, Yorkshire, "Improvements in jacquard engines."

479. David Blair White, Newcastle-upon-Tyne, "Improvements in apparatuses for protecting liquids from the atmosphere while remaining in and during their discharge from the vessels containing the same."

481. George John Owam, Wilmington-square, London, "A revolving pendant for giving greater security to watches and lockets against theft."

484. William Becket Johnson, Manchester, "Improvements in steam engines."—*Petitions recorded 22nd February*, 1862.

485. William Johnston, Glasgow, Lanarkshire, N.B., "Improvements in gas and other lamps and stoves."

487. John Cunningham and Robert Cunningham, Paisley, Renfrewshire, N.B., "An improved ornamental fabric, and improvements in weaving and in jacquard apparatus."

488. John Coope Haddan, Bessborough-gardens, Pimlico, London, "Improvements in small arms, and in artillery, and in projectiles for artillery."

491. William Clark, Chancery-lane, London, "Improvements in apparatus for feeding or supplying steam boilers with water."—A communication from François Pradel and François Théobald Wahl, Boulevart St. Martin, Paris.

493. Percy Graham Buchanan Westmacott, Newcastle-upon-Tyne, "Improvements in constructing and applying armour plating to ships, vessels, and forts."

495. Lewis Davis, Gloucester-gardens, Hyde Park, and Frederick Major Parkes, Marylebone road, London, "An improvement in the production or manufacture of gas for lighting and heating."

496. Richard Archibald Brooman, Fleet-street, London, "Improvements in reaping and mowing machines."—A communication from Marie Pierre Amaranthe Ferdinand Mazier, Laigle, France.

497. Frederick St George Smith, Drogheda, Ireland, "Improvements in machinery for grinding or reducing quartz, bones, grain, and other substances."—Partly a communication from Edward Furber, New York, U.S.—*Petitions recorded 24th February*, 1862.

503. John Piddington, Gracechurch-street, London, "Improved condensing apparatus adapted for high-pressure steam engines, especially locomotive engines."—A communication from William Winter, Charlottenburg, near Berlin, Prussia.

505. William Clark, Chancery-lane, London, "Improvements in tobacco pipes."—A communication from Mr. Paul Ambroise Doury, Boulevart St. Martin, Paris.

506. Thomas Watson and Robert Dracup, Thornton, Bradford, Yorkshire, "Improvements in means or apparatus for preparing and combing wool and other fibres."

511. William McIntyre Cranston, King William-street, London, "Improvements in machinery for reaping and mowing."—Partly a communication from Walter Abbott Wood, Hoosick Falls, Rensselaer County, New York, U.S.

512. Courtenay Kingsford, Fenchurch-street, London, "A new composition for the manufacture of bread."

513. Pierre Joseph Guyet, Paris, "An improved coupling for uniting pipes between locomotives and tenders, applicable also to the coupling of other pipes."

514. Harry Whiteside Cook, Manchester, "An improved mode of, and apparatus for, propelling carriages and vehicles by means of electricity."—*Petitions recorded 25th February*, 1862.

515. John Boocock and Thomas Davenport, Bury, Lancashire, "Improvements in machinery for preparing, spinning, and doubling cotton and other fibrous materials."

517. Alexander Stephen, jun., Glasgow, Lanarkshire, N.B., "Improvements in the construction of ships or vessels."

523. Thomas King and Robert Varvill, Liverpool, "Improvements in apparatus for controlling the flow of fluids for flushing water-closets."

525. William Miller, Upper Stamford-street, Blackfriars, Surrey, "Improvements in the manufacture of sugar."

527. William Clark, Chancery-lane, London, "Improvements in the clasps or fastenings of bracelets, neck chains, and other articles of jewellery."—A communication from Eugène Fauche and Charles Auguste Ravaut, Boulevart St. Martin, Paris.

529. William Peacock Savage, Roxham, Downham, Norfolk, "Improvements in fire-arms."

531. John Smith, sen., Coven, near Wolverhampton, "Improvements in drying wheat and other grain."—*Petitions recorded 26th February*, 1862.

535. William Armand Gilbee, South-street, Finsbury, London, "Improvements in the construction of fire-grates for steam and other boilers, and suitable to all kinds of fires."—A communication from De Vos-Verraert, Brussels.

536. William Smith, Salisbury-street, Adelphi, London, "Improvements in the method of making cigarettes, and in the apparatus and materials to be employed therein."—A communication from M. Lemaire-Daimé, Andresy, France

537. James Tangye, Birmingham, "An improvement or improvements in hydraulic lifting jacks."

539. Thomas Bray, Dewsbury, Yorkshire, "Improvements in ornamenting wood in imitation of inlaid work."

541. John Robert Foster, Winsley-street, Oxford-street, London, "Improvements in the manufacture of bullion fringe or cord."

543. Joseph Revell, Dukinfield, Cheshire, "Improvements in oil cans."—*Petitions recorded 27th February*, 1862.

544. Pierre Destaing Azemar, Paris, "An improved mechanical arrangement for the winding up and the setting of the hands of watches by means of the knob of the pendant."

545. William Henry Muntz, Millbrook-lodge, Hampshire, "Improvements in paddle-wheels."

546 Alexander Woodlands Makinson, Westminster, and William Fothergill Batho, Birmingham, "Improvements in locomotive engines."

547. John Cleophas Ratliff, Coventry, Warwickshire, "Improvements in the covers or bindings for books and blotting cases."

548. George McKenzie, William Fullarton Murray, and John Hamilton, Glasgow, Lanarkshire, N.B., "Improvements in machinery or apparatus for the manufacture of bobbins or holders for textile materials."

549. John Pollock, Budge-row, London, "Improvements in apparatus for protecting trousers from mud."

550. Jacques Lazare Charcouchet, Lyons, France, "Improvements in machinery for breaking stone."

552. James Parker, Lilford-road, Camberwell, Surrey, "An improved mode of applying steam as a motive power for propelling vessels and for other purposes."—*Petitions recorded 28th February*, 1862.

553. Thomas Cowburn, Safety-valve Works, Little Peter-street, Manchester, "Improvements in apparatus for raising and discharging boiling soap, and for dividing the same into bars when congealed."

554. Thomas Bradford, Cathedral Steps, Manchester, "Improvements in washing machines for cleansing domestic garments, fibrous materials, and for manufacturing purposes."

557. Matthew Dodds, Bedburn Ironworks, Hamsterley, Durham, "Improvements in machinery for moulding, forming or shaping articles of iron or other malleable metals, and for shearing or cutting such metals."

558. Pierre Henri Boyer, Paris, "Improvements in the manufacture of boots and shoes."

560. Maurice Gabriel and Arnold Gabriel, Ludgate hill, London, "Improvements in the bases of artificial teeth."

561. Sam Hague, Westwinstead Litchfield County, Connecticut, "Improvements in machinery or apparatus for raising hammers and stamping with them hot or cold metals."

562. Adolphe Ernest Ragon, Bernard-street, Russell-square, London, "Improvements in electric alarums for telegraphic purposes."—A communication from Pierre Jules Emile Vinay, Place Dauphine, Paris.

563. Andrew Potts, Cappagh, County Doo, Ire land, "Improvements in machinery or apparatus for scutching and refining flax, hemp, and other vegetable substances."

564. Patrick Robertson, Sun-court, Cornhill, London, "Improvements in treating yeast, and in the manufacture of ammoniacal salts, and a substitute for animal charcoal."

565. Samuel Godfrey Reynolds, Bristol, Rhode Island, U.S., "Certain improvements in power spading machines."

566. Josiah George Jennings, Holland-street, Blackfriars, Surrey, "Improvements in the construction of chimneys or flues."

567. Joseph Bradlee Kendall, Boston, Massachusetts, U.S., "An improved horse-shoe."

568. Louis Martin, Tenison-street, York-road, Lambeth, Surrey, and Oliver Penfold, Blackmoor-street, Drury-lane, London, "An improved candle-lamp."

569. Cornelius Boolds, South-terrace, Kennington Park, Surrey, "Improvements in fastenings for gloves."

570. John Whitmore Davis and Francis Davis, Hull, Yorkshire, "Improvements in apparatus for supplying feed-water to steam boilers."

571. Henry Bowen, Cardiff, Glamorganshire, "Improvements ing as meters."—*Petitions recorded 1st March*, 1862.

574. Thomas Bell, Wishaw, Lanarkshire, N.B., "Improvements in apparatus for distilling shale and other bituminous minerals."

575. Abraham Sheldon, Tipton, and James Sheldon, West Bromwich, Staffordshire, "An improvement or improvements in smelting furnaces."

576. Joseph Schofield, Huddersfield, Yorkshire, "Improvements in looms for weaving."

577. Andrew Tevendale, Liverpool, "Improvements in the apparatus used in connection with cooking-stoves and domestic fireplaces for the manufacture and supply of gas."

579. Alfred Bedborough, Southampton, "Improvements in pillar letter boxes and letter bags."

580 Jean Baptiste Andre Quiquandon, Paris, "Improvements in jacquard machines, and in the pattern cards to be employed therein."

581. Gustav Bischof, jun., Swansea, "Improvements in treating ores and solutions containing copper and iron, or either of them, to obtain products therefrom."

582. William Conisbee, Herberts building, Waterloo road, Southwark, "Improvements in colour-printing machines for letter-press or block printing."

583. Henry Bunning, Field House, New Cross, Deptford, Kent, "Improvements in the manufacture of lubricating grease or compounds."

584. Frederick Burnett Houghton, Clarendon-terrace, Kensington, "Improvements in the manufacture of paper."—*Petitions recorded 3rd March*, 1862.

587. Bridge Standen, Salford, near Manchester, "Improvements in the preparation or manufacture of portable manure or fertilising compound, and in the collection or extraction therefrom of a certain liquid applicable to various purposes, and also in machinery or apparatus to be employed therein."

588. Philipp Schafer and Frederick Schafer, Golden-square, London, "An improvement in travelling bags, portmanteaus, and other similar bags and cases."

589. John Thomas Smith, Lee, Kent, "An improved sight for fire-arms, applicable also as an apparatus for measuring angles."

590. William Tongue, Bradford, Yorkshire, "Improvements in machinery

for breaking, rubbing, and scutching flax, hemp, or other vegetable fibrous materials, and in processes for treating silk waste."

501. ANGELO JAMES SEDLEY, Regent-street, London, "Improvements in metallic bedsteads, sofa-bedsteads, and folding chairs or seats."

593. THOMAS GREENWOOD, Leeds, Yorkshire, "Improvements in sewing machines."

594. GEORGE FULLER GUY, Bury St. Edmonds, Suffolk, "Improvements in electro-magnetic motive power engines."—*Petitions recorded 4th March*, 1862.

596. WILLIAM TONGUE, Bradford, Yorkshire, "Improvements in machinery for preparing silk, flax, hemp, or other fibrous materials."

600. THOMAS BOSTOCK, Stone, Staffordshire, "Improvements in the manufacture of boots and shoes."

602. FREDERIC NEWTON GISBORNE, Adelaide-place, London Bridge, London, "Improvements in the mode of indicating numerals or letters in railway tickets and other articles by peculiar devices cut therein, and in apparatus for effecting the same."—*Petitions recorded 5th March*, 1862.

604. JONATHAN BARKER, Todmorden, Yorkshire, "Improvements in, and means or apparatus for, casting drums, pullies, gear, and other wheels and bushes or keys for the same."

606. THOMAS HACK and ALFRED EDWIN CARTER, West Middlesex Waterworks, Kensington, Middlesex, "Improvements in screw cocks."—*Petitions recorded 6th March*, 1862.

Patents on which the Stamp Duty of £50 has been Paid

653. WILLIAM CLARK, Chancery-lane, London.—A communication.—Dated 15th March, 1859.

631. JOHN CUNLIFFE and FREDERICK PIGGOTT Manchester, and GEORGE MALLINSON, Salford, Lancashire.—Dated 12th March, 1859.

641. RICHARD ARCHIBALD BROOMAN, Fleet-street, London.—A communication.—Dated 14th March, 1859.

761. GEORGE HAZELTINE, King-street, London.—A communication.—Dated 26th March, 1859.

706. WILLIAM COLBORNE CAMERIDGE, Bristol, Somersetshire.—Dated 19th March, 1859.

640. RICHARD WALLER, Baker-street, Portman-square, London.—Dated 14th March, 1859.

649. WALTER LANGTON, Belvidere-road, Lambeth, Surrey.—Dated 15th March, 1859.

Patents on which the Stamp Duty of £100 has been paid.

555. JAMES MURDOCH NAPIER, York-road, Lambeth, Surrey.—Dated 12th March, 1855.

574. EDMUND JOHNSON MITCHELL, Bradford, Yorkshire.—Dated 14th March, 1855.

571. JONAS MARLAND, Sun Vale Ironworks, Walsden, Lancashire.—Dated 14th March, 1855.

647. JAMES WILLIS, Cheapside, London.—Dated 24th March, 1855.

741. PETER ROTHWELL JACKSON, Salford, Lancashire.—Dated 3rd April, 1855.

801. SAMUEL HOLT, Shaw Heath, Stockport, Cheshire.—Dated 11th April, 1855.

815. EDWARD ELLIS ALLEN, Strand, London.—Dated 17th April, 1855.

Erratum.

After 2398, for "2411" read "2418."

Notices to Proceed

2780. JOHN BERESFORD LOVE, Philadelphia, U.S., "Improvements in the mode of combining together, and securing to the sides of navigable vessels and water-batteries, armour-plates of iron or steel."

2781. JOHN PETER BOURQUIN, Newman-street, Oxford-street, London, "Improvements in ornamenting the covers of photographic albums, books, writing-cases, and other like articles."

2783. HENRY ORTH, Wissembourg, France, "An improved soap."—*Petitions recorded 8th November*, 1861.

2787. ALEXANDER PRINCE, Trafalgar-square, Charing-cross, London, "Improvements in furnaces for reducing zinc ores."—A communication from Adolphe Charlier, Stolberg, near Aix la-Chapelle, Prussia.—*Petition recorded 6th November*, 1861.

2792. JOHN WALMSLEY, New Accrington, Lancashire, "Improvements in looms for weaving."

2794. ALEXANDER WILLIAM WILLIAMSON, University College, Gower-street, London, "Improvements in the construction of steam boilers."

2798. HENRY GOULD GIBSON, Mark-lane, London, "Improvements in apparatuses for drying hops, malt, grain, and other vegetable substances, part of which is applicable as a fan or blower."—A communication from Joseph Perrigault, Rennes, France.—*Petitions recorded 7th November*, 1861.

2806. JOSEPH TYLER, Pratt-street, Camden Town, London, "Improvements in the manufacture of clarionets."

2808. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in the treatment of carpets."—A communication from Jean Armand Edmond Poloncean, Paris.

2809. JOHN BYRNE Whitehouse, County Antrim, Ireland, "Improvements in machinery or apparatus for scutching and refining flax, hemp, jute, and other fibrous substances."—*Petitions recorded 8th November*, 1861.

2811. DAVID COWAN, Hungerford-street, Strand, London, "Improvements in the construction of pneumatic subaqueous tubes for passenger or goods traffic, and in machinery for the manufacture thereof."

2815. FRANCOIS HENRY MARIE COME DAMIENS CHEVALIER FENIS DE LACOMBE, Paris, "Improvements in generating hydrogen gas for illuminating or other purposes, and in apparatus used therein."

2816. SAM HAGUE, Westwinsted, Litchfield county, Connecticut, U.S., "Improvements in the manufacture of hoes, adzes, or other similar articles."

2819. JOHN FISHER, Carrington, near Nottingham, "Improvements in apparatus for indicating or regulating the passing of railway trains."

2824. WILLIAM CLARK, Chancery-lane, London, "Improvements in portable and other filters."—A communication from Jules Pacôme, Alfred Havard, and Jean Baptiste Bourgoise, Boulevart St. Martin, Paris.

2825. FRANCIS O'REILLY, Shaw-street, Dublin, "A new or improved table or apparatus for tailors to work at without sitting."—*Petitions recorded 9th November*, 1861.

2830. JAMES JOHN SHEDLOCK, Weirdale-villas, Earl's-court, Kensington, Middlesex, "Improvements in gas meters."—*Petition recorded 11th November*, 1861.

2835. ROBERT BELLIS, Chester, "An improved method of laying wood floors."

2836. JOHN DAVIDSON, Lock, Staffordshire, "Improvements in apparatus for communicating between the passengers and the guard and engine-driver of a railway train."

2844. LOUIS FRANCOIS DUVAL and LOUIS ANDRE BEAUDET, Paris, "A new process of tanning."

2845. MICHAEL HENRY, Fleet-street, London, "An improvement in and composition for treating iron and steel, and articles manufactured thereof."—A communication from Alphonse Muller de la Mothe, Boulevart St. Martin, Paris.—*Petition recorded 12th November*, 1861.

2847. THOMAS BUTTERWORTH COLLINGWOOD and ABRAHAM BUTTERWORTH, Rochdale, Lancashire, "Improvements in throstle and doubling frames for spinning and doubling fibrous materials."

2851. EDWARD CURTIS KEMP, Avon place, Pershore-road, Birmingham, "Improvements in gas lamps, glasses, and other fittings."

2853. LOUIS ROLLAND, Quai Jemmapes, Paris, "An improved spring door-shutter with a movable lever."

2856. JOSEPH VAUGHAN, Birmingham, "An improvement or improvements in the manufacture of bayonets, and in apparatus or machinery to be employed therein."

2859. FREDERICK CONEY, Waterloo-road, Surrey, "An improved stock for firearms."

2862. ALFRED EDWIN CARTER and THOMAS HACK, West Middlesex Waterworks, Hammersmith, "Improvements in screw cocks."

2865. HENRY ROBINSON FRICKER, Lemon-street, Whitechapel, London, and JOHN MANLEY, Fairmantle-street, Truro, Cornwall, "Improvements in apparatus for facilitating the cleansing of sewers and other water-courses or ways."—*Petitions recorded 13th November*, 1861.

2875. JOHN NIXON, Cardiff, Glamorganshire, "Improvements in apparatus for ventilating coal or other mines or other underground excavations."

2876. JAMES SPRATT, Camden-road-villas, Camden Town, London, "Improvements in the preparation of food for hogs, dogs, cats, and poultry, and in apparatus for the same."—*Petitions recorded 13th November*, 1861.

2883. JONATHAN CHARLES GODALL, Great College street, Camden Town, London, and JOHN BEALE, East Greenwich, "Improvements in machinery for folding envelopes."

2885. EUGENE E'TANQUE, Mont de Marsan, Landes, France, "An improved instrument for drawing teeth."—*Petitions recorded 14th November*, 1861.

2899. ANTHONY JOHN MUNDELLA and WILLIAM OXIOS, Nottingham, "Improvements in machinery or apparatus for the manufacture of looped fabrics."—*Petition recorded 18th November*, 1861.

2909. JOSEPH SCHLOSS, Cannon-street West, London, "Improvements in ponches."—*Petition recorded 19th November*, 1861.

2914. FREDERICK JOHNSON, North-street, Westmin-ter, "Improvements in ground or earth screws."—*Petition recorded 20th November*, 1861.

2940. MICHAEL HENRY, Fleet-street, London, "Improved means of rendering steam-tight the opening for the passage of the piston-rod through the cylinder-cover in steam engines, which means are applicable also to other parts of steam engines and parts of other engines, machines, and apparatus for the rendering thereof steam-tight and fluid tight."—A communication from Francisque Million, Boulevart St. Martin, Paris.—*Petition recorded 22nd November*, 1861.

2960 FRANCIS ALTON CALVERT, Manchester, "Improvements in machinery and apparatus for burring, carding, and combing wool and other fibrous substances."—*Petition recorded 27th November*, 1861.

3001. SAMUEL ALFRED CARPENTER, Birmingham, "An improvement or improvements in attaching name-plates or labels to umbrellas, parasols, walking-sticks, and whips."—*Petition recorded 28th November*, 1861.

3019. JOHN COOPER, St. Margaret's Ironworks, Ipswich, Suffolk, and CHARLES GARROOD, Penge, Surrey, "Improvements in cultivators, horse hoes, and horse rakes."—*Petition recorded 30th November*, 1861.

3083. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in treating atmospheric air and other elastic fluids for motive power purposes, and in engines and apparatus to be employed therein."—A communication from Charles Dickson Archibald, New York, U.S.—*Petition recorded 9th December*, 1861.

3222 THOMAS EDWARD VICKERS, Sheffield, Yorkshire, "Improvements in the wheels of railway engines and carriages, and in the machinery or apparatus to be used in making the same."—*Petition recorded 24th December*, 1861.

57. WILLIAM BRADSHAW, Jun., Coventry, Warwickshire, "Improvements in watches."—*Petition recorded 8th January*, 1862.

196. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in the prevention or removal of incrustation in or from steam generators, and in the apparatus employed therein."—A communication from Stanislas Michel Lecacheux and Bernard Sartre, Marseilles, France.—*Petition recorded 25th January*, 1862.

203. SAMUEL ALFRED CARPENTER, Birmingham, "An improvement or improvements in covering and combining strips or bands of steel for crinoline or crinoline skirts."—*Petition recorded 27th January*, 1862.

251. ALEXANDRE CESAR BARNABE MALOIS, Boulevart St. Martin, Paris, "Improvements in the manufacture of boot and shoe heels, and in machinery to be used therein."—*Petition recorded 30th January*, 1862.

302. EDWARD FISHER SMITH and THOMAS SWINNERTON, Dudley, Worcestershire, "Improvements in the manufacture of coke, and in kilns or ovens for the manufacture of coke."—*Petition recorded 5th February*, 1862.

337. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in smoothing irons."—A communication from Charles Jean Baptiste Eugène Caillouè, Paris.—*Petition recorded 11th February*, 1862.

381. ALFRED CHARLES FEBUTT, Blackman-street, Borough, Southwark, "Improvements in reclining, easy, and other chairs."—*Petition recorded 13th February*, 1862.

404. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in electro-magnetic time-keepers."—A communication from John Henry Koosen, Dresden, Saxony.

405. WILLIAM AVERY, Birmingham, "Improvements in machinery for the manufacture of screws, a part or parts of which improvements may also be used in the manufacture of pins, rivets, and nails."

413. JOHN CHATTERTON, Highbury, and WILLOUGHBY SMITH, Dalston, Middlesex, "Improvements in telegraph cables."—*Petitions recorded 15th February*, 1862.

440. WILLIAM BRIDGES ADAMS, Holly Mount, Hampstead, Middlesex, "Improvements in springs, and their arrangement for moving and stationary purposes."

445. JAMES PATTERSON, Middle Temple, London, "Improvements in means or apparatus for reburning animal charcoal."—A communication from George Alexander Drummond, Montreal, Canada East.

448. JAMES WILCOX, Ludgate-hill, London, "Improvements in the manufacture of frills or ruffles and in the machinery or apparatus employed therein."—A communication from Chauncey Orrin Crosbey, New Haven, Connecticut, U S.—*Petitions recorded 19th February*, 1862.

455. JAMES PATERSON, Middle Temple, London, "Improvements in the use of animal charcoal."—A communication from George Alexander Drummond, Montreal, Canada East.—*Petition recorded 20th February*, 1862.

528. EDWIN GEORGE BRUZAUD, Pembroke-road, Kensington, "Improvements in pianofortes."—*Petition recorded 26th February*, 1862.

543. JOSEPH REVELL, Dukinfield, Cheshire, "Improvements in oil cans."—*Petition recorded 27th February*, 1862.

552. JAMES PARKER, Lilford-road, Camberwell, Surrey, "An improved mode of applying steam as a motive power for propelling vessels and for other purposes."—*Petition recorded 28th February*, 1862.

567. JOSEPH BRADLEE KENDALL, Boston, Massachusetts, U.S., "An improved horse shoe."—*Petition recorded 1st March*, 1862.

587. BRIDGE STANDEN, Salford, near Manchester, "Improvements in the preparation or manufacture of portable manure or fertilising compound, and in the collection or extraction therefrom of a certain liquid applicable to various purposes, and also in machinery or apparatus to be employed therein."

590. WILLIAM TONGUE, Bradford, Yorkshire, "Improvements in machinery for breaking, rubbing, and scutching flax, hemp, or other vegetable fibrous materials, and in processes for treating silk waste."—*Petitions recorded 4th March*, 1862.

596. WILLIAM TONGUE, Bradford, Yorkshire, "Improvements in machinery for preparing silk, flax, hemp, or other fibrous materials."—*Petition recorded 5th March*, 1862.

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 15th March, 1862.

1931, 1d.; 1962, 1d.; 1963, 6d.; 1964, 6d.; 1965, 3d.; 1966, 6d.; 1967, 10d.; 1968, 3d.; 1969, 7d.; 1970, 3d.; 1971, 2d.; 1972, 3d.; 1973, 7d.; 1974, 3d.; 1975, 11d.; 1976, 1s. 2d.; 1977, 10d.; 1978, 3d.; 1979, 1s.; 1980, 7d.; 1981, 7d.; 1982; 6d.; 1983, 7d.; 1984, 3d.; 1985, 3d.; 1986, 3d.; 1987, 10d.; 1988, 3d.; 1989, 6d.; 1990, 6d.; 1991, 7d.; 1992, 10d.; 1993, 4d.; 1994, 2s. 6d.; 1995, 9d.; 1996, 3d.; 1997, 1s. 2d.; 1998, 1s.; 1999, 10d.; 2000, 3d.; 2001, 9d.; 2002, 7d.; 2003, 3d.; 2004, 6d.; 2005, 3d.; 2006, 3d.; 2007, 2d.; 2008, 2s. 2d.; 2009, 4d.; 2010, 3d.; 2011, 9d.; 2012, 3d.; 2013, 4d.; 2014, 3d.; 2015, 10d.; 2016, 3d.; 2017, 3d.; 1252*, 4d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, or Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2171. P. TAYLOR, *City-road, Hulme, Manchester*, "*Apparatus for removing the sediment from, and preventing incrustation in, steam boilers.*"—*Dated 30th August*, 1861.

This invention consists in applying a pipe to the interior of a steam boiler, which pipe is made with a longitudinal slot or slots extending the whole or the greater part of the length of the boiler, and communicating with an off pipe in which is a discharge valve capable of being opened and closed rapidly. The valve is of the usual mushroom shape, and in the boss or on the spindle of the valve is a diagonal groove, taking in a fixed stud; the groove is of such an inclination that, by turning the spindle about one-half round, the valve is opened sufficiently to discharge the sediment which enters the pipe through the slot or slots above referred to.

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2145. S. CARPENTER, *Bunbury*, "*Carriage wheels.*"—*Dated 28th August*, 1861.

For the purposes of this invention, in constructing carriage wheels where wood spokes and wood fellies are used, in place of the end of each spoke entering the felly as heretofore, a double metal socket is applied to the end of each spoke, in such manner that the end of the spoke which ordinarily comes next the pulley is received into the larger portion of the double socket, while the smaller part of wood which ordinarily passes into the hole or recess formed to receive it in the felly enters the smaller portion of the double socket, and that smaller portion of the double socket enters the hole or recess in the felly, such hole or recess being made larger for the purpose of receiving the smaller portion of the socket, together with the part of the end of the wood spoke which is therein; but it is preferred that the end of the spoke which enters the smaller portion of the metal socket should be made less than is ordinarily would be, and the smaller portion of the metal socket made exteriorily of the same dimensions as the end of the spoke would be if no metal socket were used. The double sockets may be made of any suitable metal, but it is preferred that they should be made of malleable cast iron.—*Not proceeded with.*

2150. J. LOVE, *Lower Brook-street, Grosvenor-square, London*, "*An improved signal.*"—*Dated 29th August*, 1861.

This signal may be used on railway trains, or for any purpose for which it may be found applicable. When used on railway trains it consists of a metal tube running along the roof of each carriage, with a movable joint at each end (worked by springs), to allow carriages to be coupled or uncoupled. The last carriage of the train has that end of its tube which is furthest from the locomotive blocked, and the end of the tube or series of tubes next the engine is stopped by a sounding box or gong fitted to the tender. The signal is given by a small rifled revolver fitted in a rest, with a long trigger and crank in a round barrel, open at top, and sliding within another barrel, similar to the slide of a telescope. This portion of the apparatus is inserted into the roof of each, or any of the carriages under the tube, and opening into it. In signalling it is only necessary to press up the inner barrel until it receives the catch, and the revolver goes off. The said inner barrel must then be restored to its normal position, or it would interfere with the action of the apparatus in other carriages. The ball so discharged from the revolver strikes the metallic plate or gong, the driver answers by his whistle, and stops the train, the action of the signal being simple, certain, and instantaneous.

2163. J. HARRIS, *Hanwell, near London*, "*Stopping or retarding railway and other carriages and trains, &c.*"—*Dated 30th August*, 1861.

This invention is for improvements on a former invention for which letters patent were granted to the present patentee, dated 24th January, 1857 (No 216), and consists, chiefly, in the employment of air tight vessels or reservoirs, made of metal or other material, fitted with safety valves and pressure gauges, and placed in some convenient part or parts of railway or other carriages, on an engine or tender, in an engine-house manufactory, mill, on board ship, or other position. The patentee connects with one or more of those vessels, and communicating therewith by air tight pipes, cylinders fitted with pistons, the rods of which are attached to the brakes or brake levers on one or more or all of the carriages, as well as the engine and tender, as set forth in the specification of the patentee's former invention. The vessels or reservoirs have air forced into them by means of an air pump or pumps, which are fitted to the carriage, engine, or tender, and worked by either eccentrics or other appliances from the axles of such carriage, and so arranged as to be thrown in and out of gear as required. The pump may also be worked by hand wherever brakes for stopping or retarding machinery, or the means of quickly opening or closing cocks or valves for shutting off steam, gas, or water may be necessary. The pump communicates direct by air tight pipes with the vessels for containing compressed air. There are also pipes leading from the vessels to the cylinders in connection with the several brakes, and in those pipes conveniently placed is a three-way cock or valve to be worked by hand. The vessels, which for convenience may be placed under the seats in railway carriages, are always kept charged with compressed air by means of the air pump, so as to operate instantaneously and simultaneously, when required, on all the brakes. To cause them to so act, a cock or valve is opened, which allows the compressed air to act upon the pistons connected with the brakes, the amount of pressure, which is quite under control, being regulated by circumstances. The brakes are immediately liberated on reversing the three-way cock or valve, which allows the air to escape from the cylinders. Slightly modified, the apparatus may be made to actuate ship's rudders, and the heavy valve gearing in marine and other steam engines, and to move other bodies.

2174. C. FEMBERTON, *Deptford*, "*Railway, ship, and other signals.*"—*Dated 31st August*, 1861.

This invention cannot be described without reference to the drawings.

2183. G. F. GORANSSON, *Gefle, Sweden*, "*Manufacture of tyres for railway wheels, &c.*"—*Dated 31st August*, 1861.

This invention consists in the manufacture of tyres for railway purposes of a more homogeneous kind than has been heretofore obtained. This result is obtained by casting the hoops of steel and malleable iron somewhat broader than the wheels intended to be formed from them; these hoops are then placed in a boss made strong enough to retain the metal in shape under the next operation. Inside this boss, and also inside the hoops to be operated upon, is placed a punch or circular metal piece of the size of the inner diameter of the hoop; the hoop being placed between the boss and punch, it is then operated upon by a power hammer, the hammer piece of which may be round, so as to cover the whole circumference of the hoop at each stroke, or of the ordinary construction, this hammer being employed to consolidate or render homogeneous the metallic hoops; the hoops are afterwards rolled to the size required.—*Not proceeded with.*

2185. W. CLARK, *Chancery-lane, London*, "*Signal apparatus applicable for the prevention of railway train collisions.*"—*A communication.*—*Dated 2nd September*, 1861.

This invention relates to a self-acting apparatus for indicating to the driver of a train whether the line is clear, and the preceding train at the proper distance ahead or not. The tender or other part of the train is furnished with an inclined bar of wood, which, by acting on a roller forming part of the apparatus, will move a pointed bar of the said apparatus into position to signal a subsequent train that the line is blocked. This apparatus is not disengaged until the train passes beyond the corresponding apparatus placed at suitable distance ahead connected to the before mentioned by wires. These apparatuses, which are placed at suitable distances apart on the line, are connected alternately to each other by wires; that is to say, the first apparatus is connected to the third and the second to the fourth, and so on. On the locomotive is placed an indicating disc and bell, which are put in action by means of a crank acted on by the pointed bar, before mentioned, which causes the disc to turn a quarter of a circle, and, at the same time, the clapper on the stem of the disc strikes the signal bell, and warns the engine driver that the preceding train has not passed the apparatus, in connection with which the signal (of the line being blocked) is given.

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2141. J. RONALD, *Liverpool*, "*Machinery for dressing hemp, flax, &c.*"—*Dated 28th August*, 1861.

This invention consists, mainly, in substituting for gill teeth, brushes formed of bristles, whalebone, prassava, or other animal or vegetable fibre, mounted on rotating cylinders, or their mechanical equivalent, for dressing hemp, flax, manilla, and other like long fibres.

2165. C. WORMS and J. WARBURTON, *Bradford*, "*Treating animal fibre recovered from rags.*"—*Dated 30th August*, 1861.

Heretofore it has been common to treat rags of mixed fibre with acid to destroy the vegetable and leave the animal fibre. Now this invention consists in preparing such fibre to be again manufactured into fabrics by the combined process of carding or otherwise preparing it, and then combing it; the process of carding opens out, and, to some extent, straightens the fibre, whilst the combing process separates the short from the long.—*Not proceeded with.*

2166. J. BISHOP, *Gloucester street, Camden-town*, "*Weaving of velvet or pile fabrics made entirely or partially of silk.*"—*Dated 30th August*, 1861.

Instead of having in the loom, as in the old plan, one beam or roller for the loop warp, and two shafts or lambs rising both at the same time, and one bottom beam or roller and warp and four shafts or lambs, which alternately rise and fall, two at the same time, and three shutes or lines between every wire, the patentee employs, according to this invention, several beams or rollers for the said top warp, and several top warps, which should contain, however, no more material than the one top warp on the old plan, the material being equally divided out to each beam or roller. He also employs two shafts or lambs, and "rises" one shaft or lamb at a time. Also one bottom roller and warp, and two shafts or lambs, which should contain no more than half the quantity of material upon the old plan of rising and falling alternately. And he "rises" one bottom warp shaft with one top warp shaft; also he employs two shutes or lines between every wire.

2179. J. M. DUNLOP, *Manchester*, "*Cleansing cotton seeds.*"—*Dated 31st August*, 1861.

According to this invention, in place of allowing the seeds (which have been previously subjected to any of the ordinary gins or machines for separating the cotton therefrom) to pass continuously through the gin, they are retained in the hopper or case in presence of the saw teeth of the gin, and are again and again acted on thereby until they are well and sufficiently cleaned or freed from the small quantities of cotton which constantly adhere to them when removing cotton from the seeds as now practised. The machinery employed in carrying out the invention may be varied, but the patentee prefers that a machine should be used very similar in construction to an ordinary saw gin, and that the part of each saw that enters the hopper or case should pass through a slit in the hopper; and in place of the hopper being constantly open, so that the seeds may at once and continuously descend past the saw teeth, the bottom of the hopper is kept closed, until, by the repeated action of the saws on the quantity of seed in the hopper or case, the remaining adhering cotton from the previous process has been removed from the seeds.

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

2148. S. CORBETT, *Wellington, Salop*, "*Mills for crushing and grinding.*"—*Dated 29th August*, 1861.

This invention consists, First, in the improvement described in fixing in the said mills the flat or conical revolving, grinding, or cutting plates or surfaces, by which, with the fast or stationary plates or surfaces, the grinding, crushing, or hulling is effected. The invention consists, Secondly, in the improvement described in fixing in the said mills the fast or stationary grinding or cutting plates or surfaces, by which with the revolving plates or surfaces the grinding, crushing, or hulling is effected. The invention consists, Thirdly, in adapting springs to the spindle carrying the revolving, grinding, or cutting plate or surface of mills, so as to make the said plate yield and adjust itself to any irregularity of pressure, and thereby to prevent accident to the said plate, or to the mill, in case of nails or other hard substances accidentally getting between the grinding or cutting surfaces. The invention consists, Fourthly, in the improvement described

in feeding the grain or other matters to the improved mills. The invention consists, Lastly, in constructing the grinding or cutting surfaces of the rotating and fixed plates or discs of mills as described with reference to the drawings.

2153. A. V. Newton, *Chancery-lane, London*, "*Machinery for cleaning rice and other grains.*"—*A communication.—Dated 29th August*, 1861.

This invention relates to that class of rice-cleaning machinery in which a revolving archimedean screw or spiral wings are employed to force the grains of rice or other products against and past each other, and by the rubbing and friction of their surfaces to clean the same. The improvements consist, First, in extending upwards the rear end of the cylinder or case containing the screw, and through which the grain is passed for the purpose of being cleaned, so that the extended end may receive a corresponding telescopic slide, by adjusting which vertically the length of the passage for the grain may be increased or diminished. The telescopic slide will therefore enable the weight and resistance of the rice forced through the said upright extended portion by the screw to produce the required degree of friction and rubbing of the surfaces of the grains of rice requisite for effectually cleaning the same. As a further improvement it is proposed to use a peculiarly formed hopper divided by a vertical partition into two compartments, either of which is capable of being brought at pleasure into connection with the cylinder containing the screw. The divided hopper is not, however, essential to the efficient working of the machine.

2155. L. D. Owen, *New Oxford-street, London*, "*Ploughs.*"—*A communication —Dated 30th August*, 1861.

The patentee, according to this invention, makes the working surface of the mould board in the form of a section of the interior surface of a hollow cylinder, the centre or axis of the said cylinder being parallel or nearly so horizontally to the base of the mould board or bottom of the plough. He makes the plough point with a coulter or cutter rising from it, nearly perpendicular, of sufficient height to cut or divide the soil that is to be turned from the land side.

2160. W. E. Gedge, *Wellington-street, Strand, London*, "*Thrashing machines.*"—*A communication.—Dated 30th August*, 1861.

The object of this invention is to render thrashing machines capable of separating and purifying the seed of clover lucerne, red hay, and other plants fit for fodder, and these improvements consist. First, of an iron plate solidly fixed along the entire length of the counter beater of a thrashing machine of any description, such plate being pricked with a graver until rasping teeth are raised close together and well defined; above it is secured by small bolts passing through the openings of the grating to a band of iron which receives them. This plate forms very slightly prominent ribs, following the rods of the counter beater which serves to support it. Secondly, of an arched plate bolted to the blades of the beater; this plate is also pricked with the graving tool into rasping teeth, slightly more prominent than those of the counter beater; these teeth seize and press the layer of plants from which the seed is to be removed upon the counter beater, where they are torn and crushed by the activity of the beater. Thirdly, of a sorting sieve for separating the straw from the flour, and facilitating the purification of the seed. This sieve is suspended to a frame by flexible leather bands, which lend themselves easily to the necessary motion; a light wooden pallet with handle is added to bring the layer to the mouth of the machine.—*Not proceeded with.*

2169. W. Hensman, *Woburn, and* W. Hensman, *jun., Linslade*, "*Apparatus for tilling land by steam power.*"—*Dated 31st August*, 1861.

This invention consists, First, of improvements in the windlass or apparatus by which the motive power of the steam engine is communicated to the ploughs or cultivators for tilling land. Secondly, of improvements in the cultivators or implements used for that purpose. The improved windlass consists of a shaft frame on wheels, which carries a pair of drums, upon which the traction rope is wound, revolving by means of pipes or bushes upon the main axle; the outer rim of each drum is toothed. On each side of the shaft frame there is an upright bracket to which a compound lever is jointed. Above the drums there is a horizontal shaft, having at one end a rigger to receive a band from the steam engine, and two pinions which gear into the toothed rims of the drums. This shaft works in bearings on the levers before mentioned, the ends of which are connected to brakes acting upon the drums. Each drum, with its pinion lever and brake, is independent of the other. The improvements in cultivators consist of a frame or carriage mounted on travelling or furrow wheels, and furnished with steering or guiding apparatus, which frame carries two or more beams for the attachment of plough-shares, tines, or other cultivators, in such manner as to be adjustable to any required width or depth of furrow. The ploughs and beams may be so arranged as to be easily reversed at the end of each furrow by means of an universal joint; or they may be jointed to a central cross bar of the frame, and their hinder ends supported by a balance lever. The ploughs may be of any of the ordinary kinds, but the inventors prefer to use an improved form of plough with an adjustable coulter, turn over share, and sliding shield, to lay the furrow slices all one way. The tines are two edged, either with or without cross blades, and have a dovetailed hole in the centre through which the stem is passed and secured by a cross pin; the tines are held to the frame by adjustable clumps which permit them to have any required inclination. These cultivators are drawn by ropes winding upon the windlass actuated by a steam engine in the usual manner.—*Not proceeded with.*

Class 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

211. P. Effertz, *Manchester*, "*Apparatus for making bricks, tiles, drain pipes, &c.*"—*Dated 5th September*, 1861.

This machine is intended for producing perforated solid and paving bricks, gutter tiles, roofing tiles, cornice tiles, pan tiles, drain pipes, and other similar articles. The clay is fed into the machine through a hopper, mixed by a combination of screws through a grate to be cleansed from stones and other objectionable matters, modelled or mouldered by pressure to the desired shape, and received as an endless band by a rolling table in front of the machine. This rolling table is provided with a self-acting cutter put in motion by the band of clay emerging from the machine, and cutting the said band into any length desired at right angles to the surface, or at an angle proportionate to the velocity. The necessary pressure is exerted through a combination of screws requiring less power than any other now in use. The machine consists of two main parts or divisions. Firstly, the press for mixing, cleansing, and shaping the clay. Secondly, the self-acting cutting table on which the band of clay emerging from the mould is cut. The invention cannot be described without refererence to the drawings.

Class 6.—FIRE-ARMS.—None.

Class 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

2140. J. Harding, *Manchester*, "*An improved Inverness cape.*"—*Dated 29th August*, 1861.

According to this invention, instead of allowing the wings of the cape to be open down the front, as is now the case, the inventor stitches them fast to the body, so that they cannot fly open and annoy the wearer, yet allow the free use of the arms, and by this means the cape is more readily adjusted to the figure.—*Not proceeded with.*

2152. P. Jewell, *Bond-street, Brighton*, "*Concertinas.*"—*Dated 29th August*, 1861.

Part of this invention consists in applying an additional row of studs at each end of a German concertina, in combination with suitable mechanism for sounding the semitones of the chromatic scales, each stud of such additional row being arranged in such manner that it will, when suitably acted on, sound one or other of two semitones. And another part of the invention consists in applying to German and other concertinas parallel plates of glass, interior of the instruments, opposite, but at a short distance from, the holes or air passages, by which the tones of the instruments will be modified and improved.

2168. W. Clark, *Chancery-lane, London*, "*Shirts and chemises.*"—*A communication.—Dated 31st August*, 1861.

This invention cannot be described without reference to the drawings.

2172. T. M. Jones, *Great Pulteney-street, London*, "*Apparatus for suspending and turning meat, fowls, and such like articles for for roasting.*"—*Dated 31st August*, 1861.

According to this invention the inventor has a spindle supported vertically in a suitable frame for the said apparatus, on which spindle is fixed a horizontal escape wheel, gearing into the pallets or teeth at the centre of an oscillating bar, and on the ends of the said bar are adjustable weights free to slide for the purpose of regulating the speed of the apparatus as required. To the lower end of the said escape wheel spindle is connected the hook on which the article to be roasted is placed, and the said spindle is, therefore, carried through the lower bearing resting therein on a shoulder or other support on the said spindle, and projecting below the case in which the said apparatus is enclosed. Motion is communicated to the said escape wheel by means of a weight suspended by a line or chain which passes round a pulley fixed on the said spindle, and such motion continues until the weight has run down, when, as the escape wheel is free to turn in either direction, the apparatus may be again set in motion by removing the weight to the other end of the line or chain. The said weight, line, or chain may hang free by the side of the roasting screen or oven, or be conducted through tubes for enclosing it; or the apparatus may be arranged in a box, when the weight line may be carried along to, and hang down at, a convenient position.

2186. W. Muller, *High Holborn, London*, "*Apparatus for roasting coffee.*"—*Dated 2nd September*, 1861.

This invention is carried into effect as follows:—Within a vessel, by preference circular, and adapted to be placed on an ordinary fire, the patentee applies a vertical axis with arms or vanes to keep the contents in motion whilst over the fire. To this vessel he applies a movable cover, and a movable handle to give motion to the axis, and afford facility for the removal of the cover, besides a handle or handles by which to hold the vessel on the fire during the roasting. A vessel thus arranged is especially adapted for domestic use.

Class 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

2146. J. Duncan, *Greenock*, "*Manufacture of sugar.*"—*Dated 28th August*, 1861.

Under one modification of this invention, the vacuum pan is arranged and constructed with a series of discs, either solid or hollow, tubes, or other generally similar surfaces. These discs or equivalent surfaces are arranged within the vacuum pan in such a manner as to admit of rotatory or other motion being communicated thereto, the object of fitting these rotatory or movable surfaces within the pan being the keeping down the temperature during the boiling operation. Another of the present improvements consists in counteracting the alkalinity of the sugar solution by means of sulphurous acid, which is added in sufficient quantity to neutralise the amount of alkali contained in the saccharine solution. The invention also comprehends an improved mode of reburning animal charcoal which has been used in the refining of sugar. Under one modification the retort or vessel in which the charcoal is contained is fitted with a central longitudinal rod or bar, having a series of scrapers or vertical discs fitted to it. Motion is communicated to this rod by means of suitable gearing, so as to cause it to move to and fro, as well as rise and fall. In this way the rod (with its scrapers) is caused to move longitudinally and vertically, and so cause the charcoal to be pressed forward by the action of the scrapers, and thus render the process of burning continuous. As the rod with its scrapers moves to and fro in its elliptical path, it continuously brings forward and exposes a fresh supply of the animal charcoal to the heated surface of the retort, thus effecting a considerable saving of time as compared with the ordinary mode.—*Not proceeded with.*

2159. A. Taille, *Agen, France*, "*Manure*"—*Dated 30th August*, 1861.

This improved manure may be divided into a first and second composition. The patentee composes the first exclusively of animal matters, such as waste horn of every description, hoofs, hair, or wool, scrapings or parings of hides, and all other animal remains obtained from tanneries, leather cuttings of every description, and old leather. He places all these matters in a digester boiler, into which he introduces steam from a second boiler by a conducting tube leading from one boiler to the other. He raises the pressure of the steam to three or four atmospheres, according to the hardness of the matters under treatment, which also serves to guide him as to the length of time they should be submitted to this high pressure, which is exercised according to circumstances from fifteen to twenty hours, by which time the matters will be entirely and completely dissolved either into a marmalade, if they have been placed in the boiler in a slightly moist state, or, if more thoroughly charged with moisture, into a liquid state. The matters being dissolved he withdraws them from the boiler, and places them in a malaxing or kneading machine, which completes their intimate admixture; and at the moment of effecting this amalgamation in the kneader he adds a certain quantity of bone in impalpable powder. This compost is then (if it be winter) placed upon a drying apparatus; if summer it is simply dried in the sun; and finally it is submitted to mill stones to be pulverised to the fineness required.

2158. S. Pluchart, *Paris*, "*An improved beverage called moka-beer.*"—*Dated 30th August*, 1861.

This improved beverage is manufactured as follows, viz., 300 parts by measure of fermented strong coffee; 300 do. of tapa: 65 do. of a solution of sugar and gum senegal; 10 do. of an alcoholic extract of bitter orange peel; 325 do. of water. The liquid thus obtained is mixed in equal proportions with aerated water, or made up with an equal proportion of water into an aerated beverage, and forms the moka-beer; or the liquid may be drunk without any addition of water.—*Not proceeded with.*

Class 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

2147. M. Theiler, *Einsiedeln, Switzerland*, "*Type printing telegraphs.*"—*Dated 28th August*, 1861.

This invention consists in a novel arrangement and construction of the type printing instrument, whereby chronometry is dispensed with, the instrument being worked by means of a key similar to that of a single needle or a Morse instrument. The letters are engraved or fixed on the periphery of a wheel or disc, and they are inked by a band, or in any other well known manner. The strip of paper or the tape upon which the messages are to be printed is passed before the type wheel by block work, and is struck by a hammer of the blockwork against the wheel, when the required letter presents itself before it. An escapement wheel, actuated by a spring, is mounted upon the axle of the type wheel, and is held in its position by a hook or catch. Two levers are applied for raising this hook, each of which is moved by an electric magnet when a current passes through its coil; and when the hook is raised and the escapement liberated each of the two levers will take into a part of the escapement, thereby allowing the escapement and type wheel to perform only a certain portion of a revolution. The principal part of the instrument is the escapement, which has its teeth arranged so as to stop the type wheel at any one of its divisions corresponding with the number and order of currents employed. These currents are produced by a local battery, and pass alternately through one or the other of the magnets by means of a double relay, able to serve or open the way alternately to the one or the other of the magnets. This double relay is worked in either the one or the other of the two connectors by reversing the line current by means of a key, similar to a single needle, or a combination of such with a Morse key. The blockwork, which is at rest after having performed all the functions connected with the printing of a letter, is started by the motion of any of the escapement levers, but directly stopped again, and only allowed motion to complete the next letter when the levers are at rest.—*Not proceeded with.*

Class 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

2100. L. M. Casella, *Hatton-garden, London*, "*Mercurial thermometers.*"—*Dated 22nd August*, 1861.

This invention refers particularly to minimum temperature thermometers, and consists in providing an additional chamber communicating with the mercury, on which the mercury is free to rise and fall with variation of temperature, and in forming the chamber in such manner that, on the mercury being caused to flow out of such chamber, as hereafter explained, the flow will be arrested and the mercury in the ordinary thermometer tube will indicate the actual temperature at the time of making the observation, the lowest degree to which the temperature may have fallen having been indicated by the ordinary tube up to that moment. The most convenient means of carrying this invention into effect is as hereafter described. The patentee attaches at or near the lower end of an ordinary thermometer indicating tube, another shorter and bent tube of larger bore, into which the mercury is free to flow. He obtains the stop in the short tube by forming the bore of two different diameters. As the temperature falls, so does the mercury in the indicating tube, but no matter how high the temperature may rise, the mercury in the indicating tube does not show such rise (except as hereafter explained), but indicates the minimum degree to which the temperature may have fallen, the bent tube being sufficiently capacious to receive any mercury which may be expanded consequent upon any increase in temperature. Thus the thermometer will always indicate the lowest degree to which the temperature may have fallen since it was last set or moved. Now, to ascertain the actual temperature, carefully raise the bulb end of the thermometer to allow the mercury to flow down the indicating tube, when the mercury will flow out of the bent tube, and, on reaching the stop occasioned by the difference of diameter of bore in the bent tube, the mercury will suddenly stop in the indicating tube and show the actual temperature.

2101. T. F. Doyle, *Guildford-place Russell-square, London*, "*Raising and forcing fluids.*"—*Dated 22nd August*, 1861.

This invention is carried into effect by the following means:—Within a segmental chamber the patentee applies a pair of surfaces acting together and radiating from a common centre, whilst they are capable of motion therein, so that alternately in the motions given to such surfaces by an eccentric or by other suitable means space may be formed to receive fluid into such chamber, first on one side, and then on the other, and then to force such fluid therefrom through suitable valves and by suitable passages. The moving surfaces are made true to the chamber in which they move by packing or otherwise in order to their being fluid tight.

2102. W. Baines, *Smethwick*, "*Improvements in the construction of girders, frames, or other apparatus fixed or movable, and for certain peculiar forms or sections of iron used therein.*"—*Dated 22nd August*, 1861.

In the forms or sections of plates used in the construction of these frames or compound girders, one part of each is male and another part female; by hinging these parts together they become inserted, and being secured by bolts or rivets effect a vertical union and continuous bearing, hanching or extending where required. In constructing the movable parts of railway turntables the patentee bends and forms the plates into suitable parts or segments, and secures them in their respective places by bolts or rivets, thus constituting one entire frame, forming its necessary cross girders, which can be produced to suit any angle for any number of roads upon the table.

2105 M. Blakey, *Leeds*, "*Rotary pumps.*"—*Dated 23rd August*, 1862.

These improvements relate to means or apparatus by which a continuous and regular stream of water (such as, for example, is necessary for the feeding of stationary and locomotive steam boilers for fire engines and other similar purposes) may be obtained, and thereby the said stream of water may be forced to rise a considerable height with comparatively a small amount of power. The improvements consist in a hollow cylinder containing in its inside two or more pump barrels arranged radially and diagonally opposite each other, each pair of which pump barrels are connected and worked by one ram moving in a diagonal direction. This cylinder being inserted in a ring with two outlets, which outlets are partially connected by slots in the interior surface of the ring, receives a rotary motion—*Not proceeded with.*

2112. W. Evans, *Willow-walk, Bermondsey, and* E. Concanen, *Cheshunt-terrace, Bermondsey*, "*Pens or writing instruments.*"—*Dated 23rd August*, 1861.

This new manufacture of pens relates to the manufacture of such writing instruments of horn, which is first prepared in sheets of suitable thickness, in which it retains its natural formation or structure; or it may be dissolved and formed into horn sheet suitable for the purpose, as is well understood in preparing sheet horn. In either case the inventor stamps or otherwise cuts blanks from such sheet horn of a form and size suitable for pens in manner similar to that in which steel pens are cut; the blanks so cut are then softened by steam or other suitable process, and moulded to the forms required, and are suitably furnished with splits, which may or may not terminate in a hole punched in the blank; after moulding these pens are allowed to resume their natural state of the horn or sheet from which they were manufactured—*Not proceeded with.*

2109. W. D. Player, *Birmingham*, "*Linen buttons.*"—*Dated 23rd August*, 1861.

This invention consists in forming two eyeletted holes in the shell of the buttons commonly known as linen buttons, the said eyeletted holes being made at points equidistant from the centre of the shell, and on the same diameter. The metal situated between the eyeletted holes forms a bar over which the thread is passed, by which the buttons are sewn to the garments. The eyeletted holes may either be formed by turning back the metal of the edges of holes in the shell, or separate eyelets may be inserted and fixed in plain holes pierced in the said shell. The said eyeletted shells may either be covered in front by means of a perforated disc of linen, the perforations in which correspond with the eyeletted holes, the said disc being fixed to the shell by the said eyeletted holes, and the back of the shell being covered with an unperforated disc of linen, or left uncovered.

2111. H. Ingle, *Shoe-lane, and* J. Ingle, *Pimlico, London*, "*Printing machines*"—*Dated 22nd August*, 1861.

This invention relates, First, to an improvement upon means of driving the table in printing machines, for which letters patent were granted to H. Ingle, 14th January, 1858 (No. 64). The present improvement consists in substituting for the toothed sector, in the specification of the said letters patent described, a compound lever, one end of one arm of which is pivotted to one of the upright frames of the machine, while the other end is pivotted to the lower end of the other arm, the upper end of which is jointed to the table; the to and fro motion is obtained by a rod connecting the compound lever to a crank on the main driving shaft. The invention consists, secondly, in driving the inking roller, and causing the vibrator to rise at the same time by a ratchet and pawl and adjusting roller driven by a rod connected to a crank on the driving wheel shaft or other suitable motor.—*Not proceeded with.*

2114. M. Hyams, *City-road, London*, "*Smoking pipes and cigar pipes.*"—*Dated 24th August*, 1861.

The patentee claims, First, the employment in or combination with pipe-clay, preparatory to moulding pipes or cigar tubes therefrom, of one or more of the following agents: namely, oxide of iron, carbonate of soda, and non-alkaline salts, excepting magnesia, carbonate of magnesia, and silicate of soda, as described. Secondly, the imparting of aroma or aromatic qualities to pipes and cigar tubes substantially as described.

2115. J. Driver, *Keighley, and* J. Jessop, *Bradford*, "*Apparatus employed in washing, wringing, and mangling fabrics.*"—*Dated 24th August*, 1861.

This invention relates, First, to a method of constructing metallic rollers and parts thereof used in washing, wringing, and mangling machines. For this purpose the core boxes are formed lengthwise in two halves, each adapted to receive a movable model arbor or axle with (supposing four arms at each end to be required) one whole arm at each end, and two half arms. Having placed the model arbor or axis in position in one half of the box, the patentees ram in sand as a half core, so that, when the model arbor or axle is removed, the impression thereof may remain. They then do the like with the other half core box. The two half cores thus obtained form one core, adapted when placed in the mould for the surface of the cylinder or roller to produce in one casting a cylinder roller with its axis or arbor, and the arms supporting it, or, if desired, the axle may be separately formed with holes through at the arms to be cast on. Secondly, the improvements relate to forming the axles of castors or supporting wheels of washing, wringing, and mangling machines in casting the framing thereof. Thirdly, the improvements relate to the principle and means of supporting the axle of the upper of the squezing rollers in such machines. They form the bearings or dies between the axles of the two squeezing rollers at each end in two parts, adapted to admit of the two rollers coming as close as desired to each other. One part of each bearing is formed hollow as a socket to receive a projection from the other, which is also hollow to receive a suitable spring. These springs, acting with a top spring or top springs, or other means of pressure, serve to give a compensating pressure adapted to the different thickness of cloths introduced and removed from between these rollers, and without jerking or concussion of the parts. They also apply levers, elliptic or other springs, to answer the same purpose as above. Fourthly, they form the metal squeezing rollers fluid-tight, and with an opening with stopper to each to admit of the hot fluid being introduced and retained therein for heating such rollers, and then of flowing away or being drawn off when desired. Fifthly, the improvements relate to forming the bottoms of the tubs or vessels of washing machines of plain iron, cast with ears or other means of connection.

2118. H. B. Catlupe, jun., *United Service Club, St. James'*, "*Timekeepers.*"—*Dated 24th August*, 1861.

This invention consists of an instrument whereby the hour of the day or night is shown with the accuracy of the clock, but without any of the machinery used in clockwork. The patentee takes a tube of thin glass of small internal diameter, say about the eighth of an inch, and about eighteen inches in length, open at both ends, and having its diameter slightly contracted at two points, each distant about an inch from each end, at which points the external diameter of the tube is caused to bulge or become somewhat larger than the main portion. This is effected by heating the tube at the desired points by the blow pipe, and slightly shortening the tube by pressure, so as to form simultaneously an outward bulge and inward contraction. A plug of cotton wool, filtering paper, or other suitable material, is inserted at one end of the tube as far as the contraction, above which a portion of porous, earthy, or other suitable matter is inserted, and then another small quantity of cotton wool or other suitable material is added; after which a quantity of mercury is poured into the other end sufficient to occupy about an inch of the length of the tube, and a similar plug is then inserted to make each end of the tube correspond. A second tube of glass, closed at one end and of an internal diameter slightly larger than the external diameter of the first tube, is made the receptacle thereof, its length being merely sufficient to contain the small tube and to allow of its open end being acted upon by the blow pipe and closed hermetically by its aid. The motive power of the clock is obtained from the gravity of the mercury, regulated by the suction and passage of the air through the plugs, so that the mercury as it falls in the inner tube will force the air below it through the porous plug and into the outer tube, but the mercury itself will be prevented by the plug from escaping from the inner to the outer tube. These two tubes, now as it were in one, are secured by spring clips to a frame carrying or bearing an index marked on the frame itself, or attached to it and placed vertically, the index having at requisite equal distances marked thereon a scale of lines and numbers representing the hours and quarters. The instrument is suspended by hangers of wire, or any other suitable material, so as always to keep the tubes in a perpendicular position. The mercury will sink gradually, but in an invariable ratio from the upper to the lower end of the tube, and indicate by its lower level the hour on the index. When the mercury reaches the lower end of the tube, or approximates thereto, the position of the instrument is to be reversed, and, if necessary, the tube itself is moved upwards or downwards along the index through the clips in order to bring the level of the mercury to the proper hour thereon. For the purpose of ascertaining the hour of the night, the index may consist of ground glass, having cloth or other suitable transparent substance attached to a frame, in the centre of which the tube is arranged perpendicularly, and a small lamp or other illuminator is also to be attached in or about the apparatus for the purpose of giving light to the entire index. The mercury will then appear opaque, and clearly indicate the hour on the transparent index, thus forming a noiseless night clock and lamp, without the necessity of using any other light in the room.

2121. J. Clark, *Glasgow*, "*Envelopes and other covers.*"—*Dated 26th August*, 1861.

In carrying out the improvements in gumming a "cut" or pile of envelopes or other blanks is placed upon a table with the tongue resting upon and projecting slightly over a projecting part of the table edge, whilst adjustable stops at the back keep the blanks in position. A kind of doctor is placed

and rests with its weight, or is pressed by springs or otherwise upon the flaps of the blanks, leaving exposed beyond it as much of the tongue as is to be gummed. The gum in a liquid state is allowed to drop regularly upon the exposed part of the tongues, and is also applied at starting to the front of the doctor. The blanks are drawn singly, and in rapid succession, from under the doctor from behind, and are thereby gummed in a superior and uniform manner.—*Not proceeded with.*

2123. G. NYE, *Mount-street, Lambeth*, "*Apparatus for administering injection in a continuous stream; also applicable as an eye douche.*"—*Dated 20th August*, 1861.

This invention relates to two arrangements of apparatus. The first of these arrangements consists of an apparatus in which a vulcanised india-rubber vessel fitted with air valves is affixed at the top of a reservoir intended to contain the water or other fluid, so that by compressing the said india-rubber vessel air is forced into the reservoir, and the water or fluid projected from it in a continuous stream. The reservoir may some times be furnished with an injection tube fitted with a stop-cock and working on a joint. In the second arrangement of apparatus a metallic air vessel is employed enclosing an induction pipe in which is a chamber fitted with a valve for opening and closing the eduction way: at the bottom of the air vessel is secured a foot also fitted with a valve, and at the top of the air vessel is affixed a vulcanised india-rubber vessel, by the alternate compression and expansion or recoil of which water or other fluid is forced into the air vessel, and thence projected through the outlet pipe in a continuous stream. The valve that opens and closes the eduction way is so arranged that it may be readily attained, removed, and replaced.

2129. W. E. NEWTON, *Chancery-lane, London*, "*Machinery for filtering liquids decolourising saccharine and other juices, and rectifying alcoholic liquors.*"—*Dated 20th August*, 1861.

This invention consists in the employment of an apparatus, constructed on the principle of the centrifugal drying machine, for the purpose of decolorising saccharine juices and other liquids, and for the rectification of alcoholic liquors, and generally for filtration and for the separation of liquids from impurities.—*Not proceeded with.*

2132. E. PELTIER, *Paris*, "*Metallic boxes.*"—*Dated 27th August*, 1861.

These improvements relate to the manufacture of boxes of sheet metal having six or any other suitable number of sides, and they consist in certain improved modes of fixing together the side part or body of the box to the bottom and top or lid thereof by means of bezel, setting, or pumped joints, instead of the soldering, brasing, or welding hitherto made use of for such purpose. The invention is particularly applicable to the manufacture of boxes of tin plate, or any other suitable sheet metal, such, for instance, as are made use of for containing gunpowder or other similar articles.

2136. J. B. FONDEE, *Sodinlinsart, Belgium*, "*Fire grates for steam and other boilers, and suitable to all kinds of fires.*"—*Dated 27th August*, 1861.

This invention consists in constructing openings (like an open tube) communicating with each other in the length and breadth of the furnace, and permitting the circulation of air received from without by suitable openings in the front and all over the grate. The square space formed by the crossing of the bars (which may be of any other form, according to the position of the perforated bars) are filled with fuel, around which a free circulation of air takes place. The grate is placed parallel to the door of the furnace, which may be of any required length or breadth. The grate is obtained by placing a number of grate bars, as described, side by side. The holes of the perforated bars begin at the entrance of the furnace, the framework and plate of which are perforated with holes corresponding, and in a direct line with those in the grate bars for the admission of the air into the furnace.—*Not proceeded with.*

2137. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Dampers for stamping purposes.*"—*A communication.—Dated 27th August*, 1861.

This invention consists in the employment of pieces of sponge, covered with cloth or felt, placed in a suitable chamber, and operated in manner after described. According to one modification a reservoir supplied with ink or other suitable liquid is employed. In the upper part of this reservoir is fitted a perforated metal plate. This plate forms the bottom of a chamber for containing sponge or other suitable absorbent material, which sponge is covered with felt, cloth, or other suitable material, secured to the chamber by a metal ring or collar. The felt or cloth forms the surface of the damper, which, when not in use, is covered by a cap provided for that purpose, thus protecting it from dust or injury. The ink is supplied through an opening in the side of the reservoir, and is provided with a screwed cap or cover. The ink flows from the reservoir through the perforations in the bottom of the chamber containing the sponge and keeps the sponge always damp and ready for use.—*Not proceeded with.*

2139. J. M. HART, *Cheapside, and* R. LAVENDER, *New-road, Hornsey*, "*Handles or knobs of locks and latches.*"—*Dated 27th August*, 1861.

According to this invention, when two handles (one on each side of a door) are used, one of them may be made fast to the spindle as heretofore, and the spindle is formed square, or of other angular form, with a thread cut into the angles to a length likely to be required, and to receive a nut the external figure of which corresponds with that of a recess in the knob or handle, or is so constructed that turning of the knob or handle will, whilst it turns the spindle, hold the nut from turning thereon. The rosette or rose on the side of the fixed handle is provided with blades or projections in a radial direction adapted to pass into corresponding saw cuts in the door; or it is provided with other suitable projections to pass into corresponding recesses in the door to hold the rose or rosette from turning; or it may be fixed by screws or other means. At the other end of the spindle there is a supplemental or false rose, or a plate with similar projections to pass into suitable recesses on that side of the door; or the false rose may be otherwise secured to the door. On the opposite side of this supplemental rose or plate there is a cylindrical projection with a thread on what may be called the rose proper, or visible, and which is held on to the neck of the knob or handle by a screw ring or nut or other suitable means; the knob or handle is applied by the screwing on of the visible rose or rosette to the supplemental or false rose or plate; or the rose proper may be attached to the false rose by studs or projections from the one passing into corresponding receptacles in the other. This visible rose is retained from being readily loosened from the supplemental one by a spring with a stud or projection on the one acting on the teeth or corrugations on the other, or by simple friction, which may be aided by a ring of india rubber or other packing, or by other means. By these means the same spindle is adapted to various thicknesses of doors, as well as to different kinds of locks and latches, and to irregularities of either locks or latches, or doors or knobs, or handles or parts thereof.

2140. A. GRANGER, *Holborn, London*, "*Shirt collars and fronts, wristbands and cuffs, neckties, &c.*"—*Dated 28th August*, 1861.

For the purposes of this invention, in place of making the above named articles of linen, cotton, or other woven fabric, paper cloth or paper, as heretofore practised, the patentee manufactures such articles from the following materials, the first of which is generally known by the name of label forril, or bookbinders' cloth, or cotton sheepskin (a material well known and employed for other purposes), the surface of which is prepared with French chalk, starch, and a solution of buffalo hide to thicken and impart a white, glazed, or enamelled surface thereto; or a preparation of size and chalk may be employed for this purpose. Another material from which he manufactures collars, cuffs, and other similar articles of wearing apparel, according to this invention, consists in employing a thin woven fabric, the surface of which is japanned, painted, or prepared with certain pigments, such as are well known and employed for producing a white, glossy, or enamelled surface to such and similar materials for other purposes, in order to varnish and render the same waterproof, and so as in texture to resemble linen or other woven fabric; or a material of this character known by the name of American or leather cloth may be employed for these purposes, the manufacture of which is well known for other purposes; or he employs for the purposes of this invention a material called "asses' skin," painted and prepared as is well understood, and similar in character to that which is employed in pocket books for writing upon.

COMPLETE SPECIFICATIONS.

1557. W. MCINTYRE CRANSTON, "*Mowing machines.*"—*A communication.—Dated 24th July*, 1861.

This invention cannot be described without reference to the drawings.

1945. M. A. F. MENNONS, *Paris*, "*Grates of reverberatory and other metallurgic furnaces.*"—*A communication.—Dated 5th August*, 1861.

The patentee claims the substitution for the massive fire-bars at present generally employed in reverberatory and other metallurgic furnaces of a series of thin bars mounted on an oscillating frame, and arranged as described.

1947. M. A. F. MENNONS, *Paris*, "*An improved odontalgic elixir.*"—*A communication.—Dated 6th August*, 1861.

This invention consists in the preparation of a medicinal extract, applicable to the treatment of caries and other diseases of the teeth. This extract is obtained as follows:—To about ten imperial quarts of good Cognac brandy, or an equivalent of any other alcoholic spirit, are added cochicaria 2½ lb. avoirdupois), tulfoil 13½ oz., pulverised cloves 1 oz., pulverised cinnamon, 1 oz., pulverised cochineal 2 oz. The mass is left to infuse for fifteen days, after which it is filtered and completed by the addition of tincture of quinquina 10 oz., concentrated essence of aniseed 1½ oz., concentrated essence of mint ¾ oz.

1960. W. H. RICHARDS, *Newton, Massachusetts*, "*Combined knife, fork, and spoon for camp and other purposes.*"—*Dated 7th August*, 1861.

This invention cannot be described without reference to the drawings.

2088. M. A. F. MENNONS, *Paris*, "*Presses for lithographic printing.*"—*A communication.—Dated 21st August*, 1861.

This invention cannot be described without reference to the drawings.

2119. M. A. F. MENNONS, *Paris*, "*Improvements in the propulsion and steerage of ships or vessels, and in the construction and arrangement of machinery connected therewith.*"—*A communication.—Dated 26th August*, 1861.

This invention cannot be described without reference to the drawings.

2268. M. A. F. MENNONS, *Paris*, "*An improved combination of chemical and mechanical processes for the conversion of fibrous vegetable matters into paper pulp.*"—*A communication.—Dated 12th September*, 1861.

This invention cannot be described without reference to the drawings.

2387. J. BANKS, *Salisbury-street, Adelphi, London*, "*Electro-magnetic telegraph printing apparatus or marking instruments.*"—*Dated 25th September*, 1861.

The patentee claims, First, the construction, arrangement of parts, and mode of working electro-magnetic printing or marking apparatus. Secondly, the revolving armature and the mode of mounting and working the same in electro-magnetic telegraph apparatus. Thirdly, the combination of the freely revolving marking disc with the direct acting striker. Fourthly, the adaptation of the direct acting and freely revolving armature for the purposes of relay and transmission, all as described.

2439. H. HICKMAN, *Birmingham*, "*Protecting the locks and sights of fire-arms.*"—*Dated 30th September*, 1861.

This invention consists in providing a protective cover or cap for the locks and sights of fire-arms, more particularly for rifles and sporting guns, which cover or cap is of such form and material as to afford a thorough waterproof protection, readily applied, and as readily removed, whilst, at the same time, its form admits of being conveniently carried in the pocket when it is not in use.

2556. G. TWIGG, *Birmingham*, "*Clasps or fastenings for stay busks.*"—*Dated 12th October*, 1861.

This invention cannot be described without reference to the drawings.

2561. B. TAYLOR *and* C. EDKINS, *Birmingham*, "*Improvements in porte-robes or dress-suspenders, and also in apparatus for the suspension of curtains, draperies, &c.*"—*Dated 14th October*, 1861.

This invention consists, First, in improvements in porte-robes or dress-suspenders by making such dress-suspenders a part of or combined with a waist-belt, of the ordinary description worn by ladies, employing hooks or dress clips suspended by a cover or chain running through eyelet-holes in the waist-belt, so that the cords upon which the hooks or dress-clips are hung is easily adjustable to a greater or less length, to suit the convenience of the wearer. The invention consists also in improvements adapted for the suspension of curtains and draperies used with French bedsteads. A tubular ring of metal is substituted for the belt already described; this ring is to be screwed, in the manner usual with such draperies, into the ceiling or other joists, the cord or chain passing in the interior of the tubular ring, and the loops for the hooks through perforations in the ring; from these hooks the curtains are to hang, or the chain and hook may be employed if desired.

2575. J. J. ADAMS, *New York, U.S.*, "*Flexible back brushes for cleaning and dusting horses, &c.*"—*Dated 16th October*, 1861.

This invention consists in an improved mode of manufacturing a flexible brush, having its body made of leather, or any other suitable flexible material, all the rows of bristles except the outer one being first drawn into the body portion of the brush, next the top or cover-plate being cemented to the body part, and, finally, the last or outside row of bristles being drawn into the holes formed in the body portion by means of a wire passing down through the body and cap-plate of the brush. This mode of applying and securing the last row of bristles enables the patentee to entirely dispense with the line of sewing required by the old method to be made entirely around and through the brush, in order to confine the body and cover or hand-plate together.

2580. W. SMITH, *Salisbury-street, Adelphi, London*, "*Apparatus for, and method of, increasing the illuminating power of gas.*"—*A communication.—Dated 17th October*, 1861.

This invention consists in the use of a box containing capillary arrangements or apparatus, as described, for producing an atmosphere of benzone vapour for the purpose of charging the gas passed therethrough, as set forth. Also, in the use or employment of the capillary arrangement or apparatus described, whether benzone or any other liquid carbon be employed, for the same or similar purposes.

2669. E. CHAMBERS, *Melbourne*, "*The use of hydraulic power for the breaking, crushing, or pulverising of quartz, blue stone, or other stone of any description, and the use of a wrought iron lever or jaw in machines for crushing quartz or any other mineral, and the use of steel teeth and steel shield pieces for the levers or jaws in such machines.*"—*Dated 25th October*, 1861.

As a means of gaining power the patentee proposes to apply a hydraulic machine with the rams acting direct on a compound lever or jaw, and to attach to the frame of the machine a cylinder (to be worked by steam, water, or other agent) with the plunger-rod of a hydraulic ram continued (as shown in drawings), whereby the machine is not encumbered with any revolving shafts or gearing of any description, and, therefore, friction is done away with.

2683. M. A. F. MENNONS, *Paris*, "*Apparatus for ascertaining the presence and degree or cessation of vitality in the human body, and in animals of the higher class, applicable to the arcanic of health, disease, and death.*"—*A communication.—Dated 29th October*, 1861.

This invention consists in a novel combination of acoustic instruments by aid of which the variable degrees of animal vitality in health or disease may be translated into signs of known value, and by which the transition from life to death may be verified with absolute certainty.

2686. J. L. SICARD, *Nice, France*, "*Apparatus for purifying, measuring, and weighing grain and oleaginous seeds.*"—*Dated 30th October*, 1861.

This invention consists, First, in the construction of an apparatus for purifying, measuring, and weighing corn and oleaginous seed. Secondly, in the application to the lever of a Roman balance or steel yard of a ball for compensating for the differences of weight caused by the variation of temperature in the measures employed.

2756. J. WRIGHT, *Bridge-street, Blackfriars, London*, "*Improvements in the method of and apparatus for separating foreign matters from the droppings from carding machines, and for returning the residue thereunto.*"—*Partly a communication.—Dated 2nd November*, 1861.

This invention cannot be described without reference to the drawings.

2808. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Treatment of carpets.*"—*A communication.—Dated 8th November*, 1861.

It is here proposed by the inventor to apply to the back of the carpet to be treated one or more coats of drying oil, varnish, india-rubber solution, or other highly adhesive and siccative composition or cement, which application has the effect of firmly uniting the woollen pile or loops with the ordinary linen warp, forming the back of the fabric, and so preventing their disengagement or detachment therefrom.

2817. J. FISHER, *Carrington, near Nottingham*, "*Apparatus for indicating or regulating the passing of railway trains.*"—*Dated 9th November*, 1861.

The patentee claims the use or employment of a cylinder for containing fluid, fitted with a piston or bucket, in manner and for the purpose described, by which, through the intervention of a curved lever-arm, headle, or pressure-piece, or their mechanical equivalents, and the necessary intermediate connections, the passing of an engine or train is made to act upon the piston or bucket, and elevate, project, or bring into operation a curved lever, or its mechanical equivalent, for operating upon a whistle or other audible signal fitted upon the engine, tender, or other part of the next succeeding or following train, and by the gradual unsetting of the apparatus, corresponding with the lapse of time, the time which has elapsed since the passing of the previous train may be approximately measured and recorded upon the engine of such succeeding train, as described.

2943. M. HENRY, *Fleet-street, London*, "*Rendering steam-tight the opening for the passage of the piston-rod through the cylinder cover in steam engines.*"—*A communication.—Dated 22nd November*, 1861.

For the purpose of this invention a movable metallic box, socket, tube, or tubular piece—hereinafter, to avoid repetition, mostly called packing or surrounding appliances—is fitted or placed at the part to be rendered steam or fluid-tight, so as to surround the piston-rod or other article to which it is applied, and is so arranged as to effect or answer the purpose of a packing, that is to say, to keep the parts steam-tight or fluid-tight, or to obtain steam-tightness or fluid-tightness between the surfaces. The said packing or surrounding appliance may be made in one or more parts or pieces, and the passage formed through or in it for the reception of the piston-rod or other article that it surrounds may be bored so as to present smooth sides or surface, or such sides or surface may be formed with grooves round the same.

3078. C. F. VARLEY, *Kentish-town*, "*Electric telegraphs.*"—*Dated 9th December*, 1861.

This invention cannot be described without reference to the drawings.

3101. M. A. F. MENNONS, *Paris*, "*Jack machinery for moving heavy bodies.*"—*A communication.—Dated 11th December*, 1861.

This invention cannot be described without reference to the drawings.

3112. M. A. F. MENNONS, *Furnival's-inn, London*, "*Defecating and purifying cane and other saccharine juices.*"—*A communication.—Dated 12th December*, 1861.

This invention consists in the application of albumen to the defecation and purification of cane, beetroot, and other saccharine juices.

3251. M. HENRY, *Fleet-street, London*, "*Improvements in fire arms, and in adapting bayonets or cutting or piercing weapons thereto.*"—*A communication.—Dated 27th December*, 1861.

This invention relates, First, to breech loading fire-arms, and its principal feature consists in the employment of an improved breech which the inventor calls an oscillating breech, by which he means a movable breech, or capable of being oscillated, rocked, turned, or worked on a fixed fulcrum, pivot, axis, or centre of motion, situated at a point or part above or below the breech itself, or portion of the piece forming the breech that comes in a line with the barrel, in such manner that the said breech shall turn or work on its fulcrum, pivot, or axis, to the right or left, as required, but shall not revolve round a central axis, like revolving breeches, for which reason this improved breech is herein called the oscillating breech, to distinguish it from rotating breeches. For fitting together the portions that constitute the fire-arm a novel and simple method is adopted. In arms which are fired by a needle, striker, or exploding rod, the latter have fitted over or round it a nut which the inventor calls a shielding nut, and which is so placed and arranged that, by adjusting it suitably, the cock or hammer can be prevented from firing the charge when the arm is not intended to be discharged. In double barrelled arms, where two cocks are used, an arrangement is adopted in which either cock may act either on the needle, striker, or exploding rod of its own barrel, or on that of the other barrel, as required, so that the arm may be discharged in case of emergency while one barrel is loaded, and the other open, as well while both barrels are loaded. An improved carbine, intended as an arm of precision, and called by the inventor "Carabine de precision," is constructed according to this invention, having a rifled barrel, and an oscillating breech, and furnished with a bayonet or weapon placed in the stock. This arm is believed to be especially applicable for adoption in the army and navy, and is also suitable for employment in wild beast chase.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

IRONMASTER'S REPORTS ON 'CHANGE IN BIRMINGHAM AND WOLVERHAMPTON: *Speculations in Anticipation of the Close of the American Dispute*—COAL TRADE: *Activity perceptible in Domestic Samples*—BIRMINGHAM, WOLVERHAMPTON, AND EAST WORCESTERSHIRE GENERAL TRADES: *Decided Improvement: Cases Specified*—THE AFFAIRS OF MESSRS. KIMBERLEY AND GOLD, OF BIRMINGHAM—MR. GRIFFITHS AND HIS PARTNER—METAL SHEATHING AND TUBE WORKS—NEW PUMPING ENGINES—COMMITTAL OF ENGINE TENTERS FOR MANSLAUGHTER.

YESTERDAY in Birmingham, and in Wolverhampton on Wednesday, the business done was not, considering the advanced period of the season, anything like what it ought to have been. This is still supposing the existence of the American difficulty. A few sales of pig iron took place, but the quantities which changed hands were very meagre, and at prices decidedly in favour of buyers. The finished iron trade was reported as, on the whole, unimproved, but there were individual cases in which the reports were that a good steady trade was being done. Complaints were made that very low rates were being taken for plates as well as for the more frequently used samples. The transactions on a large scale by an American agent, in anticipation of the termination of the war, were reported, and occasioned a tolerably good feeling where men had not made up their minds that the struggle must yet be a prolonged one. The agent referred to has just arranged for extensive purchases of pig iron on his own account, and the most sanguine of the trade argue that, if the Federalists should obtain another decisive victory or two, capitalists in this country will be prepared to speculate in the purchase of pig iron which is now being obtained at so very low a figure. On the whole, therefore, the tone of the trade is a shade more cheerful than it was, and there is as much work being done as was the case last week.

The coal trade still exhibits considerable activity, but, as the season advances, a falling-off will necessarily take place.

The reports from Birmingham are more encouraging. It appears that at most of the large manufactories there are more orders in, and that in all but the fancy trades an improvement has taken place. The edge-tool makers, tube makers, and gun makers are all busy; and these find employment for a very large number of the artisans. It is in those branches, which in that respect are of minor importance, in which the slackness still continues. The platers are rather better off; in the metal trades there has not been much stir at present; and the demand for copper is limited, but the price is rather firmer than it was a week ago.

In and about Wolverhampton some of the trades, especially those engaged in the fitting trade, are becoming slack through the working out of their orders. Generally, however, as with the iron trade, most branches are quite as well to do as they were a week ago. In Willenhall the general manufacturers are decidedly better off. One firm, who are producing the best class of locks for building, are now working full time; a state of prosperity that it is a long time since they before enjoyed. Even the padlock trade of Willenhall, which has been so very depressed for a long time, is now reviving in that district. The small masters in almost every branch of the hardware trades in and about Wolverhampton are tolerably cheerful, and now wish only for the close of the embroglio on the other side of the Atlantic to be at an end. That accomplished, they feel sure that a brisk summer trade would ensue.

The labour market is being slightly rated; and the extent of partial relief at Birmingham and Wolverhampton unions is decreasing.

Serious complaints are still, however, being made in the Dudley and Stourbridge, and generally in the East Worcestershire district, of the little work that is being done either by the nail makers, the chain makers, the anvil makers, or any of the other trades carried on in those districts. In their case, however, things, although but little, are doubtless better than they were. The fencing trade in particular is now beginningto stir there a little.

The bankruptcy of Messrs. Kimberley and Gold, hinge manufacturers, of Birmingham, is virtually superseded, the creditors having agreed to accept the full 20s. in the pound payable by instalments at six, nine, twelve, and eighteen months.

At Birmingham a few gentlemen have just entered into "articles of association" for the purpose of raising capital and carrying on the metal sheathing and tube works of Messrs. Elliott, of Lilly Oak. The firm retain an interest, and the capital is augmented to £100,000 in £1,000 shares, which were privately subscribed for.

The South Staffordshire Waterworks Company have just put up, at their new reservoir at Conygree, near Dudley, for the supply of that town and the neighbourhood with water, a pair of non-condensing horizontal expansive engines. The steam cylinders are 25in. in diameter (5ft. strokes), each having a crank and fly-wheel motion, so that they may be worked separately or together. The fly-wheels are 20ft. diameter; weight, 8 tons each. The valve gear is of modern construction, consisting of four double beat gun metal valves in chests or muzzles, two for induction (6in. diameter), and two for exhaust (7½in. diameter), each valve having a separate lift arranged so that the steam may be cut off at any required portion of the strokes. The pumps are double acting (lift and force), 9in. diameter, and are fixed on the bed frames of the engines at the back end of the steam cylinders, and are worked by a prolongation of the piston rods with a clear length of stroke between the stuffing boxes of the pumps and cylinder covers, so that the hot rod may not enter the pump barrels to cause vapour to impair the vacuum or the action of the pumps. The suction and delivery valves are of gun metal double beat, 8½in. diameter, each in a separate clack box, covered by a lid so as to be readily approached. There are two air vessels 2ft. 6in. diameter, 13ft. high, one to each pump, connected by 8in. delivery pipes uniting with a 12in. breeches or junction pipe to the rising main. The whole of the pipes, air vessels, pumps, &c., were proved by hydraulic pressure to 300 lb. on the square inch, in the presence of the company's engineer, before they left the maker's works. The boilers are four in number, are of the kind generally known as the "Cornish plan," are 6ft. 2in. diameter and 30ft. long, with two 28-in. fire tubes. Each boiler is surmounted with a very capacious steam dome, 3ft. diameter and 5ft. high. The shell of the boilers are made of Messrs. G. B. Thorneycroft and Co.'s best Staffordshire plate, and the fire tubes of "Low Moor;" and were tested to 100 lb. on the square inch (hydraulic pressure), on the maker's premises, in the presence of the company's engineer. The fire-gates are provided with suitable air passages through doors and bridges in fire tubes to prevent smoke, and the feed water is heated to 160 deg. before it enters the

boilers. The speed of the engines and pumps is twenty-four strokes, or 240ft. per minute, with a pressure of 45 lb., cutting off at two-fifths parts of stroke. The pressure per square inch on the pumps is 116 lb. when delivering or pumping into the "Shaver's End Reservoir," near Dudley. The new reservoir is supplied direct from the company's pumping station at Lichfield, through a 12-in. main of pipes, and the engines are so arranged as to pump either out of the main or reservoir. The whole of the above work is now in full operation, and has been supplied by Messrs. J. and G. Davies, of the Albion and Limerick Engine Works, Tipton, South Staffordshire, in a style to secure to that firm, as they deserve, the entire satisfaction of the company's engineers, Messrs. McLean and Stileman.

As was the case with the engine tenter who allowed his boiler to become dry at the Corbyn's Hall Ironworks, and killed five men, so also the engine tenter who drew seven men over the pulley at Tividale, last week, and injured eight, one of whom has since died—both men have been committed for trial for manslaughter.

Mr. Samuel Griffiths, of Wolverhampton, denies to us that Mr. E. B. Thorneycroft, whose name is so near a resemblance to G. B. Thorneycroft, has stated on the deed of arrangement which he (Mr. Griffiths) has filed that he is not a partner in the firm of "E. B. Thorneycroft and Co.," who lately carried on the "Staffordshire" and now carry on other works for the manufacture of finished iron. Mr. Griffiths states that Mr. Thorneycroft has only said that he is not a partner in the freehold of the estate.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

LIVERPOOL: *The Mersey Dock Board: Jubilee of the Literary and Philosophical Society*—THE SCOTIA AND THE GREAT BRITAIN—THE RAILWAY WORKS AT CREWE—TRENT, ANCHOLME, AND GRIMSBY RAILWAY—THE RIVER NENE: *Admiralty Inquiry at Peterborough*—STATE OF EMPLOYMENT AT MANCHESTER: *The Machinists and Foundries*—THE NORTH: *Trade on Tyneside: Tyne Shipbuilding: Improvements on the Tyne*—STATE OF TRADE: *Sheffield: Derbyshire*—THE LATE PROFESSOR BARLOW.

WE proceed to summarise a few of the items of intelligence which Liverpool as usual offers. At a meeting of the Mersey Docks Board it was intimated that a letter had been received from the Trinity Board stating that the advantages presented by the lime light over the ordinary system as exhibited at the South Foreland in the latter part of last year were not sufficient to warrant its general adoption.

The Liverpool Literary and Philosophical Society celebrated its fiftieth anniversary yesterday evening week by a *soirée* of a very high character at the Town Hall. "All the talents" of Liverpool were assembled on the occasion. An interesting feature was the introduction of Morse's electric telegraph apparatus, communication being obtained by printing in cipher. Messages were interchanged between Liverpool, London, and Manchester, and the *modus operandi* was explained. The apparatus sent by the United Kingdom Electric Telegraph Company was under the direction of their superintendent, Mr. Allan S. Scott. Amongst the novelties exhibited was Moule's patent photogen for taking portraits at night equal to those obtained by daylight. This apparatus was exhibited in one of the ante-rooms on the ground floor, and several portraits were taken by it during the evening.

It is understood that the Scotia, the last splendid addition to the Cunard line, will start on her first voyage from Liverpool to New York on Saturday, May 10. The Great Britain is announced to sail from Liverpool to Melbourne on Thursday, May 15. The merits of the Great Britain as a powerful and reliable ocean steamer seem to be increasingly recognised. In the latter part of 1858 she made a voyage out to Melbourne in 64 days; home in 67. The succeeding passage was 57 days out, and 62 days home. The next passage was 62 days out, and 68 days home. The following passage 63 days out, and 66 days home. The last Australian mail announced her arrival out in 63 days; and she is telegraphed as having left a full ship, on the 13th of January. The result of three years' passages thus clearly demonstrates that the use of steam as an auxiliary enables the length of the voyage to be reckoned upon with certainty, within a day or two.

An amusing fragment of gossip reaches us from Crewe. The bell used at the railway works to summon the men to work and to announce the meal times, having been found insufficiently loud to be heard by all the workmen, a kind of gong has been constructed, which is sounded by steam. It creates a noise somewhat resembling an intense groan, which has been very plainly heard at Holmes Chapel, a distance of more then eight miles. [This little morsel forcibly illustrates the vast extent of the Crewe Works.]

Operations on the Trent, Ancholme, and Grimsby Railway, including the bridges over the Trent and the Keadby Canal, are advancing rapidly. The new line is expected to greatly facilitate the conveyance of coals in the district.

Mr. J. G Cockburn Curtis, C.E., has been holding an official inquiry at Peterboro' in reference to the Nene Valley navigation and drainage question. The proceedings excited great interest in the neighbourhood, and among the engineers present may be mentioned Mr. T. Page (the eminent bridge engineer), Mr. H. Page, Mr. Amos, and Mr. Johnson, Mr. Lunn and Mr. Adams. Mr. Johnson represented Mr. Fowler, engineer-in-chief to the Nene Valley Commissioners, who are now promoting a bill in Parliament on the subject, and produced plans of certain proposed works, the main feature of which was the construction of a sluice across the river Nene at the Dog-in-a-Doublet, about four miles below Peterboro'. A great deal of the examination was directed to the effects of the sluice upon the navigation of the river Nene between Peterboro' and Wisbech, and upon the supply of fresh water to the latter town. It was proposed to maintain the water between the Dog-and-Doublet sluice and Peterboro' at a navigation level of 33ft. above datum; the sluice to be closed when the water below the sluice did not reach the level, or when the tidal water, if salt or brackish, was above that height. Mr. J. Jackson, for the corporation of Wisbech, directed the attention of the inspector to clause 43 in the Nene Valley Act of 1852, which authorised the execution of the works in the river commencing below the town, and proceeding upwards to Bevis Hall; and then to clause 233, which was an Admiralty clause, which enacted that the commissioners should first commence and complete the works authorised in the lower division, and should not commence any other works till the works in the lower division were completed. Mr. Jackson urged that the Admiralty had required two opening bridges to be made, one at Wisbech and the other at the Dog-in-a-Doublet. Wisbech had exhausted the whole of its resources, the tonnage dues being absorbed, the estates mortgaged for navigation purposes, the whole of the rental (amounting to upwards of £1,700) being so applied, and the house property rated to the full extent of 10d. in the pound for the same purpose. There was no other instance in which such pressure had been occasioned to a town for the maintenance of a river. The commissioners had failed to construct the works in conformity with the parliamentary plan, the dwarf piling below the town not having been executed, the bends in the river not having been removed, &c. If the obligations of the commissioners were repealed, the effect would be very prejudicial. The people of Wisbech had already had painful experience of the effect of dams across the river, and he need only refer to Mr. M'Clean's report for evidence as to what the effect was on navigation. After taking a great deal of evidence, in the course of which he complimented Mr. Jackson on the manner in which the case for the promoters had been got up, the inspector proceeded with a large party of gentlemen to make a personal inspection of the river in a steamer placed at his disposal by Mr. Young, the Mayor of Wisbech. Mr. Curtis, whose report will of course not be made known for some little time, took a number of soundings at various points.

The last official return as to the state of employment in Manchester shows that of 47 machinists 15 are working full time with all hands, 21 full time with a portion of their hands, and 11 are on short time. Of 24 foundries 5 are working full time with all hands, 16 are working full time with a portion of their hands, and 3 are on short time. Of 7,182 persons attached to the machinists' establishments 4,956 were still working full time; and of 4,224 persons who could be employed in the foundries 3,067 were still fully engaged.

On Tyneside things are still dull, and commercial men are stated to be taking in sail in anticipation of continued dulness for the rest of the year. We are not disposed, however, to take too gloomy a view of affairs, for a termination of the miserable struggle in America would soon change the aspect of things. On Saturday Messrs. C. Mitchell and Co., of Low Walker, launched an iron screw steamer, for the Inter-Colonial Royal Mail Steam Navigation Company, trading between New Zealand and Australia. The dimensions of the steamer, which received the name of the Claude Hamilton, were as follow:—Length of vessel, 215ft.; breadth, 28ft.; depth, 17ft.; she is fitted with high-pressure condensing engines of 100 nominal horse-power, by Messrs. R. Morrison and Co., of the Ouseburn Engine Works. Amongst those present at the launch of the steamer were Mr. Robert Bowman, of London, the company's consulting engineer; Captain Gibson, of Hull, who takes command of this ship, &c. Messrs. Mitchell and Co. have at present on hand a screw yacht for the Baltic, and two screw steamers of 600 tons and 800 tons respectively. On the same afternoon a steamer, intended for one of the express boats of the Red Star Company on the Tyne, was launched from Messrs. Rogerson and Co.'s, of St. Peter's. She promises a high rate of speed. Mr. T. Y. Hall, in a communication on the improvement of the Tyne, observes:—"When the plans of Mr. Ure, the river engineer, are fully carried out ships and steamers of 2,000 or 3,000 tons will be able to come into the Jarrow docks, whilst ships of 600 tons, and steam vessels of 1,200 tons, will be able to ascend, with ease and economy, four or five miles above the High-level Bridge into the very centre of the western portion of this (coal) district, where cheap coal, suitable for household, coking, and gas purposes, will for a long time be obtained in great abundance. Coal owners will no longer have to carry their coals by railway or in keels, for long distances, to the ships moored in the Tyne; and so the prosperity of the town and trade of Newcastle, as well as that of the whole of the Tyne, will be immensely increased, and Newcastle will be kept as the central point for the business matters of the river and the coal trade. The plans of the engineer, for which an Act of Parliament has been obtained, will deepen the channel from Tynemouth Bar to Newburn, shorten the distance, and generally cheapen the transit. By temporary barriers, placed so as to throw the river into a narrow channel, increasing thereby the scouring power of the tide, and by the use of the new dredger of 60-horse power (which cost £40,000), and other dredgers, the river to the west of Newcastle can, in the course of two or three years, be rendered deeper by at least 8ft. than it is at present. Tynemouth Bar can be pushed into 10ft. deeper water, making it 31ft. in depth at high water of ordinary spring tides. The stone-dyke barrier across the Tyne below Leamington (13 miles west from Tynemouth) can easily be blown up for about 100 yards or so; and Newcastle Old Bridge (a great obstruction to navigation) be pulled down, and reconstructed on better principles. There is no good reason, therefore, why we should not, in a very few years, have even 31ft. of water at Tynemouth Bar; and from Newcastle to Blaydon 8ft. more than there is at present. This would render the Tyne, as a coal-port, infinitely superior to the river Wear and its docks, or any other river, port, or harbour, on this coast, and (coal being obtainable at less cost) as good or better than Cardiff, Swansea, or Newport, on the coast of Wales, or probably any other harbour in the kingdom." The Tyne Improvement Commissioners held their usual monthly meeting yesterday week. The Blaydon Chemical Company submitted a memorial calling special attention to the unsatisfactory state of the stream at Derwenthaugh, and asking for the use of a dredger above the bridge. The reasonableness of the request was admitted, and, for the present, it was resolved to remedy the defects complained of by the application of "spoon-bags," the engineer being instructed to report on the cost of a small dredger to work in the locality in question. On the long pending question of the lines of finished piers, suggested in the report of Mr. Walker, a decision has at length been come to. Of the three alternative plans the commission has resolved to adopt the second, which will extend out to a depth of 30ft. at low water or spring tides, and will cost £660,000. The time calculated for the completion of the works is six years.

The state of business affairs at Sheffield is still depressing. The edge tool trade, however, is moderately brisk, both on home and continental account. There is a fair degree of animation in the steel trade, the larger houses having good orders on hand. The falling-off in orders is considerable, and no improvement can be anticipated at present. There is no doubt, indeed, that both Austria and Russia are in rather a bad way at present. In Derbyshire the iron trade is exceedingly dull, and the demand for coals is much reduced. The railway wagon firms, however, are still busy. A train, comprising thirty-eight trucks, loaded with 160 tons of armour plates for Government frigates, was despatched from the Atlas Steel and Iron Works, Sheffield (Messrs. J. Brown and Co.'s), last week for London and Portsmouth. The iron used in the manufacture of the plates was made at the Sheepbridge Works, near Chesterfield.

The daily papers have already given a few particulars with regard to the late venerable Professor Barlow, who, although he perhaps outlived his generation and was little known latterly, was a veteran *savant* of the highest reputation, his two sons, Mr. Peter Barlow and Mr. William Barlow, occupying, also, an honourable position among modern engineers. Professor Barlow, when a country schoolmaster, in Norfolk, at the close of the last century, commenced a regular correspondence in the "Ladies' Diary," then under the management of Dr. Hutton, Professor of Mathematics at Woolwich, whose attention was forcibly attracted to the contributions furnished by his rural correspondent. In the year 1801, when the Royal Military Academy, having added to the number of its scholars, required an additional master, Dr. Hutton recommended Mr. Barlow to come forward as a candidate. He was successful, and this situation made him acquainted with Mr. Bonnycastle, to whose knowledge of all subjects connected with mathematics he acknowledged himself much indebted, he being the means of reducing Mr. Barlow's attainments to some systematic order. Through the recommendation of Mr. Bonnycastle Mr. Barlow commenced, in 1808, writing for the "Encyclopaedia" conducted by Dr. Rees, and from the letter H to the end contributed the greater part of the mathematical articles of that work. In 1811 he published his first work, on "The Theory of Numbers," in 1813 his "Mathematical Dictionary," and, in the same year, his "Mathematical Tables." Up to this time Mr. Barlow's pursuits had generally a reference to abstract science. In 1815 he commenced his first attempt at applying these sciences to practical matters, founded on experiments on the strength of wood, iron, and other material. This formed the basis of his work on "The Strength of Materials," published in 1817, which, being well received by the architects and civil engineers of the metropolis, led to an intimate acquaintance with the leading professors of those arts, and Mr. Barlow's subsequent career was one of continuous honour and success. How he assisted Telford in connection with the Menai Bridge, and Brunel with the Thames Tunnel, we need not here repeat, our present purpose being principally to remind our readers that Mr. Barlow dated from the remote days of Hutton and Bonnycastle.

BRICK FLOORS *versus* WOODEN ONES.—At a cotton-mill, where about 3,000 people are employed, one of the young females was about to be discharged on account of continued ill-health. Her reply was, "If you will place me where I can work on a wooden floor instead of on brick, I shall be all right." The master yielded to her request: she recovered her health so decidedly, and he was so struck with the result, that he is having every brick taken up and replaced by wood.—*Builder*.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£ s. d.	Dis. p. ct.
IRON, English Bar and Bolt:—			
in London	pr tn	5 15 0	3
in Wales	„	5 0 0	„
in Liverpool	„	5 10 0	„
Staffordshire Bars (Deliv. into boats at works; Nom. rates last qr. day for favourite brands)	„	7 0 0	1½
Sheet, Singl.	„	8 10 0	„
Dbl.	„	10 0 0	„
Hoop	„	8 0 0	„
Rod, round	„	7 0 0	„
Nail Rod, sq	„	7 5 0	„
SHIPPING IRON, Staffordsh. Bars (Delivered in Liverpool 10s. per ton less)	„	7 0 0	2
Sheet, Single	„	8 15 0	„
Double	„	10 5 0	„
Hoop	„	8 5 0	„
Rod Round	„	7 [illegible] 0	„
Nail Rod. Square	„	7 5 0	„
IRON, Rails, in Wales, cash	„	5 7 6	nett
„ „ 6 months	„	5 10 0	„
Old, to cut up	„	0 0 0	„
Railway Chairs, in Wales	„	4 0 0	„
in Clyde	„	3 15 0	„
Pig No. 1, in Clyde	„	2 9 6	„
3-5ths No. 1 & 2-5ths No. 3		2 9 6	„
No. 1, in Wales	„	3 10 0	„
No. 1, in Tyne and Tees	„	2 12 0	„
Ditto, Forge	„	9 0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	„	3 10 0	„
Welsh Forge Pig (all Mine), at the Port	„	3 5 0	„
Acadian Pig, Charcoal	„	7 10 0	„
Scotch Pig, No. 1, in London	„	0 0 0	„

		£ s. d.	Dis. p. ct.
IRON, Swedish, Indian assortments	pr tn	11 5 0	2
Russian CCND to arrive	„	16 0 0	„
STEEL, Swedish Keg, ham.	„	15 10 0	2½
Ditto, rolled	„	15 0 0	„
Fagot		17 0 0	„
SPELTER, on the spot	„	18 7 6	nett
To arrive	„	18 10 0	„
Hard, remelted	„	17 0 0	„
ZINC, in sheets	„	23 0 0	„
COPPER, Tile, 14 to 28 lb.	„	95 0 0	2
Tough Cake	„	98 0 0	„
Sheathing and Bolts	pr lb.	0 0 11	„
Sheet	„	0 0 11	„
Bottoms	„	0 0 11½	„
Old	„	0 0 9	„
Yellow Metal	„	0 0 9	„
Bars	„	97 0 0	„
Russian do.	„	0 0 0	„
LEAD, British Pig	„	20 5 0	„
Spanish	„	19 10 0	„
W. B.	„	21 5 0	„
Sheet	„	21 5 0	„
TIN, English Block, nom.	„	120 0 0	„
Bar „	„	121 0 0	„
Refined „	„	122 0 0	„
Foreign Banca	„	126 0 0	„
Straits	„	118 0 0	„
TIN PLATES, Charcoal, IC	pr bx	1 9 0	„
Ditto IX	„	1 15 0	„
Coke, IC	„	1 3 0	„
Ditto IX	„	1 9	
Do. at Newport, 1s. pr bx less		—	„
Do. at L'pool, 6d.	„	—	
CANADA, Plates	pr tn	12 0 0	2
QUICKSILVER	pr bt	0	

RAILS continue in good demand.

SCOTCH PIG IRON.—The market has been rather inactive during the past week, and but little business done, prices remaining as last quoted, viz., 49s. 6d. cash Mixed Nos. f.o.b. Glasgow.

SPELTER is much firmer, and an advance of nearly 15s., established business having been done up to £18 7s. 6d. per ton on the spot.

COPPER somewhat firmer.

LEAD may be had 10s. cheaper, viz., £20 5s. for best English pig. W.B. quoted £21 5s. and sheet £21.

TIN.—English continues in good demand, Banca quoted £126, and Straits £118. Market quiet.

TIN PLATES in good request.

March 20th, 1862. MOATE AND Co., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861 £ s.	£ s.	1862 £ s.	£ s.
Teak	15 10	17 0	15 0	16 0
Quebec, red pine	3 10	4 10	3 5	4 0
yellow pine	3 0	4 0	3 0	3 15
St. John, N.B., yel.	5 0	5 10	5 0	5 10
Quebec, oak, white	5 0	5 10	5 0	5 10
birch	3 10	4 0	4 10	0 0
Memel	0 0	0 0	0 0	0 0
elm	3 10	4 15	3 10	4 15
Dantzic, oak	3 10	6 0	3 10	6 0
fir	2 15	3 10	3 0	4 0
Memel, fir	3 10	4 0	3 10	4 0
Riga	3 5	3 10	3 10	3 15
Swedish	2 15	3 0	2 15	3 0
Masts, Queb. rd pine	5 0	6 0	5 0	6 0
yl. pine	5 0	6 0	5 0	6 0
rd pine	0 0	0 0	0 0	0 0
Lathwood, Dantz, fm	6 0	6 10	6 0	7 0
St. Peters.	8 0	8 10	9 0	9 10
Deals, per C., 12 ft. by 3 by 9 in.				
Quebec, wht. spruce	13 0	18 0	15 0	19 0
St. John, wht. spruce	13 0	16 0	15 0	17 10

Per load—	1861 £ s.	£ s.	1862 £ s.	£ s.
Yel. pine, per reduced C.				
Canada, 1st quality	17 0	18 10	17 10	19 0
2nd do.	12 0	12 10	12 0	13 0
Archangel, yellow	13 0	13 10	14 0	15 0
St. Petersb., yel.	12 0	12 10	13 10	13 10
Finland	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	15 0
Gothenburg, yel.	10 0	11 10	10 0	12 10
white	9 10	10 0	9 10	11 0
Gefle, yellow	10 0	11 0	11 0	12 10
Soderhamn	10 0	10 10	11 0	12 10
Christiania, per C 12 ft. by 3 by 9 in., yellow	22 0	25 0	22 0	24 0
Deck plank, Dntz per 40 ft. 3 in.	0 11	1 4	0 14	
Staves, per standard M				
Quebec, pipe	70 0	75 0	50	55 0
puncheon	16 0	18 0	16 0	18
Baltic, crown pipe	160 0	170 0	170	180

SCOTCH PIG IRON REPORT.

		s.	d.		
No. 1 Gartsherrie	.. ..	55	3	f.o.b	Glasgow.
„ 1 G.M.B.	.. ..	49	0	„	do.
„ 3 Do.	.. ..	48	0	„	do.
M. Nos. Do.	.. ..	48	6	„	do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths „ 3 .. G.M.B.	Cash prompt	49	4½	per ton.
	1 mo. open	49	7½	do.
	2 mos. „	49	10½	do.
	3 „ „	50	3	do.

MANUFACTURED IRON.

	£	s.	d.
Bars, Govan	7	0	0
„ Common	6	10	0
Drumpeller, Common	6	10	0
Do. Best	7	10	0
Plates and Sheets	10	0	0
Rails	7	0	0
Pipes	4	17	6
Chairs	4	0	0

GLASGOW, 19th March, 1862.

A fair business continues to be transacted in our pig iron market for shipping orders. The demand particularly from France and Italy is very good; but in the other branches of our trade there is great inactivity. Speculation has for the time almost disappeared, and the purchases for our home consumption are limited. Exports last week were 12,011 tons against 7,982 tons in the corresponding week of last year.

SHAW, THOMSON, and MOORE, Metal Brokers.

WATER AT WAKEFIELD.—For a long time past the Wakefield Town Council and the Wakefield Waterworks Company have been at loggerheads. On all hands it is granted that the present water supply is bad in quality, and some four months ago the company set on foot a new scheme. This the town council have opposed because they considered it a bad scheme; and also because they wished to get the works in their own hands, considering such eventually will have to be the case. And after negotiations had taken place between the two bodies for its purchase, and nothing coming of them, the council petitioned against the bill introduced into Parliament by the Waterworks Company. On Wednesday evening last a town's meeting was convened to consider two questions—first, the propriety of purchasing the regular works and privilege of the Waterworks Company; and secondly, whether the petition was to be proceeded with. It was decided that it was not advisable to purchase the works at present, and to withdraw the petition provided certain clauses to be introduced into the bill now before Parliament be agreed to by the Waterworks Company. The result is, the waterworks having refused the last provision, that matters are in as unsatisfactory a position as ever.

CHOICE OF WALL PAPER FOR ROOMS.—Light, above all things, should be well considered. It rarely happens that an apartment is too light; but if such ever should happen to be the case a remedy is readily found in the application of colour. This will proscribe at once the use of dark colours, because they absorb the light: red and violet surface *en masse* are not at all favourable to the complexion: light blue is less favourable than green. The colours of paperhangings recommended by Chevreul as producing good and appropriate results are those which present designs of a light tone, either normal or coloured grey; upon a white ground or the reverse, and in which the pattern is at least equal in extent of surface to the ground; for a small pattern has a very poor effect in large rooms. Patterns of two or more tones of the same colour, or those that produce little contrast, are preferable to attractive and glaring designs, which destroy the repose a wall should exhibit. Hangings are made to have very chaste and excellent effects with appropriate borders. We should first consider which harmony we wish to produce—the harmony of analogy or the harmony of contrast. The harmony of contrast is very suitable to surfaces of a uniform pure tint: for instance, a pale yellow ground with a monochrome ornament may be well relieved by purple and white in small quantities, with a little blue; for white surfaces with pale grey ornament, or *vice versâ*, are contrasted well with gold: orange or yellow may also be in tones with a very pure effect.—*Builder*.

THE GASWORKS OF LONDON.

(*Continued from page 179.*)

The production of gas commences the moment the coal is within the heated retort, and before the men can secure the lids a greater or less body of flame appears at the mouth-pieces, characteristic of the energy with which coal gas enters into combustion with air. The quantity of gas obtained from a ton of ordinary gas coal is commonly within the limits of 9,300 and 9,500 cubic feet, although if the distillation were continued beyond the usual period of six hours an additional quantity of gas would be obtained, but of inferior illuminating power. At the Surrey Consumers' works, where the retorts are not worked at as high a heat as is adopted at some other establishments, we are informed that the yield of gas is somewhat below 9,000ft. per ton, the illuminating power, however, being rather above the average. This difference in the rate of production is believed to be due to the mode in which the retorts are set and worked. As described in our last number, the retort benches at Rotherhithe are in two stages, the fires, which are made to act first on the upper stage of six clay retorts, descending afterwards to eight iron retorts below. This arrangement is found to be economical in respect of the quantity of coke consumed in firing, for, whereas, in all, or nearly all, the other gasworks in London, one-third of all the coke, left after the distillation of the gas, is burnt under the retorts, only one-fourth of the whole quantity of coke made is burnt in the Surrey Consumers' Works. The coke left on the distillation of a ton of coal is usually one chaldron of 36 bushels, weighing between 13 cwt. and 14 cwt., or about two-thirds of the original weight of the coal before it went into the retorts. Thus, in the majority of the gasworks in London, one-third of 13½ cwt. or 4½ cwt. of coke is burnt under the retorts for every ton of coal carbonised, the other two-thirds of all the coke made being sold at the rate of say 11s. a chaldron, equal to from 16s. to 17s. per ton. At the Surrey Consumers' works, therefore, hardly 3½ cwt. of coke is burnt for every ton of coal put into the retorts, 10 cwt., or three-fourths of a chaldron, remaining for sale. Every hundredweight of coke saved is worth 10d., but if the saving is attended with a loss in the production of gas, of say 250ft., worth 13½d., the economy must be altogether illusive. It has been said that when Mr. Croll's system of combined clay and iron retorts was in use at the Great Central Consumers' works, the expenditure of coke was sometimes as low as one-eighth of the whole quantity made, or about 1¾ cwt. only for every ton of coal carbonised. However this may have been, and whether or no an average production of gas was obtained, the system has been abandoned, as it is likely to be, also, at the Surrey Consumers' works at Rotherhithe.

The heat on the retorts is commonly maintained between a cherry red and a bright orange, clay retorts being heated considerably above the temperature corresponding to a cherry red heat on iron. By means of sight holes, opening through the brickwork between the retorts, as also by the appearance of the retorts themselves, when opened for the purpose of drawing the charges, the firemen are enabled to judge of their temperature and to regulate the fires accordingly. At the Imperial Gasworks, at least, at the Hackney-road station, the coke is fed red hot from the retorts into the furnaces, although at most gasworks all the coke is quenched.

Our readers will hardly require to be told that, besides gas, tar and ammoniacal liquor are produced in the retort during the distillation of the coal, and carried over into the mains and vessels into which the crude gas first passes. A ton of Newcastle coal will yield, in the ordinary course of gas-making, about ten gallons of tar and an equal quantity of ammoniacal liquor. From cannel coal the quantities of each are about 14 gallons, the yield of gas being 11,500 cubic feet per ton; and from cannel-tar naphtha is distilled. We shall have occasion, however, again to refer to the treatment and value of the residual products in question.

"Drawing" the retorts, at the end of every charge, is simple enough, but in consequence of the heat it is a severe task for the men. At the end of the proper period of distillation, generally six hours, the lids are removed simultaneously from both ends of each bench, the first access of air being attended with the explosion, in a voluminous flame, of the gas remaining in the retorts. The incandescent coke, much enlarged from the original bulk of the coal, and cohering in a single mass, has then to be quickly broken up and raked out upon the retort-house floor, iron rakes with long handles being employed in the work. The return of gas to the retorts is prevented by the self-sealing apparatus in the hydraulic main, to be presently described.

Before leaving the retorts we may notice that the formation of carbonaceous scurf upon their internal surfaces, once the cause of so much trouble in gasworks, is now greatly lessened, possibly in consequence of the general use of exhausting apparatus, whereby hardly any pressure is now maintained in the retorts above the ordinary pressure of the atmosphere. With retorts worked under a high pressure, the deposition of carbon goes on rapidly. The use of double retorts opening at both ends has, furthermore, tended to prevent the accumulation of scurf, as, while the retorts are open for drawing and charging, the uninterrupted flow of air from end to end promotes the combustion of the carbon, thus keeping the internal surfaces of the retorts tolerably clear.

We may now follow the gas in its progress from the retort to the condensing and purifying apparatus. The stand-pipes, or ascension-pipes, from 4in. to 6in. in diameter, rise from the mouth-pieces as already explained, a socket being cast on each mouth-piece, in which the stand-pipe is secured by a rust joint. There is almost always a stand-pipe rising from each end of a double retort, although, in a few works, all the gas made in a 20ft. retort has to find its way out at one end. Where cannel gas is made a good deal of pitch is deposited on the insides of the stand-pipes, and at the Western Gasworks, where the retorts are charged every four hours, the stand-pipes need clearing out every time a charge is drawn.

By proper connections the stand-pipes, which rise 5ft. or 6ft. above the top of the bench of retorts, are bent over and downwards so as to enter the hydraulic main, a tube from 18in. to 30in. in diameter, and extending for the entire length of the retort house, sometimes in front of the stand-pipes, but more commonly behind them. Over a very large number of the retorts at the Pancras station of the Imperial Gasworks a single hydraulic main extends along the middle of the long range of benches, communicating with the ascension-pipes from both ends of each retort. At the Surrey Consumers' works a single main is also used along the middle of the contiguous benches. This plan is not to be recommended, however, as if the main becomes obstructed, the whole works are stopped; whereas, with two mains to each range of retorts, the whole work can be thrown upon one while the other is being cleared out or repaired. In making cannel gas, at least at the Western Gasworks, the mains become choked with pitch in three or four months; whereas, with Newcastle coal, they would not require clearing out oftener than once in as many years. The use of a single main, therefore, in a cannel gaswork, would be attended with some inconvenience, and the long inclined ascension-pipes, also required in that case, would cause additional trouble.

The hydraulic main was formerly made of cast iron, and many cast iron mains are still in use, and possibly some gas engineers still prefer them. They are now, however, very commonly made of wrought iron plates, ⅜in. in thickness. The Phœnix Company was among the first in London to employ wrought-iron mains. Theirs are 2ft. in internal diameter, being circular in section, with the exception of a flat seat at the top for the attachment of the dip-pipes. At the Equitable, the Commercial, the Great Central, the Western, the Crystal Palace District, and, perhaps, at some others of the London gasworks, wrought-iron hydraulic mains are also adopted. The main at the Western Gasworks is made square in section, with removable doors or lids on the back to allow of clearing out the pitch, the rapid deposition of which has already been noticed.

The hydraulic main is half filled, at first, with water, which is retained by a plate or weir fixed in the ends of the main in such manner that, upon any addition to its liquid contents, the excess flows over, through a descending pipe, into a collecting vessel below. The tar brought with the gas from the retorts soon displaces a part of the water, and sinks to the bottom of the main, the ammonia uniting with the rest and floating on the surface, as ammoniacal liquor. Ammonia is a gas formed by the combination of nitrogen with hydrogen, both constituents existing in the coal. Water absorbs ammonia with great avidity, and thus it is that the greater part of the ammonia produced in the distillation of gas-coal is arrested in the hydraulic main.

The dip-pipes enter the top of the main through a tight joint and descend until their open mouths are 2½in. or 3in. below the level of the ammoniacal liquor in the main. Thus the gas can only enter the main by displacing the liquid which, otherwise, would rise in the pipe to the same level on its inside as on its outside, and thus, too, when once in the main, the gas cannot possibly return to the dip-pipe. This simple arrangement was devised, we believe, by the late Mr. Clegg, and it does its author great credit. Known as the water joint, it is applied in the greater number of vessels employed in gas-making, the tar-trap, the condensers, the purifiers, and the gas-holders, in all of which the gas is retained without the possibility of escape by the simple interposition of a few inches of water between the edge of one pipe or vessel and that of another surrounding or enclosing it.

From the hydraulic main to the condenser the gas passes simply through a pipe in connection with a tar-trap for retaining the tar and ammoniacal liquor.

In most of the London gasworks the gas passes from the main at once to the condenser, and afterwards to the exhauster, but at the City Gasworks, the London, the Phœnix, the South Metropolitan, and, possibly, some others, this order is reversed, the gas being exhausted directly from the main. At the several stations of the Chartered Gas Company both the condensers and scrubbers are placed between the main and the exhausters. We will, then, glance first at the condensers, in which the gas drops the tar and ammoniacal liquor, or as much of it, at least, as escapes deposition in the hydraulic main. No one who has been over the nineteen gasworks of London would suppose that there was any sort of rule for the proportion between the condensing surface and the quantity of gas in motion. Something like five square feet of surface for every 1000ft. of gas made in twenty-four hours has been insisted upon by some engineers; but others, we believe, manage with less than one-fourth of the surface which this rule would allow. The greatest differences exist, also, in the mode in which the condensing surface is employed to cool the gas. Thus, at the South Metropolitan works, a circuit of perhaps 120ft. or 150ft. in length of 10-inch pipe is carried to and fro in a cistern of water so intersected by partitions as to produce a gentle flow of water in a direction opposite to that in which the gas is moving. The principle is the same as that of the refrigerators used by brewers for cooling worts. At all the other works vertical condensing pipes, exposed to the atmosphere, are employed, but in occasional instances, as at the Great Central and the Crystal Palace District works, hollow pipes are employed, with the air circulating both outside and inside an annular space; and at many works water is allowed to drip over the pipes, at least, while the sun is out. The pipes are generally coated with gas tar, both as a protection against rust, and because a black colour is the best for a rapid radiation of heat. At the Pancras station of the Imperial Company the condenser consists of 10 columns or pipes, each 3ft. 6in. in diameter, and painted red. There is, we are told, no internal air-pipe, and water is allowed to trickle over the condenser while the sun is out. We believe that the whole make of gas at these great works, sometimes amounting to nearly 5,000,000 cubic feet in 24 hours, passes through this condenser, although its surface, we should suppose, hardly exceeds 3,500 square feet. There are many gas engineers who now object to a rapid condensation of the gas, on the ground that more of the carbon is likely to be precipitated as tar, and the gas thereby impoverished. This view is taken, at least by engineers engaged in cannel gas-making, and we believe it is shared to some extent by makers of ordinary gas.

The tar reservoirs below the condensing pipes are variously made. Sometimes, as at the Ratcliff Gasworks, a separate box is provided for each pair of pipes, but, more commonly, a long box is divided by partitions reaching down nearly to the bottom, the tar, contained in the box, preventing the direct passage of gas from one division to another. The condensing apparatus which, properly performing a given amount of work, and having ample strength and durability, weighs the least, is, one would suppose, the best. The pipes are generally made as thin as they can be safely cast, and the tar boxes require but little more strength than suffices to prevent their being broken by accidental blows. The surface of the tar reservoir itself assists the cooling of the gas, but it is desirable to keep it of a moderate size. With thin castings, the partitions cast in to compel the gas to traverse the full circuit of the pipes no doubt afford a desirable stiffness to the boxes, but otherwise the condenser at the London Gasworks, Vauxhall, would be the simplest and, perhaps, the most preferable of those not having internal air-pipes. Here the bottom box is made without division plates, each pair of pipes being connected, in the open air, by a bend, from which a short pipe descends and passes through the cover of the box, well into the tar within.

In some of the old condensers, with two parallel circuits or rows of pipes, the gas going first through one row and returning by the other, the juxtaposition of a warm and a cold pipe upon the same division of the bottom box has been found objectionable, and hence, where two parallel rows of pipes are used, it is now preferred to take the gas up one pipe in one row and down another in the other row, so that the two pipes rising from any one division of the tar box may have, as nearly as may be, the same temperature.

All the joints about the condenser are made with flanges where required, the pipe joints being spigot and socket, made either with iron rust well caulked, or with yarn and lead.

Those who are familiar with the mode of heating the blast for iron furnaces, might be disposed to wonder at the comparatively low temperature imparted to the gas by the vast extent of highly heated surfaces of the retorts. In the heating ovens of blast furnaces a million cubic feet of air are often heated every hour to a temperature which will "cut lead," and it is occasionally the case that the air-pipes beyond the ovens become heated by the passing blast to a dull red. But, in a range of 150 long retorts, making little more than 50,000 cubic feet of gas per hour, and yet exposing several thousand square of surfaces heated with, say one ton of coke every hour, the temperature of the escaping gas is such that it is often drawn from the main directly through the exhauster, without the least injury to the finished surfaces and delicate spring packing of that apparatus. In many of the condensers, too, even when placed between the main and the exhauster, the socket joints are made with tarred yarn and lead. The explanation of this moderation of temperature in the gas is to be found in the fact that, in the conversion from the solid to the aeriform state, a great amount of heat becomes latent. Were the retorts filled with air, it would soon become excessively heated, and a red heat on the mouth-pieces, lids, and even the ascension-pipes, would be a matter of course. But as soon as a portion of the gas already formed in the retort becomes hot, its heat is in a great measure absorbed by the nascent gas at the same instant issuing from the pores of the coal, and thus the temperature is constantly kept down to a point much below what might be expected if the amount of external heat applied were alone considered.

From the condenser the gas is taken to the exhauster, except where, as already noted, the latter draws directly from the hydraulic main. Mr. Grafton, the original patentee of the clay retort, is said to have been the first to show that, by pumping the gas from the retorts, so as to relieve them from the accumulated resistance of all the water-joints which the gas encounters on its way thence to the gas-holder, the furring of the retorts with carbon was, in a great measure, prevented. This accumulated pressure often amounts to 33in. of water, 28in. being common, when we include the dip of the pipes through which the gas enters the hydraulic main. With exhausters a partial vacuum is often maintained in the main, so that if a small opening be made air will rush in instead of gas coming out. In the retorts, however, a very slight pressure, equal, say, to 1in. or 2in. of water, is maintained, the difference between this plenum and the partial vacuum in the hydraulic main being accounted for by the resistance offered to the gas by the dip of the pipes, say 3in., into the tar in the main.

The first exhausters were reciprocating pumps, a sheet-iron cylinder, open at the bottom, and having a flap valve opening upwards at the top, being made to work up and down, with its lower edge in water, around the rising end of a pipe, admitting the gas, and having also a valve, opening upwards, at its top, the whole apparatus being enclosed in a gas-tight case. Exhausters of this kind are still at work at the Pancras station of the Imperial Company's works. They were very much cheaper in first cost than Beale's exhausters now used; but the old plan finds few advocates now. The friction of the apparatus, although moving freely in water, was found to be considerable, and it imparted objectionable fluctuations to the gas, causing the water-gauge and the lights at the burners to oscillate violently.

Mr. Beale, of Greenwich, produced a rotatory steam-engine, many years ago, which, by way of bantering a distinguished opponent of that class of moters, he named the "Anti-John Scott Russell Steam Engine." A considerable number of these engines are still at work, and there are many besides the patentee who have much faith in their ultimate triumph over reciprocating engines. One of small power drives all the machinery in Mr. Beale's own workshop, at a very trifling cost for repairs, the expenditure of fuel being no more than for any ordinary engine of equal

power. At the South Metropolitan Gasworks one of these engines is employed for driving the exhausters, and another for hoisting coal from the canal boats coming up alongside. But Mr. Beale has found altogether the best market for his engines among the gas companies, who purchase them for exhausters. Every gas company in London, with the exception of the Equitable and the Great Central Consumers', uses them, the motive power, in the majority of cases, being a little upright trunk engine of neat design and fine workmanship, made by Mr. Beale, and fitted up on the same base-plate with the exhauster. At the South Metropolitan Gasworks, however, as already mentioned, one of Mr. Beale's rotatory engines is employed to drive the exhausters, and at the several works of the Chartered and Phœnix Companies, and at the Commercial, Western, and perhaps some other works, they are driven by separate beam engines, generally by Scotch builders, the latter being a fact for which we cannot exactly account.

Mr. Beale's exhauster consists of a stationary cylindrical case, with a horizontal axis, within which revolves a shaft, placed eccentrically with respect to the axis of the case, and carrying two flat plates or pistons adjusted to fit accurately to the internal surface of the case. The principle is identical with that of the majority of rotatory engines and pumps. The tarry particles which, even after the gas has passed the condenser, follow it to the scrubbers, keep the wearing surfaces of the exhauster well lubricated.

The exhausters are generally placed by themselves in an apartment making considerable pretensions to elegance. In one respect, therefore, those who delight in strong contrasts might derive much pleasure from a visit to some of the great gasworks of London,—let us say the Pancras and Hackney-road stations of the Imperial Company, or the Commercial Gasworks at Stepney. From the smutty interior of the retort house, and from the ammoniacal stench of the out-door premises generally, to say nothing of the overpowering fumes from the sulphate of ammonia apparatus in works provided with that profitable adjunct, the visitor may retreat into an apartment fit for a nobleman's dining-room, well ventilated and bearing evidence, on all sides, of an amount of taste and scrupulous neatness which, the commercial man would conclude, were strangely misapplied in a gasworks. We will not mention the works, but there are a number, and among them some of the most profitable gas-making concerns in the metropolis, where, instead of being the glory of the establishment, the exhausting-room is its disgrace. But let us pass on, merely noting that the exhausters are generally worked with a partial vacuum, corresponding to 1in. or 2in. of water below the atmosphere on one side, and against a pressure of from 24in. to 30in. on the other.

At most of the gasworks of the metropolis scrubbers are employed, a few, as the London, the Phœnix, and the City, having washers, the London, at Vauxhall, having no scrubbers, while the two others named have both scrubbers and washers. In the scrubber the last particle of tar is supposed to be taken up, and the means for arresting this impurity consist of a thick layer or a series of layers of coke contained in a close vessel, and exposing a great aggregate surface to the gas. At the Phœnix works broken crockery-ware is preferred to coke, as, after having become coated with tar, the former may be thoroughly cleansed by turning, when required, on a blast of steam for a few minutes, which melts and separates the tar, leaving the broken dinner-plates and old bottle glass to be used *ad infinitum*. In many works, the coke is constantly sprinkled with water, admitted through two or more tubular radial arms, revolving, by the reaction of the water, in the manner of the arms of a Barker's mill, the water being discharged through a number of small holes, as in the spargers used by the brewers for washing the extract out of the mashed grains of malt. At the Horseferry-road station of the Chartered Gas Company, the gas is subjected to three separate scrubbings, at different stages in the whole process. Here, however, the scrubbers are lined with lead, and the liquid employed in them is diluted sulphuric acid, first admitted at a specific gravity of 1·030, and worked over and over the coke until the density has risen to 1·210, when a fresh solution of acid is substituted. For one of the large scrubbers somewhere about 300 gallons of dilute acid are employed at a time, a pump made throughout of lead, mixed with a little antimony to give hardness to its substance, being used to pump up the acid from the bottom and into a reservoir at the top, whence it falls again, streaming through a lead plate perforated with a great number of small holes. The acid solution becomes in this way saturated with the ammonia present in the gas, and is then evaporated for sulphate of ammonia, a salt in request by alum and manure manufacturers, and bringing from £13 5s. to £13 10s. a ton, the commercial sulphuric acid employed in the process costing about £7 a ton. The ammoniacal liquor is treated also for the manufacture of the same salt. A similar apparatus is employed at the Crystal Palace District works. At the London, and at the Surrey Consumers' works, the ammoniacal liquor from the main is first boiled in an iron boiler, and what goes over is taken into a lead tank, where it is saturated with its equivalent of sulphuric acid, and evaporated by steam contained in lead pipes which are made to traverse the tank close to the bottom. At most or all of the other works the ammoniacal liquor is sold to the manufacturing chemists. At the City Gasworks, where both scrubbers and washers are used, the latter are supplied with a solution of hydrochloride of manganese to the strength of 32 on Twaddel's hydrometer, and after this solution has become saturated with ammonia it is sold to the chemists, who evaporate it for sal-ammoniac (chloro-hydride of ammonia).

Those curious as to motors may be interested to know that, at the City Gasworks, the agitators in the washers are worked by an overshot water wheel, for which the water is pumped up, at high tides, by a steam engine. The washers require to be constantly in motion, and, were they driven by steam, an engineman would have to be always in attendance. As it is, the engine pumps up enough water in a few hours to supply the wheel for a whole day. The wheel is not far from 25ft. in diameter, but exceedingly light, and the water is let on to the top buckets through three pipes, each perhaps 1in. or 1¼in. in diameter, and placed one in advance of another, so as to discharge into three buckets at the same time. The work to be done is very light, the agitators, once in motion, taking the liquid around with them, and which, indeed, only requires to be kept in motion to prevent the deposition of the hydro-chloride of manganese in solution.

Another curious mode of obtaining power was resorted to some years ago, at the Johnstone Gasworks, near Glasgow, a small fan being placed in the chimney, where it was worked by the strong draught, and thereby made effective as a motor for driving the exhausters.

(To be continued.)

INSTITUTION OF CIVIL ENGINEERS.

March 18 and 25, 1862.

John Hawkshaw, Esq., President, in the chair.

The paper read was a "Description of Works at the Ports of Swansea, Silloth, and Blyth." By Mr. James Abernethy, M. Inst. C.E.

The author stated that he proposed to give an account of the past and present history of these ports, so far as it possessed engineering interest, and to describe the works connected with them, rather with a view to the elucidation of general principles than of entering into matters of detail.

The port of Swansea was situated in the centre of an extensive bay, at the embouchure of the river Tawe, up which the tide flowed for a distance of three miles; but, as the ordinary flow of the river was trifling, the maintenance of the channel was chiefly dependent upon the ebb and flow of a large body of tidal water between the piers. Previous to the year 1791, there were only a few insignificant wharves near the mouth of the river, and there was a bar at the entrance, over which the depth of water did not exceed from 16ft. to 17ft. at spring tides. The effect of the construction of the piers, which still remained as they were completed, in the year 1800, from the designs of Captain Huddart, F.R.S., had been to lower the bar and to drive it further out to sea; so that, in 1831, the depth of water had been increased to 20ft. The eastern pier was 1,340ft., and the western was 580ft. in length. The author then alluded to the report submitted to the Harbour Trustees by Mr. Telford on the 5th of February, 1827, in which he recommended that the old and a proposed new channel of the river should be converted into floats, as well as to the opinions of several other engineers, including Mr. Jesse Hartley, who, in 1831, suggested that a new cut should be made for the river, which was to be "canalised" by the construction of a weir across the mouth, and that the town reach should be appropriated to a dock and half-tide basin. In the following year Mr. Hartley, in a further report, adhered generally to his former plan, but advised, in addition, the deepening of the harbour by dredging. Fortunately, in the author's opinion, the works for the "canalisation" of the river were not carried out. A new channel was, however, commenced in 1840, and completed in 1844, at an expense of £23,000. Its effect had been to lessen the risk to shipping, and, by giving a better direction and greater force to the outgoing current, to improve the navigation. In 1845 Mr. Rendel was consulted as to floating dock accommodation; and under his direction, the construction of an entrance, with a double cill, was proceeded with, as a preliminary step to the conversion either of the river or of the town reach into a float; but of this work the masonry alone was executed.

In his first report to the trustees, in February, 1849, the author proposed the formation of a dock on the site of the town reach, or old bed of the river. It was subsequently determined to construct a dock and half-tide basin, of the respective areas of 11 acres and 2¾ acres, with a lock entrance to the dock 160ft. long and 56ft. wide, and an entrance to the half-tide basin, 60ft. in width, having a depth of water over the cills of 22ft. 6in., and 25ft. 6in. at high-water of ordinary spring tides. A small lock connected the Swansea Canal with the float, and another, at the head of the float, communicated with the various works on the banks of the river above. A small dock leading from the float, with an extensive range of warehouses round its margin, was also constructed at the same time for the Duke of Beaufort. The works for the lock and float were commenced in November, 1849, and completed in December, 1851; those for the half-tide basin were begun in 1856, and were finished early in 1861. The total cost of these works, exclusive of the quay walls, had amounted to £95,688. In addition, the lower portion of the river to the pier heads was straightened, and both it and the new cut were deepened by dredging. By these means the depth of the entrance channel had been increased four feet since 1850. There was nothing peculiar in the construction of their works, but their execution was attended with some difficulty, as a large portion had to be performed by tide work, with as little interruption as possible to the trade of the port. The foundations varied from hard concreted gravel to soft sandy clay, extending to a considerable length.

The most important work connected with the port of Swansea was the range of floating dock accommodation called the South Dock, which was formed on the foreshore of the sea beyond high-water mark. An Act was obtained, in 1847, for the construction of this dock, according to a design furnished by Mr. T. Page, M. Inst. C. E. In 1850 the author was requested to make the necessary plans for a trumpet-mouth entrance basin, having an area of three acres; for a half-tide, or outer-dock, entrance, 70ft. in width, with a single pair of gates, having a depth of water over the cill of 24ft.; for a half-tide basin, or outer dock, containing an area of four acres, with a depth over the cill of 25ft. 6in.; for an entrance lock, 300ft. long and 60ft. wide, divided by intermediate gates so as to form a greater or a smaller lock, with an average depth over the inner cill of 22ft. 6in.; and for a dock having an area of thirteen acres, with a depth of 24ft. Considerable progress had been made with these works, when they were suspended, in 1855, for want of funds. They were resumed in 1857, and were completed in 1859, at a total cost of £169,073. One of the first operations was the formation of an embankment to exclude the sea. Careful observations showed that the main action of the sea and the set of the tides were to the eastward, towards the Mumbles headland. It was, therefore, decided to construct a series of timber groynes, at intervals of 1,500ft., extending from the shore to the line of the proposed embankment. Rough boulder gravel, found immediately under the sand and the made ground, was tipped between the seaward-ends of the groynes, until a shingle beach, of great depth, was gradually formed, which served as a face to the embankment, and proved an effective barrier to the encroachments of the sea. The centre of the embankment was composed of the clay and peat found in the excavations, so that something like a puddle dyke was formed, and very ordinary means were sufficient to keep down the accumulation of water within the works. When the sea embankment had advanced some distance, the masonry of the dock walls was proceeded with. These walls consisted of rubble, with coursed rubble facework to a height of two feet below the general level of the surface of the water in the dock. They were faced in the upper part with ashlar, projecting three inches beyond the rubble facework. They were backed with the lightest and driest material that could be procured, in layers forming an angle from the wall, and rubble drains, with pipes for carrying off any spring, or upland waters, were placed at intervals in the walls. In no instance had any failure taken place, although the walls were subjected to a severe test; inasmuch as they were nearly completed when the works were suspended, and, on their resumption, the dock and outer basin were found to have become filled with water. Details were then given of the lock and entrance, from which it appeared that they were constructed, generally, with elliptical inverted arches of rubble, the quoins and floors, or platforms, being of sandstone ashlar, obtained from the coal measures in the neighbourhood. The pointed cill stones and the hollow quoins were of greenstone and syenite, from the Carling Nose and Mount Barnton Quarries, near Edinburgh. The cill stones were carefully toothed and bonded into the floor stones, so as to avoid a long straight joint. The recess and side walls were of rubble, with ashlar facework in the upper portion, similar to the dock walls, but the wing walls were faced throughout with ashlar. The filling and discharging culverts were of brickwork. The sluice frames and paddles were of cast iron, faced with brass. In the lock and entrance gates the heel mitre posts and the lower rib were of the best teak and English oak, and the ribs and planking were of pitch pine. Across the lock there was a swivel bridge, in one leaf, consisting of two wrought-iron tubular girders, with a superstructure fitted for railway or road traffic. There being no backwater, the waste from lockage was supplied by a steam centrifugal pumping engine of 24-horse power.

The successful application of hydraulic power for working the usual hand gear at the float lock, and at the lock at Newport dock, with much heavier gates, determined the author to adopt the same plan at the new dock entrance, as, in case of any accident happening to the hydraulic machinery, the usual means were then always available. As it was of the utmost importance in the shipping of Welsh coal that as little breakage as possible should take place, the hydraulic drops, or hoists, were so constructed as to deliver the coal into the hold of any class of vessel immediately at the hatchway, allowance being also made for the difference in size of the broad-gauge coal wagons, the weight of which varied from 14 to 19 tons. The various machines employed for opening and shutting the gates, bridges, and sluices, for working the capstans, for discharging ballast, and for loading coal, as well as for the shipping and discharging of general cargoes, were upon Sir William Armstrong's hydraulic system, having accumulators equivalent to an effective pressure of 750 lb. per square inch. High-pressure direct-acting steam engines of 80, 30, and 12-horse power were used at the Swansea Docks, the distribution of power being regulated by self-acting arrangements in connection with the accumulators, apportionted in each case to the powers of the machines at present erected. At the float lock each line of shafting was driven by a small water pressure engine placed near the middle; but owing to the length of the lock at the new dock, and other minor circumstances, the line of shafting was broken, and was driven by two separate hydraulic engines on each side of the lock. The time employed in opening or closing the gates was about two minutes and a half, which was as great a speed as could be adopted with safety to the gates. The sluices were worked direct by a piston and plunger placed immediately above them. The wrought-iron swing bridge was turned in and out by means of two hydraulic cylinders acting in opposite directions, and attached to a drum beneath the bridge by means of a chain. The bridge could be opened or shut in one minute and a half. The ballast cranes were each capable of discharging from 350 to 400 tons per day. Coal was brought up for shipping on two distinct systems. In one it was carried in end-tipping wagons, and in the other in wrought-iron boxes with false bottoms, each holding 2½ tons, and four being placed upon one truck. About 1,000 tons per day could be shipped by each machine; and both could deliver the coal on board at a faster rate than the "trimming" in the hold of the vessel could be accomplished. The machine for delivering the coal from boxes was placed above that for discharging the end-tipping wagons, and both were commanded by one man. By this combination a cone of coal could be formed in the hold of the vessel by lowering the boxes through the hatchway, and then upon this cone the remainder could be delivered from the shoot in connection with the wagon-tipping arrangement. Details were then given of the mechanism by which the hoists were worked, from which it appeared that, when a loaded wagon was run on to the rails of the tipping frame, the cradle on which it rested was either raised or lowered to the level of the shoot as might be necessary, having a range of 21ft. for that purpose. The catches of the wagon door were then knocked out, and the pressure applied to the tipping frame. The empty wagon was brought back to the point where the rails of the traverser on the cradle and the staith met. The catch securing the traverser to the cradle was then liberated, and the wagon was allowed to run down to the return line, on to which it was pushed. The traverser was next hauled back to the cradle by a ram, and lowered to the point, defined by self-acting stops, where the full wagons were taken on. The system pursued in discharging from the boxes was then minutely described.

With respect to the work performed by the hydraulic machinery, and its costs, it seemed that, during the year ending October, 1860, the actual expenditure for engine power had been £22 16s. 1d. per week, or at the rate of 0·26 of a penny per cubic foot of water used for pressure. The cost of working was—by the cranes nine-tenths, by the combined drop five-tenths, and by the wagon drops four-tenths of a penny per ton. But inasmuch as the engine power was never fully employed, this statement must not be received as conclusive, as regarded the capabilities of the machinery. With the 80-horse power steam engine it was believed that 100,000 cubic feet of water could be pumped per week, at a cost of £30, or at the rate of 0·072 of a penny per cubic foot of water; and that of this quantity 80,000 cubic feet would be available for working the cranes and the coal drops at a cost, for the hydraulic power alone, of about one farthing and one-seventh of a penny per ton respectively.

The commercial effect of the construction of the dock works and of the general improvement of the harbour was shown by the great increase in the tonnage of vessels frequenting the port. In 1851, on the completion of the first, or north dock, this amounted to 209,454 tons only. In 1860 it was 584,355 tons, and, during the year 1861, the foreign tonnage had increased ten per cent., and the trade was likely to extend, owing to improved communications with the steam-coal and the iron-producing districts, as well as with the heart of the kingdom.

As a detailed description of the works constructed at the entrance of the port of Blyth had already been communicated to the Institution by Mr. M. Scott, M. Inst. C.E., the author only alluded to the change which had taken place in the condition of the channel since the year 1854. It was then exceedingly tortuous, in many places dry at spring tides, and the entrance was obstructed by a spit of sand. As the channel ran, for its entire length, parallel with a lee-shore, exposed to the direct action of north-easterly seas, scarcely a winter passed without vessels being wrecked on the beach on the southern side. To remedy these evils, an eastern breakwater, 4,500ft. in length, and a western half-tide training wall, 4,060ft. in length, had been constructed, and the channel had been straightened and deepened by dredging, at a total cost of £67,320. In designing these works the author was guided by experience obtained at Aberdeen harbour, the entrance to which was similarly situated. The result of the construction of the works at Blyth was, that the outgoing current had been increased to a velocity of five knots per hour, at its greatest strength, whereas formerly it was lost immediately on passing the line of the foreshore. The bar, or spit of sand across the entrance, had been entirely removed, and there was now a depth of eight feet or nine feet at low water immediately opposite the breakwater. The depth throughout the channel had been increased four feet, and vessels, after passing the breakwater, were effectually protected from the action of north-easterly or on-shore gales.

In the year 1854 an Act was obtained, after considerable opposition in Parliament, for the construction of works at Silloth, on the Solway Frith, the general design of which was stated to be due to Mr. John B. Hartley, M. Inst. C.E, although the direction of their execution was intrusted to the author. The works comprised a pier, or jetty, 1,000 feet in length, on the seaward side of the dock entrance; an entrance channel parallel with the jetty 100ft. in width at the bottom, which was generally sixteen feet below the level of the adjoining beach, with side slopes of 6 to 16, and a fall of 2ft. 6in. in its entire length; an embankment on the foreshore, projecting 400ft. beyond high-water mark, and inclosing

the entrance to the dock, which was 60ft. in width, with a depth of water over the cill of 24ft. at high water ordinary spring tides; and a dock containing an area of four acres, with a depth of 25ft. 6in. A general description was then given of the principal peculiarities of the tidal and other features of the estuary. The navigation at Silloth Bay had remained unchanged for a long time, and the anchorage within it afforded good holding ground, and was sheltered by sandbanks from the action of heavy westerly seas.

The objections which were urged against the scheme were then stated, and contrasted with the results which had followed the completion of the works. It was considered that the flowing current might be deflected to the English side, and would there form the principal navigable channel; and it was believed that, if a training work was constructed below Annan point, accretion would take place on the upper part of Powfoot sand, and a constant navigable channel would be maintained from Annan to Silloth. The works indicated that great care must be exercised in projecting solid moles from the foreshore of an estuary, on any sandy coast, as an entrance to ports. The sea channel, formed inside the jetty, had proved successful, and its maintenance was no longer a matter of doubt, as the depth and the sectional area remained the same as on its first formation two years back. With respect to the construction of the docks, by the aid of wells sunk on the site of the works, and a moderate degree of pumping power, the sand and gravel of which the excavation consisted were drained, and by the aid of sheet piling and concrete no difficulty was found in making good foundations.

The entrance gates, cranes, and coal hoists were worked by hydraulic machinery similar to that at Swansea and at Newport, except that the coal hoists were exceptional, and deserved special notice, as involving the question of the relative capabilities and advantages of a high or a low level system for loading coal. The author believed that, although there might be situations where the former system must be carried out, yet that, at such places as Silloth and Newport, the low level system was superior, both for convenience and economy; as the cost of high level erections was avoided, siding accommodation could be afforded with greater facility and at less cost, while the quays were unencumbered, except by the spaces required for the hoists. The quantity of coal that could be put on board was only limited by the amount that could be trimmed in the hold of the vessel. The cost had been found to aproximate to that at Swansea, one farthing per ton. The hoists, which were constructed to receive both tipping and hopper wagons, were then minutely described, and it was stated that the total cost of the works which had been executed at Silloth from 1856 to 1859 had amounted to £122,000.

INSTITUTION OF NAVAL ARCHITECTS.

March 27th, 1862.

ON THE "MANUFACTURE OF ARMOUR PLATES"

By Captain J. FORD.

THAT the British navy must be re-constructed by the substitution of armour-plated ships of war for its old wooden walls is now universally admitted.

It becomes, therefore, a most important question, What is the best method of manufacturing the armour plates?

The subject was first brought under the consideration of the writer when the Thames Ironworks Company received the order for building the "Warrior," and it became a question with the firm whether they should erect steam hammers for the purpose of forging, or increase the power of their mills for rolling the plates.

At that period, after careful consideration, the conclusion was adopted, that the plan of hammering would produce the best results, and subsequent experience has, in the opinion of the writer, fully borne out that view.

That the best material for these plates is iron appears to be established by all the experiments which have been made; many trials of plates of homogeneous metal or steel of various descriptions have shown that, although thin steel plates have resisted shot better than iron ones, when the thickness was increased beyond ¾in., there was visible inferiority, and the thicker plates altogether failed.

Two qualities in the iron appear to be of prime necessity—toughness and solidity. If the iron is hard and brittle, it is easily cracked and broken by the shot; if unsound, either from blisters or lamination arising from imperfect welding, the power of resistance is proportionately diminished. It has been conclusively proved that any given thickness of iron, if composed of layers of thin plates, has very little resisting power in comparison with the same thickness of solid plate, and a plate apparently solid, but imperfectly welded, exhibits the same weakness.

The process of rolling plates 4½in. thick has been described by the head of the eminent firm of Messrs. Brown and Co., of Sheffield, in a paper read by him at the Institution of Mechanical Engineers, Birmingham, as follows:—

Bars 12in. broad, 1in. thick, are first rolled; five of these are then piled and rolled into a rough slab; two of these slabs are rolled into a plate 1½in. thick; four of these plates are then piled and rolled into a plate 2½in. thick; and, finally, four of these 2½-in. plates are piled and rolled into the finished plate.

The hammered plates manufactured at the Thames Ironworks are made in the following manner:—Scrap iron of the best description is carefully selected and cleaned, piled, hammered into a bloom, and then rolled into bars 6in. broad, 1in. thick; these bars are cut up, piled, and again hammered into a slab; several of these slabs are put together, heated, and hammered to the form required, and this process being repeated, the plate goes on gradually increasing to the length required.

In the manufacture of the best hammered plates there is no mystery; it depends simply on the selection of the best material, and the employment of the most skilled and careful workmanship.

The writer confidently believes that scrap iron, rolled and hammered as before described, is decidedly the best material, and superior to any description of the puddled iron from which all the rolled plates are understood to be made. That the toughness of iron is dependent greatly upon the amount of working it undergoes cannot be doubted. This working has already been given to a great extent to scrap iron, and the process of rolling it into the 6-in. bars, which are the raw material of the future plate, gives it a degree of toughness and fibre which it appears to retain through all the subsequent heating and hammering.

The tendency of hammering to harden does not take away this toughness, and the process of annealing restores much of what is lost. Numerous experiments on single plates which have been fired at, and close observation in the drilling, planing, and bending of the large quantities of plates which have been hammered in this manner, have shown that the brittleness which has been attributed to hammered iron is entirely avoided, and that the toughness of the iron is superior to that of the best rolled plates which have hitherto been produced. Solidity and freedom from blisters or lamination is unquestionably more certain in the hammering process; and when it is considered that to produce a rolled plate 160 thicknesses of iron must be perfectly welded at every point throughout the finished plate, under penalty of there being lamination, the frequent occurrence of this evil would seem to be inevitable; the presence of dirt between any two layers, or the failure to reach a welding heat in any part of the centre of the large masses which have to be dealt with, being certain to produce this fatal result.

It must also be remembered that as the hammered plate is gradually built up of the slabs before described, a comparatively small portion of the mass requires to be placed in the furnace and heated at one time, while in the rolled plate the final pile, 10in. in thickness, and weighing six or seven tons, must be brought to a welding heat at once, and the operation of rolling completed before this heat is lost. To obtain this heat throughout the mass without burning the edges most exposed to the fire can hardly be counted upon as a uniform result, and when this has been accomplished, any delay in dragging it from the furnace, getting it to the rolls, forcing it between them, and completing the rolling process, will spoil it, and the loss, even of a few moments, may be fatal to the success of the operation.

These difficulties, of course, increase with the thickness and weight of the plates; the foregoing observations are made with reference to plates 4½in. thick, such as are on the sides of the Warrior and her companions; but when, as in the case of the Minotaur and her sister ships now building, the thickness of the plates is increased to 5½in., it may well be doubted if these difficulties can be successfully overcome in the rolling process.

It will not, perhaps, be out of place, to refer to the return made to an order of the House of Commons, dated May 17th, 1861, of the mode of manufacturing the armour-plates of the Warrior, and three of her companion ships, and the number of plates condemned in the process of manufacture, with the reasons for their condemnation. The Warrior's plates, about 950 tons, were all hammered, and only five plates proved faulty in the process of manufacturing. Of the plates for the Defence and Resistance, together about 1,200 tons, all but six were rolled; forty-five were condemned for being blistered, laminated, or over-heated; and of the plates for the Black Prince, 950 tons in all, of which about 100 tons were rolled, and the rest hammered, ten rolled plates and thirty-two hammered plates were condemned. It is to be observed, however, that in the manufacture of the hammered plates for the "Black Prince," the whole operation was performed under the hammer, and the process of rolling the initial bloom into 6-in. bars was admitted. It is understood that, in the hammered plates which have failed comparatively under trial, this preliminary rolling has not been adopted, and to this, to some extent, their failure to stand the test may be due.

The experiments made at Shoeburyness by the Plate Committee on plates of various thicknesses, and upon the Warrior and other targets, have not yet been reported on by the committee; but it is understood by the writer, who by the courtesy of the committee has had the opportunity of observing many of the experiments, that those manufactured as described at the Thames Iron Works have exhibited uniform and superior excellence, which has also been exemplified in all the trials of sample plates selected by the Government officers, and fired at at Portsmouth.

The attempt has recently been made to effect a combination of the two processes of hammering and rolling; the slab 10 in. or thereabouts in thickness being forged under the hammer, then heated *en masse*, and rolled in the same manner as the pile, forming the final process described for the rolled plate. To this the writer objects that this plan involves the serious difficulties already adverted to as consequent on the heating and rolling of so large a mass. Thus far experiment confirms this opinion, as the plates manufactured in this manner have proved under trial greatly inferior both to the rolled plates and those hammered at the Thames Ironworks.

In the minor qualties of smoothness of surface and uniformity of thickness, it may be observed that the hammered plates are quite equal to the rolled, and, with respect to cost of production up to the thickness of 4½in., the market price of hammered and rolled plates is the same; but, if the thickness and weight be increased, the cost of rolling will without doubt be seriously enhanced, while that of hammering will remain but little, if at all, altered.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

March 18th, 1862.

J. C. DYER, Esq., Vice-President, in the Chair.

DR. JOULE made a communication "On the Probable Cause of Electrical Storms."

The very close correspondence between the theoretical rate of cooling in ascending, and the actual, indicates a rapid transmission of the atmosphere from above to below, and *vice versâ*, continually going on. We may believe that during thunderstorms this interchange goes on with much greater than ordinary rapidity. At a considerable distance from the thundercloud, where the atmosphere is free from cloud, the air descends, acquiring temperature according to the law of convective equilibrium in dry air. The air then traverses the ground towards the region where the storm is raging, acquiring moisture as it proceeds, but probably without much diminution of temperature, on account of the heated ground making up for the cold of evaporation. Arrived under the thundercloud, the air rises, losing temperature, but at a diminished rate, owing to the condensation of its vapour to form part of the immense cumulus cloud which overcasts the sky on these occasions. The upward current of air carries the cloud and incipient rain drops upwards, but presently, in consequence of the increased capacity of the mass from the presence of a large quantity of water, the refrigeration of the air, in consequence of its dilatation, will be so far diminished as to prevent the condensation of fresh vapour, and ultimately to redissolve the upper portion of the cloud. This phenomenon, which has been noticed by Rankine in the cylinder of the steam engine, will account for the defined outline of the upper edges of cumulus clouds. The upward current no doubt extends occasionally to regions below the freezing temperature. If cloud be carried with it, snow or hail will be formed, which, if sufficiently abundant, will pass through the cloud and fall to the ground before it is melted. Now, the dry cold air in which the snow and hail are formed is a perfect insulator. Ice has also been proved, by Archard, of Berlin, to be a non-conductor and an electric. Even water, in friction against an insulator, is known from the experiments of Armstrong, explained by himself and Faraday, to be able to produce powerful electric effects, and this fact has been suggested by Faraday to explain powerful electric effects in the atmosphere. Sturgeon has noted the remarkable development of electricity by hail showers. Few heavy thunderstorms occur without the fall of hail. Hail, whether in summer or winter, is almost, if not invariably, accompanied with lightning In the presence of these facts it seems not unreasonable to consider the formation of hail as essential to great electrical storms; although, as has been pointed out by Professor Thomson, very considerable electrical effects might be expected from the negatively charged air on the surface of the earth being drawn up into columns, and although, as the same philosopher has observed, every shower of rain gives the phenomena of a thunderstorm in miniature. The physical action of insulators and electrics in mutual friction must certainly produce very marked effects on the grand scale of nature. If we suppose that the falling hail is electrified by the air it meets, the electrification of the cloud into which the hail falls might thus be constantly increased until the balance between it and the inductively electrified earth is restored by a flash of lightning. If the hail is negatively electrified by the dry air with which it comes in contact the latter will float off charged with positive electricity, which may account for the normal positive condition of the atmosphere in serene weather, as well as the electrification of the upper strata evidenced by the aurora borealis. The friction of wind has been supposed by Herschel to contribute to the intense electrification of the cloud which overhangs volcanoes during eruption.

Dr. Calvert also read a paper "On the Employment of Galvanised Iron for Armour-plated Ships."

The author stated that no doubt many gentleman present were acquainted with the fact that he had been for some time past engaged in ascertaining the chemical composition of various woods employed and susceptible of being employed in the navy. On a recent visit to one of the dockyards he found that while the armour-plates were fixed against a layer of teak, the ribs of the ship were of oak, and that the iron bolts which were to fasten the plates were to pass through the oak ribs. It occurred to him that the inconvenience which would probably result from the action of the oak upon the iron might be obviated by substituting galvanised iron bolts for those now in use, and he therefore instituted a series of experiments, the results of which he had great pleasure in laying before the meeting.

The first series of experiments consisted in having driven through large pieces of oak, bolts and screws of iron and galvanised iron prepared by his friends, Messrs. Richard Johnson and Brother, of Dale-street, Manchester, which were then immersed in soft and sea water for the last three months. The results clearly showed, first, that the friction did not remove the zinc from the galvanised iron; secondly, that the oak and galvanised bolts were unchanged; whilst in the case of the iron bolts they were much rusted, and the pieces of oak had become quite black by the formation of tannate and gallate of peroxide of iron. During the experiments the waters were changed every week, and those containing the galvanised iron appeared unchanged, whilst in the case of the iron, they had a dark blue-black appearance, owing to the formation of gallate and tannate of iron.

In order to ascertain the comparative action of soft and salt water upon iron and galvanised iron when in contact with oak under identical circumstances, he made the following series of experiments.

Plates of galvanised iron having 18in. of surface lost during three months the following weights:—

	SOFT WATER.	SEA WATER.
Plate No. 1	0.10 grains.	
,, No. 2	0.11 ,,	
,, No. 3		6·095 grains.
,, No. 4		0·090 ,,

Similar plates of iron lost during the same time:—

	SOFT WATER.	SEA WATER.
Plate No. 1	1·23 grains.	
,, No. 2	1·52 ,,	
,, No. 3		2·40 grains.
,, No. 4		2·28 ,,

There can therefore be no doubt that galvanised iron offers great advantages, the action of water on it being less than a tenth of the same action on ordinary iron. As there is no doubt that iron when galvanised is in the most favourable electrical condition to resist the action of oxygen, being in an electro-negative condition, it follows that in all probability the use of galvanised iron would be very advantageous in armour-plated and other iron ships. The author hoped that Government and other large ship builders would avail themselves of this suggestion, and make experiments on a large scale to verify the results he had obtained.

MANCHESTER ASSOCIATION FOR THE PREVENTION OF BOILER EXPLOSIONS.

AT the last ordinary monthly meeting of the Association, held at the offices, 41, Corporation-street, Manchester, on Tuesday last, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the last month there have been examined 388 engines, 2 specially; 514 boilers, 10 specially, 8 internally, 51 thoroughly, and 445 externally, in which the following defects have been found:—Fracture, 11 (4 dangerous); corrosion, 28 (1 dangerous); safety valves out of order, 8; water gauges ditto, 15; pressure gauges ditto, 13; feed apparatus ditto, 2; blow-off cocks ditto, 56, (2 dangerous); fusible plugs ditto, 2; furnaces out of shape, 14 (5 dangerous); total, 140, (12 dangerous). Boilers without glass water gauges, 17; without pressure gauges, 7; without blow-off cocks, 53; without back pressure valves, 87; while a single boiler was found without any independent safety-valve, having only the limited use of one in partnership with another boiler, the connection to which depended on the junction valve being open.

"An explosion of a most fatal character, resulting in the loss of no less than six lives, has happened during the past month; while another, which took place in the preceding one, in addition to the five referred to in the last monthly report, occurred to a locomotive boiler, in consequence of the plates being internally corroded to ¼in. in thickness. Not one of these boilers, however, was under the inspection of this Association.

"In the first of the above cases the boiler was a vertical one, and had been at work for eight years. It was set so as to utilise the waste heat of one or more iron furnaces, the flames from which first surrounded its lower half, and then passed into a central internal-descending flue through openings in its side. Its outer shell was egg-ended in shape, the height being 21ft. 3in., the diameter 9ft., and the thickness of the plates ⅞ths. In the internal-descending flue the diameter was 4ft. 8in., and the thickness of the plates ⅝in. all over. The crown, which was attached to the flue by means of an angle iron only ⅝in. thick, was formed by two plates, a seam of rivets running across the centre, and was stated to have been cambered about 4in., upon which—since it was not strengthened by any stays whatever—it entirely depended for stiffness and power to resist the downward strain tending to collapse. The boiler had been fitted with two safety valves, loaded to about 50 lb. on the square inch, one of them a dead weight valve, and both of very ample area, the diameter of each being 6in.; also there had been a self-acting alarm float, with other necessary gauges and feed apparatus.

"I examined the boiler the day after the explosion had happened, and found that it had flown upwards through the roof of the building, when, being caught with a strong north-east wind blowing at the time, it had been carried a considerable distance, and landed on an adjoining mound of earth. It is probable that, had there been less wind, it would have fallen on the building, and thereby not only have crashed in the roof and machinery in its fall, but added considerably to the loss of life. As the explosion occurred just at daybreak, no reliable observations were made of its flight; but, from the chimneys it cleared in its course, it must evidently have soared to a considerable height.

"It is remarkable that five out of eight weights of flat disc, or cheese shape, with which the direct acting safety valve had been loaded, retained their position on the boiler throughout its flight, although they had no other attachment than the stability afforded by the safety valve as a base upon which they were piled. Judging from the position in which they lay, they appear only to have broken away on the shock of the boiler coming to the ground.

"The cause of the explosion was apparent at a glance. The entire crown of the vertical-descending flue had been blown out, the angle-iron by which the crown was attached to the sides of the flue being rent at the root completely round the whole circle. The two circular seams of rivets in this angle iron were both undisturbed; one retaining a part of it on the cylindrical sides of the flue, while the other held the remainder to the crown plate, with which it was carried away entire.

"Evidence was adduced at the inquest to prove that the failure of this angle iron resulted from overheating of the plates, consequent on shortness of water; the line of argument adopted being that no pressure the boiler could have sustained would have been sufficient to have shorn the angle iron unless red hot, and experiments were instituted which were stated to prove that nothing less than a pressure of 1,260 lb. on the square inch could have rent the boiler as it had been, unless the plates had been heated from shortness of water. The jury brought in a verdict of manslaughter against the attendant, on the ground of negligence, and he was consequently committed for trial at the approaching assizes.

"I beg to differ most decidedly from the above evidence, and to take the following view of the failure of the angle iron, which will be readily understood by those of our members who have watched the tendency of the front plate in their double-flued boilers to groove. The total pressure on the crown-plate was about 50 tons, the whole of which had to be borne by this ⅝-in. angle iron, which was much too light for the duty. This load would vary with every alteration in the pressure of the steam, and be entirely removed when the boiler was at rest, and re-imposed when the steam was again got up. These constant variations of load would produce an alternating movement in the angle iron, which would fret and rapidly deteriorate it, rendering fracture ultimately inevitable, and its occurrence merely a matter of time. It is to this cause, continued incessantly through eight years—the life of the boiler—that I attribute the failure of the angle iron, and consequently the explosion, and not to shortness of water.

"I cannot doubt that an application of the hydraulic test would

have detected this weakness in the angle iron in time to have prevented the explosion, the occurrence of which affords an illustration of the hazard of trusting so much to a single angle iron; and the fact of 99 having proved trustworthy is no guarantee that the hundredth may not fail, as in the present instance. It is always bad engineering to trust so much to a single thread, especially where loss of life may occur from its failure.

"It will be remembered that in the last monthly report it was stated that three boilers, working side by side, had been reported to have exploded simultaneously, the occurrence being attended with loss of life to the engineman. I have since then visited the scene of the explosion, and found the report a true one, while the injury caused to the surrounding property was beyond any I had before witnessed.

"These boilers had been of plain, cylindrical egg-ended construction, fired underneath, and about 30ft. long, which, in addition to a Cornish one, with a single flue, had originally worked side by side, being all connected together. The latter being out of work at the time, escaped, or, from the injuries it received from the explosion of the others, would certainly have shared their fate. The egg-ended boilers had rent in the main, at the transverse seams, and the portions had flown more than a quarter of a mile apart. One of these had alighted on a cottage, which it had seriously damaged; another into a reservoir; the egg-ends flying to the greatest distance, and smaller fragments falling nearer their original seat. The chimney, as well as a blast furnace, were brought down and reduced to a heap of ruins by one of the egg-ends in its flight; while a second furnace had the feeding gallery at its top dismantled. The roof of the adjoining engine-house was completely stripped of its covering, and the woodwork shifted bodily, breaking one of the engine beams by its movement. The original seatings of the boilers were reduced to an unintelligible heap, while bricks, and the *débris* generally, were scattered like grape shot over the surrounding land in every direction. The Cornish boiler had been blown from its seat, and so strained by its fall that it had rent at the bottom of one of its transverse seams, as well as at the front plate at the junction of the furnace tube.

"The cause of the explosion was again attributed, as in the preceding instance, to shortness of water, consequent on the negligence of the attendant, who, it was supposed, had first allowed the plates to become overheated, and then suddenly admitted a rush of cold water. I carefully examined the parts, with a view of ascertaining how far this supposition was correct, but could not come to the conclusion that it was proved to be so. The supply of the feed to the boilers was found, on examination shortly after the explosion, to be cut off, which contradicted the supposition that a rush of cold water was let in immediately before its occurrence. Again, the engine had been at work for about a quarter of an hour, and, had the explosion been caused by a sudden pressure of steam, generated by the dash of water upon heated plates, it would have taken place immediately on the starting of the engine. On consideration of the whole of the circumstances, which space forbids us recounting in detail, I think it most probable that, in the first instance, one of the boilers rent over the fire, at a transverse seam, the treachery of which in these under-fired boilers is so common, and to instances of which the attention of the members has been called in the reports. Plain cylindrical boilers rending in this way always fly a great distance, as these had done, having time, while in the act of completing the rent from the bottom to the top of the transverse seam, to take a sufficient angle of elevation both for the clearance of obstacles and the attainment of long range. The escape of water and steam from this opening at the bottom of the boiler would destroy the brick seating and blow up the sister ones, which, falling again on an irregular bed of loose brick, would become so strained as to rend, just as the empty Cornish boiler already described had done, and which, in boilers having their steam up, would be inevitably followed by explosion.

"I consider the above a further illustration of the inferiority of external to internal firing, and would point out that every one of the five explosions reported during the last month happened not to internally but to externally fired boilers, and am increasingly impressed with the fact that this district has done wisely in selecting the Cornish type of boiler in preference to the plain cylindrical egg-ended one, and that, not only on the ground of efficiency and economy, upon which there can be no question, but also as regards safety."

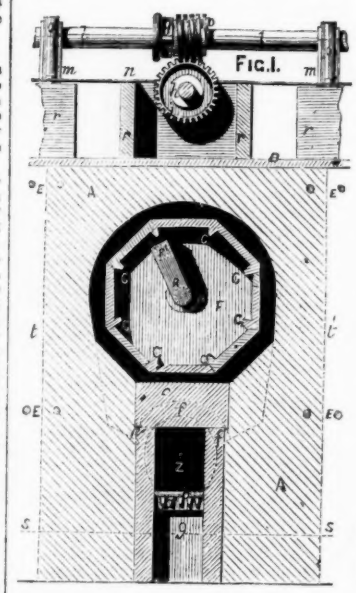
STEAM FIRE ENGINES.

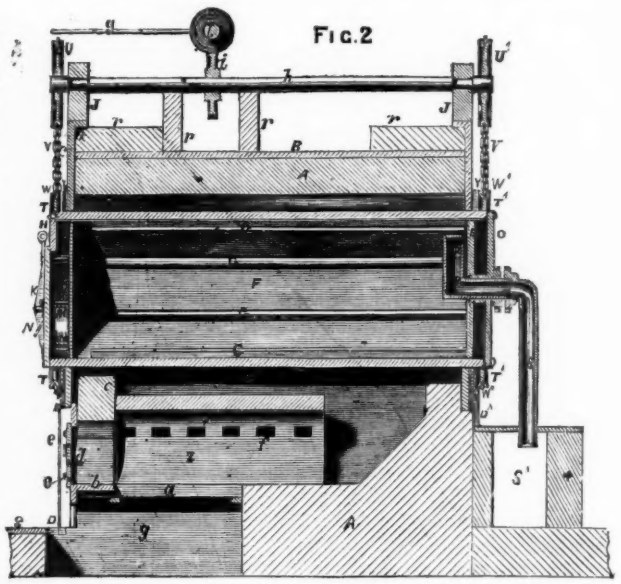
On Monday last a trial of the American steam fire engine, brought to this country by Mr. Lee, of the Novelty Ironworks, New York, took place at the distillery of Mr. Frederick Hodges, Lambeth. Besides several distinguished visitors, including the Duke of Sutherland, the Earl of Caithness, Mr. T. Hankey, M.P., &c., a large number of engineers, among whom were Mr. Scott Russell, Mr. J. E. McConnell, Mr. C. E. Amos, Mr. Appold, Mr. Shand, &c., were present. Mr. Hodges first exhibited the working of his two hand engines, the largest in London, a detachment of the Grenadier Guards, 80 in number, being mustered for manning the handles. The hand engines drew their water from a well 6ft. below the suction valve, and one of them threw a 1-in. jet about 125ft. high, the chimney of the distillery, 140ft. high, forming a good standard of measurement. The hand engines were worked by 40 men each. The steam fire-engine was then brought out, the fire laid, and the match applied at 3.58 P.M. In five minutes the pointer of the steam gauge began to move, in seven minutes the pressure of steam was 5 lb., in ten minutes 12 lb., in eleven minutes 15 lb., and the engine commenced working at this pressure. A minute afterwards the steam was at 30 lb., in two minutes 65 lb., and in three minutes 120 lb., whence it gradually rose to 140 lb. The boiler made steam in the greatest abundance, and it was sometimes requisite to check the fire to keep the pressure below 200 lb. The engine was worked by Mr. Lee, the patentee, assisted by Mr. Charles B. King. The water was taken from a source a few feet above the engine, and led into the pump under the moderate pressure thus obtained. A 1in. jet was thrown at least 5ft. over the top of the chimney, or 145ft. vertically. The *Times*' report states the height to which the jet was thrown as 150ft. The same sized jet was afterwards thrown 191ft. horizontally.

The engine is of the smallest size made in America, having a single 7in. cylinder, 8½in. stroke, and weighing but 3,700lb., or 35 cwt., being less than the working weight of one of the ordinary brigade engines, and hardly more than one half as heavy as the land steam fire engine at Watling-street. At the highest speed, when the pump, which is of the rotary kind, was making 600 revolutions per minute, the steam piston making 20 single strokes per second, or running 850ft. per minute, the engine was almost perfectly steady, the oscillation at the top of the chimney being scarcely perceptible. The engine is of a somewhat airy appearance, the hind wheels being 5ft., and the front wheels 4ft. in diameter, and the framing and working parts of light proportions and handsome finish.

After the trials of the several engines, a number of gentlemen sat down to an excellent dinner, in Mr. Hodges' private residence, adjoining the works. We can hardly suppose that there is any considerable proportion of the inhabitants of London who are at all aware of the extent and resources of Mr. Hodges' Volunteer Fire Brigade, an organisation which would do credit even to many large corporations. Occupying extra-hazardous premises, upon which the insurance companies refuse to insure above half of the full value, Mr. Hodges is compelled to protect himself, and none who have seen a muster of his brigade can deny that it ranks second only to that of the London Fire Engine Establishment. So sensible are the citizens of Lambeth of the great value to them of Mr. Hodges' fire engine establishment, that they are about to present him with a magnificent engine, now in course of construction by Messrs. Merryweather and Son, of Long Acre, for whom Signor Casentini, a well-known decorator, is embellishing the exterior of the engine in the highest style of art. The steam fire engine, too, tried on Monday, is, we believe, to remain permanently at Mr. Hodges' works.

CAREY & PIERCE'S MODE OF RE-BURNING ANIMAL CHARCOAL.





The illustrations represent a retort for reburning animal charcoal upon the plan of Stephen Carey and William M. Pierce, of East Ham. In the figures A, A^1, is the brickwork to enclose and support the apparatus; B, tile floor over the top; D, D^1, buck staves; F, F^1, the revolving cylinder or retort; J, inner plate stopping against angle fillets; K, K^1, double door or flap hinged to front plate; L, fastenings to secure door when closed; M, nut and screw bolts, enclosed in tubing, to connect inner and outer plates of door; N, link to receive hook at end of chain used to raise and lower the lid or door; O, back plate screwed or fitted over back end of retort; P, inner plate stopping against fillets; Q, Q^1, space between inner and outer plates; R, pipe or tube at back of retort, with aperture R^1, near the top for carrying off the foul gas, steam, or vapour; S, outside pipe connected with ditto to carry the said gas, steam, or vapour into the chest and flues under; S, brick chest covered with iron plate; T, T^1, revolving rims fitted or keyed on to ends of the retort to form pulley wheels; U, U^1, upper pulley wheels; V, V^1, endless chains passing over and around upper and lower pulley wheels; W, W^1, grooves on edges of pulley wheels moulded or formed to bed or receive the endless chains; Y, Y^1, loose sheet iron plates or shields fitted round retort and made to revolve with same; Z, furnace. *a*, furnace bars; *b*, dead plate; *c*, fire-brick lump; *d*, furnace door and frame; *e*, perforations through door; *f*, fire-brick arch perforations f^1 over furnace (shown by dotted lines in transverse section Fig. 3); *g*, ash-pit made to hold water; *h*, transverse shaft to connect and work the upper pulleys; *i*, cog wheel keyed or fitted on to ditto; *j*, j^1, plummer blocks to carry shaft; *k*, k^1, ledges and brackets top of breast plates to carry plummer blocks; *l*, longitudinal shaft; *m*, plummer blocks to support ditto; *n*, longitudinal iron straps and bolts to hold down and steady the plummer blocks and shaft; *o*, iron straps round plummer blocks; *p*, endless worm or screw fitted on longitudinal shaft to work cog wheel; *q*, clutch and lever to put machinery in and out of gear; *r*, brickwork to enclose and support machinery; *s*, level of pavement; *t*, t^1, centre lines between each set of apparatus.

In order to carry out the object of invention a long cylinder or retort F, is made of an octagon or other polygonal form, with ribs or fillets G bevelled on each side, and formed or cast upon the inner longitudinal angles of the said cylinder or retort; these ribs run nearly the whole length of the cylinder or retort, stopping short within a little distance of the ends of the same in order to receive the inner plates J and P of the front and back ends of the cylinder or retort, and the two lower ribs are made shorter in front near the door to facilitate the discharge of the contents. The cylinder or retort is built in brickwork and heated by a furnace Z. A plate H is fitted or screwed on or into the front edge of the cylinder or retort, or hinged at the top, and sometimes with an aperture K^1 formed therein a little distance from the top and down to the bottom of the same, and a double door or flap K is fitted or hung thereon, a sight hole I being made in the outer plate to view the contents whilst burning. An iron plate *o* is also fitted on or into the back edge of the cylinder or retort, and another plate P is fitted a short distance within the same. A hollow trunnion or spindle P^1 is formed or cast on the inner plate P, through which a pipe or tube R is passed and turned up inside the cylinder, with an aperture R^1 near the top, for the purpose of carrying off the gas, steam, or vapour generated in the cylinder into the box *s* below, and by flues into the main chimney. At each end of the cylinder or retort a ring or pulley wheel T, T^1, is fitted or keyed on to the outside of the same, and formed with grooves W, W^1, to receive an endless chain V, V^1; the said chain passes round the same and over an upper and smaller pulley wheel U, U^1, fixed over each; these pulley wheels carry the cylinder or retort and give it motion. The two upper pulleys are connected together by a transverse shaft *h* running from front to back over the top, and are set in motion by an endless worm or screw *p* keyed or fitted on to the longitudinal shaft *l*, and made to work in the cog wheel *i* fitted or keyed on to the said transverse shaft; a clutch *q* with lever handle q^1 is fitted by the side of the worm to put the machinery in and out of gear. The machinery is set in motion by cog wheels, bands, or other ordinary means worked by steam or other ordinary power.

The whole of the apparatus is set in brickwork A, with arch over and furnace Z under, as shown, or in any other ordinary manner. An iron breast plate C with circular hole in centre made large enough to allow the cylinder or retort to revolve therein, is fixed in front of the brickwork, and another C^1 at the back; these plates are secured together by vertica buck staves D, D^1, with nut and screw rods E, E, running all through to contect the same. A shelf or ledge supported by brackets K^1 is cast or formed at the top of each breast plate, turning inwards to support the plummer blocks *j*, j^1, of the transverse shaft *h*. It is singular that some of the charcoal burners do not make the attempt to apply clay retorts to their purpose, instead of adhering as they do to the present ponderous, costly, and destructible iron cylinders.

THE MACHINERY ANNEXE AT THE EXHIBITION.

(From the *Times*.)

We avail ourselves of this opportunity to resume the notices we intend giving from time to time of the various branches of industrial manufactures included in the classes, and the chief objects which will be shown in each. Classes 5, 7, 8, and 10 may all be spoken of under one head as the classes for machinery in motion. These have been placed under the superintendence of Mr. D. K. Clark, C.E., who has been and is still working hard to get his branch of the Exhibition into perfect order by the 1st of May. In this department, as in some others, the superiority of English manufacturers will be almost uncontested. France, Belgium, Prussia, and other foreign countries are all sending machines, but it is not too much praise of our own to say that, as a rule, they will merely act as foils to set off the unrivalled excellence of our own. France, for instance, is showing a double throw crank, made at a single forging, of about six or seven tons' weight, while in the eastern annexe, in the department for mining, will be a similar crank, made at one forging by the Mersey Steelworks, weighing upwards of twenty-five tons. In Class 5, for locomotive carriages and other railway plant, will be shown Mr. Ramsbottom's simple and most admirable invention for watering tenders of trains while at full speed. This was originally invented to facilitate still further the rapid progress of the Irish express train (better known as the Wild Irishman) between Holyhead and London. The plan simply consists of a sunk trough filled with water, laid at certain stations between the rails, and into which, as the engine approaches, a slanting, trumpet-shaped shoot is lowered, up which the velocity of the engine forces the water with such power as to fill the tender tanks in a single minute. Mr. Ramsbottom will show two engines and tenders, one full sized, as running on the North-Western Railway at present, and one a model, to run on a railway 80ft. long, with water trough between, to illustrate the invention. As in this annexe we shall find machines of every possible size, form, and use, so among the locomotives in Class 5 we shall meet every variety that has been, is, or will be running for years to come. American engines will be here with their hoarse whistles and balloon-shaped funnels; and here will be Mr. Connell's leviathan express engine and tender, weighing 35 tons net weight, side by side with the Neath Abbey Ironworks locomotive, which only weighs 10 tons. The great facilities of the 5½-ft. gauge in giving space to engineers to proportion locomotives properly will be practically exemplified by the engines of Beyer, Peacock, and Co. for India, the engines of Sharp, Stewart, and Co. for Ireland, and the engines of the Armstrongs for the Spanish railways, and an example of the cramped proportions of the narrow gauge engines will contrast with these. Every possible variety of permanent way, with all the newest and most improved modes of fastening, will be shown. Weighing machines will be exhibited by Pooley and Son and by R. Hitchen, specially made for weighing railway trucks, with six tables, one to each wheel to give separate weights; these are likely, as they become generally adopted, to be most useful in the prevention of accidents by getting the weights distributed in equal proportions on each wheel. Mr. John Ashbury, of Manchester, exhibits the raw materials, such as wood, pig iron, copper, tin, lead, pigments, oils, &c., requisite to make one complete railway wagon side by side with the finished wagon itself. This last wagon was constructed and finished on Tuesday, the 26th, from precise duplicates of the raw materials shown, in twelve hours. The immense strides made in machinery for cotton preparing, spinning, and weaving, will be most amply illustrated by all our leading manufactures. Platt Brothers alone occupy about 6,000 square feet, exhibiting mules nearly 100ft. long. Messrs. Harrison, of Blackburn, Hodgson, of Bradford, &c., will show cotton and alpaca weaving machines, and, among others, will be the alpaca looms from Saltaire. Flax and jute-spinning are of rising importance, as fast competing with the same description of French manufacture. There will be plenty of these machines from Coombe and Co., of Belfast, and Parker and Sons, of Dundee, and a beautiful automatic spooling machine by Brookes, showing the winding of the cotton thread into bobbins. In manufacturing machines and tools the ponderous machinery of our leading firms for planing armour-plates for war vessels will be exhibited, with a brickmaking machine of Clayton's, capable of making 30,000 bricks a day when in full work. In the "Process Court" will be machines showing envelope-folding and paper collar making, with a silk velvet weaving machine by Robinson, of Cheapside; and a potter's wheel in full work, by Doulton and Watts.

Some fine specimens of marine engines will be shown by Penn, Maudslay, Rennie, Humphreys and Tennant, and other eminent makers. Every one of these is of the screw engine type, for apparently paddle engines are old fashioned now, though it is only eleven years since, at the last Exhibition, they were in the zenith of their fame, and screw engines were almost in their infancy. Mr. Penn at first intended to have shown the whole of the engines for the Achilles, a sister ship to the Warrior, though with greater horse power. This, however, unfortunately, cannot be done, and he will only send one cylinder, one connecting rod, and crank axle, the latter being 30ft. long and 20in. diameter, and weighing about 20 tons. He will also show a pair of trunk engines, of 600-horse power, while Humphreys and Tennant will exhibit the engines of her Majesty's ship North Star. In machinery for sugar mills, &c., Messrs. Mirrlees and Tait, of Glasgow, send the largest and the smallest sugar mills that have yet been made; the former weighing 140 tons, the rollers being nearly 3 ft. in diameter and 7 ft. long, the smaller mill weighing scarcely more than five tons. Mr. J. Wilson, of London, has a very novel arrangement of a portable engine, with boiler and mill all on one single plate. David Napier and Son, of Lambeth, send a most ingenious centrifugal machine for separating the molasses from the sugar; and also an automatic balance similar to that used in the Royal Mint for separating light and heavy sovereigns from those of proper weight. Forrester and Co., of Liverpool, send large vacuum pans on a platform 50ft. long and 22ft. wide, raised on columns

10ft. high above the floor of the annexe. This will be erected in the centre arch, so as to command a perfect view over all the machines in motion, both English and foreign. On this platform, also, will be erected a peal of Russian bells. In hydraulic machinery Messrs. Easton and Amos exhibit a pump of immense power for raising a great body of water to a low elevation, such as would be used in draining marsh lands. Messrs. Gwyn send another kind of pump, which will raise a body of water 10ft. broad by 6in. thick to a height of 25ft.; in fact, so as to form a magnificent cascade. Carrett, Marshall, and Co. also exhibit a most ingenious combination of pumps and steam engines. There was some talk of placing in this or the eastern annexe the Warrior target which was so vainly assaulted by all kinds of ordnance at Shoeburyness last October. It is to be hoped that, for the sake of the public and our foreign visitors, this idea may yet be carried out, for the target in itself would be in the highest degree interesting. Enough, however, even without this fine piece of ironwork, will be shown in the annexe for machinery in motion to place us far beyond the reach of competition from those we have challenged into the lists. Without a doubt, our show will be one of the finest of its kind that has been seen in this country, and if the commissioners only provide steam enough to keep all the engines going at once, the mere show of flying wheels, of rods and shafts, pumping, spinning, and steam engines of every kind, will be something the like of which has not been known before. The total space occupied by the machinery classes is upwards of 110,000 square feet,—a larger area by far than is occupied by any single division in the Exhibition.

M. AND R. M. MERRYWEATHER'S PUMPS.

THESE improvements, by M. and R. M. Merryweather, of Long-acre, have reference, firstly, to the position and arrangement of the parts of double-acting horizontal pumps, and consist in placing both the suction and delivery valves in a chamber beneath the pump barrel, which the water enters and leaves at its extreme ends, so that any dirt or grit that may be drawn up with the water is ejected, and prevented from injuring the pump barrel. Secondly, in surrounding a horizontal pump barrel eccentrically with a cylinder communicating with the delivery outlet, so as to form an air vessel

FIG. 1.

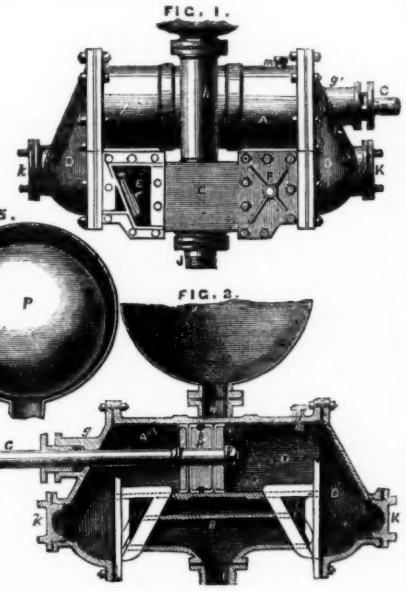


FIG. 5.

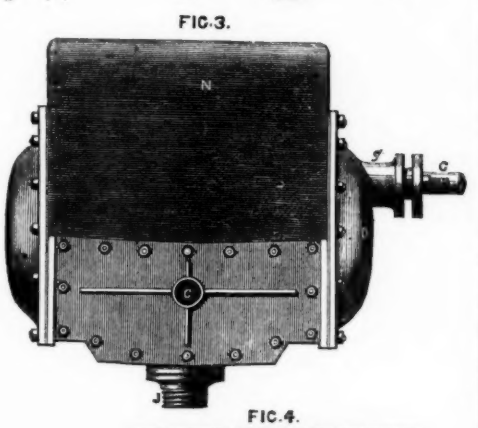
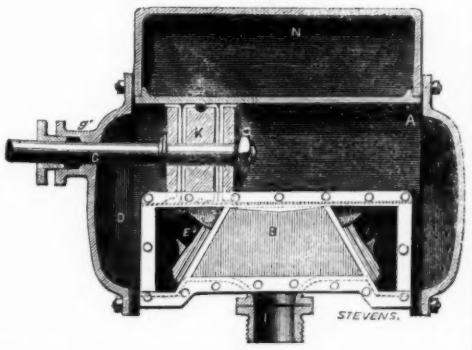


FIG. 2.

FIG. 3.

FIG. 4.



for equalising the stream of water. Thirdly, in an arrangement for lubricating the piston of pumps, by mounting on the piston rod two pistons, with a space between them; this space being filled with oil continually lubricates the piston. Fourthly, the introduction into air vessels of flexible or elastic receptacles filled with air, by which means all the advantages arising from the elasticity of air will be obtained, while the absorption of air by the water will be prevented.

Fig. 1 is a side elevation of a horizontal double-acting pump constructed agreeably to one part of our said invention, and Fig. 2 is a sectional view.

A, A, is the pump barrel, with two valve chambers B and C attached to its under side, and communicating with it by means of the passages D, D. The suction valves are situated in a chamber B, and the delivery valves in a chamber C on the other side of a central dividing partition. One of the delivery valves is shown in position at E, the covering plate being removed; F is the other covering plate in its place; G is the piston rod working through a stuffing box g^1; a passage h, on the outside of the pump barrel, forms a communication between the delivery valve chamber C and the air vessel H. I is the suction orifice, and J the delivery; k, k, are screw plugs, closing apertures in the passages D, D, through which access can readily be had to the valves in case of obstruction. In the section Fig. 2, E^2 are the suction valves; K is the cupped piston, formed double, with a cavity at l for holding oil. When the piston is at the extreme end of its stroke, the cavity l comes under an aperture m, through which oil can be introduced, and the aperture then closed by a screw plug. As the piston moves backward and forward, the barrel is effectually lubricated by the oil in the cavity l.

Fig. 3 is a side elevation, and Fig. 4 a section, of a horizontal double-acting pump, surrounded eccentrically (or otherwise) by a cylinder in communication with the delivery outlet, so as to form an air vessel. A, A, is the pump barrel; N, the surrounding cylinder, communicating with the delivery valves and outlet; E^2 are the suction valves; I, the suction, and J the delivery orifices, leading to and from their respective valve chambers. Fig. 5 is a sectional view of a spherical air vessel, into which has been introduced a flexible or elastic receptacle or air-holder P, filled with air, either at the ordinary atmospheric pressure, or, by preference, with a pressure of two or more atmospheres, by which means all the advantages arising from the elasticity of the contained air will be obtained while the absorption of air by the water will be effectually prevented.

THE MALAHIDE VIADUCT.

(Concluded from page 180.)

IN considering the length of the compression bars, a question arises as to whether the tension lattices which intersect them in the centre can be considered as securely fixing these points as regards lateral deviation. Inasmuch as the weight of a flat pillar depends on the square of its length, this is a most important consideration; for, if the tension lattice was capable of keeping the centre of the compression bar immovable, the latter might be regarded as two short pillars instead of one long one, and might, consequently, be made of lighter section. That the tension bars do actually give great lateral support to weak compression bars may readily be seen in a great many existing bridges, even of large spans, where very long, thin bars are loaded to a far greater extent than they could possibly sustain if not so supported. It is quite evident, however, that the tension diagonal can give no lateral support until the bars have already deviated from their original places, so that distortion must have commenced before this support is available.

As regards any increased strain on the tension bars, from the extra duty they may thus be required to perform, it is easy to show that it cannot be considerable. Firstly, suppose the compression bar A, B, to bend in the plane of the beam to the extent F, E—C, D, being the tension bar crossing it—it is quite evident that if B, F, represents the strain passing down the bar B, E, the resistance of the bent bar, F, E, will represent the force necessary to keep it in equilibrium; therefore the additional strain on C, D, will be the load on B, A, diminished in the proportion the amount of deflection bears to half the length of the bar, which in practice is always a very small fraction. Secondly, the effect of lateral deviation is to throw a tensive strain on C, D, equal to the compression strain on A, B, because the angles at which the forces act being the same equilibrium can only obtain when they are also equal. But as the loads, the tension, and compression bars in any one part of a beam are very nearly equal, the strain due to lateral deflection can never greatly exceed what the tension bar is constructed to carry, without lateral deviation. The rivets connecting the angle irons to the flange plates are ⅞in. diameter, those connecting the lattice bars to the flanges vary from ⅞in. to 1¼in., according to the section of the bars; the latter are all in double shear, and so arranged that the sectional area of rivets holding each bar is at least equal to half the area of the bar. Some extracts from the specification will best explain the remaining details of construction.

"The position of the fish plates at the joining of the flange plates and angle irons is not shown on the drawings, to enable the contractor to use the longest plates and bars possible; but it will be strictly required that the same available sectional area be preserved in every part of a beam, as is shown on the drawings. No rivets may be used to fish the flange plates except the two rows of ⅞in. rivets, shown on plans. No rivets may be used to fish the angle irons except those of the flange plates or ⅞in. rivets in the same lines as the two rows fastening the diagonal bars.

"All holes in plates or bars over ¾in. thick must be drilled, but if ¾in. thick or under they may be punched.

"All malleable iron used in this contract must bear a strain by tension of, at least, twenty tons per square inch of its section in any part of the plate or bar.

"All cast iron shall bear a strain by tension of at least six tons to the square inch of its section.

"The contractor shall provide for testing, in such way as shall be satisfactory to the company's engineer, 10 per cent. of the bars and plates to be used, the part to be tested being cut from the end or edges of the iron as shall be pointed out; and if it shall happen that a sample tested of any lot gives way with a less strain than specified, it shall be in the power of the company's engineer, or any one acting for him, to reject the whole lot.

"All the beams shall be tested, if required, in the presence of the company's engineer, or some one acting for him, and to their satisfaction: the larger inside girders to forty tons, the smaller to thirty tons distributed."

It will be noticed that in the specification the quality of the iron is definitely fixed by a standard that can readily be measured. The ridiculous clause, hitherto in general use, defining iron by particular brands, is happily going very much out of fashion, though it is remarkable that it is not easy to get ironmasters to guarantee their iron to bear any given unit strain. The lattice bars were all rivetted to the flanges by Cook's patent steam rivetting machine, a diagram of which the patentee has kindly sent to illustrate this paper. It differs from Garforth's machine in not being direct-acting; the steam cylinder is placed vertically; the connecting-rod working through a trunk is connected to a lever keyed on a rocking shaft, forming also an eccentric which actuates the rivetting die. Nothing can exceed the quality of work done by this machine; the author finds that it is equal to four gangs of rivetters, each gang being composed of three men and a boy. In doing plain straight work 1,500 rivets a day, of ten hours, can be put in. The rivets are heated in a small air furnace, as at the Britannia Bridge.

It was found impossible to close the 1¼in. rivets in a satisfactory manner by hand; a head was indeed formed, but the body of the rivet remained quite loose in the hole. In rivetting by pressure the iron is forced into all the inequalities of the holes, in proof of which it is found that nearly one-half more iron is required to make an ordinary ⅞in. rivet head by pressure than by hand. The specimens of rivetting on the table, one row of which was done by this machine and one by hand, at once show this difference.

The girders were all tested by laying on the specified weight of pig iron before they left the contractor's yard. To facilitate this operation two pieces of 12in. × 4in. plank, of a length equal to the span, were laid on the ground, the pig iron was piled on them, and the beam to be tested being laid on blocks a few inches higher than the load the weight was lifted on by means of ⅞in. screws passing in pairs, through crossheads resting on the beams, into the planks below; these screws were so spaced that a crosshead rested over every intersection of the lattices with the flanges. As soon as a beam was tested, the rods were unscrewed, the crossheads removed, and the girder lifted out without disturbing the load or screws, which were thus ready for the next beam. The deflections were taken by means of a fine line, fastened at one end of the beam, and kept stretched by a weight after passing over a delicately made pulley at the other. The deflections were very regular, and call for no special notice; the mean amount for the large beams was 0·55in., that of the small beams 0·39in.

The time occupied in testing did not exceed a quarter of an hour. In testing isolated beams of this description, the author has observed that, in consequence of the strain in the tension and compression lattices not passing exactly through the centre of the beam, but in planes at a short distance from, though parallel to each other, a considerable tendency to twist is apparent, rendering it necessary to support the ends of the beam on opposite corners on the tension side.

This circumstance renders it very important, in isolated beams, to divide the compression bars, and make the tension diagonals pass between them. In some small beams, recently made for the Royal Canal Bridge on the Dublin and Drogheda Railway, which were tested to 10 tons to the square inch, this twisting was so great that the load could not be laid on without fixing temporary hard wooden pillars between the flanges over the abutments.

The specification originally provided that the ironwork was to receive two coats of oil paint. This, however, was given up in favour of a hot bath of coal tar, which was administered in the following manner:—Under the large travelling crane at the Dublin terminus a cast iron tank 53ft. long, 2ft. 6in. wide, and 5ft. deep was erected and filled with coal tar. Under one end was placed a small furnace, with the flue running under and all round the tank to a chimney at the other end. As fast as the beams were delivered the travelling crane deposited them one at a time in the tank, to simmer as long as the demand for them would admit—some one hour, some two days. When drawn out they were allowed to drain for a short time previous to loading on the wagons. It is hardly necessary to state that this treatment ensured a most perfect coating of tar.

The beams having been lowered into their places by the travelling cranes on the bridge, were connected by horizontal and vertical crossbracing. The former is composed of eight bars of 5in. × ⅜in. flat iron in each span running at right angles to the beams, and rivetted under and over the bottoms and top flanges. In the same plane with them, and secured in the same way, are the diagonal ties of 3in. × ⅜in. iron.

The vertical bracing is formed of 5in. × 2in. × ⅜in. -iron diagonals, four sets to each span, rivetted to the inner sides of the flanges, directly under the 5in. × ⅜in. flat bars, their ends being twisted and cranked so as to admit their crossing each other, and being rivetted back to back at their intersections.

The provision for expansion in a bridge of this length, with slight piers based on an uncertain foundation, was matter of anxious consideration, the more so as the viaduct is on a gradient of 1 in 83·2, and it was feared that there might be a tendency in the whole bridge to work down to the lower end. To guard against this Mr. Harty contrived a most ingenious and simple expansion apparatus. On every other pier, as already stated, the beams rested directly on metal wall plates, but on the intermediate piers their free ends were capable of motion on 2in. metal rollers arranged in wrought iron roller frames. Furthermore, the ends of the bottom flanges were cut away on opposite sides so as to pass each other, and were connected by pairs of short links rocking on a centre pin secured in the wall plate. By this arrangement the beams, though free to move, are yet secured to the piers, and the relative position of the two cannot alter. The author is not aware of a similar contrivance ever having been adopted before

The maximum expansion of the Britannia Bridge, 1,510ft. long, is 6⅝in., so that the Malahide viaduct may expand 2·4in., or 0·4in. on each expansion pier; considering, however, that the beams are very near the sea, and protected from extreme heat and cold by the timber sheeting, the actual amount of motion is not likely to exceed the half of that stated.

An inquiry of great practical interest, though perhaps not directly connected with the subject of this paper, is the relation between the theoretical and actual weight of beams, the relative quantity of material necessary to the flanges and webs respectively, and the amount of economy to be effected by reducing the flanges and webs in proportion to the strains. With a view to illustrating this more clearly Tables III. and IV. have been constructed:—

TABLE III.

	Actual weight.		Actual weight, deducting for corrosion.		Theoretical weight of beam to break under four times working load.	
	lb.					
Top flange ..	3,805	32·82	3,003	32·17	1,745	41·40
Compression lattices ..	1,473	23·06	1,145	21·63	707	24·48
Tension lattices	1,200		874		265	
Bottom flange	3,805	32·82	3,003	32·17	1,438	34·11
Packings, joint plates, rivet heads	1,309	11·29	1,309	14·02		
	11,592	100·00	9,334	100·00	4,215	100·00

TABLE IV.

	Actual beam, less allowance for corrosion.			Theoretical beam.		
	Uniform section.	Section proportioned to strain.	Per cent.	Uniform section.	Section proportioned to strain.	Per cent.
Top flange ..	3,858	3,003	77·8	2,619	1,745	66·63
Compression lattice ..	1,456	1,145	76·07	2,387	707	32·27
Tension lattice	1,198	874		801	265	
Bottom flange	3,858	3,003	77·8	21,35	1,438	67·35
	10,370	8,025	77·3	7,942	4,215	53·

In Table No. III it appears that in the beam as it now stands the weight of the flanges, which are equal, is two-thirds the weight of the whole beam, the remaining one-third being taken up by the web, packings, rivet heads, and joint plates. The same proportion holds good when the ⅛in. of surface allowed for corrosion has been deducted, but the packings, &c., which at present are 11½ per cent. of weight of the whole beam, become 14 per cent., as might be expected, since their weight is very slightly affected by the deduction. In the last two columns of the table is the weight of a beam supposed to be cut out of solid iron, with every portion accurately proportioned to the strain, which in the top flange is taken at 4 tons to the inch, in the bottom and tension lattices at 5 tons, and in the compression bars to one-fourth the breaking load by the formula $w = 215\ \frac{t^2\ b}{l^2}$. The flanges in this case absorb three-fourths of the weight, the lattice bars only one-fourth. The quantity of iron sacrificed to compensate for corrosion is a little over a ton per beam, representing about £768 in the entire bridge, whereas the unavoidable waste of iron in overlaps, packings, joint plates, rivet heads, exclusive of the ton above noticed, is nearly 46 cwt. more than 46 per cent.

Table No. IV gives a comparative view of the amount of saving effected by reducing the flanges towards the ends and the webs towards the centre. Thus in the beam as it now stands there is a saving of 22 per cent. in the flanges and 24 per cent. in the web, being a saving of nearly 23 per cent. in the whole beam, whereas in the theoretical beam there appears a saving of 33⅓ per cent. in the top flange, nearly 33 per cent. in the bottom, 68 per cent. in the web,

and 47 per cent. in the whole beam. As regards the flanges in this case the saving is what may be inferred without actual calculation, because it is well known that the area of a parabola is two-thirds that of the circumscribed rectangle; now the flange of a uniformly loaded beam ought to vary in section as the ordinates of a parabola, consequently its weight should be two-thirds that of a flange of uniform section throughout. It may then be assumed without much error that the flanges form generally two-thirds the weight of a beam, the diagonals and packings, &c., one-third; that, in practice, it is possible generally to save one-fourth the material by carefully proportioning the several parts. In the large tubes of the Britannia bridge the weight of the top and bottom flanges is nearly equal, while the sides are a little more than one-third the whole weight, viz., 37 per cent.

From these considerations it is very easy to arrive at a quick method of estimating the weight of any given girder.

The sectional area at the centre of one flange being obtained, the weight per foot is known, $\frac{1}{4}$ of this at least may be saved by proper arrangement of the materials, and the weight of the whole beam will be three times this result.

The Board of Trade limits the strain as wrought iron to 4 tons to the square inch in compression and 5 tons in tension; this would make the bottom flanges of beams lighter than the top, were it not for the weakening effect of rivet holes; it is, therefore, generally correct to make the bottom flange the same gross area as the top. By dividing the strain in tons in the centre of a flange by 4, we obtain the sectional area, multiplying this by $3\frac{1}{3}$, lb., the weight of a 1in. square bar a foot long, we obtain the weight per foot of the flange; multiplying this by 3, we obtain the weight per foot of the beam, supposing its section to be uniform; and finally multiplying by $\frac{3}{4}$, we get the average weight of a beam the flanges and lattices of which are proportioned in some degree to the varying strains. If we assume the depths of a beam to be 1ft. : 12·8ft., a very good proportion this formula becomes.

$$\text{Weight per foot in lb.} \quad \frac{\text{Tons.}\ W \times 12{\cdot}8 \times 3\frac{1}{3} \times 3 \times 3}{8 \times 1 \times 4 \times 4} = 3\,W.$$

Or, in other words, multiply the distributed load in tons a beam is required to carry by 3, and the result is the weight in lb. per foot of the beam. This rule will be found very useful in making rough estimates of bridges.

The following is the weight of bridge:—

		Tons.	cwt.	qr.
72 beams	100 per cent.	307	18	2
Crossbracing	10·7 ,, ...	33	1	3
Rollers and frames	1·2 ,, ...	3	14	2
Wall plates and joggles	4·6 ,, ...	14	8	3
		359	3	3

The contract price for all the ironwork, including fixing beams in their places, and fitting in cross bracing, but exclusive of carriage or placing the beams on the piers, was £6,000. The wages paid for men employed in erecting and fitting bracing and expansion gear amounted to £144, a little over 8s. per ton. After the beams had been fixed in their places they were prepared for the reception of the 4in. sheeting by levelling over the plates and rivets with longitudinal timber packings made to fit close on the top flanges, recesses being cut for the rivet heads, joint plates, &c.: the sheeting was then laid across in lengths generally equal to half the breadth of the bridge, with every seventh or eighth plank running right across. Where the short pieces met in the middle of the 6ft. space, their ends were secured by bars of $3\frac{1}{2} \times \frac{1}{4}$ flat iron placed over and under the joint, and connected by a few bolts. The sheeting was secured to the beams by means of hook-headed bolts catching the flanges. Memel timber was first obtained by contract at 1s. 10½d. per cubic foot, delivered at the terminus in plank 4in. thick, not less than 11in. wide; but the quality and rate of delivery not proving satisfactory, Dantzic timber was obtained from an eminent firm on the North Wall at 2s. 6d. per cubic foot, the original contractor being at the extra expense incurred thereby. The longitudinal sleepers were secured by wood screws to the 4in. sheeting, and the rails laid in the usual manner. A simple post and handrail on either side of the bridge, and a thin layer of clean gravel to protect the timber from fire, completed the bridge.

Mr. Harty's original estimate of the cost of reconstruction was £12,181 9s., from which he deducted £300, the estimated value of old bridge, leaving £11,881 9s. as the sum to be expended. The actual outlay was £11,741 13s. 3d., or £440 less than the estimate. The cost of the bridge is, therefore, a little over £20 10s. per foot; this sum may thus be divided:—

Timber in sheeting and handrail, 6,178 cubic ft., at 3s. per ft.	£927
Contract price for iron superstructure	6,000
Cost of masonry in piers, removal of old bridge, and all other works not specified	4,600
Piece work, cost of preparing foundations and crane roads for 11 piers	215
	£11,742

There are about 66 yards cube in each pier, making probably about 750 cube yards rock, ashlar work, and cut stone copings. In comparing the cost of this viaduct with other bridges, it will be necessary to bear in mind the large allowance made for corrosion, and the circumstance that the two outer ranges of girders are strong enough in themselves to carry a third line of rails.

The author has thought this viaduct worthy the attention of the Institution, as affording an example of a singularly well-designed and executed piece of work. He would especially draw the attention of the student members to the great forethought, method, and minute attention to details displayed by the engineer, and he trusts that this paper will prove a valuable record to those who may hereafter wish to guide their practice by the light of existing engineering works.

In conclusion it is necessary to explain that, at the time this paper was begun, Mr. Harty was not a member of this Institution; that beyond being contractor for the ironwork the author had nothing whatever to say to the design or execution of the works: he has merely undertaken to record what struck him as being a valuable example of railway engineering.

SOCIETY OF ARTS.

March 19th, 1862.

Mr. Alderman Mechi in the Chair.

ON THE SEWERING OF TOWNS AND DRAINING OF HOUSES.

By Robert Rawlinson, C.E., F.G.S., &c. &c. &c., Member of the Sanitary Commission sent out by her Majesty's Government to the Army in the Crimea.

Town sewerage on a grand scale is certainly co-existent with the Roman Empire, and earthenware pipes are, probably, as old as the art of pottery. It has been ascertained that pipes of earthenware, "hand-thrown" on a potters' wheel, and not unlike, in form and dimensions, to hand-made pipes of the present day, were used throughout the East in the remotest periods we are acquainted with, to conduct springs of water for human uses.

Earthenware pipes have been found beneath the great mounds of Assyrian ruins, which pipes are supposed to have been drains; and the stalls in the Colosseum of Rome were drained with earthenware pipes. Earthenware pipes were also used by the Romans for watercourses.

The cloacæ of Rome, including the Cloaca Maxima, according to Livy, are as old as the reign of Tarquinius Superbus. Some authors declare that the construction of these public sewers must belong to an Etruscan nation, which preceded the birth of Romulus and Remus.

These old sewers, the ruins of which are to be seen in Rome to this day, were also "sub ways" and sewers, having raised paths along the sides, and "side entrances" for tributaries, from palaces and fountains. There were large cloacæ in the several cities throughout the empire, as mentioned in Pliny's letters to the Emperor Trajan. I have met, in the works of travellers, with descriptions of other ancient sewers and drains found beneath ruins in the East, the date of the formation of such sewers being lost in the darkness of antiquity. It is, no doubt, impossible to trace out the origin of sewers and drains; their "invention," construction, and use, probably took place and commenced with civilisation. We cannot, however, settle this point this evening. We have another purpose, namely, to discuss the uses and the abuses of sewers and drains at this day.

The Roman cloacæ were, probably, in many instances, of the character of the great sewers in this metropolis—the Fleet, the Ranelagh, and others—watercourses enclosed and arched to serve as sewers. The remains of sewers and drains found amidst ruins show us that their application was limited, and their uses only imperfectly understood. If sewers and drains had been generally in use amidst the populous cities and towns of antiquity we should now find their remains abundantly. We know the extent of the Roman Empire more fully and better by the buried remains of Roman pottery than by history, or than by any ruins or traces of ruins remaining on the surface. Brick sewers and earthenware pipe drains, if they had ever existed, would have been as enduring in their materials as frail pottery, or as the stone and brick cloacæ of ancient Rome and the drains of the Colosseum. We do not find such remains in abundance, and therefore conclude that a limited construction only took place for special purposes. The Roman cloacæ were originally under the superintendence of the censors; subsequently under that of the ædiles. The Emperors Agrippa and Trajan constructed many cloacæ during their reigns. We, in these modern times, divest our Imperial Government of all such useful power.

Earthenware pipes, of three and four inches diameter, were made in England more than a half-a-century since, in Lambeth and in other places. Mr. Doulton, sen., can recollect their being made during this space of time, and I have received other evidence as to the make of earthenware pipes 40 or 50 years ago in England. The first modern use of them, for sewer purposes, was suggested by Mr. Edwin Chadwick, C.B., soon after the year 1840. Mr. John Roe states in his report to the Harrow Local Board of Health (1854):—"The introduction of stoneware pipes for general drainage arose from a suggestion made by Mr. Chadwick to me, in his desire to obtain smooth interior surface; and the first sewer pipes made for that purpose in the metropolis were for the Holborn and Finsbury office." In consequence, Mr. Roe further states, "immense benefit to sanitary measures has been afforded by the use of earthenware pipes, where judiciously applied and properly laid. They save fully two-thirds the cost of brick sewers; that is, where brick sewers for a town would cost £30,000, the same town may be sewered by earthenware pipes for a cost of £10,000, and the cheaper pipes will effect the work far safer to health and life than the costly brick constructions." Combined back drainage is of the utmost importance, in point of economy, and also in efficiency of working, where the drain-pipes are properly laid. There are many thousands of instances of successfully combined back drainage, in scores of towns, and complaints of failure or of annoyance are very rare. I do not think they amount to one per cent. upon the work executed. Mr. John Roe, in 1854, stated that, "36 years previously (1818), 200 houses on one estate, in the Holborn and Finsbury districts, had combined back drainage, and no complaint of their working or otherwise ever came in in that period of time to the office." Mr. Roe further states, "in many country towns and places, back drainage may be usefully adopted." This is the doctrine the first Board of Health anticipated and confirmed. In some places back drainage will be impracticable, and, of course, should not then be adopted.

It is a great advantage to have a regular flow of water through any sewer. Drains are choked more from want of water than by having too much passed through them. Combine drains as much as practicable, lay them well, joint them evenly, properly, and smoothly, and there will be very few if any chokings.

Fully to understand the worst effects of want of sanitary arrangements in towns we must go back to the days of the plague, sweating-sickness, and other similar diseases, and read up the literature of 1600 and 1700, by Nathan Hodges, M.D., on the Plague of London, 1665; a discourse on the Plague by Dr. Mead; an essay on the different causes of pestilent diseases, by John Quincy, M.D., and others; until we come to James Lind, M.D., and Sir John Pringle, the one on diseases in the navy, and the other on diseases in the army. We may then visit the cities and towns in the East, where plague rages to this day, and see the causes in existence which prevailed in England two centuries since, and some of which causes prevail even now. Filth, squalor, darkness, neglect, vice, crime, and premature death; an annual mortality of 40, 50, and 60 in the 1,000 regularly, with an increase up to 100, 200, and even, in some places, 500 or a moiety of the entire population in one year, of plague and general sickness; "the living too few to bury the dead." The annual mortality of England at present in towns rages from 30 to as low as 15, and even 11, in each 1,000. It is thought 15 ought not to be exceeded even in our towns.

The Sanitary Commission of 1855 in the Crimea showed what could be done for an army in the field, where the mortality fell below that of the same troops in barracks at home, the French army knowing no such abatement. When fever had been all but banished from the British army and hospitals, the French at the end of the war were said to be losing by sickness in hospitals at a rate of 5,000 per month. 15,000 men perished in hospital during the last three months of the war, as per French army medical returns.

There are no doubt many causes for disease in excess, but overcrowding, defective ventilation, and surrounding filth, seems to be of the worst. Proper sewers and drains will improve a town but will not do all that is required.

The causes of fever in Liverpool, previous to the year 1840, were overcrowded cellar dwellings. The causes in Glasgow and in Edinburgh are overcrowded upper rooms and attics. The narrow streets, crowded houses, and small rooms of many continental towns may be improved by sewerage, drainage, surface pavements, and regular cleansing. But many of the causes of disease in excess might remain.

"Sewer," according to Lord Coke, a place where water "issues," or, vulgarly, "sues," whence the word "suera" or sewers. There are laws relating to sewers from Magna Charta to recent times. Callis, on the law of sewers, is the great authority. These laws, however, relate to sea defences, weirs, rivers, estuaries, and land-floods, rather than to town sewers.

Many persons use the words sewer and sewage improperly; they should be used as—

Sewer, a public sewer in street or road.
Sewage, that which flows through a sewer—the fluid.
Sewers or sewerage, the plural of sewer.
Drain, a tributary to a sewer from house, building, or court.
Drains or drainage, the plural of drain.

Sewers were first constructed in London under an Act (6 Henry VI., c. 5), 1428, amended by Parliament in the reign of Henry VIII., and since this period to the present time there have been many amendments and alterations of laws for regulating sewers, into which I do not propose to inquire. The streets of London were begun to be paved in 1533. The first sewers in London would no doubt be in the several valleys on the line of existing watercourses, the Fleet Ditch, the Ranelagh Level, &c. These watercourses were arched over, and the drainage of the adjoining streets and houses passed into them.

Stowe states that, "Antiently, until the time of the Conqueror, and two-hundred years later, this city of London was watered (besides the famous river of Thames on the south part), with the river of the Wells, as it was then called, on the west; with a water called Walbrook running through the midst of the city into the river of Thames, sewering the heart thereof; and with a fourth water or bourn, which ran within the city through Langbourn Ward, watering that part in the east. In the west suburbs was also another great water, called Oldborn, which had its fall into the river of Wells."

The Fleet Ditch* was no doubt originally (in ordinary weather) a stream of bright, sparkling, sweet, and wholesome spring water—a river of "wells." But as early as 1290 the monks of White Friars complained to the king that the putrid exhalations arising from the river of Wells or Fleet were so powerful as to overcome all the frankincense burned at their altars during divine service, and even occasioning the deaths of many of the brethren. The Fleet continued to receive additional impurities, until it became in the time of Pope—

"The king of dyke, than whom no sluice of mud
With deeper sable blots the silver flood."

Barges are said to have sailed up the Cloaca Maxima and the Fleet sewer alike: in both instances natural watercourses having been arched over and made receptacles of sewage.

Although the first formation of public sewers in the British metropolis dates so far back as 1428, by far the greater portion of the 1,500 miles of the main sewers in London have been constructed since the year 1824, Mr. John Roe having had the perseverance, honour, and credit of effecting more improvements in the main sewers of his districts, Holborn and Finsbury, up to the end of his period of service, than any other man. The improvement of adopting the egg shape, in place of vertical sides for sewers, the introduction of side entrances, and means of flushing, and the experiments carried out by Mr. Roe and tables based on these experiments, are invaluable for the metropolis. Mr. Roe found the construction of sewers a matter of guess; he left it a matter of scientific certainty. If all the sewers of this great metropolis had been laid out and constructed on the plan proposed and adopted by Mr. Roe, in his divisions, vast additional sums of money would have been saved, and (humanly speaking) many lives prolonged; the flat-bottomed sewers which now exists would have had semi-circular channels, and the deposit which now accumulates and corrupts would have been regularly washed out, or periodically "flushed" out at short intervals. Mr. Haywood has more recently done for the city what Mr. Roe did for Holborn and Finsbury.

The ventilation of sewers by vertical shafts and open grates in the centres of the streets was, no doubt, an improvement, though a very clumsy and disagreeable plan. Previous to the formation of these open ventilators typhus and typhoid fevers prevailed in many houses connected by drains with the sewers, and near the untrapped gully-holes. Mr. Fuller, a medical gentleman, in his evidence, 1834, states that eight-tenths of all the cases of typhus fever he witnessed he could trace to foul drains or foul gullies. The late Dr. Southwood Smith gave evidence to the same effect.

At present there is much injury effected by sewer gases passing through drains and into houses. In 1859, on the use of a disinfectant in the public sewers having a powerful odour, all the houses directly drained by these sewers were tainted, showing that there was a flow of air from the sewers to the houses. This should not be, and can only be avoided by external ventilation of each house drain.

The progress of a nation may be measured by increase of population, by spread of education, by increase of commerce and wealth, by increased value of human life and respect for it, and by improvements in morals, in obedience to the laws of the realm, and in religion. We may read, in the eloquent pages of our great historian, Lord Macaulay, how England appeared about the year 1688. He wrote:—"Everything has been changed but the great features of nature and a few massive and durable works of human art. We might find out Snowdon and Windemere, the Cheddar Cliffs and Beachy Head—we might find out here and there a Norman minster, or a castle which witnessed the wars of the Roses; but, with such rare exceptions, everything would be strange to us. Many thousands of square miles which are now rich corn land and meadow, intersected by green edge rows, and dotted with villages and pleasant country seats, would appear as moors overgrown with furze, or fens abandoned to wild ducks; we should see straggling huts built of wood and covered with thatch, where we now see manufacturing towns and seaports renowned to the furthest ends of the world."

The population of England in 1690 was computed at nearly five millions and a half. The manners of the inhabitants were in accordance with the state of the country. In the northern counties bands of Scottish marauders fought with moss-troopers—the parishes were required to keep bloodhounds for the purpose of hunting freebooters—oxen were penned at night beneath the overhanging battlements of the residences—the inmates slept with arms by their sides—and, on a journey, it was necessary to carry provisions, for the country was a wilderness which afforded no supplies. Such was the state of England at the commencement of the year 1700, or little more than a century and a half since. To find a parallel to this state of things, we must now go to Russia in the north, and to the cities of the Sultan in the east. Here we may see vast tracts of land uncultivated, and without proper roads—the inhabitants wearing, and even working with, weapons of defence and offence in their belts or sashes—cities and towns reeking in filth—hovels for houses—food of the worst and poorest character—no security for person or property, human life having the least possible value—poor cultivation of land—no proper roads—in the towns no sewers no drains, but a maximum of human misery and degrading vice in the East, and of drunkenness and ignorance in the North.

To ascertain the state of England in our own day, and at the present time, we must study in "Blue Books" the sanitary reports; and, although a commencement of sanitary work has been made, there are vast and wealthy populations living amidst cesspits and cesspools. The good work has, however, been commenced—about 400 cities, towns, and places in England having adopted the powers of the "Public Health Act," 1848; or of the "Local Government Act," 1858. The "Common Lodging Houses Act" of Lord Shaftesbury may be adopted; and, where put in force, the results are most beneficial.

The question of sewerage and drainings concerns the poor more than the wealthy. Firstly, on account of numbers; and secondly, because of close crowding. The poor must live, or linger rather, in squalor, sickness, and misery, and die prematurely, in such habitations as are provided for them. The fatal room tenements in English towns, the mud cabins of Ireland, and the boothies of Scotland, all tend to fill our gaols, lunatic asylums, and workhouses. When shall we learn and fully comprehend the fact that it will be more in accordance with the requirements of civilisation, and even more economical to prevent vice, and to make virtue possible, rather than to expend all our energies on reformatories, to make home comfortable rather than to build and endow public libraries, lecture-rooms, and reading-rooms? Do not neglect these, but first make the poor man's home wholesome.

The preponderance of numbers is shown in the case of Manchester and Salford. From a return by the Poor Law Board of the numbers and occupiers of dwellings in Parliamentary boroughs, it is shown that in Manchester, in 1859, there were 64,426 separate dwellings, of which number 24,457, or 38 per cent., were of £10 annual rental or upwards; 22,538, or 35 per cent., below £10 and above £6 rental; and 17,431, or 27 per cent., not exceeding £6; or, in the whole, about 62 per cent. at and below £10 rental.

In Salford there were 20,156 dwellings; 5,205, or 26 per cent., £10 rental and above; 8,131, or 40 per cent., of £6 and below £10 rental; 6,820, or 34 per cent., not exceeding £6 rental. Taking Manchester and Salford in one district, there were 84,582 dwellings, of which 29,662, or 35 per cent., were £10 rental and upwards; 30,669, or 36 per cent., of £6, and not exceeding £10 rental; and 24,251, or 29 per cent., at and under £6 annual rental.

Many of the houses below £8 per annum rental are of faulty construction. They are generally in rows, back to back, having no back doors nor windows, no yard nor privy, no sinkstone, nor internal water supply. Many sleeping rooms have no flue, nor adequate means of ventilation. Privies have to be used in common, and, of course, are not what the name implies: they are frequently ruinous, and sickeningly dirty. Experience has shown that numbers of families should not be compelled to use privies common to several houses, unless regular cleansing is enforced. Every dwelling house

* "Fleet." This name is derived from the rapid flow of water from the higher districts drained.

should have its own convenience. It is a libel on the poor to say they will not care for their own comfort. There are thousands of instances to the contrary. In Manchester, for the poor, waterclosets are the exception. The local municipal regulations discountenance them.

The annual death-rate in Manchester is 30·56 per thousand, or double the death-rate in some districts. The death-rate throughout the manufacturing towns of Lancashire and Yorkshire generally is high, and will continue to be so until better sanitary regulations are adopted and enforced. The excuse offered by the Manchester Corporation is, "Supplying the poor with waterclosets would waste water, and foul the rivers." Proper apparatus will prevent the first, and intercepting sewers the latter.

London shows a diminished death-rate in proportion to the abolition of cesspools, although the sewerage is most defective, and the river Thames is fouled. Many thousands of cesspools have been abolished in the metropolis, probably not less than 100,000, within the last twenty years, bu many thousands remain. Mr. John Roe, and some of the other district engineers, improved many miles in length of the metropolitan sewers and drains, but there are still many miles in length ruinous and foul. London is, however, much more healthy than the manufacturing towns of Lancashire and Yorkshire.

Those who wish to experience the horrible character of the cesspits and middensteads of Manchester, Liverpool, and other northern towns, should study the statistics as they are weekly recorded, of 1,200 and 1,400 such places emptied, and then make a few night inspections of the localities in the hands of the "night-men:" the stench is abominable, many times worse than the Thames at its worst. The rivers flowing through Manchester can scarcely be worse than at present. The Irwell, the Medlock, and the Irk, are a disgrace to our civilisation. They are fouled from their sources to their estuary; and if the erection of water-closets could be absolutely prohibited the construction of intercepting sewers should be made imperative. The solids of sewage can be precipitated, but agricultural land is the proper place and use for sewage.

In many cities and towns where sewerage and drainage are carried out water-closets are in general use. This is the case in the metropolis. For several years past some 1,000 soil-pans have been made and sold per week, or some 50,000 per annum, and they are, of course, used. In the cities and towns of Berwick-upon-Tweed, Alnwick, Morpeth, Carlisle, Lancaster, Halifax, Worthing, and many other places in England, the poor use this convenience, and do not abuse it. In Manchester 100,000 loads of night-soil are annually removed at a loss of some £6,000 per annum. In London the removal of dry ashes produces an income to the parishes.

There is no general rule for the dimensions of town sewers for populations below 100,000 in proportion to surface area; and any engineer who adopts the dimensions given in certain published tables will most probably make an expensive mistake for the district in which he is operating. The tables which are based on experiments made in the metropolitan sewers are no doubt correct and absolute for the districts from which they were constructed, and will be applicable to any other similar district, if all the peculiarities and contingencies are similar, but they are not applicable to towns generally. I have never used these rules, and should have caused great waste of money if I had done so. The science of engineering cannot be tabulated, and this truth ought to be inculcated on every student. As well say that all sorts of diseases can be cured with one set or sort of pills, as that tables of strengths of materials and dimensions of sewers can be relied upon without the experience of practice. The published tables I allude to have worked injury, not only in Great Britain, but all over the continent, where many sewerage works have been attempted. The civilised world looks to this country for practical information on this subject.

The recorded experiments of the best hydraulic engineers on the flow of water in open channels and in pipes may be relied upon. There is little to learn in this branch of hydraulics. Pipes have capacity in proportion to the squares of their diameters, and water obtains downward velocity in strict accordance with the laws of gravity, modified by friction in its thousands of forms. The invert gradient of a sewer is one element in the law of flow. The head of water and delivery are other elements, giving velocity and scouring power. I only object to tables of sectional dimensions for general use. The town of Alnwick, in Northumberland, with 2,000 acres of drainage area, its 7,000 population, and some, 1,000 water-closets, is sewered by an earthenware pipe 18in. diameter, and having a gradient of 1 in 400. Carlisle, with its 1,900 acres of drainage area, and 35,000 population, has an outlet sewer of 3ft. 9in. by 2ft. 6in., with a fall of 1 in 700.

At Worksop the outlet sewer is an earthenware pipe, 15in. diameter, laid at an inclination of 1 in 600. The population is upwards of 7,000, and the drainage area very large.

At Lancaster the outlet sewer is of brick, 5ft. 3in. by 3ft. 6in., and laid at an inclination of 1 in 1,000. The population is about 15,000, and the drainage area considerable, having a rapid fall in some parts.

At West Ham, with an area of 4,730 acres principally of flat water-logged marsh land, the outlet sewer is of brick, 5ft. 3in. by 3ft. 6in., having a cast-iron invert laid level, and at low-water line of spring tides.

In all these cases the dimensions of the outlet sewers do not accord with the tables alluded to, and yet the sewers perform the work required to be done. Surface water and heavy falls of rain pass, as previously, over the surface, but there is not a duplicate system, nor do I advocate such.

At Carlisle the outlet is frequently blocked by land-floods; at Lancaster, daily, by tides; and at West Ham pumping is resorted to.

The first questions an engineer should ask himself with respect to any district or area to be sewered should be these:—"How have surface waters passed off up to this time without the aid of sewers or drains?" "Haveany surface impediments been formed?—if so, what are the effects, and can such impediments be removed?" "Have houses been erected and cellars excavated in improper places, and where injurious flooding cannot be prevented excepting at a ruinous cost to the rated property of the district generally?" "Can watercourses in the valley lines be deepened at a moderate cost?" and, "Can embanking and pumping be resorted to economically?" "Are there any mills and mill-dams which impede drainage and cause injurious subsoil—flooding regularly, andinjurious flooding at intervals?" All these questions have a most important bearing on the dimensions of sewers.

It may look very egotistical, but I can better give an account of my own practice than that of any other person, and detail my own experience more confidently than stereotype it in tables, which must, in such form, be misleading and injurious.

Natural streams down valley lines should never be converted into sewers. The maximum flow of water in such streams is to the minimum as three hundred or four hundred to one. Any sewer formed in such valley line of sufficient capacity to carry off flood waters would be much larger than requisite for the ordinary flow, and would become a cause of nuisance in dry weather. All valley lines should be improved, and the beds of natural streams should be preserved free and open for the escape of surface and flood waters. Sewers and drains should be of sufficient capacity to remove roof, yard, street soil, subsoil, and slop water from the area drained during ordinary weather, and should be graduated to the amount of work to be done. Floodwater outlets or overflows into valley lines, or natural streams, to relieve the sewers during heavy rains, should be provided. There may be large gratings to remove surface storm waters at the outlet points of valley lines, but care must be taken not to make such places large stagnant cesspits.

All sewers and drains should be properly ventilated. This may be effected by connecting down-spouts with house-drains in proper situations; by connecting sewers with tall chimneys; or by providing, on the sewers and drains, ventilating shafts with charcoal filters for oxidising sewer-gases. All sewers should have means of inspection, flushing, and cleansing provided. Sewers should be laid in straight lines, and with regular gradients. At each alternate change in direction, or alteration of gradient, a manhole or entrance to the sewer should be constructed. Agricultural drain tiles are laid in straight lines. Ploughing, on the most approved plan, is also in straight lines. In both cases, truth and efficiency of workmanship are attained, and straight sewers and drains insure good workmanship. One defective link breaks the chain; one defective pipe joint or defective yard of sewer is injurious.

Brick sewers should be formed of radiated bricks, set in hydraulic mortar. Pipes should be jointed with clay puddle, or with cement, or mortar, or asphalte, according to the nature of the ground in which the pipes are laid. Great care should be taken in laying pipes in rock, in gravel, and also in clay. Many lines of sewer pipes are injured by injudicious filling of a trench, or by a fall of clay or earth crushing the pipes. The inlets of all drains should be properly protected, and the openings should be reduced so that any substance entering the drain may pass freely into the main sewer.

Where a sewer or drain has once choked, and the ground is opened out for repairs, do not close it in again, but construct a manhole or lamphole, that any future obstruction may be removed at once.

Sewers and drains act as subsoil-drains to the full depth at which they are laid. In wet subsoils provision should be made for allowing subsoil water to enter the sewers. A continuous flow of subsoil water along a sewer or drain is generally an advantage, as the solids of sewage are more readily removed.

Neither sewers nor drains should be laid under new inhabited dwellings. If it be absolutely necessary to carry a drain under a house the drain should be carefully laid, and the joints made perfectly tight, so as to prevent the escape of sewer gases into the adjoining subsoil. Many lines of earthenware pipe sewers and drains are ruined when laid in porous subsoils with leaking joints. The fluid sewage leaks away, and leaves the solids to accumulate and ultimately to choke the sewer or drain, as the case may be. Puddle should be used in such cases.

All junctions with main sewers should be made at a point above the ordinary water level in such sewers; and at the junction of branch or main sewers, the top of the sewer should be on the same level. Additional fall should be given at junctions or bends, to overcome increased friction. Junction entrances, provided for branch sewers and house drainage, should be protected by earthenware, plates, or "disc-plugs." Street gullies should be small, compact, and double-trapped. There should be a sediment box, easily removed and easily replaced. Means of flushing should be provided in the gully, that choking of the pipe connection with the sewer may be impossible. Large cesspit gullies are a nuisance. Small gullies of cast iron are generally found the cheapest and best; increase the number of small gullies rather than construct large cesspit gullies.

Fresh sewage, when properly diluted, filtered, or disinfected, may be passed into rivers, or into the sea, without causing nuisance or injury to fish. In arranging outlet sewers, provision should be made for applying the sewage to land in the immediate neighbourhood, for agricultural uses, by gravitation if practicable. Pumping by steam or other power is available. A town standing on ground having quick gradients requires special arrangements to break the rush of water down and of gases up. This can be done by breaking the line with a vertical fall, placing a flap over the mouth of the sewer, and ventilating at this point. The outlet ends of all sewers should be protected with a covering flap, to prevent the wind blowing in and driving back sewage gases. A cast iron pipe of comparatively small dimensions on any river outlet sewer will pass the dry weather flow of sewage to and below the summer level of the river, so as not to be a nuisance.

It is not the special province of an engineer to enter into the question of diseases and their causes. There are many causes of disease other than filth, the result of no sewage, or of defective sewage; and even fevers may break out in a sewered town. Deficient and bad food, defective house accommodation and overcrowding, intemperance, and excesses of any kind, mental excitement, improper and deficient clothing, all tend to disease. The foundation of social improvement and comfort is, however, proper sewage. The scale may be arranged in the following order, as things necessary in towns for health and comfort to the highest degree:—

1st. Main-sewage, house-drainage, and street-pavements.

2nd. Good house-accommodation; rooms for the sexes, separate, with full ventilation.

3rd. Wholesome food, pure water, and proper clothing.

Then may be added, baths, reading-rooms, and museums.

A city of palaces, museums, picture-galleries, and of cesspools, is a sorry affair—a place to avoid rather than to dwell in. The cesspools of Paris detrac from the beauties of the city above ground; and who is to visit and dwell in the cities of the Continent generally if they remain neglected? Climate is blamed for producing disease in excess and premature death, but my experience has taught me that in any country and climate we must look to the habits of the people, and within their houses, rather than to the climate, for causes of disease in excess.

The cost of town sewerage works is an important matter; and as continental governments look to England, and especially to the British metropolis, it is only right that they should have some sort of rule to judge by. In my experience I find that towns of and below 30,000 of population may have complete sewage at or below one pound sterling per head. Where a population is compacted into a small area, and means of outlet are not distant, as in the cities on the Rhine, the estimate of one pound sterling may be relied on. But large brick sewers for men to walk and work in must not be constructed. The sewers must be of small sectional area, and so arranged that they may be cleansed absolutely and perfectly without sending men in and through them.

All rivers and streams are natural outlets for drainage, and, since men have dwelt on the banks of rivers, surface refuse has been allowed to pass into and mingle with the waters. There is at present a great outcry against the pollution of rivers by sewers, and the killing of fish. The question may be asked, "Whether it is better to pollute rivers, or towns and houses? to kill fish, or to kill men?" I do not advocate the pollution of rivers, but the application of sewage to land for agricultural uses. If it will not pay, in some cases, as a commercial speculation, make it compulsory, and pay the cost by rate. By far the most expensive process in any community is filth in cesspools beneath houses, or on the surface around human dwellings.

Proper sewers and drains deliver sewage at the outfall fresh, and in this state fish are not killed, but are fed. The putrid sewage flushed from the foul sewers of the metropolis during hot weather by a thunder storm taints the river and poisons fish; but even in the hot summer of 1859 the mortality in London was low, although the Thames was foul. As cesspools have been abolished, the public health has improved, and if all the sewers were of sectional dimensions, forms, and gradients (as they may be) to transit fresh sewage, and not retain it until putrefaction sets in, the public health would be further improved. It is practicable to so improve and manage the public sewers of this metropolis, that sewage one day old shall not remain, and shall be in motion towards some outlet; and in motion there is safety, but danger in stagnation.

The full and proper ventilation of sewers and drains is of the utmost importance; drains should be so laid and arranged as to render contamination of the air within houses (by sewage gases) impossible. At present the sewers of the metropolis, with exceptions in the City, as recorded by Dr. Letheby and Mr. Haywood, ventilate, for the most part, direct to the open air, by means of the vertical shaft from the crown of the sewer. The gases of decomposition rise direct out, and road dirt, stones, and grit fall in. The gases foul the air in the street, and the dirt, ground by traffic through the open grates, blocks the invert of the sewers. The proper way to ventilate is to form a side-chamber, or side-shaft, and to place charcoal in the passage of communication from the vertical shaft by the side-chamber, so that all the gas escaping may be oxidised. The side-chamber receives the dirt falling through the ventilating-grate; it cannot enter the sewers. House-drains may also be ventilated in a similar manner.

(To be continued.)

SEWING MACHINES.

The number of sewing machines made and sold both in Europe and America up to the present time exceeds 350,000, and the number now in use is about 250,000. At least 250,000 have been made in the United States, and 100,000 in Great Britain, France, and Germany. The average sale weekly is about 2,000. Their manufacture and sale gives constant employment to at least 4,000 persons. The capital invested in the trade is about £1,000,000. The number of females employed in using machines, and in preparing and finishing their work, is about 750,000, and the wages paid to them exceeds, on an average, £290,000 weekly. As each machine performs as much work as six needlewomen, it saves the labour of five, and if the wages of the latter be reckoned at 7s. 6d. per week, the sewing machine, as a labour-saving invention, is worth over £22,000,000 per annum; that is, it adds twenty-two millions annually to the wealth of mankind. This sum represents, not a transfer of so much capital from one employment to another, but an actual gain to the world—a gain which we individually feel in better made and cheaper clothing.

This estimate will appear very moderate to those who recollect the evidence given at Washington, in August, 1860, on the application of Elias Howe for the extension of his patent. It was then computed that the use of the sewing machine effects a saving, in the United States alone, of twenty millions sterling per annum. This estimate, however, is probably too high.*

The number of sewing machines now in use in Great Britain and Ireland is over 15,000. The amount of capital invested in the trade in this country is between £20,000 and £100,000.

Between 300 and 1,000 mechanics are constantly engaged in their manufacture, and their wages amount to at least £15,000 per annum. The average weekly sale of machines in Great Britain alone is between 100 and 200. The number of females whose sole employment is working sewing machines is not less than 15,000, and they earn, on an average, between £20 and £25 each per annum, or from 8s. to 10s. each per week. The average wages in London at present is 12s. per week. The total amount paid annually to workers in the United Kingdom may be estimated at £375,000. Supposing each machine to save the labour of only five persons, and wages to be only 5s. per week, the sewing machine adds about £975,000, or very nearly one million sterling annually to the wealth of Great Britain.

Very nearly one-half of all the sewing machines in this country were manufactured in the United States. At present we are importing machines at the rate of about 4,000 per annum. For foreign-made sewing machines we paid in 1861 over £40,000. In London alone eleven shops are open for their sale, and only about six for the sale of home-made machines. Over the whole kingdom the same proportion holds. About twice as many machines are sold on behalf of American manufacturers as by English manufacturers.

The sewing machine trade was introduced into England in 1853. Not one of the machines for sewing shown at the Exhibition of 1851 was of any great practical value, and none like them have ever been manufactured or brought into common use. The trade has been only about nine years in existence, yet within these nine years it has added, on the lowest possible estimate, two millions sterling to the capital of the United Kingdom.

A seamstress can make only about 40 stitches per minute—a sewing machine makes from 300 to 1,500 per minute—on an average each machine does as much work as from 5 to 12 hands. Machines used in stitching leather and similar heavy materials are driven at a less speed than those used upon linen, calico, and cloth; the best machines sew about one yard per minute, and in a manner far superior to hand sewing.

The preceding facts and estimates may serve to remove that feeling of indifference, incredulity, and opposition which the public and sometimes even engineers entertain towards great innovations like the sewing machine. Sewing machine manufacturers can no longer be regarded as schemers and speculators; they form a large and respectable class of mechanical engineers; their trade is well-established and prosperous, and its history and present position have now strong claims upon public attention. In the approaching Great Exhibition we do not expect to find any article which will attract around it a larger crowd of visitors than the sewing machine.

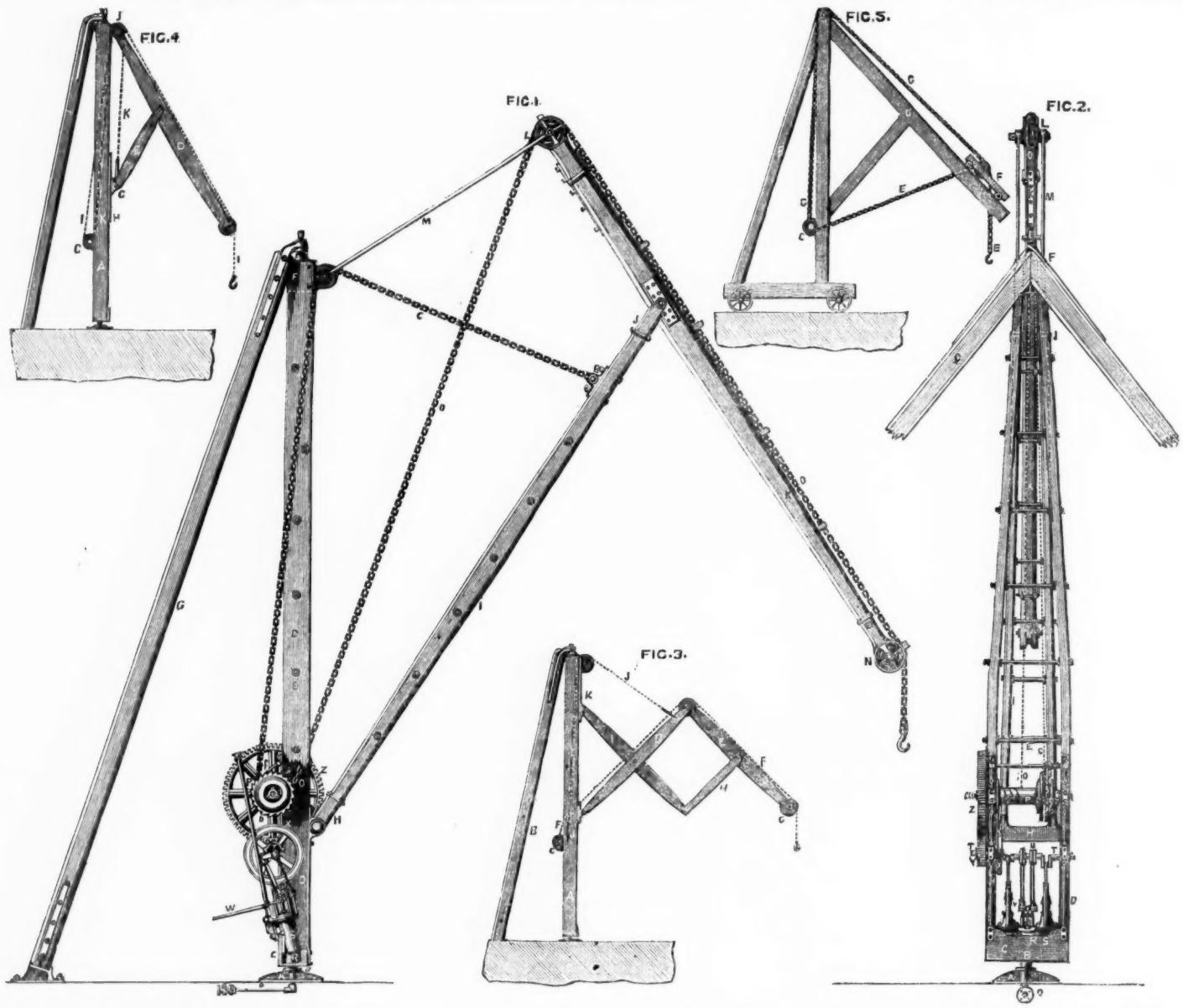
Sewing machines may be divided into two classes:—1st, those using one thread; and, 2nd, those using two or more threads. The former make the chain, tambour, or loop stitch, the twisted loop stitch, the running or basting stitch, the belaying double loop stitch, &c. The latter make the lock or shuttle stitch, the twisted lock stitch, the knot stitch, the double loop or double chain stitch, &c.

In every complete sewing machine there must be 1, a needle or its equivalent; 2, an apparatus for passing the needle and thread through the fabric; 3, an apparatus for holding the fabric; 4, an apparatus for moving the fabric step by step, called a propeller or feed; 5, an apparatus for putting tension or a drag upon the thread, and, 6, an apparatus for securing the stitch. In machines using two threads there must be an apparatus for carrying the second thread and for looping the two threads together.

The common hand-sewing needle, the double pointed needle, with one eye or two eyes in the middle, the crochet needle or hook, the spring-eyed needle, a needle with a sliding piece to close the eye, and the eye-pointed needle, have all been employed in sewing machines. If the ordinary needle were placed in a machine it would be necessary to pass it entirely through the fabric, then to turn it and pass it through again. But to all machines using this kind of needle (and one on this principle was patented so lately as 1855 by E. A. Forbush), there are many weighty objections. Only a short piece of thread can be used and the machinery for moving and turning it must be complicated and slow in its movements. The needles used in the machines for running or basting patented by Bostwick (1844), Walker (1846), Mercy (1849), and Bernard (1852), are varieties of the ordinary needle, but the machines and the stitch produced by them are comparatively worthless. Machines using the double pointed needle (patented by Weisenthall in 1755) are also of little value. Neither Heilmann's embroidering machine (1829), nor Cropper and Milne's (1835), nor Thomas's (1848), nor Brown's (1849), nor Houldsworth's (1852), nor Bernard's (1852), nor Douglass', with two or more eyes at the middle (1853), nor Bernard's (1853), for making the button-hole stitch, has been found to be useful or practicable. The tambouring or crochet needle is the form used in the first sewing machines, and it is still common in embroidering machines. Since 1804 (the date of Duncan's patent) it has been frequently tried, and with many different combinations of machinery; its use, however, is attended with so many practical difficulties that it is now almost abandoned as an instrument for sewing. A peculiar form of crochet needle is described in the patent granted to Elmer Townsend in 1854. The hook in this machine is reversed, so that, instead of drawing the thread from one side of the cloth to the other, it pushes the thread before it; but such a modification cannot be regarded as an improvement. The spring-eyed or bearded needle, which has been introduced into several machines (see A. V. Newton's patent, Jan. 18, 1853, E. J. Hughes' patents, June 30, 1852, Dec. 27, 1853), and one of which is still we believe on sale in London, was designed as an improvement upon the crochet needle, but of its merits we cannot speak highly. Wickersham's needle (patented Nov. 10, 1852, May 10, 1853), which is fitted with a sliding piece to close the hook previous to its withdrawal from the fabric, and the needle used in the Howard and Davis's machine (patented Feb. 3, 1854), which has a tubular shank, with a closing slide working therein, are varieties of the crochet needle; they can hardly be regarded as improvements upon it. The eye-pointed needle is the form which has been found to be best adapted for sewing machines. The first English machine (a single-thread tambouring machine) in which it was used was patented only about twenty years ago (May 4, 1841, Newton and Archbold). The same kind of needle is described in Fisher and Gibbon's specification, but with two eyes. In Howe's machine (Dec. 1, 1846) we find for the first time an eye

* For additional statistics regarding sewing machines in America, see The Engineer for January 27, 1860.

BARCLAY'S APPARATUS FOR RAISING, LOWERING, OR MOVING HEAVY BODIES.



pointed which is grooved, and a similar needle grooved on one or both sides, and either straight or curved, is used in all the machines now made. Since 1846 no improvements of any great value have been made in the construction of machine needles. The only one deserving notice is the shortening in some machines of the working portion or shank of the needle. Their manufacture now forms a separate department of the needle trade. The groove in English made needles is stamped; in American made needles it is cut out. At present there is no difference in quality between first class home and foreign made needles, while the former are now lower in price.

In machines using a straight needle the latter is attached to a perpendicular sliding bar, which receives motion from a pulley through a lever rocking bar or revolving shaft. In most shuttle machines the motion of the needle bar is not uniform, as the needle near the bottom of its stroke rests to allow the shuttle to pass through the loop of the upper thread. Hence a cam or its equivalent is introduced to communicate motion from the pulley to the needle carrier, and to regulate the working of the needle so as to allow time for the formation and tightening of the stitch. This want of uniformity in the motion of the needle (which appears necessary to machines using a shuttle, unless additional machinery is introduced for keeping open the loops of the needle and holding the upper thread) renders them more liable to wear, more noisy and less rapid in their action than single-thread machines, or those using a stationary bobbin. In theory, the best machines for heavy work are those which use a revolving bar and cog wheels, like Singer's and others on the same principle. As the friction and noise occasioned by the cog wheels are, however, objectionable, especially for light and medium work, other methods of communicating motion to the needle bar have been adopted, such as by a rocking shaft, or by a revolving shaft moved, controlled by jointed connecting rods, but none of these substitutes is well adapted for heavy work. Machines using a straight lever, like Thomas's, appear to be well adapted, and are extensively used for light work, while those using a bent lever, like Howes', Grover and Baker's, Simpson's, &c., may be adjusted to work either in heavy or light materials. The experience of those who have used different kinds of shuttle machines for four or five years confirms the theory that the straight and bent lever is best for light and medium work, and the revolving shaft for the heaviest work. Shirt-makers generally prefer Thomas's small machine; boot-makers, saddlers, harness-makers, &c., as generally prefer Singer's heavy machine. Howe's cylinder machine (in which a curved needle and vibrating needle bar are used) is the only one of its class adapted for heavy work, and its acknowledged excellence for leather is owing rather to its accuracy of construction and the perfection of other parts of its arrangement than to the apparatus for actuating the needle. For light work and a high speed the best mode of actuating the needle carrier is by means of a vibrating arm. This arrangement, which requires the use of a curved needle, is generally adapted in machines which use a stationary bobbin for its equivalent, instead of a reciprocating shuttle, for carrying the lower thread. As in this class of machines the needle does not pause or rest during its stroke, the apparatus for carrying and moving the needle may be reduced to the simplest possible form, and the highest degree of speed, durability, and quietness of action obtained with the least comparative expenditure of power. The needle, however, being curved, is not so well adapted for leather and similar heavy materials.

(To be continued.)

BARCLAY'S APPARATUS FOR RAISING, LOWERING, OR MOVING HEAVY BODIES.

Fig. 1 is an elevation of one arrangement of cranes, according to the invention of Andrew Barclay, of Kilmarnock; Fig. 2 is an end elevation; Figs. 3, 4, and 5 are elevations, showing other arrangements.

Referring to the Figs. 1 and 2 the crane is supported on a cast iron base-plate A, which is bolted down to the masonry beneath or the platform on which the crane is erected. The central part of the base plate forms a tubular socket to receive the pivot B, which forms the lower extremity of the crane. If the crane is arranged to be actuated by steam power, as shown, the pivot B is made tubular, and works steam-tight in the socket A, so as to serve for the admission passage of the steam to the cylinders above. The lower part of the main pillar of the crane, from which the pivot B projects, forms a cast iron box C, from the ends of which spring the side pieces forming the crane post or main pillar D. The framing of the pillar is bolted together by transverse tie bars E, and terminates at the upper part in the cap F. The pillar is steadied and partly supported by the back stays G, which are bolted down to the platform or wharf, the eyes on the upper parts of the stays passing over the pivot in the cap F, in the usual way. To the lower part of the pillar D is bolted the bearing plate of the jointed socket-piece H; this socket-piece is made duplex to receive the side pieces, which form the jib I. The parts of the jib are connected in manner similar to the pillar D, or in any other convenient way. The outer ends of the ribs of the jib I terminate in iron caps J, to admit of the secondary jib K being jointed thereto, and of its moving freely about the point of support. This jib is formed of a spar of timber or other suitable material; the upper extremity is fitted with an iron cap and pulley L, the spindle of which is connected by the links M to the spindle of the pulley in the cap F of the pillar D. At the lower end of the jib K is fitted the cap and pulley N, over which the hoisting and lowering chain O passes; this chain is carried from the winding barrel P upwards over the pulley L, and downwards to the pulley N, where it terminates with the usual hook and swivel for slinging the load.

In this modification the crane is shown as arranged to be driven by steam power, the moving parts being actuated by a small pair of coupled engines. The steam is conveyed from the boiler, which may be fixed in convenient proximity to a stationary crane, or upon the platform of a portable one, and passes by the pipe Q, up through the socket A and tubular pivot C to the valve casing R, and from thence into the cylinders S, the piston rods being connected in the usual way with the driving shaft T. Each engine is fitted with a pair of eccentrics U, and link motions V, which are operated by the hand lever W, arranged as shown, or in other manner, to be within convenient reach of the attendant, and enable him to drive the engines either forward or backwards as required. On the shaft T, and inside the frame of the pillar D, is keyed the fly wheel X, and on the outer extremity of the shaft is the pinion Y, which gives motion to the wheel Z on the winding barrel P, on which the chain O is wound. Outside the barrel P, and running loosely on the shaft *a*, to which the barrel P is keyed, is a small barrel *b*, on which the chain *c* is wound on the barrel in a direction contrary to that of the chain O on the barrel P. The chain *c* is carried upwards and over the pulley F, its extremity being attached to a transverse bar carried in the brackets *d*, which are bolted to the jib I, the office of the chain *c* being simply to lower or draw in the jib I, which causes the load on the chain O to be carried either outwards or inwards in a horizontal line, that is to say, if it is required to move a load from a wharf to the hatchway of a vessel lying alongside, the barrel *b* is coupled with the shaft *a*, and the engines are set in motion so as to wind in the chain *c*, and bring the jib I nearer or quite to the vertical position. The movement of the jib I also brings the end of the jib K inwards, which moves with accelerated velocity. The load is attached to the hook of the chain O; the action of the engine is reversed so as to run out the chain *c* and allow the jib I to descend; this movement carries the load with a rapid sweep over the hatchway; the barrel *b* is uncoupled, while the winding barrel P is caused to turn in the opposite direction to pay out the chain O, and lower the load into the hold. From the arrangement of the chains O and *c*, the movement of the end of the jib K, and consequently of the load, is always in a horizontal direction, for just as the chain *c* is caused to effect the movement of the jib I, the chain O is given off or wound on to the barrel P, to compensate for the alteration in the angular position of the jib K. The outer flange of the barrel *b* forms a ratchet wheel *e*, into the teeth of which the pawl *f*, carried on a transverse spindle extending across the main pillar D falls. Outside the ratchet wheel *e* is a coupling keyed on the shaft *a*; this coupling is made with a disc, having a rounded rim *g*, by means of which the attendant causes the barrel *b* to rotate or not with the barrel P, according to the required movement of the jib I. To prevent accidents or breakage of the parts in case the engines should be set in motion in the wrong direction, the teeth of the coupling are hinged so as to move out of the way and allow the coupling to rotate without injury. For hoisting and lowering the barrel P is alone required, but when the load has to be moved to and fro in a horizontal direction, or nearly so, then the barrel *b* must be brought into requisition to effect the necessary movement of the jib I.

Steam Engines on Common Roads in South America.—In 1861 two of Boydell's traction locomotives for common roads were imported into Venezuela by Messrs. Willet and Las Casas, who had obtained a grant for the exclusive use of such engines on all the roads of the Republic for ten years. Each engine weighed eleven tons, and had cylinders of 7-in. diameter, and 20-in. stroke. The great peculiarity of these engines consists in each having two large driving wheels, which carry an adjustible endless jointed railway. On the Venezuela engines each driving wheel is 6ft. in diameter, and there are two small steering wheels in front. The parts of the two engines were put together at La Guayra, and their route was to Caraccas, distant only seven miles in a straight line, but 27 miles by the wild, crooked mountain road, which rises one foot in seven, and attains a total elevation of 7,000ft. We have been informed by a gentleman from Venezuela that these engines travelled up this steep road, drawing several cars, with perfect safety, and yet it is a dangerous pathway for single horse carriages, as it is so narrow in some places that there is scarcely a foot to spare between the pathway and precipices 1,000ft. in depth. The people of Caraccas were astonished when they beheld these engines travelling up their mountain road, entering their town, and turning their narrow streets with perfect ease, drawing ten wagons loaded with coal behind them. This is the greatest feat of mountain travelling, we believe, that has ever been performed by the steam engine.—*Scientific American.*

TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

P. S.—*For a boiler to work to 150 lb. we should prefer to test to 225 lb. only.*

M. H. (Paisley).—*We cannot answer your question, and should only bring in a host of non-paying advertisements were we to publish it.*

Tyro.—*We will leave you to study out the action of the engine. We presume the patent is intended to cover the arrangement of the valve as described.*

An Engineer.—*A great deal was published four or five years ago about the gyroscope. You must possess yourself of the scientific journals of the period to which we refer.*

W.—*There is a little work on brassfounding called the "Brassfounder's Guide," but we believe it is an American work. Perhaps Messrs. Spon, of* 16, *Bucklersbury, can supply it.*

R. H. T.—*We do not suppose you could ever realise a farthing from bringing forward plans to raise the Albert obelisk. Hence we could not advise you to incur any expense in the matter. If you wish to give your plans to the Commissioners you could do so without putting yourself to more expense than writing to them.*

A. B.—*To calculate the power of a compound engine you require to know the pressure in each cylinder. The power of each cylinder must be obtained separately in the ordinary manner, the pressure in each being taken as the difference between the average pressures on opposite sides of the same piston. If you have no indicator diagrams you must calculate the pressures knowing the initial pressure and the ratio of expansion. If there is an average pressure of, say, 5 lb. per square inch above the atmosphere upon the larger piston, there will necessarily be just so much back pressure upon the smaller piston.*

A Filer.—*There is no rule for answering such question, because the friction of the water could only be ascertained by experiment. A pressure of 1,000 lb. per square inch corresponds to a head of 2,304ft. of water, under which head the theoretical velocity of escaping water would be 384ft. per second, the velocity for 750 lb. pressure being 333ft. per second, which, were there no friction, would give for a ¾in. opening 59 gallons and 53 gallons of water respectively under the two heads. But what would be the velocity of water through your apparatus it would be impossible to say until you experimented upon it. It would certainly not pass one-half of the quantities above calculated, even when the valve was wide open. The flow would increase in a higher ratio than the opening of the valve.*

SCREW, PADDLE, AND RUDDER SUPERSEDED.

(*To the Editor of The Engineer.*)

Sir,—A new system of propulsion, whereby the inventor modestly proposes to dispense with paddle, screw, and rudder, having been advertised from this address, an impression, calculated to cause me trouble, if not injury, has been created. May I request, therefore, that you will do me the favour of stating in your journal that I am, neither directly nor indirectly, connected with the affair, and that all my knowledge and information respecting the same has been derived from the public prints.

3, Leadenhall-street, March 25th, 1862. Matthew A. Soul.

STEAM CULTIVATION.

(*To the Editor of The Engineer.*)

Sir,—In The Engineer of last week Mr. Romaine asked space to correct some errors I made in my paper on Steam Cultivation.

Mr. Romaine had evidently not read my paper attentively, or he would not have confounded my remarks on self-propelling engines with his own scheme.

Without using the name of any inventor, I merely stated that engines travelling over the surface, drawing their implements with them, consume fourfold the fuel and water of an engine stationary, working implements by means of wire ropes. As I said nothing about speed it ought to have been evident to Mr. Romaine that I assumed the speed of the implements to be equal in both cases.

I give this explanation lest it should be supposed that I was unjust towards Mr. Romaine. James Howard.

Britannia Ironworks, Bedford, March 20th, 1862.

MEETINGS NEXT WEEK.

Institution of Civil Engineers.—Tuesday, April 1st, at 8 p.m., 1st, "Railway Accidents." By Capt. Douglas Galton, R.E., F.R.S., Assoc. Inst. C.E. 2nd, "Railway Accidents" By Mr. Brunlees, M. Inst. C.E.

Society of Arts.—Wednesday, 8 p.m., "On the Introduction and Use of Elastic Gums and Analogous Substances." By Frederick Walton.

Advertisements cannot be guaranteed insertion unless delivered before eight o'clock on Thursday evening in each week. The charge for four lines and under is half-a-crown; each line afterwards, sixpence. The line averages nine words; blocks are charged the same rate for the space they fill. All single advertisements from the country must be accompanied by stamps in payment.

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THE ENGINEER.

FRIDAY, MARCH 28, 1862.

THE ARMSTRONG GUN.

Reports have reached England, this week, of a novel naval engagement, on the other side of the Atlantic, in which an iron-plated steam frigate first demolished a couple of wooden sailing ships of war, and was afterwards beaten off by another iron-plated craft which came up in the very nick of time. From the accounts it appears that the heaviest smooth-bore ordnance, to wit, 9in. and 11in. Dahlgren guns, were necessary to make any impression upon the iron plates with which the Merrimac was covered, while none of her guns inflicted the slightest injury upon her antagonist, the Monitor. The results of this contest are likely to hasten the adoption of iron plating on the sides of fighting ships in the navies of all naval nations. The wooden ships have been proved to be as vulnerable as old packing cases, to say nothing of the danger to which they are exposed from shells filled with melted iron. Taking it for granted, therefore, that every government having a navy to maintain will resort to plated ships, how shall we provide ourselves, whenever we may be compelled to fight them? We can do nothing with rifled guns, at least with those at present in the service. It has been conclusively proved, by a great many experiments, that neither the so-called Armstrong nor the Whitworth gun are of the slightest use when fired gainst 5in. plates, especially if the plates be inclined. This fact was particularly verified the other day in the attack upon the plated target at Shoeburyness. The Armstrongs, too, have had wrought iron shot which do not break up even after they have done all the work of which they are capable. The heavy smooth bores, say the 68-pounder 95 cwt. guns, are the only ones in the service which have succeeded in perforating a 4½in. or 5in. iron plate of good quality. The majority of the public have found it difficult to understand how it is that a rifled gun which can throw a shot four or five miles, has less destructive effect at short range than an old fashioned piece which cannot throw two miles. But, while actual experiment has left no room for doubting the fact itself, it is one which, after all, admits of a ready explanation upon the established principles of gunnery and projectiles. By a simple contrivance known as the ballistic pendulum, the initial velocity of cannon shot may be easily ascertained, the motion imparted to the heavy mass of the pendulum by the impact of the shot fired against it, together with the relative weights of the pendulum and shot, being all the *data* requisite for calculating the velocity of the latter. Thus ascertained, the initial velocity of the heavy Armstrong shot has been found to vary from 1,000ft. to 1,200ft. per second, while that of the 68 lb. shot, fired with 16 lb. of powder from a 95 cwt. gun, is something over 2,000ft. Now the actual forces contained in moving bodies are as the squares of their velocities, and were it possible to provide a vacuum in which to fire the shots in question, the round shot would have nearly four times the force, and, therefore, nearly four times the range of that fired from the Armstrong gun. But in the open air, the round shot, at a high speed, encounters a nearly four-fold greater atmospheric resistance upon every square inch of its disc than the pointed shot, while also the former has, perhaps, double the area of disc opposed to the air. Hence the velocity of the round shot rapidly falls off on leaving the gun, and thus, although having great destructive power at short range, its force is spent after a flight of perhaps one, perhaps two miles. These facts are as well established as anything in practical science, and yet we have abundant reason for believing that they are altogether unknown to many of those who should be most familiar with them The results of practice will at last, however, convince those whose perceptions are alive to no other evidence, and we may at last find the War Office acting upon the belief that, for fighting iron-plated ships, rifled guns are hardly better than pop-guns. At long ranges all guns are equally useless in attacking plated ships, while the vessel which goes armed only with them to bowl away at distant wooden men-of-war will have nothing with which to cope with more formidable enemies alongside. That any guns in use in the British navy can crush in thick iron plates, especially if inclined, is doubtful, but, if there be any, it is the smooth bore only. Thus far the Admiralty have wisely provided the old 68-pounders for most of the new frigates for which 100-pounder Armstrongs were first contemplated. The Hector, however, building at Gasgow, and which is to have 24 of the former description of gun on her main deck, is also, it appears, to have 6 of the 100-pounder, 82 cwt. Armstrongs, in the same position. The *Times'* naval correspondent thus comments upon this decision, which, we may perhaps hope, may yet be reconsidered:—

It will be observed that while no mention is made of guns for the upper deck, six 100-pounder Armstrongs are fixed as part complement for the main deck, notwithstanding that past experience proves that Armstrong guns, from their breaking of breech pieces, and consequent escape of gases and explosions abaft, are unsuited for a ship's main deck. In fact, a strong feeling exists among naval officers that the Armstrong guns, with their present complication of parts behind the chambers, and the present imperfect mode of closing the breech, are unsuited for naval service, except when placed on a ship's upper deck, where they may be useful for purposes of chase, or throwing a projectile a long distance, and where, should an explosion take place, the broken breech and gases may escape into the air overhead, and thus lessen the chance of injuring the gun's crew. So far is this feeling acknowledged that provision is being made in the drawings for the shields of Captain Coles' ship for the substitution of the 95 cwt. smooth-bore gun for the 100-pounder Armstrong, should the closing of the breech of the latter continue in the same uncertain state as it is at present."

Considering that the *Times* lately declined to publish Captain Halsted's reply to Sir William Armstrong's monster puff of the productions of his Elswick establishment, on the plea of the editor that it was impolitic to say aught to shake the confidence of the sailors in a weapon with which so many ships of war were already provided, we are pleased to see, in the columns of our contemporary, such a candid admission as we have just quoted of some of the notorious defects of the gun in question. It is not long, either, since the *Times* informed its readers that three of the 100-pounder Armstrongs broke down together on their first trial, and it might have added that of eighteen 40-pounders from the same maker lately tried in a batch, eight failed on the spot. It might have added that £10,000 of condemned steel "vent pieces," or breech-pieces as they really are, are lying at Woolwich, that £20,000 worth of Sir William's round-end lead-coated 100-pound shot have gone irretrievably to the bad, and that of the four descriptions of fuses which that gentleman has turned out, every one has signally failed, the *Times'* columns containing the obituary, the other day, of an immense lot of the "pillar fuses," the last improvement which our great military engineer has produced. It might have added that Sir William has now completely abandoned his breech-loading system for large guns, having fallen back upon a muzzle-loader, which he calls a shunt, notable for great cost and excessive windage.

Thus we are going on with our guns. While the French are rifling their cast-iron guns with advantage, our Government is sending back its best cast-iron guns to Lowmoor, receiving for them as old iron only as much per ton as is paid for shot. Surely when shot of the best iron are so much needed these guns might be kept for that purpose. The Carron guns were lately being sent back to Scotland, but the virtue of their iron at length saved them from the cupola, the War Office having issued an order that no more should be sent away from Woolwich. The public may yet learn that some of the great number of Armstrongs now on hand are to be sold for old iron, and that better guns for naval purposes will again be ordered from Lowmoor and Carron.

LOCOMOTIVE ENGINES.

Those who saw the locomotives—the Lord of the Isles, Ariel's Girdle, and others—in the Exhibition of 1851, will have some curiosity to see what sort of engines will find their way this year to the Exhibition shed at South Kensington. Engines will be sent, we hear, from the Great Western Railway and its Welsh extensions; but we presume those from Swindon will be of much the same kind as were shown eleven years ago, inasmuch as, notwithstanding the rapidity with which intelligence spreads now-a-days, we have heard of no improvements as having been made since 1851 at that seat of locomotive engineering. It may be that some of Messrs. Rothwell's tank locomotives will be brought up from the Bristol and Exeter Railway to show off their 9ft. driving-wheels, the largest in England, and to illustrate the peculiarities of the bogie, with which our locomotive engineers appear at last anxious to acquaint themselves. Whether one of the great tank engines from the Vale of Neath Railway will be exhibited we do not know. Messrs. Sharp, Stewart, and Co., of Manchester, will, we believe, send one or more locomotives, and it may be that they will exhibit one of the 20in. cylinder ten-wheel tank engines now building for the Bhore Ghaut incline of the Great Indian Peninsula Railway. These engines will have bogies in front, and, we believe, that about all we shall have to show as new in the way of locomotives will be the adaptation of this useful improvement, and that, also, of means for successfully burning coal. As for the bogie, we ought to have been using it, as the Americans have been doing, for the last thirty years. It is possible that a few of our earlier railways did not, from their slight and easy curvature, require its application, but upon the 7,000 or 8,000 miles of new line, built in the United Kingdom since 1840 or 1842, the bogie has been all along urgently required, and we can only wonder at the tardiness of its introduction. No geometrician would pretend to make three points, in a straight line, coincide with a curve; and locomotive engineers, who are supposed to know something of geometry, have shown much hardihood in forcing six-wheel engines through curves of 10 chains radius. The Canadian railways have preferred to import most of their locomotives from the United States, and although leading wheels, in the English style, were at first specified, and the Yankee builders required to supply them, the English engineers who have had charge of the Canadian railways have finally elected to adopt the "truck," and have even taken out the old leading wheels to make room for it. There are very few, if any, locomotives now running in Canada without bogies. On one of the lines of the North, where the bogie has been introduced within the last two or three years, it has, we learn, answered the highest expectations of the locomotive superintendent, and half-a-dozen new engines, now ordered, are to be fitted with the same improvement. Instead, as some builders have done, of placing the bogie wheels close together, they have been spread in these engines to a distance of 5ft. 6in. from centre to centre, the diameter of the bogie wheels being 3ft. With this spread of wheels the bogie rides more steadily than where they are placed closely together. The centre of the bogie is exactly under the centre of the smoke box, and the distance from the centre pintle to the hind pair of 5ft. coupled wheels is 16ft. 7½in., making a total wheel base of 19ft. 6½in., with which the engines run regularly around curves of 10 chains radius with great ease.

As for coal burning, there has certainly been great progress made since 1851, but the improvement, clearly as it may appear in the fuel accounts of our railway companies, has been attended with very little visible change in the structure of locomotives. Take the London and South Western Railway, for example, where not long since extensive changes appeared likely to be made in all the locomotive boilers on the line. As it is, however, Mr. Beattie has managed to substitute coal almost exclusively in the place of coke, even with the large stock of boilers of the ordinary construction. The extent and results of this substitution in the 177 locomotives belonging to the company, may be stated exactly as follows:—

Half-year ending	Train miles run.	Tons coke burnt.	Tons coal burnt.	Total cost of fuel.	lb. fuel per train mile.	Cost of fuel per train mile.
June, 1860	1,836,135	2,778	18,469	£19,541	25·9	2·554d.
Dec. ,, ...	2,133,856	2,547	21,603	21,452	25·3	2·413
June, 1861	2,155,801	1,657	21,751	19,818	24·3	2·206
Dec., ,, ...	2,255,995	1,363	21,655	19,193	22·9	2·041

We cannot say whether other companies can show an improvement equal to that effected by the London and South Western, but it is certain that, with very slight alterations in and additions to the ordinary locomotive boiler, many railway companies have gone into coal burning on the large scale, and with satisfactory results. Engineers and others, however, who may examine the locomotives in the coming Exhibition, to learn what has been done to enable them to burn a fuel, the use of which, in 1851, was altogether inadmissible, will probaby be disappointed to find that in no respect are the coal burners substantially different from the coke burners. The steam jet or blower in the chimney, applied by the late Mr. John Gray as long ago as 1837, and the "baffle-plate" just in front of the door, appear to constitute all that is essential in burning coal, at least as now practised. Few now pretend that double fire-boxes, combustion chambers, steam-jets in the fire-box, fire-bricks, &c., &c., are required, and they have been pretty generally dismissed. The substantial economy in working is, however, all the more acceptable from being obtainable in the use of the very large amount of existing stock. As for ourselves, at least, we do not intend to find fault because it has not been attained by highly original devices, affecting the general structure of the locomotive. Yet we cannot forbear remarking the singularity of the circumstance that when, 25 years ago, John Gray burnt coal almost precisely as it is now burnt in locomotives, none had faith, or, at least, none would see the importance of the innovation. It was the same ten years afterwards, when the late Mr. Dewrance worked his coal-burning engine, the Condor, over the Liverpool and Manchester Railway. Mr. Samuel Hall, too, had made a demonstration of the readiness with which coal might be made to take the place of coke, in locomotives, in 1840, but at that time few had turned their attention to the retrenchment of railway expenses, and coke-ovens multiplied accordingly. Mr. Hall, if he be still living, must have fre-

quently reflected upon the instability of engineering opinion, for not only is his plan of coal burning, which few, if any, would admit would answer in 1840, made to yield excellent results in 1862, but his surface condenser, which, although mechanically successful, was condemned more than twenty years ago, is now regarded as one of the greatest improvements in our time. For, say what we will, comparatively little improvement has been made, unless, perhaps, in the means for bringing the water more thoroughly over the condensing surface, while in one of the most improved steamships now running—the Mooltan—the condensers are acknowledged to be Hall's, almost in their original integrity.

To proceed with locomotives:—The movement in favour of light engines, which promised so much in 1851, has ceased for some time, and it is hopeless, under the present exigencies of railway traffic, to look for anything further in that direction, until some radical improvement shall have been made both in the permanent way and in the engine itself. As it is, the size and weight of locomotives have only kept pace with the increasing demands upon their power, and it was most illogical, therefore, after 25-ton engines had been found to be practically necessary, to assume that, without any corresponding improvement, 15-ton engines would answer just as well. The fallacy was certain to collapse under the weight of experience, and now very little is heard of pigmy locomotives.

There will be engines at the Exhibition, no doubt, without pumps, the injector being substituted therefor. This is an improvement, but not exactly an improvement of the locomotive *per se*, inasmuch as the same contrivance affixed to a brewer's boiler might as well be called an improvement in breweries.

As for outside and inside cylinders, steam domes, and perforated steam pipes without domes, valve gear, &c., practical opinion, as embodied in recent practice, has hardly changed within the last eleven years. We are inclined to think, however, that the outside cylinders are making additional way in professional favour, and the reasons can be stated thus: the inside cylinder engine has almost or quite outgrown the narrow gauge; locomotive superintendents have learned to counterbalance the driving wheels, and are disposed to place the cylinders horizontally. Whenever the bogie comes into general use, so that the horizontal outside cylinder can be got in without throwing a single pair of stiff leading wheels too far forward or too far back, the outside cylinder engine will, we believe, be generally preferred, the breakage of crank axles already forming the subject of loud complaint on lines where inside cylinders are still employed.

We ought not to overlook the growing preference for steel in place of iron, as in tyres, and, in some cases, axles, and even wheels, boiler plates, fire-boxes, tubes, &c., for already a number of locomotive engines appear disposed to "go over" to steel altogether. Whatever tends to increase the strength, and thus to promote the safety of a locomotive boiler, a locomotive axle, or any other detail of that great engine of modern intercourse, is undoubtedly an improvement in the locomotive, although no mechanical ingenuity whatever is required in the employment of steel, or "homogeneous metal," as some steel is now called, in place of iron. We have no doubt that every part of a locomotive, without a single exception, might be made of steel with advantage, and, although we shall not see a steel locomotive this year, we may look for one in 1872, if there be an International Exhibition in London that year.

LITERATURE.

A Manual of Civil Engineering. By William John Macquorn Rankine, Civil Engineer, LL.D.; F.R.SS. London and Edinburgh; F.R.S.S.A.: A.I.N.A.; Regius Professor of Civil Engineering and Mechanics in the University of Glasgow, &c. &c.

Dr. Rankine has unquestionably carried out a great design in a most successful manner in the volume before us. Instead of following in the beaten track of writers on civil engineering, he has struck out an excellent path for himself, and pursued it to the end with extrordinary ability and industry. He has divided his work into three parts. The first relates to those engineering operations which depend on geometrical principles alone — Surveying, Levelling, and the Setting-out of Works, comprehended under the appropriate name of Engineering Geodesy, or Field-work. The second part relates to the Properties of the Materials used in Engineering Works—such as earth, stone, timber, and iron; and the art of forming them into structures, embankments, bridges, &c. The last division, under the name of Combined Structures, sets forth the principles according to which the structures described in the second part are combined into extensive works of engineering, such as roads, railways, river improvements, waterworks, canals, sea-defences, harbours, &c. This general plan of the work—which is manifestly a very natural and proper one—is developed not only with great care, but with a high degree of originality likewise, and, also, with a happy balance between theoretical investigations and practical facts. We find no evidence in this volume, however, of a disposition to sacrifice clearness to novelty, the author's single aim throughout being to make the thoughtful reader master of the body of professional knowledge here brought together. In order to keep down mere mathematical investigations as much as possible, the author has wisely opened the second part of the work with a collection of mechanical principles and formulæ, entitled a "Summary of the Principles of Stability and Strength," to which simple references only are afterwards required.

It is quite impossible to give anything in the shape of a detailed notice of the contents of this last and best of Dr. Rankine's valuable professional works, within the compass of the space at our disposal. We must do it the justice to say, however, that we have read carefully through most of its 800 pages, and are thoroughly convinced that it far surpasses in merit every existing work of the kind. It abounds with proofs that the author's great abilities and sound scientific knowledge have been engaged in the simplification of its smallest details; that the very latest results of experimental inquiry have been embodied in it; that useful practical suggestions, which a less sagacious author would have excluded, have been recorded for the reader's benefit; and that, in short, the means are here afforded for rendering any competent man who shall study the book thoroughly a most accomplished and finished civil engineer, in so far, we mean, as the study of any book whatever can fulfil that object. As a "Manual" (which it avowedly is), for the hands of the professional civil engineer, it is sufficient, and it is, as we have said, unrivalled, and even when we say this we fall short of that high appreciation of Dr. Rankine's labours which we should like to express. The book before us is, in fact, an honour to the author, to the university that commands his services, and to the whole profession of civil engineers. We wish we could hope to see a work of equal theoretical and practical value produced by the professor of an English university, or by any civil engineer on this side the border.

Transactions of the Institution of Naval Architects. Vol. II. Edited by E. J. Reed, M.I.N.A., and Secretary to the Institution. 1861. Office, 7, Adelphi-terrace, London, W.C.

The publication of these *Transactions* in handsome quarto volumes, annually, affords us the opportunity of directing the attention of our readers to them more pointedly than is convenient in the case of the proceedings of those societies whose papers and discussions are issued at irregular intervals in the form of pamphlets. It is important that these *Transactions* should be specially noticed for another reason, also, viz., that they contain contributions which are, and are designed to be, of permanent value as scientific records. In the volume before us there are several papers of this character, among which we may mention Mr. Scott Russell's on the "Wave-line Principle of Ship Construction" (concluded from the preceding volume); those by Mr. Samuel Read, and by Mr. Frederick K. Barnes, on "Methods of Calculating the Statical and Dynamical Stabilities of Ships;" one on the "Rolling of Ships," by Mr. W. Froude; another on "American River Steamers," by Mr. Norman Scott Russell; and another on the "Deviation of the Compass in Iron and other Vessels," by Mr. F. J. O. Evans, the Superintendent of the Compass Department of the Admiralty. All these are communications of permanent value, and most of them are illustrated with copper-plate engravings of a very elaborate and costly nature.

In addition to the above, there are numerous contributions of a more temporary, but nevertheless considerable, interest in the present volume. Papers on iron-cased ships of war, by Sir Howard Douglas, Mr. Scott Russell, Mr. Samuda, and Mr. Lungley, followed by a lengthened discussion, sustained chiefly by naval officers of distinction, are given, together with others upon the classification of iron ships by Mr. Grantham, and upon unsinkable iron ships by Mr. Lungley.

An introduction by the editor states that the institution has progressed very cheeringly during the past year, and now comprises nearly 500 members and associates. Officers of the Royal Navy have joined in large numbers, and among them we observe the names of the Hon. Sir Frederick Grey, K.C.B., Vice-Admiral, and Rear-Admiral Drummond, the new naval Lords of the Admiralty; of Sir Frederick Nicolson, the Commodore of Woolwich Dockyard; Captain Sir J. C. Dalrymple Hay, R.N., M.P., Chairman of the Government Iron Plate Committee, and many others, showing clearly enough that the institution, young as it is, has won the full confidence of the Admiralty authorities. We also observe on its list of associates the names of the Duke of Buccleuch and Queensbury, the Marquis of Breadalbane, and many other noblemen and gentlemen of such wealth as to leave no possibility of the body experiencing a deficiency of funds.

The proceedings of the institution this year promise to furnish materials for a third volume no less interesting or valuable than the two already issued.

Manual of Railway Engineering in Ireland. With Appendices, including the Irish Tramway Acts. By Charles P. Cotton. Dublin: Edward Ponsonby, 116, Grafton-street.

This is a little manual well deserving a word of commendation. It treats first of the preparation of Parliamentary plans, and the execution of work connected therewith; including methods of correcting plans in the field and in the office, plotting the section, lithographing the plan and section, referencing, preparing notices, framing the estimate, and so forth. It then treats of the preparation of detailed plans and sections, with bridge designs, previous to the letting of the contract. An analysis of the Railways' Clauses Act is here given, and is followed by short chapters on field-work in preparing contract plans and sections, pegging or staking, levelling, plotting the section, surveying, farm mapping, the lodgment of contract plans and purchase of land by arbitration, drawings of bridges, culverts, &c., and estimating. For setting out railway curves, the author prefers the method introduced by Dr. Rankine in 1841, and well-described in his *Manual of Civil Engineering* (p. 102, &c.) previously noticed; but in an appendix he briefly explains the method by offsets, and also that by chaining along the tangents, and laying off rectangular offsets of calculated lengths. Other appendices are given, including one in which the Tramways Acts are printed. The little book is illustrated by a few carefully-prepared plates, and is otherwise well executed. It will be of great use as a hand-book for young Irish engineers.

A Handy Book on the Law of Bankruptcy; including the Practice under 7 and 8 Vict., c. 70 (the Gentleman's Act). By James Walter Smith, Esq., LL.D., Barrister-at-Law. London: Effingham Wilson, Royal Exchange.

This is a timely little work by a gentleman who has very successfully prepared several previous "Handy Books"—on Bills, Partnerships, Banking, Master and Servant, &c. It is a useful digest of bankruptcy procedure under the new law, and will be worth very much more than the shilling asked for it to any one interested in the subject. We need do no more than announce its appearance.

STEAMSHIP TRIALS.

A number of important trial trips have been made during the week.

The contractor's trial of the Resistance, at light draught of water, took place at Sheerness, on Wednesday last. The Resistance is sister ship to the Defence, and is of 600-horse power, and 3,668 tons, and will carry 18 guns. The following are the results of the trial:—Average speed, with full boiler power, 12·331 knots; pressure of steam, 20; revolutions, 70; vacuum, 25 to 26; average speed, with half boiler power, 11·394 knots; pressure of steam, 20; revolutions, 64; vacuum, 26. The circle was accomplished in 7 min. 25 sec., the diameter of the circle being about 300 yards. The engines were stopped dead in 4 secs., started ahead in 5 secs., and turned from that position astern in 4 secs. Draught of water forward, 19ft. 9in.; aft, 23ft. 6 in.; Griffiths' screw, pitch 21ft. The average temperatures during the trial were—engine room, 97; after stokehole, 100; fore stokehole, 80; on deck, 47. These results have been accomplished with a velocity of piston-rod of upwards of 500ft. per minute, and this, too, with a smoothness of motion and entire absence of vibration specially noticed by all on board. The Resistance answered her helm in a very satisfactory manner.

The iron-clad screw steamship Defence, 18, which left Portsmouth on the 17th inst., arrived in Plymouth Sound on Tuesday evening. On the 19th, when off Start Point, a gale from the eastward was experienced. The ship was run to the westward, and when 100 miles beyond the Scilly Islands was, on the 20th, hauled to the wind, and tried on all points under steam and under sail, during a strong gale from east-north-east. The Defence has proved herself easy at sea, rolls very little, and steers well. The greatest speed attained under steam and canvas was 13 knots; under canvas only, 10½ knots.

On Saturday, the 22nd, a preliminary trial of the screw steam frigate Arethusa, 51 guns, took place at Sheerness. The ship was built at Pembroke, about seventeen years ago, as a sailing frigate, but has since been converted into a screw frigate at Chatham dockyard. The alterations which she has undergone consist in her being lengthened amidships 41ft., and having had her stern altered and lengthened 12ft. to adapt her for the screw. Her bow still retains its original bluff form. The extreme length of the vessel between perpendiculars is now 252ft.; length of keel for tonnage, 217ft.; extreme breadth, 52ft. 8in.; ditto for tonnage, 52ft. 2in.; depth of hold, 17ft. 1in.; burden in tons, 3,142. The Arethusa is the second completed of three vessels, the machinery of which has been made with the view to certain results in accordance with orders from the Admiralty. The vessels chosen for the trial of these experiments are the Octavia, 51, the machinery of which has been completed and officially tried by Messrs. Maudslay, Son, and Field; the Arethusa, which has been fitted with machinery by Messrs. John Penn and Son; and the Constance, which is being fitted by Messrs Randolph and Elder. The peculiarity in the machinery of these vessels is that they are fitted with each a pair of engines of 500-horse power, which are to effect a greater amount of power at a less working cost than any yet introduced into her Majesty's navy. The Arethusa is fitted with a pair of expansive trunk engines, with two cylinders, 86½in. diameter, the trunk being 33in. diameter, and the length of stroke 42in., with Spencer's surface condensers, containing nearly six miles of 1in. tubing. The boilers, four in number, with four furnaces to each, are fitted with superheating apparatus. The propeller is Griffiths' patent, pitch 20ft. to 26ft., present pitch 23ft. The performance of the machinery during the trial was most satisfactory, both as to the working of the engines and the results produced. After the ship had been taken to the measured mile (a distance of twelve miles from port), the engines working most of the way at full speed, it was considered advisable (as this was the first time there had been an opportunity of testing the qualities of the machinery at full power) to give the engines a thorough examination previous to the trial on the mile; this having taken a considerable time, and the vessel having left the harbour so late in the day, it was found impossible to satisfactorily complete the trial on that day, consequently four runs only were made on the mile, the average results of which were 12·654 knots; pressure of steam, 24; revolutions, 63; vacuum, 28½. The force of wind during the time was from 5 to 6. The circle was turned in six minutes; the diameter of circle about five times the length of the vessel. The average temperatures during the day were—engine-room, 54 deg.; fore stokehole, 83 deg.; after stokehole, 87 deg. The regular official trial will shortly take place.

The contractors' trial of the engines of the Albion, 80, took place on Friday last at Plymouth. The ship measures 3,005 tons. In her sailing days she was described as the "rolling Albion." She has a peg-top bottom, in consequence of which it is necessary to raise her machinery, so that a man can walk about underneath. The area of the midship section, which is very angular, is 710ft. Her engines, by Messrs. Humphreys, Tennant, and Co., are of 400-horse power, of the same kind as those in the Liverpool, which are of 600-horse power. They are horizontal, direct acting, exceedingly simple and compact, and any part can be approached while they are in motion. The screw shaft is 90ft. long by 12½in. in diameter, the diameter of the screw is 17ft. and the pitch 19ft. The draught of the ship forward is 18ft. 9in., and aft 21ft. 6in. The average speed, attained with full boiler power, after six trials at the measured mile, was 11 knots; revolutions 69 per minute; pressure 20 lb.; vacuum, 27in.; half boiler power, 8·887 knots; revolutions, 54. The results of the experiments were considered very satisfactory.

A fourth trial trip of the Phœbe, 51, took place outside Plymouth Breakwater on Monday last. The engines, direct air-pump, are by Messrs. R. Napier and Sons, of Glasgow, who were represented by Mr. Brown. They are of 500-horse power nominal; diameter of cylinder, 65in.; and length of stroke, 3ft. 6in. The length of the shaft is 96ft.; diameter, 12in. The diameter of screw, Griffiths', is 18ft.; pitch, 22ft.; and length, 3ft. The engines were worked on Monday up to an indicated power of 1,900 horses; revolutions, 61 per minute; pressure per square inch, 20 lb.; and vacuum, 25½in.

The South-Western Company's steamship Havre, Captain Smith, running between Southampton and Havre, has just completed a thorough overhaul and refitment to meet the requirements of the approaching Exhibition traffic. Among other improvements she has been fitted with new boilers and feathering paddlewheels, gaining thereby a considerable acceleration of speed, and she is now one of the fastest as well as the largest vessel engaged in the passenger trade between France and this country. The Havre was taken out for a trial on Saturday, and attained an average speed on four runs at the measured mile in Stoke's Bay of 13·645 knots, equal to 16 statute miles per hour; revolutions of her engines, 31.

Steamship Economy.—We are informed that the Canadian steamships Hibernian and Norwegian, fitted with improved engines and Spencer's surface condensers, are now running with a regular consumption of 32 tons of coal in 24 hours, working up to an indicated power of 1,200 horses, or rather less than 2½ lb. per horse power per hour.

The Iron Trade in Cleveland.—Messrs. Whitwell and Company have blown in two of their new furnaces at South Stockton, and the South Durham Iron Company intend blowing in another furnace in the course of three weeks or a month. Messrs. Head and Ashby, of Stockton-on-Tees, have obtained a large order for iron bridges for railways in Italy. The order is for twenty-nine bridges, and will require upwards of 1,000 tons of iron to complete them.

The Galway Steamships.—The report of the Atlantic Royal Mail directors states that the Hibernia, built by Palmer, of Newcastle, is being repaired by Messrs. Laird, at a cost of £30,000, and the Columbia, built by Samuelson, of Hull, at a cost of £50,000. The Anglia, also built by Samuelson, is being repaired on the Thames at a cost of £40,000. The two former vessels will be ready for sea by the end of April. The capital of the company has been increased to the extent of £600,000 in preference stock, of which £400,000 has already been placed.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

THE ARMSTRONG GUN.

SIR,—Captain Halsted having given many instances of failures in the Armstrong gun, and considered the weapon in a practical point of view, I beg to give a short resumé of our present position, which will show the necessity for the adoption of a better system of ordnance.

Experiments at Shoeburyness have now established that the finely grooved 100-pounder, now called a 110-pounder, cannot give its projectile, even when made of wrought iron, a sufficient velocity to crush the present armour-plates, and have shown that the Armstrongs are for this purpose inferior to the old cast iron smooth bore 68-pounder, and also to any new strong rifled gun firing a non-leaded projectile.

The want of velocity in the 100-pounder shot is a radical defect, and cannot be got over without abandoning the lead coating; and the plan of throttling the projectile at the breech chamber, until it cuts its way through the grooves, necessitates the employment of a comparatively small powder charge to save the gun. So damaging, however, is this nipping and subsequent detention until the fine grooves perform the operation of rifling the covering (lead hardened with tin) of the shot, that the 40-pounders still fail constantly in proof; and although the 100-pounders generally pass the ordeal in safety, it is only since windage has been given, and the shot allowed to pass easily out through the bore. This has been effected by reducing the lead on the proof shot to a smaller diameter than that on the service projectiles—a still greater reduction having been made; in fact scarcely any lead is put upon the heavy cylinders used for testing *the* 100-pounder which was said to have stood such a wonderful proof!

The detention of the service projectiles in the bore is very damaging to the endurance of these built-up Armstrongs. If, in the lengthened period of the strain, the highly compressed elastic fluid upon the inner tube causes it rapidly to deteriorate, a tubing of steel might remedy this defect, but Captain Blakely has already patented the plan.

These and other deficiencies in the finely grooved Armstrongs doubtless caused Sir William to introduce the shunt rifling for a peculiar pattern of iron ordnance cast for the navy, but which failed, and afterwards to bring a modification of the plan (on which he stated he had been two years experimenting) before the C.E. meeting of last year, desiring to use it for all coil guns above if not including 40-pounders; but although the officers at Shoeburyness, who witnessed the higher velocity of the non-leaded shunt projectiles, preferred the system to that of the fine groove, the preconceived notions of the superiority of the "original Armstrongs," on the part of others, led to the re-establishment of the lead coated plan, after a temporary suspension of manufacture.

The employment of non-leaded projectiles, which did away with the necessity for a movable breech, enabled 18 lb. of powder to be fired with less injury to the coil structure of the gun than is done by the 12 lb. and 14 lb. charges in forcing the leaded shot through the fine grooving; and had the systems for firing simple iron projectiles been fairly put into competition with the Armstrong plans—similarly strong guns being used—it would have long since been seen that the fancied superiority of the finely grooved weapon was solely due to nicety of fitting and delicacy of finish, and that the compound shunt projectile, though superior in some respects to the leaded shot, was very inferior to the "simple iron projectile."

With respect to the windage always given with simple iron projectiles, but which is thought by those not well informed to be advantageously closed by the lead coating, continental artillerists assert that a moderate amount is an advantage: it certainly acts as a safety valve, and the elastic fluid which thus escapes cleanses the bore, and drives out a column of air which would otherwise impede the passage of the shot. Windage admits, also, of the guns being loaded from the muzzle as well as from the breech, making the same projectiles available for breech and for muzzle loaders; it likewise materially lessens the amount of friction against the bore which would otherwise detain the shot, and it reduces the wear at the vent orifice. As to expanding projectiles, which are intended for muzzle loading ordnance, they may answer tolerably well for weak guns, but the lead affixed to their rear would be upset by the heavy charges used in the powerful ordnance needed to attain sufficiently high velocities to smash plates: in fact, the lead coating plans that were well enough adapted to the infancy of rifling are wholly unsuited for the day of armour plates; and especially unsuited for a nation of great mechanical skill and able to fit any bearing of iron shot to any shape of rifling.

The value of rifling has been much over-estimated. A rifled gun is valuable on account of firing a shell of large molten iron or powder capacity, and projecting it to a great distance with precision; but to fire a solid, round headed shot of the Armstrong pattern, at close quarters, is attended with the disadvantage of throwing an enormous strain upon the gun, and that without giving the projectile sufficient velocity to do the same smashing work which is so easily effected by the round ball. Hence it is advisable, until guns can be made which do not deteriorate with firing, to unite the advantages of the smooth bore and of the rifle in the same weapon. This union can be effected without detracting from the employment of the flat-headed shot or the still more formidable projectile which combines the punch front with an incendiary shell rear. There cannot, therefore, be any sufficient reason for straining the gun to the utmost in firing an Armstrong solid round-headed projectile at close quarters, when it is less destructive than the round ball.

Instead, however, of combining the advantages of the solid round ball and those of the elongated shell there are now only 8in. cast iron shell guns, for the armaments of those vessels which cannot carry the solid shot guns of 95 cwt., which only the iron-plated ships can do. These round shell guns, which are useless against armour plates, have to be mixed with 32-pounders, that are equally inefficient, and with 40-pounder Armstrongs (perhaps a 70-pounder or two besides), which are even worse; for these guns use a new sized grain of powder, a different charge, and project a long shell containing barely 2¾ lb. of powder—a solid bolt of too small a diameter to be formidable to even a wooden ship.

Touching the system of rifling which can best combine the powers of the rolling round ball with the advantages of the explosive elongated projectile, it is evident that that system is the best which requires the least portion of the surface of the bore to be cut away, and which, joined with great precision (mainly dependent upon accuracy of fitting), affords the surest mode of firing elongated molten or powder shells without their cracking, for incendiary projectiles would, in war, often have to be fired from the heavier ships, both near and across vessels or boats engaged in the in-shore attack, just as is often necessary upon land to fire over advanced works. These conditions are attainable by making three narrow grooves, having rounded shoulders for the elongated shell first to centre itself upon without jar, and afterwards to be supported during its passage out of the gun. But these conditions are not attainable where there are no such rounded shoulders, or where most of the surface of the bore is swept out by the rifling, for then the elongated projectile would be wedged against the grooving with a crushing strain, and the round ball, instead of rolling over and going out straight, as in the former case, would lose much of the propelling force of the powder from excessive windage, and the ball, being slack in the bore, would rub against the grooving and get an eccentric motion in its passage out, so that it would neither hit a full smashing blow, nor ricochet straight if it impinged upon the water. But the smashing power of solid round balls has not yet been fully developed, for, although the present cast iron 68 lb. balls penetrate the 4½-in. plates, when they do not split, still the far larger proportion of balls break up without piercing them. But were they to be made of Bessemer or Mushet metal, instead of the ordinary cast iron, they would, at only a small increase of cost (when manufactured in large quantities), be much more formidable.

The great windage, also, which was and is still given with smooth bore guns, because the round balls were formerly not cast spherical, could be advantageously reduced by one half, which would give a considerably higher velocity; and this improvement would save the bore of the gun, besides being of great advantage in a properly rifled piece, as the grooving would give the air space necessary for quick loading. The French (and other nations) have succeeded in uniting the advantages of the rifle with the power of the smooth bore gun, utilising all their stores; and they have strengthened their 30-pounder and 50-pounder on the Blakely plan, and rifled them so as to throw respectively a 60 lb. weight shell containing 5½ lb. of powder, and a 89 lb. shell holding a considerably larger charge; but these guns are still called 30-pounder and 50-pounder, and fire solid round balls of 30 lb. to 50 lb. weight. Is it then wise to give the Armstrongs a nomenclature which conveys a false idea of their power? If may hereafter not redound to the praise of the navy should an enemy armed with 50-pounders fall in with an Englishman mounting only Armstrong's 40-pounders.

Even the French 30-pounder shells contain more than double the bursting charge of the Armstrong 40-pounders, and their iron shot would make twice as large a hole as the lead-coated projectile of only the diameter of a round 14-pounder ball. Are we, then, not risking our prestige, or at least lessening the credit that might otherwise accrue to our sailors, by conveying an impression of the size and power of the Armstrongs so very much beyond the reality?

ARTILLERIST.

THE EXHIBITION BUILDING.

SIR,—You may, perhaps, find a few remarks on the International Exhibition building worthy of insertion in your valuable columns. I do not mean to pass in review the different parts of the building, nor shall I attempt to explain why the commissioners have thought it necessary that at least the outside should be the most singular on record. Perhaps some new law has been propounded by which such things as efficiency, and what is usually understood by architectural taste, are proved to be incompatible, or, perhaps—but it is useless to surmise, as I feel my own incapacity to fathom such mysteries, and, on the other hand, it would be simply ridiculous to accuse Royal Commissioners and royal engineers of being wanting in such a trivial and commonplace qualification as good taste. Comparisons are odious, and I shall leave to odious people the presumptuous task of comparing the building of 1851 with the present creation, but who can be astonished if they fail to express their belief in the great progress exhibition buildings have made during the last twelve years, since the vulgar are never capable of appreciating perfection in anything? They may think that, after all, Paxton was not an ordinary man, but then this is a low prejudice; they may think that there was something noble and bold in that palace of glass, but the initiated are supposed to acknowledge that the monster domes on the present building, which look as though they had dropped from the clouds, eclipse anything yet achieved by the art of building.

Besides, what novelty is displayed in every corner of the building? No slavish regard to proportions; no pettyfogging consideration of form; in fact it reflects in its architecture the military spirit of the country, and seems to invite firing into.

But I must draw myself away from the contemplation of the great genius of Captain Fowke in his lofty flights and descend to a lower order of things which may more particularly interest the public.

That part of the building which is destined to receive machinery is built exclusively of wood. The roof is supported by wooden arches resting themselves on wooden supports, both of which are formed of laths nailed together, the whole presenting a structure which makes the experienced feel somewhat uncomfortable while within it.

It is true the shed is made for temporary purposes only, but, unless something be done to strengthen it, I fear that its temporary nature may be practically exemplified before its promoters calculate. The shed is decidedly unsafe, and I am convinced that on the continent, where government inspection is more rigidly enforced, it would not have been permitted. On looking in a line with two opposite supports, it is not only palpable that the arcs are bent on the right and left of the centre line, but that the supports themselves are literally curved. Again, by looking along the wooden wall, which forms the outside of the shed, an evident bend is detected, as though the roof were forcing its support into the street, a circumstance which is not unlikely to happen if proper remedies are not forthcoming.

Last week there was a heavy fall of snow in London, owing to which the roof became more heavily loaded than usual, and the distortion of the shed quite alarming.

I noticed that some practical man had placed a prop against one or two of the supports, perceiving, no doubt, the danger that threatened.

Now, snow may fall again—hail probably will; and, moreover, crowds may occasion some considerable strain against the sides and supports of the shed. Therefore, for the safety of the public, I think it absolutely necessary that these glaring faults of construction should be rectified without delay.

This can be easily accomplished at a small expense, and I recommend Captain Fowke seriously to consider the matter, if but for his own reputation.

It is true there is no support required from the shed for the shafting, as proper cast iron pillars have been erected for this purpose. But is this a reason why the building should not be able to support itself?

C. S.

London, March 24th, 1862.

ROTARY ENGINES.

SIR,—I cannot at all agree with your correspondent's views on the applicability of the rotary engine to drive the screw propeller. He is quite correct when he says that the present form of engine is more or less unsuited for that purpose, but he does not make out a good case in favour of the rotary. His sketch looks very well on paper, but I wish he would give us a cross section of his engine, and then I think we would find a few drawbacks; until he does this, I do not wish to enter more deeply into the discussion.

As to the rotary I allude to, "J. S." will find that the words I made use of were, "except for some special purpose I consider the rotary engine the most worthless in existence." Now, the engine I allude to *was* designed for a special purpose, namely, to drive a flour mill intended to make flour equal to the best French. Now, in order to do this, a perfectly equal speed was required to be maintained, and this no reciprocating engine could give. A rotary was designed, which gives a more equal force than any water-wheel; it is absolutely without a dead point, but would be very unsuitable for the screw, because it works without expansion, and travels at a very slow speed, but for its own special purpose (and that, in my mind, is the only purpose for which a rotary is useful), it is as good a design as can be. If "J. S." still feels curiosity I will send him a sketch.

March 24th, 1862. V. P.

MANSELL'S RAILWAY WHEELS.—A petition for an extension of Mr. Mansell's patent for wooden wheels for railway carriages has been heard by the Judicial Committee of the Privy Council, and an extension of two years granted.

NEW ARMOUR PLATED SHIPS.—The Admiralty have issued letters calling upon Messrs. Jones, Quiggin, and Co., of Liverpool, Messrs. Napier, of Glasgow, Messrs. Palmer, of Newcastle-upon-Tyne, and Messrs. Samuda, of London, to tender for the construction of an iron ship on Captain Cowper Phipps Coles' plan. The tonnage of the intended ship is 2,529 tons, and she is to be fitted with six cupolas, each to be capable of being armed with two 100-pounder Armstrong guns.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

2881. JAMES GRINT, Harrison-street, Gray's-inn-road, London, "Improvements in pegs, nails, or like fastenings, for uniting the soles of boots and shoes, and other substances."—*Petition recorded 10th November*, 1861.

2890. JAMES MOORE CLEMENTS, Birmingham, "Improvements in the making or manufacturing of certain parts of garments for either sex, likewise in the manner of preparing the same for sale, as also an improved button to be attached to garments without sewing."—*Petition recorded 18th November*, 1861.

202. JOHN BROWN and JOSEPH DAVENPORT, Bolton, Lancashire, "An improved lubricating apparatus applicable to platons."—*Petition recorded 24th January*, 1862.

204. EDWARD HENRY CRAVOCK MONCKTON, Fineshade, Northampton, "Improvements in the application of electricity for obtaining ammonia and other useful products during the combustion of coal and fuel, and in the apparatus employed therein."—*Petition recorded 31st January*, 1862.

364. GODFREY JOACHIM AMAN, Liverpool, "Improvements in envelopes or bags, to hold grain or similar substances, for transmission by post or as parcels."—*Petition recorded 12th February*, 1862.

468. SPENCER SMITH, High Holborn, London, "Improvements in electro-magnetic engines for obtaining and applying motive power."—*Petition recorded 21st February*, 1862.

482. ROBERT FOSTER, jun., Beeston, Nottinghamshire, "Improvements in the construction of horticultural and other similar buildings or erections."—*Petition recorded 22nd February*, 1862.

572. ROBERT SHAW, jun., Portlaw, County Waterford, Ireland, "An improvement in fire-arms by a more convenient method of placing the ram-rod in position."—*Petition recorded 3rd March*, 1862.

598. WILLIAM HENSMAN, Woburn, Bedfordshire, and WILLIAM HENSMAN, jun., Linsdale, Buckinghamshire, "Improvements in steam ploughs and in apparatus connected therewith."—*Petition recorded 5th March*, 1862.

608. MARCUS BOURNE NEWTON, King's-cross, London, "Improvements in the manufacture and construction of junction and other drain pipes in clay or other plastic materials."

610. JOSEPH REVELL, Dukinfield, Cheshire, "Improvements in securing the rails of railways and tramways to the chairs."

612. JOHN FOWLER, jun., DAVID GREIG, and RICHARD NODDINGS, Leeds, Yorkshire, "Improvements in apparatus for cultivating or tilling land."

614. RICHARD WRIGHT, Albany-road, Camberwell, Surrey, "Improvements in heating and clarifying saccharine fluids."

618. HENRY BENTINCK COATHUPE, Junior United Service Club, St. James's, London, "Improvements in the manufacture of clips, hooks, and other such like fastenings."—*Petitions recorded 7th March*, 1862.

620. HENRY FLETCHER, Wood-street, Cheapside, London, "An improved clip for securing the steel or other expanders of crinoline to the suspenders thereof."

622. ANDREW BLAIR, Dawsholm Print Works, Dumbartonshire, N.B., "Improvements in rotatory engines."

624. SIDNEY SAMUEL BROMHEAD, Bristol, Gloucestershire, "Improvements in the construction of boxes or receptacles for coals."

626. JOHN DEANE, jun., King William-street, London, "Improvements in revolving fire-arms."

628. PIERRE JOSEPH GUYET, Paris, "Improvements in water meters."

630. WILLIAM CLARK, Chancery-lane, London, "Improvements in brims and peaks of hats, caps, and other coverings for the head."—A communication from Jonas Haas, Boulevart St. Martin, Paris.

632. JOHN FLEMING, Mincing-lane, London, "Improvements in machinery for pressing cotton."—A communication from Alexander Johnstone, Bombay, East Indies.

634. LUKE RICHARDS SYKES, New Coventry-street, London, "Improvements in gloves."

636. JOHN JAMES HENRY GERHARDT, Lawrence-lane, London, "An improved fastening for albums and other books, bags, reticules, and other articles."—A communication from Herr Kugler, Nuremberg, Germany.—*Petitions recorded 8th March*, 1862.

638. JAMES DUNCAN, Greenock, Renfrewshire, N.B., "Improvements in the manufacture of vinegar."

640. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in producing by the aid of photography copies of maps, charts, plans, and drawings."—A communication from Arthur Guy Morvan, Paris.

642. WILLIAM SPENCE, Chancery-lane, London, "Improvements in projectiles."—A communication from Ira Wells Shaler, Brooklyn, Kings, New York, U.S.

644. ALEXANDER CHARLES MACLEOD, Hanover-square, London, "Improvements in ventilating hats and coverings for the head."

646. ANDREW BARCLAY, Kilmarnock, Ayrshire, N.B., "Improvements in traction engines, and in apparatus for indicating the pressure of steam."

650. HENRY HERMAN KROMSCHROEDER, Princess-terrace, Regent's Park, London, "Improvements in gas-meters."—*Petitions recorded 10th March*, 1862.

654. WILLIAM BARTER, Brixham, Devonshire, "Improvements in apparatus for propelling vessels, and for enabling them to work off lee shores during storms."

658. COLLINSON HALL, Navestock, Essex, "Improvements in implements for breaking up the soil, and in ropes and drums to be employed in the cultivation of the soil by steam."

662. GEORGE DAVIES, Serle-street, Lincoln's-inn, London, "Improvements in attaching artificial teeth to plates and to each other, and in moulds for forming artificial teeth."—A communication from Abraham Merritt Asay, and Jacob Lambert Asay, Philadelphia, Pennsylvania, U.S.—*Petitions recorded 11th March*, 1862.

668. WILLIAM HENRY LATHAM and FREDERICK CARTWRIGHT WARD LATHAM, Bolton, Lancashire, "Certain improvements in machinery or apparatus for cutting paper, pasteboard, and other similar substances."

670. JOHN JOHNSON, Heaton Norris, Lancashire, and SAMUEL MORRIS, Stockport, Cheshire, "Improvements in steam boilers."

672. ECHLIN MOLYNEUX, jun., Seaview, Enniskerry, County Wicklow, Ireland, "An improved method of utilising the waste heat of the products of combustion as they escape from a furnace, and securing a more complete combustion of the fuel."

674. ARTHUR MARTIN A'BECKETT, Surbiton, Surrey, "Improvements in railway signal apparatus."—*Petitions recorded 12th March*, 1862.

680. JAMES SAUL HENDY, Essex-street, Strand, London, "An improvement in the construction of chimneys and chimney pots."

684. JOHN HUNTER, Dalmellington Ironworks, Ayrshire, N.B., "Improvements in apparatus for removing slag from furnaces."

686. HENRY FLETCHER, Market-street, Manchester, "Improvements in cleaning and preparing cotton, and the machinery used for that purpose."

690. SEVERIN VIRGILE BONNETIERRE, CHARLES THEODORE EMIART, and JULES FERDINAND MONTI, Rue de Malte, Paris, "An improved apparatus for regulating the pressure of steam in steam boilers, and the combustion in their furnaces."

694. SAMUEL KEARSLEY THOMPSON, Coniston, ARTHUR THOMAS THOMPSON and SAMUEL MAWSON, Bolton-le-Moors, Lancashire, "Improvements in railway apparatuses for communicating between guard and driver, and for coupling and uncoupling the carriages, parts of which apparatuses are applicable to connecting pipes and tubes."

696. HENRY FLETCHER, Wood-street, Cheapside, London, "Improvements in neckties, scarfs, cravats, and collars."

698. EDWARD BOLTON, Warrington, Lancashire, "Improved apparatus for transferring liquid matters from one vessel to another."—*Petitions recorded 13th March*, 1861.

Invention Protected for Six Months by the Deposit of a Complete Specification.

715. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris.—A communication.—*Deposited and recorded 18th March*, 1862.

Erratum.

After 2816, for "2a19" read "2817."

Patents on which the Stamp Duty of £50 has been Paid.

691. ROBERT MUSHET, Coleford, Gloucestershire.—Dated 18th March, 1859.

692. ALBERT LOUIS THIRION, Asche-en-Refail, Namur, Belgium.—Dated 18th March, 1859.

703. ROBERT MUSHET, Coleford, Gloucestershire.—Dated 19th March, 1859.

704. WILLIAM and SAMUEL PICKSTONE, Radcliff Bridge, near Manchester.—Dated 19th March, 1859.

702. JAMES HOWDEN and ALEXANDER MORTON, Glasgow, Lanarkshire, N.B.—Dated 19th March, 1859.

712. JOSEPH ROBERTS, Staley Bridge, Cheshire.—Dated 21st March, 1859.

713. SIGISMUND LEONI, St. Paul-street, London.—Dated 21st March, 1859.

707. WILLIAM HAGGETT, Sherborne, Dorsetshire.—Dated 21st March, 1859.

705. THOMAS DOWNS SHIPMAN, Toronto, Canada West, North America.—Partly a communication.—Dated 30th March, 1859.

721. WILLIAM ARMAND GILBEE, South-street, Finsbury, London.—A communication.—Dated 22nd March, 1859.

722. WILLIAM WEILD, Manchester.—Dated 22nd March, 1859.

733. CHARLES A. WATKINS, Greek-street, Soho square, London.—Dated 22nd March, 1859.

741. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London.—A communication.—Dated 23rd March, 1859.

746. FREDERIC TILLETT, Banner-street, St. Luke's, London.—Dated 23rd March, 1859.

Patents on which the Stamp Duty of £100 has been paid.

625. BENJAMIN O'NEALE STRATFORD, EARL OF ALDBOROUGH, Stratford Lodge, County Wicklow, Ireland.—Dated 20th March, 1859.

671. John Marland, Leeds, Yorkshire.—Dated 26th March, 1855.
700. John Blair, Glasgow, Lanarkshire, N.B.—Dated 29th March, 1855.
655. William Brown, Gresham-street, London.—Dated 24th March, 1855.
680. George Leonard Turney, Wood-street, Cheapside, London.—Dated 28th March, 1855.

Notices to Proceed.

2854. Thomas Proctor, Boston, Lincolnshire, "Improvements in carriers or stackers, or apparatus for facilitating the stacking of straw, hay, or agricultural produce."
2857. Charles Edmund Wilson, Monkwell-street, London, "A new article of female wearing apparel to be worn on the leg."
2861. Henry Bird, Liverpool, "Improvements in the construction of bottles and other vessels, and in stoppers for the same to indicate that they contain poison."—*Petitions recorded 13th November*, 1861.
2869. Montague Wigzell, Strand, Topsham, Devonshire, "Improvements in machinery or apparatus to be used in moulding and casting twisted nails, spiral fluted rails, bolts, and screws, for sheathing vessels, shipbuilding, building, and other purposes."
2870. Robert Heath, St. George's-place, Hyde Park-corner, London, "An improvement in umbrellas and parasols."—*Petitions recorded 14th November*, 1861.
2881. James Grint, Harrison-street, Gray's-inn-road, London, "Improvements in pegs, nails, or like fastenings for uniting the soles of boots and shoes and other substances."
2884. Matthew Gibson, St. Andrew's Works, Gallowgate, Newcastle-on-Tyne, "Improvements in reaping and mowing machines."
2886. David Stewart, Newcastle-on-Tyne, "Improvements in hydraulic cotton presses worked by steam."
2887. Robert Thomas Worton, Newberry-place, Kentish-town, London, "Improvements in pianofortes."
2888. Joseph Else and Thomas Godfrey, Mansfield, Nottinghamshire, "An improved washing apparatus."—*Petitions recorded 16th November*, 1861.
2891. John Hawkins, Lisle-street, London, "Certain improvements in bits for riding and driving."
2892. William Cliff and Edwin Cliff, St. Quentin, l'Aisne, France, "Improvements in the manufacture of lace."
2894. Frederick Cæsar Paetow, Manchester, "Improvements in machinery or apparatus for raising and finishing fabrics."—A communication from Mr. Tillman Esser, Burtscheid, Prussia.
2898. Guillaume Prodon-Bonneton and Marthe Guillaume Prodon, Thiers, Puy-de-Dome, France, "Improvements in means or apparatus for rolling metals."—*Petitions recorded 18th November*, 1861.
2901. Luke Smith and Matthew Smith, Heywood, Lancashire, "Improvements in raising liquids, and in apparatus connected therewith, parts of which are applicable to improving the quality of fermented liquors."
2903. Theophilus Redwood, Montague-street, Russell-square, London, "Improvements in the manufacture of starch, and of a vegetable sizing powder."—*Petitions recorded 19th November*, 1861.
2919. Edward Peyton and William Fothergill Batho, Birmingham, "Improvements in the moulds or chills employed in casting corner blocks, dovetail grooves, and other parts of metal bedsteads and other like articles, in frames for carrying such moulds, and in tubes for the pillars of bedsteads and other like articles."—*Petition recorded 20th November*, 1861.
2932. William Ambler, Keighley, Yorkshire, "Improvements in the manufacture of loom pickers."
2938. Edward Peyton and William Fothergill Batho, Birmingham, "Improvements in laths for supporting bedding and cushions in bedsteads, couches, sofas, and seats."—*Petitions recorded 22nd November*, 1861.
2945. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in toothed wheels, and in the apparatus used in their manufacture."—A communication from Jean Baptiste Buissart and Therese Leome Levesque, Paris.—*Petition recorded 23rd November*, 1861.
2972. Charles Stevens, Charing-cross, London, "An improved indelible anti-corrosive ink."—A communication from Louis Croc, Paris.
2975. William Firth and Robert Ridley, Leeds, Yorkshire, "Improvements in apparatus and machinery for working coal and other mines."
2976. John Henry Johnson, Lincoln's-inn-fields, London, "A new or improved apparatus for supporting the womb in cases of prolapsus uteri."—A communication from Otto Langgaard, Berlin, Prussia.
2977. George Edmund Donnithorpe, William Firth, and Robert Ridley, Leeds, Yorkshire, "Improvements in machinery and apparatus for working coal and other mines."—*Petitions recorded 26th November*, 1861.
2979. John Standfield, Stratford, Essex, "Improvements in apparatus for regulating and indicating the speed of steam engines and other machinery."—*Petition recorded 27th November*, 1861.
3029. James Burrows, Wigan, and Joseph Dougan, Haigh, Lancashire, "Certain improvements in winding or driving drums or pulleys."—*Petition recorded 3rd December*, 1861.
3108. William Henry Tooth, Rhodeswell-road, and William Yates, jun., Parliament-street, Westminster, London, "Improvements in the manufacture of iron and steel, and in the machinery, apparatus, or furnaces used therein, and for the production of gas to be employed in such manufacture."—*Petition recorded 11th December*, 1861.
3276. Alexander Edward and James Edward, Dundee, Forfarshire, N.B., "Improvements in machinery or apparatus for spinning fibrous materials."—*Petition recorded 31st December*, 1861.
60. Joel Haywood Tatum and William James Williams, Arundel-street, Strand, London, "Improvements in the manufacture and structure of wicks, and in the application of the same to the manufacture of candles."—*Petition recorded 9th January*, 1862.
264. Edward Henry Cradock Moncton, Fineshade, Northamptonshire, "Improvements in the application of electricity for obtaining ammonia and other useful products during the combustion of coal and fuel, and in the apparatus employed therein."—*Petition recorded 31st January*, 1862.
571. Henry Bowen, Cardiff, Glamorganshire, N.B., "Improvements in gas-meters."—*Petition recorded 1st March*, 1862.
583. Henry Bunning, Field House, New Cross, Deptford, Kent, "Improvements in the manufacture of lubricating grease or compounds."—*Petition recorded 3rd March*, 1862.
593. Thomas Greenwood, Leeds, Yorkshire, "Improvements in sewing machines."—*Petition recorded 4th March*, 1862.
598. William Hensman, Woburn, Bedfordshire, and William Hensman, jun., Linsdale, Buckinghamshire, "Improvements in steam ploughs, and in apparatus connected therewith."
609. Thomas Bostock, Stone, Staffordshire, "Improvements in the manufacture of boots and shoes."—*Petitions recorded 5th March*, 1862.

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing or their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 22nd March, 1862.

2018, 3d.; 2019, 3d.; 2020, 3d.; 2021, 3d.; 2022, 3d.; 2023, 3d.; 2024, 9d.; 2025, 10d.; 2026, 7d.; 2027, 11d.; 2028, 3d.; 2029, 1s. 1d.; 2030, 3d.; 2031, 4d.; 2032, 4d.; 2033, 3d.; 2034, 3d.; 2035, 3d.; 2036, 6d.; 2037, 4d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, or Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for The Engineer, *at the office of her Majesty's Commissioners of Patents.*

Class 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2207. J. M. Rowan *and* T. R. Horton, *Glasgow*, "*Steam boilers and surface condensers.*"—*Dated 5th September*, 1861.

This invention cannot be described without reference to the drawings.

2217. J. Napier, *Glasgow, N. B.*, "*Apparatus for cooling the water employed for condensing steam or other purposes.*"—*Dated 5th September*, 1861.

For the purpose of carrying out this invention the inventor takes the water, after it has been discharged from the condenser, and lets it flow into a trough placed on the top, or forming part of a box or chest; in the bottom of this trough or shallow box a number of tubes are placed, passing perpendicularly or otherwise through holes made in the bottom of the trough, and descending to some distance towards the bottom of the chest or box. These tubes, which are open at the top where they fit into the tube plate or bottom of the trough, may be made of any porous material, or they may be made of any non-porous material, having small perforations all over them, through which the water can ooze or percolate; or they may be made of any woven material, such as wire gauze, flannel, canvas, or other material, or of a combination of any of them. Through the box or chest in which these tubes are suspended, so as to reach some distance towards the bottom, a current of cold air is forced or drawn by means of fanners or other suitable means, which current of cold air, coming in contact with the water as it drips or percolates through the suspended tubes, cools it, so that it can be forthwith used again for the purpose of condensation.—*Not proceeded with.*

2224. M. A. F. Mennons, *Paris*, "*Obtaining and applying motive power.*"—*A communication.*—*Dated 6th September*, 1861.

This invention consists in the substitution, as hereafter described, of the archimedean screw to hydraulic wheels and similar motors, by means of which water power is commonly applied to the production of mechanical action. To this end one or several screws of ordinary construction are mounted horizontally on an iron bridge or framing, the extremities of which are set on closed metallic cylinders of suitable dimensions and strength. In the bed of the river are formed two pile foundations, spaced to correspond with the extremities of the above arrangement, which is sunk into position with the axes of the screws in parallel line with the current by filling with water the metallic cylinders. These cylinders may be emptied by pumps when required to be brought to the surface or otherwise moved. The power developed by the screw or screws thus submerged is applied to the millwork or other machinery erected on the bank of the water-course, by means of horizontal and vertical transmission gear, communicating with the different points at which the movement is required.

2236. E. Taylor, *Blackburn*, "*Obtaining motive power.*"—*Dated 7th September*, 1861.

In carrying this invention into effect the inventor employs a number of weights placed upon a shaft or eccentric, and also a wheel, which revolves and changes the positions of the weights, the wheel having bowls on which the weights slide, so that, as the positions of the weights are changed, they gain their leverage and give effect to the wheel, and thus obtain the motive power, which can be started and stopped and also governed by altering the position of the shaft or eccentric.—*Not proceeded with.*

2247. W. *and* J. Dowell, *Rhyl, Flintshire*, "*Motive power engine.*"—*Dated 9th September*, 1861.

This invention consists, essentially, of a wheel having an equal number of spikes or radii, each of the said spikes or radii being diametrically opposite to another. Weights carried by the said spokes or radii are worked in such a manner that those on one side of the wheel are always at a greater distance from the centre of the said wheel than the weights on the other side, and the wheel is not in equilibrium. The preponderating side of the wheel, consequently, descends, and each weight, after it has passed from the highest point through a semicircle to the lowest point, is drawn in towards the centre, while it rises and is forced out again when it arrives again at its highest point. One half of the wheel is thus kept in a constant state of preponderance, and the said wheel constantly rotates.—*Not proceeded with.*

2255. J. Anthony, *Oxford-terrace, Poplar*, "*Steam boilers and generators.*"—*Dated 10th September*, 1861.

This invention consists in carrying and continuing the fire and smoke boxes and flues or tubes of steam boilers to the top, or very near the top, of the inside of the boiler shell, or to any other position which may be found necessary, and in dividing the whole body of the tubes or flues into two, three, or more sections or nests of flues or tubes; these divisions are to be caused or formed by the planing or fixing of dampers or water spaces in or across the fire or smoke boxes, so that the flame and hot air from the furnaces may be caused thereby to pass through a portion only, or one section or nest of flues or tubes at the same time, and to successively pass from back to front of the boiler, and *vice versa*, or from side to side, until the whole of the flues or tubes in all the sections or nets have been traversed, and thence into the uptake or chimney, in the usual way. The flues or tubes are to be of the same size and number in each section or nest, or increased or diminished as the case may be, to suit the calorimiter of the same to the requirements of the boiler or generator.—*Not proceeded with.*

2258. L. P. Barre, *Paris*, "*Tubular steam boilers.*"—*Dated 11th September*, 1861.

This invention cannot be described without reference to the drawings.

Class 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2204. J. Gresham, *Manchester*, "*Apparatus for facilitating the stopping and starting of omnibuses, &c.*"—*Dated 3rd September*, 1861.

The object of this invention is to retard and stop vehicles by mechanism or apparatus by which the force or momentum of the vehicle when in motion is reserved and accumulated in such manner as to be used in starting the vehicle into motion again. The invention consists in the use of springs, air or other elastic medium, weights, or the pressure of the atmosphere. The springs are charged, the air or other elastic medium is compressed, the weights are lifted, or the atmosphere is withdrawn from a cylinder by mechanism brought into gear with the wheels of the vehicle by a suitable lever handle, and connecting and transmitting mechanism, when the vehicle is to be stopped; then, when the vehicle is to be set in motion again, the force thus reserved and accumulated will be made, by means of reversing gear, to react upon the wheels of the vehicle, and start or assist the starting of the vehicle into motion.—*Not proceeded with.*

2199. T. Scott, *Newcastle, Down, Ireland*, "*Roadways.*"—*Dated 4th September*, 1861.

This invention consists in the employment of trays or open boxes or frames of cast or wrought iron and wood, or other materials of a square or any other form, consisting of a flat or arched bottom and vertical sides, which trays, or boxes, or frames are packed full of rough or dressed flat pieces of stone, or other material, placed on edge; the top and bottom surfaces may be made parallel, so as to have a good bearing on the bottom of the tray, and to present generally a level surface on the top. The stones or other material so packed in the trays or boxes may be set in sand, gravel, or other substances, grouted with cement or mortar, so as to form one solid block, or they may be simply wedged in tight. Such trays or boxes so filled with stones or other mineral are placed on the prepared foundation of the roadway with the stone surface uppermost.—*Not proceeded with.*

2209. J. E. Ridges, *Wolverhampton, and* J. Barker, *Birmingham*, "*Composite carriages for funeral and other purposes.*"—*Dated 5th September*, 1861.

This invention consists in so constructing hearses that a compartment shall be formed in front for receiving the coffin, and at or near the centre of this compartment a strong vertical axis, projecting upward from the top, and also if required downward from the bottom, is placed, the same being secured firmly to the material forming this compartment over which strong straps or arms formed of wood, iron, or other material are placed at top and bottom, also, when a lower centre is applied, connected with the body of a carriage for receiving the mourners usually attending funerals. This body is mounted on a pair of wheels with springs in the ordinary way, and arranged and fitted with a door at the back or side, as may be considered most convenient; and the horizontal axis of the front wheels is attached to the compartment for receiving the coffin, and to which compartment the driving box and pole or shafts are also fixed, the whole working on the axis projecting upward and downward, if preferred, from the top and bottom of the hearse or front compartment, as before described, and forming what is technically termed the action or lock in four wheeled carriages, to permit the front wheels to work independent of the back wheels necessary in turning curves or short corners. And the patentees take advantage of this construction of funeral composite carriages, so that, in drawing up or stopping in front of a house, the hind wheels may be parallel to the kerb or footway, while the front wheels are so placed that the horse shall stand obliquely across the road, thereby exposing the back end of the hearse, and permitting the coffin to be placed in the end now exposed, and which end may be fitted with a door or doors, or not, as may be desirable; but the moment the horse or horses are placed in a position of straight draught or moving forward, the hinder end of the hearse will be closed by its passing in front of the back carriage or compartment, which, following the direction or line of draught of the front wheels, will form a graceful continuation or combination.

2212. J. T. Pensam, *Stamford-street, Blackfriars, London*, "*Improvements in wheels for facilitating the progress of carriages on common roads, and in the means of propelling the same.*"—*Dated 5th September*, 1861.

This invention relates to wheels provided with legs or levers capable of sliding beyond the peripheries of the said wheels, for the purpose of enabling the same to obtain a firmer hold upon the ground, and thus, actuated by any motive power, facilitating the progress of the carriages to which they may be applied; and the invention also relates to an improved arrangement of springs for propelling the same, and consists, First, in the employment of a wheel which (for example may be constructed with a double or inner and outer tire a certain distance apart, each tyre being pierced with holes through which the sliding legs may be placed, such legs being provided with a projecting pin at the side which confines the sliding of the said legs to a distance equal to that between the tires. This pin or projection is also acted on by a guide fixed at the side of the wheel, but not to it, which guide, if continued round, would describe a curve resembling an epicycloid with a concave base, such concavity being the course the pins or projections describe, whilst the outer extremity of the legs describe a straight line, or act upon the ground. A spring may be attached to this concave portion to increase or regulate the bite of the legs upon the ground. Secondly, in a series of springs, used as a portable medium for power, so arranged that one or more may be caused to act at pleasure upon the wheels.—*Not proceeded with.*

2215. T. Scott, *Newcastle, Down, Ireland*, "*Utilising the surplus momentum of railway trains and other moving bodies, and the waste and surplus power of locomotive and other engines.*"—*Dated 5th September*, 1861.

The inventor utilises such surplus momentum by causing it to actuate condensing pumps, or other apparatus for forcing air into a tank or reservoir capable of sustaining a high pressure, by which means he obtains, in the case of railway trains or other moving bodies, a resisting force capable of retarding motion and acting on a brake.—*Not proceeded with.*

2226. W. Allott *and* J. Thelwall, *Hull*, "*Manufacture of wheel tyres, hoops, &c.*"—*Dated 6th September*, 1861.

In carrying out this invention the inventors produce two rings, composed each of a bar coiled in a helical form, the coil of the one ring being in the opposite direction to that of the other, and the ends of the bar being tapered off so as to leave an even face on the ends of the helix or side of the ring. One of these rings is made of smaller diameter than the other, and is fitted inside the larger one, and as they are coiled in opposite directions the joints or seams will cross each other, thereby considerably increasing the strength of the tyre or hoop, which is free from the usual weld, and is not liable to split, as ordinary tyres are Any desired numbers of such rings or coils may be inserted one inside the other, according to the strength and dimensions of the tyre to be produced, care being taken that no two adjoining coils are in the same direction, in order that the crossing of the seams or joints may be ensured. The blank tyre or hoop thus formed is now welded under the steam hammer, and then finished by rolling in the usual or any other suitable manner.—*Not proceeded with.*

2234. M. Henry, *Fleet-street, London*, "*Signalling on railways by means of electricity.*"—*A communication.*—*Dated 6th September*, 1861.

The object of this invention is to signal on railways, by means of electricity, with a view to the prevention of accidents, and the nature or principle of the invention consists in arranging and combining apparatus for that purpose, in which a conducting wire is used, to bring together or effect a meeting between the currents of the positive poles of two batteries (one of which the patentee herein calls the "local" battery, and the other the "travelling" battery), the respective negative poles of which batteries communicate with earth, by which means an alarm furnished with electrical detent, and situated in the circuit of the negative pole of the travelling battery, is caused to remain silent, but the apparatus is so arranged that the action of the local battery may be instantaneously interrupted, when required, and the aforesaid conducting wire, which had hitherto opposed the current from the local battery to that from the travelling battery, becomes a conductor to earth from the positive pole of the travelling battery, and the circuit being closed, the alarm included therein is caused to sound, and this alarm being placed on a locomotive or other convenient part of a train, will, consequently, call the engine driver's attention in case of danger.

2241. J. Holland, *Manchester, and* J. Okell, *Ashton-under-Lyne*, "*Apparatus by which an engine or train is made to give an alarm or signal at any required place on arriving at or passing any given point on the railway.*"—*Dated 7th September*, 1861.

This invention consists in arranging a treadle or treadles at any given point on a railway, so that the wheels of an engine or train, or some suitable projection or projections from the engine or train, will, on passing, act upon this treadle or treadles (the reaction being produced by springs), and give a motion to a pair of bellows, pump, or other convenient apparatus, by which air can be forced past a valve or valves (by which it is prevented from returning) into a pipe which extends from this apparatus to the place where the alarm or signal is required to be heard, the air forced into the pipe sounding one or more whistles placed at the end of the pipe, or at branches from it, thus giving notice that an engine or train has passed the point where the treadle or treadles are fixed.

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2189. E. Alcan, *Coleman-street, London*, "*Machinery for carding and combing wool and other filamentous substances.*"—*A communication.*—*Dated 2nd September*, 1861.

This invention cannot be described without reference to the drawings.

2190. A. N. Saleres, *Paris*, "*Printing and colouring paper, chintz, and other fabrics.*"—*Dated 2nd September*, 1861.

This invention is designed for printing or colouring in one colour, or any number of different colours, paper, chintz, and other fabrics of any design or pattern, by the aid of improved machinery or apparatus of the following construction:—To a suitable framing the patentee connects a series of cylinders, say four, capable of revolving by toothed gearing; the foremost of these cylinders carries the fabric to be printed or coloured, and the hindermost cylinder works in a trough containing colouring matter. The surfaces of all the cylinders are in contact with each other. Over the foremost cylinder aforesaid he adapts a V-shape trough, divided into numerous compartments, the bottoms of which are open, and rest upon the cylinder aforesaid, and he so connects the said trough with certain mechanism as to impart thereto, when desired, a reciprocating movement lengthwise of the said trough, so that, supposing the fabric intended to be printed or coloured to be moving round with the cylinder on which it is placed, and end movement imparted to the divided trough aforesaid containing the colouring matter, wavy or undulating lines or stripes of different colours may thus be produced. Or one entire tint of the same colour may be spread over the surface of the fabric, and upon this, or the striped coloured ground aforesaid, devices, designs, or patterns may be printed of any colour through the medium of an engraved cylinder, supplied with colouring matter from the hindmost cylinder before described; or, instead of using cylinders, flat surfaces could be so arranged and actuated as to receive the colouring matters and printing impressions.

2192. W. Campion *and* H. Johnson, *Nottingham*, "*Apparatus for cutting the selvages or edges of knitted or other fabrics while being stitched.*"—*Dated 2nd September*, 1861.

This operation of cutting the selvages or edges of knitted or other fabrics has hitherto been performed by hand labour, which is a slow process, occupying much time and attended with expense. By this invention the labour, time, and expense heretofore required are dispensed with, and, consequently, much saving is effected. The improvements consist of machinery or apparatus in which is a pair of cutters of suitable construction applied to or combined with an ordinary sewing or stitching machine, by means of which the patentees cut the selvages or edges of knitted or other fabrics while they are being stitched, and at the same time lay down the selvage smoothly.

2193. D. Ward, *Beaminster, Dorsetshire*, "*Machinery for twisting and laying flax, hemp, &c.*"—*Dated 3rd September*, 1861.

This invention consists in the manufacture by machinery of what is known in the trade as laid cord, or laid twine, and which, heretofore, has usually been manufactured in long rope walks, principally by hand labour. For the purposes of this invention the threads or yarns of which the laid cord or laid twine is to be made are wound on bobbins which are placed in the machine on spindles, provided with loose flyers, to which are applied adjustable tension weights and springs adapted to each other in such a manner as to allow the yarn to come evenly off from the bobbin. The laid cord or laid twine may be composed of two, three, or more threads or yarns, and a twist is given to them by driving the spindles and flyers at a suitable speed in the required direction by means of suitable gearing. For the convenience of removing the bobbins from the spindles when required, the flyers are inserted, and their upper ends are connected by hinged cross-bars which may be raised so as to admit of the removal of the bobbins. The hinged cross-bars also prevent the arms of the flyers from expanding. The threads or yarns having had the requisite amount of twist put into them, are conducted over a breast roller to another spindle and flyer revolving in a direction opposite to that of the spindles and flyers from which they first received their twist; by these means the previously twisted threads or yarns are laid and twisted together into a hard twine or cord, which is drawn on to the bobbin on the spindle by means of a roller or pulley driven by independent gearing at a speed proportioned to that of the flyer, according to the twist required to be put into the finished cord or twine.

2204. J. K. Bayley, *Bolton-le-moors*, T. Harrison, W. Briggs, *and* R. Parker, *Atherton, Lancaster*, "*Machinery for preparing and spinning cotton, &c.*"—*Dated 5th September*, 1861.

This invention is applicable to machinery for preparing, called slubbing frames, roving frames, and jack frames, and to the machines for spinning called throstles and mules. The nature of the invention consists in giving about twice the usual amount of twist to the roving that is formed on the slubbing frame, and in driving the spindles by the usual gearing; but the inventors dispense entirely with the gearing now employed for driving the bobbins, which are taken round by the drag of the roving; the bobbins formed on the slubbing frame are taken to the roving or jack frame, and there made to revolve in order to unwind the whole or greater part of the twist that had been given in the previous machines. By this means the roving entering the drawing rollers is almost or entirely free from twist, and therefore in the best condition for being drawn. In these frames also the spindles are or may be driven as usual, and the gearing for driving the bobbins dispensed with. The bobbins or spools from the roving or jack frames are taken to the spinning machine, and there unwound to remove the twist as before described.—*Not proceeded with.*

2210. D. Heyworth, *Littleborough, Lancaster, and* J. Heyworth, *Manchester*, "*Looms.*"—*Dated 5th September*, 1861.

This invention consists, First, in an arrangement of apparatus for preventing the shuttle from passing out of its true course, or, what is generally termed, "flying out" across the top of the hand rail of the loom, by which the top of the reed is supported. Secondly, in the swell in the shuttle box being of a peculiar form, and fixed in its place by means of a leather hinge. Thirdly, in the rib or plate of wood or iron forming the front of the shuttle box at the end nearest to the reed space being of such a curved form as to guide the shuttle into the box, should it slightly deviate from its true course, when the loom is in motion. This the inventors call the "shuttle-guide." Fourthly, in fixing immediately behind the breast beam a rod or spring extending the full width of the reed space, and so arranged as to press against the underside of the cloth, thus slightly raising the same (but more especially in the centre); by this means they obtain a greater degree of body on the face of the cloth; and this they call "the cloth improver." Fifthly, in fixing on the wheel working in the pinion in the crank shaft a stud which, at each revolution of the wheel, acts upon a lever working upon a stud attached to the loom side, connected to one end

of which lever is fixed a clip, through which is passed an endless band or strap, perforated with a number of holes, and passing over a pulley having a number of pegs on its rim corresponding with the holes in the band or strap; and at some convenient distance immediately below the centre of the pegged pulley, working on a stud, and coupled with the pinion. Placed on the end of the roller termed the cloth beam is fixed a small pulley, round which the band or strap moves, and which can be raised or lowered in order to slacken or tighten the band or strap, as may be desirable; on the lever being depressed by contact with the stud on the pinion wheel, the clip tightly holding the band or strap causes the wheel or pulley on the cloth beam to move, and there being a slot in the pinion wheel through which the stud is passed, the required degree of motion is easily obtained. This they call "the improved taking up motion." Sixthly, in fixing to the side of the loom a bracket, so arranged as to form a socket in which the cranked end of a lever which, having a projecting rib pressing against the warp, passes alongside or under the warp beam; to the other end of the lever are connected chains, ropes, or straps passing over pulleys to the centre of the back of warp beam, or immediately underneath and attached to weighted Pulleys working upon the levers for weighting the beam. As the warp passes off the beam, the weights gradually slide down the levers, and, consequently, create less strain upon the warp; more or less strain can be obtained by placing lighter or heavier weights on the pulleys on the levers as may be desirable. This they call the "setting off motion or beam regulator." Seventhly, in placing on the jack wires connected to the treadles on one side a plate, which, having a half-round bottom, rests upon the treadle; in the centre of the plate is a hole, and by passing through this hole a bolt, they are enabled to screw the same tightly to the jack wires, which causes the same to work much better, and prevents the bottom of the healds from coming in contact and damaging each other. This they call the "improved treadle jack." Eighthly, in fixing at the bottom of the loom side a spring connected with the "setting on rod," the upper portion of the spring is bent at right angles, and so arranged as to prevent the stop rod from rising on the loom being stopped. This they call "the stop-rod catch." —*Not proceeded with.*

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

2264. W. STEVENS, *Hammersmith*, "*Apparatus for ploughing or cultivating the land by steam and other power.*"—*Dated 12th September*, 1861.

This invention consists, First, in the construction of a strong carriage made of wood or iron supported on wheels, to travel from one end of the field to the other in a horizontal position, to which ploughs, cultivators, harrows, or rollers or any machinery for the cultivation of the land, can be attached, the whole being supported on a main shaft, across the centre from which the implements swing and rise and fall to the land, as may be required, by the rotating of the main shaft that is worked by rack and pinion or lever, and forced into the earth at any depth required when in motion. The ploughs or implements are not fixed to the upper carriage, but swing paralleled without any tip or tipping motion; the lower frame or under carriage is so constructed that, by a very simple arrangement, ploughs, land-rollers, harrows, cultivators, or broadshears, or any other instrument used for tilling the land, can be easily fixed to enable the farmer or agriculturist to use this implement for general purposes by steam or other power. The patentee also proposes to cultivate meadow or grass lands by cutting a deep seam, and lifting the top without turning over the grass turf, so as to ventilate and allow the water and air to percolate through the earth without damaging the upper surface. The implement he uses for this purpose has a projection at each side, and a cutting part at the bottom, that forms a drain and lifts the land as they pass through; they are also fixed to the lower frame or under carriage, and placed two feet apart, or what width may be required. In the case of ploughing a strong or heavy clay land he proposes to place a box cistern, or reservoir that shall contain liquid manure, water, or other mixture, that a small quantity may continue to fall on the breast or mould-boards when at work, thereby causing them to pass through the land with much less power or draught; also the manure will be properly spread over the soil.

CLASS 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

2235. T. G. MESSENGER, *Loughborough*, "*Glazing horticultural buildings, the roofs of railway stations, &c.*"—*Dated 6th September*, 1861.

This invention consists in laying glass in such wise that each edge of the glass (which glass may be of any required shape or size) shall lie on one side of an open gutter, which said gutter may form a gutter only, or it may form a gutter and rafter, either cast or rolled in one or two parts; the said gutter is made to carry off all the condensed vapours from the interior, as well as the rain, &c.

2243. R. O. WHITE, *Blackheath Park*, "*Bricks.*"—*Dated 7th September*, 1861.

This invention is applicable when burning bricks in open clamps or kilns, where fire is mixed with the brick earth, and is also interposed in between some of the courses. For these purposes, in order that the bricks may be more uniformly burned, and come out of an open kiln or clamp of uniform quality, the system of setting the bricks in "necks," heretofore practised, is got rid of, and the bricks are set in one direction, in such manner that each course of bricks breaks course with the course above and below.

CLASS 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

2203. F. E. SCHNEIDER, *Paris*, "*Cartridges for breech-loading fire-arms.*"—*Dated 4th September*, 1861.

The patentee makes these improved cartridges with the percussion-cap placed in the centre of same, and about level with the end of the cartridge, the first with a spreading top or flange, the detonating powder occupying an annular space in the said flange, and the second with an internal metallic gudgeon or anvil, which, on the cap being struck, offers the required amount of resistance for effectually igniting the same. For the first description of cap he manufactures a cartridge with a metallic head, partially countersunk, to receive the flange-cap. For the second description of cap he manufactures a cartridge with a metallic base for the anvil to rest against during the explosion. For manufacturing the above-mentioned cartridges he makes use of four different machines. In the first of these machines he presents ribbons, or bands of steel metal, which are cut out into washers, which are afterwards countersunk to form the heads of the cartridges. In the second of these machines he unites, by pressure, the head and socket or other component parts of the cartridge, and at the same operation imprints thereon such letters or marks as may be required. For this purpose the cartridges are placed in a feed-plate under the punches, and from which, after being pressed, they are extracted ready for use. In this latter machine, in order to obtain an uniform pressure, he makes use of a compensator, that is to say, that he causes the pressure to take place on one end on a lever, the other end of which can be loaded to the required amount. In a third machine he smooths externally and internally, as well as gives a perfect circular shape to the paper shell or socket of the cartridges. For this purpose he places the shells on a metallic mandril, which he presents to a revolving ring of an internal diameter equal to the outside of the shell; this ring is slightly rounded on its inner edge, whilst its outer edge is left square, and thus the shell enters easily the smoothing ring, and, when it has completely passed through it, on the mandril being drawn back, it falls out on the other side. In a fourth machine he flutes the metallic wire, to be afterwards cut up into small pieces or anvils, and placed in the percussion-caps. For this purpose he makes use of as many circular saws as he intends to have flutes on the wire, the said saws revolving at a high velocity on a fixed axis, whilst the wire is being drawn through guides by the workman.

2216. J. NAPIER, *Glasgow, N.B.*, "*Armour-plates.*"—*Dated 5th September*, 1861.

In manufacturing armour-plates according to this invention the inventor takes a large forged or otherwise made slab or bloom, or a number of such, or a number of rolled or otherwise made plates, and heats them, and then, by means either of hydraulic pressure, or pressure produced by screw or lever, or by a combination of mechanism, he squeezes them down to the required size; and, by making these hydraulic, screw, or lever presses, or a combination thereof, with the top or bottom, or both, of the plates between which the metal operated on is to be squeezed either flat or with projections or recesses thereon, he is able to produce either plain armour-plates, as at present in use, or plates with flanges or projections, or thickened up pieces on either side and on every part of their surface. Armour-plates so made may be bolted together round their edges in the same manner as a cast-iron tank is generally made.—*Not proceeded with.*

2233. E. HARRISON, *Oldham*, and T. S. YATES, "*Substitute for gunpowder.*"—*Dated 6th September*, 1861.

This substitute for gunpowder consists in an admixture of chlorate of potash, prussiate or perprussiate of potash, sulphur, charcoal, anthracite, phosphorus, potatoe, or an extract therefrom. For general purposes take of chlorate of potash fifty-six parts; yellow prussiate of potash, twenty-eight parts; starch, four parts; sulphur, seven parts; charcoal, five parts. Or, take of chlorate of potash fifty-six parts; yellow prussiate of potash, twenty-eight parts; starch, four parts; sulphur, seven parts; coal or cannel, two and a half parts.—*Not proceeded with.*

2260. W. L. THOMAS, *Hill-street, Berkeley-square, London*, "*Improvements in projectiles.*"—*Dated 11th September*, 1861.

This invention consists in constructing projectiles with a leaden or other suitable soft metal jacket, which is expanded by means of an iron or other hard metal sabot, in manner hereafter stated. The shot or projectile is formed with an overhanging head, and with indentations or steps at the tail end; the projectile is cylindrical, except for a small distance from the tail end, where it is, by preference, oval in section; it is then formed cylindrical down to its base. On the tail or rear end of the projectile is placed an iron or other hard metal sabot or cup, in the inner surface of which steps or spaces, corresponding with the indentations in the shot itself, are formed. The indentations are so arranged that, when the cup or sabot is fitted on to the projectile, annular spaces are left between the outside of the shot and the inside of the sabot; the diameter of the shot is made equal by filling up the space between the shoulder or flange on the head and the top of the sabot with lead or other soft metal; upon the firing of the projectile the sabot is driven up on the rear end thereof, and its upper edges force the lead or other soft metal jacket up and outwards, and cause it to be expanded into the rifling or grooves of the gun.

CLASS 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

2219. C. W. HARRISON, *Holland-grove, Brixton*, "*Castors.*"—*Dated 5th September*, 1861.

This invention consists, First, in making the bowls, rollers, or wheels of vulcanised india-rubber, by which they are rendered somewhat elastic and noiseless in action. For this purpose the bowl or roller may be of spherical or of other suitable form, and composed wholly or partly of vulcanised india-rubber, having a metal axis supported and turning in the horns or frame of the castor in the usual manner, or connected to a stem or socket of suitable form. Another part of this invention consists in making the bowls, rollers, or wheels of castors wholly or partly (except their axes) of vulcanite or other hard or elastic compound of india-rubber, or of other materials combined therewith.—*Not proceeded with.*

2263. J. A. DAUNCEY, *Manchester*, "*Collars and wristbands.*"—*Dated 12th September*, 1861.

This invention consists, First, in making collars and wristbands of cloth in the ordinary way, and then applying an outside fold or layer of silk or satin, either figured, plain, or embossed. Secondly, in the use of a sheet of paper, to the back or face of which is cemented or fastened a layer of silk or satin fabric, so that, when the collar or wristband is cut, stamped, or embossed to the required shape and size, it presents a plain paper face on one side, and a figured silk or satin one on the other side. Thirdly, in making collars or wristbands of vulcanised or non-vulcanised india-rubber or gutta-percha in its rough or finished state, or any compound of the same which can be japanned, or enamelled, or varnished white or any other colour in the usual manner. Fourthly, in making collars and wristbands from all such substances as are now known under the name of leather and morocco, and from the prepared and finished japanned, enamelled, and varnished skins of animals.—*Not proceeded with.*

CLASS 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Potter, Cements, Paint, Paper, Manures, &c.

2196. P. ROBERTSON, *Sun-court, Cornhill, London*, "*Improvements in treating yeast, and in the manufacture of ammoniacal salts, and a substitute for animal charcoal.*"—*Dated 3rd September*, 1861.

For the purposes of this invention, in order to obtain any yeast, which may be kept for a considerable time without prejudice to its quality, the inventor first separates as much of the moisture as possible, by subjecting the yeast to the action of a centrifugal machine, to pressure, or otherwise, as is well understood, and then finally dries it in a chamber or vessel having shelves or supports on which are placed trays containing sulphuric acid, chloride of calcium, carbonate of potash or lime, in such manner as to be surrounded with the shelves or supports having thereon the yeast to be dried. A vacuum is obtained in the chamber or vessel by exhausting pumps or otherwise, and, in time, the yeast will be completely dried. The yeast is then reduced to powder, and is fit for use. The powder may be stored in bottles or other close vessels. In using yeast in order to manufacture ammoniacal salts, and a substitute for animal charcoal, the yeast, in a moist state, is mixed with clay and carbonate of lime or chalk; the mixture is to be dried, and then calcined. It is preferred that the mixture of the matters above mentioned should be such that the calcined product may contain at the rate of 10 parts of carbon, 80 parts of clay, and 10 parts of chalk, but these proportions may be varied. When the substitute for animal charcoal is to be used for filtering acids, the chalk may be left out, and only yeast and clay employed. In calcining the above mixture, in order to obtain the substitute for animal charcoal, water, carbonate of ammonia, oil, and gases are evolved; these are subjected to the action of a suitable condenser by which the water, oils, and carbonate of ammonia are obtained in a suitable receiver; the oils float on the water, which is charged with the carbonate of ammonia, and which salt of ammonia is changed into muriate or sulphate of ammonia in the ordinary manner.—*Not proceeded with.*

2197. G. BISCHOF, *Swansea*, "*Extracting copper and silver from ores.*"—*Partly a communication.*—*Dated 3rd September*, 1861.

For the purposes of this invention, when treating poor copper ores containing lime or dolomie, as gangue, the same is first calcined in an ordinary limekiln at such a low heat as to prevent the copper and silver being converted into silicates. The product is then washed, to remove the few particles of hydrate of lime and magnesia, whilst the particles of the copper and silver remain unaltered. Thus the ores are washed without any considerable loss. The washed calcined ores are then treated according to one of the processes hereafter described. If the quality of the ore is such as not to require to be subjected to the calcining and washing process above mentioned, it may at once be mixed with about five parts of iron pyrites for each part of copper, any iron pyrites or corresponding parts of sulphur contained in the other sulphurets already in the ore being allowed for and deducted from the quantity above mentioned. The quantity of iron pyrites may, in most cases, be adjusted by mixing ores which have an excess of iron pyrites with others not containing a sufficient quantity of them. The ore is then to be fused to obtain coarse metal (regulus), and this product is afterwards finely pulverised and calcined during a period of about five hours at a low red heat in a furnace or muffle so constructed as to be heated externally, provision being made for the passage away of the gases and vapours from the furnace or muffle, and for a supply of atmospheric air to the matters which are being calcined therein. The heat to be applied being a very low one, the body of the furnace may be constructed of plates of clay or iron. The part of the furnace below the muffle is intended to be used for the evaporation of the solutions, and for the roasting of the precipitated copper obtained as hereafter described. By these means the sulphuret (bisulphide) of copper will, for the most part (about 75 per cent.), be converted into a sulphate of copper, which is to be lixiviated in water. The residue, after dissolving out the sulphate of copper, is then to be heated with dilute sulphuric acid (concentrated sulphuric acid diluted with about twenty times its measure of water), by which the oxide of copper, not previously obtained in solution by the process of lixiviation with water, will be obtained in solution. The process of lixiviating with water and with dilute sulphuric acid may be combined, the latter being applied at once. Sulphuric acid is produced by leading the gases from the muffle or furnace, above described, into lead chambers, and the sulphuric acid thus obtained is applied without concentration. As the sulphuric acid produced is only partly consumed for dissolving the oxide of copper, the surplus may be sold or used for other technical purposes. In case silver is to be extracted, chlorides contained in the sulphuric acid to be used for the solution are removed by adding a solution of sulphate of silver, previously produced, to the sulphuric acid before its application; small quantities of chlorides in the ores are volatilised as chlorides of iron and copper. If the ore does not contain silver, then the second process of calcination and the removing of chlorides will be unnecessary.

CLASS 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

2298. T. MORRIS, R. WEARE, *and* E. H. C. MONCKTON, *Trafalgar-square, London*, "*Batteries for obtaining electric currents, and the products therefrom.*"—*Dated 14th September*, 1861.

This invention consists of an arrangement of battery cells, by which the plates or cells are not immersed, as is ordinarily the case, in a trough, and whereby the intensity of electricity is obtained more readily, and the electric current is less likely to escape. And also in the mode of producing the chemicals or excitants for the batteries; and also of an improved mode of making the cells and the divisions thereof; and of a general arrangement of earth or mineral batteries, and the useful results obtained therefrom. The patentees make these cells of two or more divisions, one of which is raised in order to act as a reservoir for the others. The tops of the cells are closed to prevent the contents from being spilled. They employ wood as a porous diaphragm, and make it more porous, and free it from resinous substances by means of caustic potash or soda. They also employ bark in the construction of the porous cells, such as stringy bark or birch bark. They construct their earth or mineral batteries by digging a suitable reservoir or reservoirs, and lining the same with glazed brick or tile, or other suitable non-conducting material, into which they introduce various minerals and chemicals, which act upon one another, and, while producing an elastic action, form chemicals which are applicable to the formation of other batteries, and are also useful for other purposes, as for forms and moulds, so as to render the battery inexpensive, and even productive. Other reservoirs may, however, be used. In reference to the mineral battery, the present arrangements are as follow, for example:—The patentees take an oxide or ore of copper, and mix with it chloride of sodium, and fill one reservoir having carbon electrodes in one cell, and in the other cell, which is divided by a porous diaphragm, they put dilute sulphuric acid, and another carbon electrode or two platinum electrodes, or other materials not acted on by the solution. The result is the formation of sulphate of soda and chloride of copper, both saleable articles, and with the additional advantage that, if the ingredients are rightly proportioned, the double decomposition prevents any unpleasant effluvium from the escape of gas or vapour. In a similar manner other ores, minerals, and chemicals may be employed to produce an electric current and similar products.

CLASS 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

2142. B. BROWNE, *King William-street, London*, "*Apparatus for concentrating ores or tailings, or separating pulverised mineral substances of different kinds or qualities from each other.*"—*A communication.*—*Dated 28th August*, 1861.

The patentee claims, First, the process of separating pulverised mineral substances from one another by agitating them in a body of water, or other fluid, and while in such agitated state delivering the mixture into a lower body of water or fluid through which the particles of minerals sink with a velocity according to their specific gravity, and by which the heavier are separated from the lighter, and fall accordingly in different layers upon the bottom, substantially as described and specified. Secondly, producing such agitation by passing currents or jets of air through the minerals, and the body of water or other fluid containing the minerals, substantially as described and specified. Thirdly, retarding the descent of the particles of minerals, by passing jets or currents of air in an opposite direction through the fluid through which the minerals sink, substantially as described, the lighter particles being more retarded than the heavier particles.

2143. W. S. GUINNESS, *New York, U.S.*, "*Sewing machines.*"—*Dated 28th August*, 1861.

In constructing shuttle sewing machines according to one part of this invention, in place of giving motion to the needle, to the shuttle carrier, and to the mechanism for moving the material being sewn by cams as heretofore usual, or by what is equivalent thereto, by crank pins working into curved slots in levers, the patentee gives motion to them directly from cranks or eccentrics, a separate crank or eccentric being employed for each of the movements for actuating the shuttle carrier, and the mechanism for moving the material being sewn, and the three cranks or eccentrics are all contained on one shaft.

2144. T. BRAY, *Dewsbury, York*, "*Ornamenting wood in imitation of intaid work.*"—*Dated 28th August*, 1861.

This invention is carried out as follows:—First, the inventor takes glue, or any kind of glutinous matter, and reduces it to the consistency of jelly, then with a soft brush, such as is used by painters, gives the clean wood one even coat. Secondly, he takes the following compound:—Gum shine, benzoine, or any soft gum which dissolves in spirit, taponis and spermaceti dissolved in pure spirit of any kind; and with this composition draws the desired pattern upon the wood with a pencil, or by the aid of patterns cut as stencil plates or otherwise. Thirdly, he takes any colour or staining material dissolved in water, and with a brush or tool, such as is used by painters, he grains or stains the whole surface in imitation of the wood, marble, or other substances required to be imitated. Fourthly, he takes pure spirit, and with a brush saturates and washes the whole thoroughly clean, by which means the stain will be removed from the parts of the surface where the composition above mentioned has been applied, according to pattern, but the stain on the other parts of the wood will not be removed therefrom when the spirit has evaporated. He polishes or varnishes the surface as may be required.—*Not proceeded with.*

FILE CUTTING BY MACHINERY.—The new works of the Patent File Machine, and File Manufacturing Company, in Lime Bank-street, Ashton Old Road, Manchester, were formally opened yesterday.

AMERICA IN THE EXHIBITION.—Her Majesty's Commissioners for the International Exhibition of 1862 have received notice that Colonel Johnson will shortly arrive in this country to act as Commissioner on behalf of the exhibitors from the United States. All communications are to be addressed in the meantime to Mr. J. E. Holmes, 17, Norfolk-street, Strand, W.C.

GAS IN THE EAST.—A prospectus has been issued of the Singapore Gas Company, with a capital of £100,000, in shares of £5 each. The town contains about 5,500 houses, exclusive of public buildings, and land for the works has been conditionally granted by the Governor, while the municipality are prepared to arrange a contract for lighting the streets, &c., for a term of years. The calculations of profit are based on the assumption that coal must be obtained from England, but the belief is that much cheaper supplies will soon be procurable from the Labuan mines or from those of India or Australia.

NAVAL ENGINEERS.—The following appointments have been made since our last:—G. E. Steel, second-class assistant-engineer, invalided, from the Termagant to the Asia, as supernumerary, for hospital treatment; J. Brough, acting second-class assistant-engineer, to the Odin; J. Jillard, chief engineer, to the Fisgard, as additional for the Adventure; Thomas G. Slade, promoted to chief engineer; Henry Cooper, engineer, to the Cumberland, for the Rattler; William Thomas, confirmed as first-class assistant-engineer in the Fox; Edward Judge, promoted to acting first-class assistant-engineer in the Falcon; Charles Hill, confirmed as second-class assistant-engineer in the Kestrel; J. Franklin, confirmed as second-class assistant engineer in the Melpomene; R. B. Nicholson, confirmed as second-class assistant-engineer in the Nile, for the Nimble; John Green, acting second-class assistant-engineer, to the Cumberland, as supernumerary; T. E. Buckle, engineer, to the Mullet; J. Lanksburg, first-class assistant-engineer, to the Mullet; W. E. Presgrave in the Indus, James Clark in the Bulldog, John Hancock (a) in the Emerald, Thomas Rose in the Gannet, and Reginald C. Oldknow in the Edgar have been promoted to first-class assistant-engineers; R. H. Trubshaw in the Cadmus, George Simpson in the Asia, S. R. Brumage in the Doris, and Thomas Barnes in the Cameleon, have been promoted to acting first-class assistant-engineers; John Simpson, acting first-class assistant-engineer, to the Royal Adelaide, for the Cuckoo, when the latter is put out of commission; J. E. B. Warrington, acting second-class assistant-engineer, to the Mullet; and James M'Graw, confirmed as second-class assistant-engineer in the Centurion; Thomas S. Lund, acting second-class assistant-engineer to the Asia, as supernumerary.

TRAFFIC RETURNS.—The traffic receipts of railways in the United Kingdom amounted for the week ending the 15th March, on 10,109½ miles, to £474,245, and for the corresponding week of last year, on 9,871½ miles, to £485,730, showing an increase of 237½ miles and a decrease of £11,485. The gross receipts on the following fourteen railways amounted in the aggregate, on 6,601½ miles, to £360,697; and for the corresponding week of 1861, on 6,445 miles, to £375,488, showing an increase of 156½ miles and a decrease of £14,521. The decrease on the Great Northern Railway amounted to £1,353; on the Great Southern and Western to £217; on the Lancashire and Yorkshire to £3,661; on the London and North-Western to £3,836; on the London and Brighton to £493; on the Manchester, Sheffield, and Lincolnshire to £1,171; on the Midland to £1,553; on the North-Eastern to £3,516; and on the South-Eastern to £1,902; total, £17,802. But from this must be deducted £1,013, the increase on the Caledonian; £96 on the Eastern Counties; £1,717 on the Great Western; £208 on the London and South-Western; and £247 on the North British—together, £3,281; leaving the decrease, as above, £14,521. The goods and mineral traffic on those lines amounted to £207,989, and for the corresponding week of 1861 to £219,933, showing a decrease of £11,944. The receipts for passengers, parcels, &c., amounted to £152,978, against £155,555, showing a decrease of £2,577. The traffic receipts on 66 other lines amounted, on 3,507¾ miles, to £113,278, and for the corresponding week of last year, on 3,426¼ miles, to £110,242, showing an increase of 81 miles and £3,036. The falling off in the traffic of the past week, as compared with the corresponding period of 1861, is more than five times as much in the goods and mineral traffic as in the passenger traffic of the great lines, caused by the depression of trade in the manufacturing districts. The traffic receipts of the past week show an increase of £11,407 as compared with those of the preceding week ending the 8th inst.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

Preliminary Meeting Yesterday: *Prices Confirmed* — Growing Demand for Best Plates—Brands Should be Scrutinised—Pig Iron: *Increasing Prices for Hematite Iron*—Coal Trade—General Hardware Trades: *Continued Improvement: Demand for the Northern and Southern States, and Spain*—The Working of the French Treaty: *The High Anglo-French Postage Rates*—Strikes by Rifle Sight Makers and Nail Makers—The Railway Carriage Works at Oldbury—The Bankruptcies of Pitt and Fletcher, and Kimberley and Gold — Careless Workmen at Blast Furnaces—The Engine Tenters charged with Manslaughter.

Yesterday (Thursday) the Preliminary Meeting of the Ironmasters' Association was held in Wolverhampton. The question of prices was the principal one that had to be decided. Excepting in the case of hoops, the rates that have prevailed for some few quarters past were adopted for recommendation to the quarterly meetings. Hoops, it was resolved, should be reduced 10s. a ton, namely, from £8 to £7 10s., thus making the difference between hoops and common bars only 10s., instead of 20s. as for some years past. The difference is not smaller than has before prevailed, and, is, it is maintained, the natural one; but a time of good trade enabled makers to obtain for hoops £1 advance, as compared with bars. A period of depression now forces a return to the early standard. An attempt was made by some makers to obtain an alteration in sheets, but it was not successful. The prices will therefore range in the ensuing three months at, for bars £7; hoops, £7 10s; sheets and plates, £8 10s.; the other sorts and best and "best best" in proportion.

The few houses who are determined to sell at no reduction upon list-rates, because they will make a quality that will not admit of any reduction, are really the best off for orders. These houses experience an excellent demand for boiler-plates at £8 10s., whilst other firms, of longer standing, find it difficult to obtain orders at 5s. under those rates. The best Staffordshire plates, such, for instance, as come into competition with the Lowmoor plates at £18, are experiencing a growing demand, and they are selling at £15, the makers, of course, alleging that they will bear any test to which the Lowmoor plates are equal. This iron is being used chiefly in the construction of marine boilers. Whilst, however, there are numerous instances throughout the country in which boiler makers are prepared to give a good price for an article upon which they can depend, there are many others in which plates are being sold for the construction of boilers marked with a well-known brand, and sold at prices between 15s. and 20s. a ton below the rates which are supposed to regulate the transactions of the owners of that brand. Buyers of South Staffordshire iron need, therefore, be vigilant in ascertaining that they obtain iron having upon it, not only a portion, but also the whole of the brand, which has hitherto been a guarantee that the article has come from the house in whom past experience has given them confidence.

The reports as to the state of the trade, which we obtained from the leading houses induce us to conclude that, as compared with last week, there are a few more orders in hand, and the vendors of hematite pigs report more numerous sales in the past few days than at any similar period since the commencement of the quarter. The prices which the latter have obtained are reported to be, for the best descriptions, half-a-crown a ton in advance of those rates which ruled three months ago. Buyers, on the contrary, are stating that they are purchasing hematite pigs at £3 2s. 6d.; and they, therefore, require the agents who have all-mine Staffordshire pigs to dispose of, to submit to a reduction upon the prices which they are giving for hematite iron. While the sales of pig iron of all descriptions, yesterday and on Wednesday, were only few and of no great value, still there was a better trade done than had been expected by some of the least hopeful of the salesmen.

The continued winterly weather occasions the demand for coal for domestic use to keep up; and for manufacturing purposes there has been as much doing since our last report as for some two or three months previously, but excepting where buyers can make contracts at an unusually low figure the quantities bought are smaller than is customary. The improvement noted last week in the general hardware trades is more than sustained. Whilst most of the orders now in hand have come from foreign markets, there is at the same time a better demand on account of the home consumption, and it is expected that in another week—the new quarter having begun—the demand will still further improve. At the same time that we have to write thus favourably, we must not omit to state that there is still a large amount of labour unemployed, in most of the branches, nor that where most is being done is there—excepting in rare instances—full time being worked. The foreign markets in which the improvement is most perceptible are those of America and Spain. For both the Northern and also the Southern States goods are now being manufactured to a larger extent than has been the case since the breaking out of the "rebellion," and Spain is now taking goods, the aggregate value of which is quite a contrast to that which a few years ago was the total worth of the goods of the class of which we are writing exported to that country by the manufacturers of this district.

The French Treaty continues to work favourably for the interests of this district, as well in regard to the increase of transactions in manufactured iron as in general hardware goods. We regard as a favourable indication of this that certain of the factors and merchants of Wolverhampton find it so far inconvenient to have to go to Birmingham to make the customary declaration to the French Vice-consul there, that the council of the Wolverhampton Chamber of Commerce are now memorialising the French Consul General in London to appoint a vice-consul in Wolverhampton. As an indication of good, we note that the council of the same chamber are memorialising Sir Rowland Hill, to reduce the rate of postage between this country and France, it being felt that the present high rates charged for the conveyance of letters across the Channel are interfering with the efficient working of the treaty.

There is a disagreement between the operatives engaged in the manufacture of rifle sights and their employers. The men have struck, and have resolved that no more work shall be taken out until the masters give the prices that have hitherto prevailed.

Certain of the operatives in the nail trade continue to make a show of resistance to the reduction in their weekly wages from 20s. to 18s. At Hales Owen, on Monday last, men who are receiving the higher sum resolved not to return to work till those who had received notice for a reduction, and were striking against it, were receiving the full 20s.

The railway-carriage works at Oldbury will henceforward be carried on by a limited liability company, to whom Mr. R. W. Johnson has parted with a considerable portion of his interest. The chairman and members of the West Midland Railway are said to be amongst the chief of the new proprietary.

The case of Pitts and Fletcher, the iron merchants of Willenhall, was again called on, in the Birmingham Bankruptcy Court, on Monday. It was stated that, in consequence of Fletcher having been committed for forgery, and being then in the Stafford Jail awaiting his trial on that charge, neither the balance-sheet nor the statement of cash accounts, for the production of which the examination had been adjourned, had been filed. It would be three months before Fletcher's trial came on, but the friends were hoping to obtain his liberation, on bail, in a week, upon which the bankrupt would appear with the statement of accounts that had been asked for, and, if possible, pass his last examination. The examination of Mr. Fletcher was adjourned *sine die*, and that of Mr. Pitt for three weeks.

An arrangement has been come to between Messrs. Kimberley and Gold, the hinge makers of Birmingham, and their creditors. The latter gentlemen propose to pay 20s. in the pound within three months, on the separate estate of Gold; and a proposal is also made to pay creditors 20s. in the pound in three instalments in three, six, and nine months upon the joint estate.

Mr. Samuel Griffiths was adjudged to pay £30 and costs in the Wolverhampton County Court, on Monday, for damage sustained by a tradesmen in Bilston, in consequence of the neglect of one of the defendant's workman at his Bilston blast furnaces to use a "lacker", whilst allowing some wagons that had been employed in filling the furnaces to descend the incline leading from the mouth of the furnace to the ground. The bottom of the incline came near to the plaintiff's shop, where two of his horses and a cart were standing at the time of the accident. Hence the damage. The defendant did not appear, and the judgment went by default.

For maliciously doing damage to the winding machinery at the blast furnaces of Messrs. Ward, ironmasters, of Wolverhampton, to the extent of £20, the working engineer of the furnaces, named Simpson Pearce, was on Monday last, at Willenhall, fined £5 and costs, or a fortnight's imprisonment, and ordered to be further imprisoned for a similar period for neglecting his work. In this case the defendant allowed his engine, whilst it was taking a load to the mouth of the furnace, to continue working till the damage had been occasioned, disregarding all the customary signals. He had previously used threatening expressions towards his employers. The engine tenter who drew seven men over the pulley at a colliery at Tividale. killing one of the number, has been committed for trial for manslaughter before the magistrates of West Bromwich as well as upon the coroner's warrant.—The working engineer, whose boiler at the Corbyn's Hall Ironworks blew up and killed five men, was acquitted at his trial on the charge of manslaughter. At an inquest since held upon three of the deceased, the jury censured the engineman for being absent from his engine at the time of the explosion.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

Northern Matters: *Newcastle Literary and Philosophical Society: Miners' Grievances and Propositions: State of Trade: Tyne General Ferry Company: Extension of Railway Communication to the Quayside*—Wakefield Water Supply—An Immense Anvil Sole — Norwich and the International Exhibition: *Messrs. Barnard, Bishop, and Barnard*—Clyde Shipbuilding: *Models for the Exhibition* — Sugar Mill for the Exhibition — State of Employment in Manchester: *Machinists and Foundries.*

We commence with the north, where several matters, as usual, invite attention. The committee of the Newcastle Literary and Philosophical Society has recently placed in its library two busts, one of Sir W. G. Armstrong and the other of the late Mr. Robert Stephenson. A meeting of delegates appointed by various collieries of Northumberland and Durham was held at Newcastle on Saturday to receive reports as to the progress of a petition in course of preparation for presentation to Parliament. The statements made by the agents selected to canvass for signatures in the two counties were generally of a satisfactory nature, the only obstacle, apparently, being a fear on the part of some of the men lest they should be dismissed from their employment, which had prevented them from taking any part in the memorial. Such cases, however, seem to have been rare, and although no resolution was adopted on the subject a suggestion that the privilege of signing the document should be accorded to all classes of the community was favourably entertained. Reports were at the same time made with respect to the shafts, ventilation, and other working arrangements of the collieries which had been visited, the result showing that, while in connection with certain mines every desirable precaution was resorted to, in others great defects and imperfections existed. The executive committee were authorised to receive, from those collieries which had not yet contributed, subscriptions towards the defrayment of the necessary expenses, and it was decided that, on the completion of the petition-sheets, a "demonstration" should take place in Newcastle.—Trade is still in an unsatisfactory state on Tyne-side, although the opening of the Baltic has caused a little movement in that direction. A few foreign orders keep local manufacturers moderately active, but at the works of Sir W. Armstrong and Co. a number of men have been discharged. Some interesting information was communicated at the half-yearly meeting of the Newcastle and Carlisle Railway Company. The smaller dividend declared was attributed by the chairman (Mr. W. Woods) to the depressed trade of the district. In the latter part of 1859 and the beginning of 1860 he said there had been great excitement in the iron trade. In the west fifteen furnaces were prepared for action, and the directors quite expected to have been able to increase their revenues by the extensive supplies of coal, coke, &c., that would have been required to feed them. Unfortunately, however, trade took a turn, a number of those furnaces were not commenced; some were put out of blast, and, in fact, only four were now in use. The directors had been disappointed in witnessing the suspension of that source of supply for which they had provided extra wagons, so that there might be no interruption in the manufacture. He was quite of opinion, however, that trade would recover from its present depression, and that this district must in the end become the seat of a most extensive production of iron. The materials required in the iron manufacture were all here on the spot, and of the first quality—they had coal and coke, they had lime, and they had ore, either native or obtainable from a distance at a small cost; and from these circumstances, and knowing that every year the cost of raw materials was very much increasing in Wales, in Staffordshire, and in Shropshire, he was quite assured in his own mind that this must, at no lengthened period, be reckoned as the iron district of the country. In his recollection there was only one furnace on the Tyne; it belonged to the Tyne Iron Company. Some time afterwards they got another, but when he told them that there were now in existence ninety-five furnaces in the counties of Northumberland and Durham, not got up by speculators, but generally by people of sound judgment and good capital, they would see that an impression was to be derived favourable to the idea of this becoming the great iron district of the country. Alluding to the improvements that had been effected in the manufacture of iron, the speaker stated that whereas, formerly, 45 up to 80 tons was considered to be a good production in a week from each furnace, now 200 tons was not considered a very large amount, and it often extended to 250 and 300 tons in some furnaces of modern construction. The directors had obtained 298 new coal wagons, and two new engines, at an expense of about £16,000, and if they were disappointed that that additional stock was not better occupied they knew that the engines and wagons were ready whenever there should be an improvement in the trade. An important scheme is pending under the title of the Tyne General Ferry Company, the promoters proposing the establishment of a uniform system of ferries passing from point to point across the river from Hedwin Stream to the mouth of the Tyne.

A paragraph in last week's Engineer called attention to certain disputes in reference to the water supply of Wakefield. It is now understood that an arrangement has been made between the Wakefield Corporation and the directors of the Wakefield Waterworks that the town shall purchase the works, and all existing liabilities of the company, at £5 per cent. on the share capital, and £25 for the shares. This plan, apart from its other advantages, will settle a long vexed question.

Messrs. Fawcett, Preston, and Co., successfully cast an immense anvil sole, weighing about 40 tons, yesterday week. The operation, which was effected without the introduction of any apparatus beyond that usually employed on the establishment, was completed in about a quarter of an hour after the furnaces were "tapped." The casting was for a new steam hammer about to be erected on their premises by the Mersey Steel and Iron Company, in addition to the numerous implements of a similar character which they already possess. Although the casting itself was made in a very short time the preparations for it had occupied a very considerable period; and from the large quantity of metal employed it has taken some time to cool.

Messrs. Barnard, Bishop, and Barnard, of Norwich, are preparing a pair of elaborate park gates for the International Exhibition. The design is stated to be of a high order, and has been practically elaborated with much pains and at a very considerable outlay.

In connection with Clyde shipbuilding it may be stated that an iron steamer named the Brisbane, constructed for the Government of Queensland, has been launched from the Overnewton yard (Messrs. C. Connell and Co.). The steamer's engines are to be supplied by Messrs. A. and J. Inglis, Whitehall Foundry. Messrs. Connell and Co. have at present on hand contracts to the amount of from £30,000 to £40,000. Messrs. W. Denny and Brothers, of Dumbarton, have prepared for the International Exhibition six models of steam vessels. The principal of these—a model of the Montreal Ocean Steamship Company's vessel the Hibernian—is upwards of 6ft. in length, and is so constructed as to show on the one side the exterior of the hull, and on the other the interior above the main deck. The passenger accommodation and the various offices are all accurately shown, and the main saloon is fitted up with all the usual furniture, tables, mirrors, sofas, &c.

A steam engine and sugar mill, constructed by Messrs. Mirrlees and Tait, of Scotland-street Ironworks, with a view to being shown in the International Exhibition, has been tried successfully during the past week. The sugar mill is driven by a high pressure steam engine, worked expansively, with beam resting on an entablature supported by six massive columns, and the power is communicated to the mill rollers by suitable compound or double gearing. The following are particulars of the various dimensions:—Diameter of engine cylinder, 22in.; length of stroke, 4ft. 6in.; diameter of fly-wheel, 20ft.; weight of do., 14 tons; diameter of mill rollers, 33in.; length of do., 7ft.; weight of a single roller, with its shaft, nearly 10 tons; weight of mill and gearing, 90 tons; weight of machinery as exhibited (without boilers), 130 tons. The rollers are calculated to make about two revolutions per minute, and to express about 40 gallons of cane juice at each revolution. A gallon of juice produces about a pound of sugar, so that in a day of ten hours this machinery is capable of making about 20 tons of sugar.

A recent return as to the state of employment in Manchester showed that of 47 machinists 14 were on full time with all hands, 20 were on full time with a portion of their hands, 12 were on short time, and 1 had stopped altogether. Of 24 foundries, 5 were on full time with all hands, 16 were on full time with a portion of their hands, and 3 were on short time.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£	s.	d.	Dis. p. ct.
IRON, English Bar and Bolt:—					
in London	pr tn	5	15	0	3
in Wales	„	5	0	0	„
in Liverpool	„	5	10	0	„
(Deliv. into boats at works; Nom. rates last qr. day for favourite brands) Staffordshire Bars	„	7	0	0	1
Sheet, Sngl.	„	8	10	0	„
Dbl.	„	10	0	0	„
Hoop	„	8	0	0	„
Rod, round	„	7	0	0	„
Nail Rod. sq	„	7	5	0	„
SHIPPING IRON, (Delivered in Liverpool 10s. per ton less) Staffordsh. Bars	„	7	0	0	2
Sheet, Single	„	8	15	0	„
Double	„	10	5	0	„
Hoop	„	8	5	0	„
Rod Round	„	7	0	0	„
Nail Rod. Square	„	7	5	0	„
IRON, Rails, in Wales, cash	„	5	7	6	nett
„ „ 6 months	„	5	10	0	„
Old, to cut up	„	0	0	0	„
Railway Chairs, in Wales	„	4	0	0	„
„ in Clyde	„	3	15	0	„
Pig No. 1, in Clyde	„	2	10	0	„
3-5ths No. 1 & 2-5ths No. 3.		2	10	0	„
No. 1, in Wales	„	3	10	0	„
No. 1, in Tyne and Tees	„	2	12	0	„
Ditto, Forge	„		9	0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	„	3	10	0	„
Welsh Forge Pig (all Mine), at the Port	„	3	5	0	„
Acadian Pig, Charcoal	„	7	10	0	„
Scotch Pig, No. 1, in London	„	0	0	0	„

		£	s.	d.	Dis p. ct.
IRON, Swedish, Indian assortments	pr tn	11	5	0	2
Russian C C N D to arrive	„	16	0	0	„
STEEL, Swedish Keg, ham.	„	15	10	0	2½
Ditto, rolled	„	15	0	0	„
Fagot		17	0	0	„
SPELTER, on the spot	„	18	10	0	nett
To arrive	„	18	12	6	„
Hard, remelted	„	17	0	0	„
ZINC, in sheets	„	23	0	0	„
COPPER, Tile, 14 to 28 lb.	„	95	0	0	2
Tough Cake	„	98	0	0	„
Sheathing and Bolts	pr lb.	0	0	11	„
Sheet	„	0	0	11	„
Bottoms	„	0	0	11	„
Old	„	0	0	9	„
Yellow Metal	„	0	0	9	„
Burra	„	97	0	0	„
Russian do.	„	0	0	0	„
LEAD, British Pig	„	20	5	0	„
Spanish	„	19	0	0	„
W. B.	„	21	5	0	„
Sheet	„	21	5	0	„
TIN, English Block, nom.	„	120	0	0	„
Bar „	„	121	0	0	„
Refined „	„	122	0	0	„
Foreign Banca	„	125	0	0	„
Straits	„	117	0	0	„
TIN PLATES, Charcoal, IC	pr bx	1	9	0	„
Ditto IX	„	1	15	0	„
Coke, IC	„	1	3	0	„
Ditto IX	„	1	9		„
Do. at Newport, 1s. pr bx less		—			„
Do. at L'pool, 6d.	„	—			
CANADA, Plates	pr tn	12	0	0	2
QUICKSILVER	pr bt		0		

Rails are without alteration, and prices firm.

Scotch Pig Iron.—There has not been much animation in the market during the past week, but prices re a little firmer, closing quiet at 50s. for cash, and 50s. 7½d. three months open, Mixed Nos. Warrants f.o.b. Glasgow.

Spelter.—There has been a moderate demand, and the nearest price on the spot is now £18 10s. per ton.

Copper somewhat firmer.

Lead easier.

Tin.—English unaltered in price, and fair demand. Foreign inactive. Banca may now be had at £125 to £125, and Straits at £117 per ton.

Tin Plates continue firm.

March 27th, 1862. Moate and Co., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £	s.	£	s.	1862. £	s.	£	s.
Teak	15	10	17	0	15	0	16	0
Quebec, red pine	3	10	4	10	3	5	4	0
yellow pine	3	0	4	0	3	0	3	15
St. John, N.B., yel.	5	0	5	10	5	0	5	10
Quebec, oak, white	5	0	5	10	5	0	5	10
birch	3	10	4	0	4	10	0	0
Memel	0	0	0	0	0	0	0	0
elm	3	10	4	15	3	10	4	15
Dantsic, oak	3	10	6	0	3	10	6	0
fir	2	15	3	10	3	0	4	0
Memel, fir	3	10	4	0	3	10	4	0
Riga	3	5	3	10	3	10	3	15
Swedish	2	15	3	0	2	15	3	0
Masts, Queb. rd pine	5	0	6	0	5	0	6	0
yl. pine	5	0	6	0	5	0	6	0
rd pine	0	0	0	0	0	0	0	0
Lathwood, Dants, fm	6	0	6	10	6	0	7	0
St. Peters.	8	0	8	10	9	0	9	10
Deals, per C., 12 ft. by 3 by 9 in.								
Quebec, wht. spruce	13	0	18	0	15	0	19	0
St. John, wht. spruce	13	0	16	0	15	0	17	10

Per load—	1861. £	s.	£	s.	1862. £	s.	£	s.
Yel. pine, per reduced C.								
Canada, 1st quality	17	0	18	10	17	10	19	0
2nd do.	12	0	12	10	12	0	13	0
Archangel, yellow	13	0	13	10	14	0	15	0
St. Petersbg. yel.	12	0	12	10	12	10	13	10
Finland	9	0	10	0	9	10	10	10
Memel	10	0	15	0	10	0	15	0
Gothenburg, yel.	10	0	11	10	10	0	12	10
white	9	10	10	0	9	10	11	0
Gefle, yellow	10	0	11	0	11	0	12	10
Soderhamn	10	0	10	10	11	0	13	10
Christiania, per C 12 ft. by 3 by 9 in. yellow	22	0	25	0	23	0	24	0
Deck plank, Dnts per 40 ft. 3 in.	0	14	1	4	0	14	1	4
Staves, per standard M								
Quebec, pipe	70	0	75	0	80	0	85	0
puncheon	16	0	18	0	16	0	18	0
Baltic, crown pipe	160	0	170	0	170	0	180	0

SCOTCH PIG IRON REPORT.

		s.	d.		
No. 1 Gartsherrie	.. ..	56	3	f.o.b	Glasgow.
„ 1 G.M.B.	.. ..	49	3	„	do.
„ 3 Do.	.. ..	48	3	„	do.
M. Nos. Do.	.. ..	48	9	„	do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths „ 3 .. G.M.B.	Cash prompt	50	3	per ton.
	1 mo. open	50	6	do.
	2 mos. „	50	9	do.
	3 „ „	51	0	do.

MANUFACTURED IRON.

	£	s.	d.
Bars, Govan	7	0	0
„ Common	6	10	0
Drumpeller, Common	6	10	0
Do. Best	7	10	0
Plates and Sheets	10	0	0
Rails	7	0	0
Pipes	4	17	6
Chairs	4	0	0

Glasgow, 28th March, 1862.

Our market has completely changed in tone during the past few days, and a keen demand has set in for pig iron, chiefly on speculation. The price has advanced fully 1s. per ton, and has every appearance of going higher.

The shipping demand is still good The home consumption is improving. Exports last week were 12,158 tons against 8,200 tons in the corresponding week of last year.

Shaw, Thomson, and Moore, Metal Brokers.

THE GASWORKS OF LONDON.

(*Continued from page* 192.)

We have followed the process of gas-making up to the purifiers. Coal gas contains many impurities, as ammonia, sulphuretted hydrogen, carbonic acid, bisulphide of carbon, &c. The ammonia is removed by passing the gas through water, as in the scrubbers already noticed, and which are thus properly to be included with the purifying apparatus. The term "purifier," however, is technically applied only to those vessels in which the gas is freed from sulphuretted hydrogen, one of the most offensive impurities of all. Dr. Henry and Mr. Clegg were the first, more than fifty-five years ago, to employ lime for the purification of gas, and Mr. Clegg soon after adopted the separate purifying vessels, the first application of the lime having been in the tank of the gas-holder itself, from which the saturated material could only be withdrawn with much inconvenience. Lime, both as a hydrate and in solution, has a strong affinity for sulphuretted hydrogen, with which it forms a hydro-sulphuret of lime, in itself an exceedingly offensive compound. Wet lime purifiers have been much used, the solution being in the proportion of one bushel of slaked lime to twenty-four or twenty-five gallons of water. Through this mixture, kept in constant agitation, the gas was made to pass, rising, thence, practically purified and fit for lighting, into the gas-holder. The removal, when necessary, of the spent lime was a disagreeable task, and except great care was taken, the stench extended over the whole neighbourhood.

At the present time there are, we believe, three gasworks in London, viz., the Vauxhall and Bankside stations of the Phœnix Company, and the Curtain-road works of the Chartered Company, where wet lime is employed in the purifiers. At the Phœnix Company's works the spent lime is run into tanks under the retorts, and the waste heat sent over it, so as to evaporate the fluid portion, which goes up the chimney-stack in vapour, leaving the lime in a comparatively inoffensive state behind. At the Bankside station the heat was originally applied beneath the waste lime tanks; but this baked the lime upon their bottoms, so that, after a short time, little heat could pass through to the fluid portion at the top of the tank. A change was therefore made, and the heat reverberated from the crowns and sides of the arches, under the benches of retorts, full upon the surface of the lime, and this plan has answered very well. At the Vauxhall station the heat first strikes down upon the top of the lime, afterwards passing along the bottom of the tanks. With these arrangements the Phœnix Company's works are not worse, in point of smell, than those of the other London companies, the characteristic odour of purified coal gas and the pungent scent of ammonia being about all that a visitor, with ordinary olfactory acuteness, would be likely to notice in this respect.

The purifying agent now generally adopted at the various gasworks of London is a hydrated oxide of iron. Edward Heard, who patented the use of lime, for purifying coal gas, as long ago as 1806, pointed out that, among other substances, metallic oxides, including that of iron, would take up and retain sulphuretted hydrogen. But from the best authorities it appears that some of the other oxides mentioned by Heard would not arrest the impurity in question, so that his knowledge of the action of all the oxides must have been imperfect. Afterwards, in 1840, Mr. Croll took out a patent, chiefly for the purification of gas from ammonia, but he stated in his specification that the sulphur might be arrested by the black oxide of manganese, or by the oxide of zinc, or the oxides of iron. As, however, an anhydrous oxide of iron will not act upon sulphuretted hydrogen, Mr. Croll's specification and claim were manifestly incomplete. Mr. Laming, in one of his patents, afterwards pointed out the advantage of employing oxide of iron with chloride of calcium in purifying gas, but nothing appears to have been done to bring artificially hydrated oxides of iron into use for the purposes of purification, until Mr. Frank Clarke Hills, of Deptford, began to introduce them, under his patent of Nov. 28th, 1849. On the passage of the gas through the oxide, the latter and the sulphuretted hydrogen are mutually decomposed, the oxide giving up its oxygen which unites with the hydrogen of the sulphuretted hydrogen, the sulphur at the same time uniting with the iron, forming a sulphuret of iron. Could this decomposition be effected but once, so that the de-oxidised purifying material could not again be used, the cost of a metallic oxide would preclude its use altogether. But in consequence of a chemical re-combination which, according to Dr. Ure, was first observed by Mr. Frederick J. Evans, the manager of the Horseferry-road station of the Chartered Gas Company, the sulphuret of iron precipitates its sulphur on exposure to the air, and again combines with oxygen, occasionally with such energy as to take fire. Thus revivified, the oxide of iron may be used again and again, often for thirty or forty times. We have, indeed, heard that the natural oxide, used at the Horseferry-road works is used sixty or seventy times over before it becomes too inert to render further service. Every time the sulphuret of iron is revivified to the condition of an oxide it precipitates its sulphur, which remains in mechanical mixture with the mass, and in this way the weight of the whole finally becomes 30 or 40 per cent. greater than the original weight of the oxide, the excess being sulphur alone. Notwithstanding this presence of sulphur in the revivified material, the gas does not take it up in fresh combination. Any quantity of gas might, indeed, be passed through crushed sulphur without becoming at all sulphuretted.

Mr. Hills' prepared oxide, containing also a little sawdust, is in general use among the London gas companies, although the Chartered Company employ a natural bog-iron ore from Sligo and Donegal, while the Surrey Consumers' have used cast iron borings well rusted, and mixed with copperas (sulphate of iron) and sawdust. The purifying material, in all cases reduced to a coarse granular powder, is placed, generally in layers, inside a succession of gas-tight vessels known as the purifiers, the gas entering at the bottom of one purifier, rising through the porous mass of purifying material, and escaping through one side of the vessel near the top, and passing thence to another. In some works the oxide is placed in a single layer, 3ft. or 4ft. in depth, but it is more commonly divided into three or four layers, from 12in. to 18in. each in depth. An additional thin layer of dry slaked lime is often added to take up whatever carbonic acid may be present in the gas.

The purifying vessels are of cast iron, of a size corresponding to the quantity of gas to be dealt with. At the Commercial Gasworks, where the greatest production of gas is not far from 2,500,000 cubic feet per day, there are four purifiers, each 24ft. square and 6ft. deep, the oxide being placed in three layers each about 18in. deep. A square purifier is not, perhaps, the most convenient for emptying, inasmuch as the men have to shovel to a greater distance from the centre than if a rectangular form were adopted. The largest purifiers we have seen are at the Imperial Company's works at Fulham, their size being 20ft. by 36ft., but the oxide is placed in very shallow layers, and has to be charged very often. The Commercial Company are about erecting two purifiers, each 18ft. by 30ft. It is sometimes the practice to work the gas successively through three purifiers, the remaining one out of the set of four being laid off for changing the oxide, or any casual repairs. The distribution of gas among the several purifiers in a set is managed with ease by means of valves in pipes communicating with each vessel. The lid of the purifier is always made of plate iron, with a flange depending at the edge and entering a water-cup extending around the cast iron sides of the purifier itself. This makes a water-joint, and at the same time permits of the lid being raised to get at the oxide whenever it requires changing. In some cases, as with the great purifiers at Fulham, the lids require to be counterweighted, and, in all cases, means are required for hoisting the lids clear of the purifiers. A stout framing is sometimes erected around and over them, so as to give a point of attachment for the lifting tackle. Where a set of purifiers are placed in a continuous row, a railway is formed of a gauge sufficient to include the whole width of the range, and a travelling platform provided with hoisting gear is mounted upon the rails. Before a lid can be lifted, and after the gas has been shut off from the entering main, it is necessary to open a man-hole or other opening in the lid, so as to admit the air to the purifier, as, otherwise, the suction in raising a surface of from 300 to 700 square feet, against an unbalanced atmospheric resistance equal to a pressure of even 5in. of water, would be from 3½ tons to 8½ tons.

The layers of oxide, previously moistened, are supported on gratings or "sieves" as they are called, which were originally made of cast iron, and are made so yet, at the Horseferry-road and the Goswell-street (Brick-lane) stations of the Chartered Gas Company. The sulphur precipitated in the oxide acts so powerfully, however, upon the cast iron grates as to eat them away in a short time, often in less than two months. For this reason wooden sieves are now used in nearly all the gasworks of London, or in all with the exception of the two just noted, and in the Phœnix Company's works, where only lime is employed in purifying. At the Chartered Company's works, however, we learn that the wooden sieves became hot, and were warped and charred in the purifiers, so that iron sieves are still employed, notwithstanding their rapid corrosion by sulphur.

The length of time during which the oxide, in a succession of purifiers, retains its desulphurising virtue depends on the relative quantities of the oxide and gas brought together, as well as on the degree of impurity in the gas and upon the original quality of the oxide itself. It is common to pass the gas through two purifiers, and when the oxide first acted upon becomes converted into a sulphuret, to turn the gas into the second and third purifier, the first, in the meantime, being laid off to be opened. The second and third are then worked together until the oxide in the second becomes inert, when the third and fourth are placed in communication, the next change being to connect the fourth and first, passing the gas from the former to the latter, and so on. At the Goswell-street station of the Chartered Company, where natural bog iron ore from Sligo is used for purifying, it is broken up and mixed with a little quick lime to take up the moisture which it contains, and also to attract whatever carbonic acid may be present. The oxide is then placed in four layers of 9in. each in each purifier. The latter, we should suppose, are not far from 15ft. by 20ft. each, although we are unable to give their exact size. With this quantity from 6,000,000 to 8,000,000 cubic feet of gas are passed through two purifiers at each charge of oxide, equal to three or four days' full produce of the establishment. That is, from 3,000,000 to 4,000,000 cubic feet of gas will be passed through say the first and second purifiers, and afterwards the same quantity through the second and third, the second purifier requiring to be charged afresh at the end of the passage of 6,000,000 or 8,000,000 feet of gas through it, and the others successively in the same manner. Of course there is no such thing as a fixed proportion between the oxide used and the gas purified; the engineer is guided wholly by the test for sulphuretted hydrogen, which is that of holding, for a few seconds in a stream of the gas, a paper previously dipped in a solution of acetate of lead, or, still better, in a solution of nitrate of silver. If any sulphuretted hydrogen be present in the gas, the paper will be blackened by the precipitation of metallic lead or silver. Whenever the gas shows foul the purifiers had better be charged afresh as quickly as possible. For ammonia, the test is turmeric paper, which, if the impurity in question be present, will be changed, on its exposure to the gas, from its proper yellow colour to a deep red or brown.

When the spent purifying material, converted from an oxide to a sulphuret of iron, is taken from the purifiers, it is spread in layers on the ground, or on boards, either in the open air or under sheds, and thus exposed to the action of the atmosphere. The black, tarry appearance which characterises the sulphuret gradually changes to a brown, and, finally, to the rusty red peculiar to the original oxide, the material being in the meantime occasionally turned over with a shovel. The precipitation of sulphur and the resumption of oxygen are occasionally so rapid, especially when the material has been used but a few times, that it smoulders, and even enters upon active inflammation. In the latter case the sulphurous vapour is almost overpowering. At the Horseferry-road station of the Chartered Company, the spent material is revivified upon an extensive grated flooring, down through which a current of air is maintained by the powerful draught of one of the chimneys, 132ft. high, on the works. After being employed a number of times, the accumulation of free sulphur, in mixture with the oxide, is such that, if a small quantity of the whole be mixed with chlorate of potash and struck upon an anvil, it will explode with great violence. The accumulation is represented, indeed, as already stated, by an increase of from thirty to forty per cent. upon the original weight of the oxide.

When saturated with sulphur the oxide is sent to Mr. Hills, the patentee, who finds some good use for it, and by which it partly pays for the fresh material returned in its stead.

The labour required for emptying and charging the purifiers every few days is costly enough to have induced some gas engineers to attempt the revivification of their purifying material in the purifiers themselves. This is accomplished by shutting off the gas from the inlet main, raising the lid, and then drawing air downwards through the layers of deoxidised and sulphuretted material by means of an exhauster in communication with a pipe at the bottom of the purifier. At the Surrey Consumers' works, where Mr. Croll's heavy mixture of iron borings, copperas, and sawdust is used, and which seldom, if ever, catches fire, this plan is found to answer very well. But at the South Metropolitan works, where Mr. Livesey has tried it with Hills' oxide, there was too great a tendency to spontaneous combustion, in which the wooden gratings or sieves would have disappeared like tinder. At the London [illegible] works, where air pipes have been laid on and an exhauster fitted up for revivifying in the purifiers, Mr. Watson does not appear to have enough confidence in the plan to adopt it in everyday work. The possible fate of the wooden sieves, upon which there is no insurance, stands much in the way of the attempt. At the Commercial works, however, Mr. Jones has his apparatus in readiness, and may have already commenced, indeed, to revivify Hills' oxide in his purifiers.

We ought here to notice the presence of the vapour of naphthaline in gas, and which begins, indeed, to deposit in thin, micaceous-looking scales of exceeding lightness, almost at the moment when the gas leaves the purifiers. Indeed, large patches of naphthaline flakes may often, if not generally, be found on the undersides of the lids of the purifiers themselves, and this singular substance will often choke the largest main so as almost entirely to prevent the passage of the gas. A blast of steam turned into the mains will disperse the obstruction like snow, but a sort of chimney-sweeping contrivance, called a "cat," is oftener employed to open the great routes of communication between the gasworks and the consumers. Fortunately, too, naphthaline is seldom deposited at any considerable distance from the works, and it can generally be cleared without going off the premises.

As to the cause of the deposition of naphthaline from gas, there are various opinions, some attributing it to certain electrical conditions of the atmosphere, but others, and by far the greater number, refer it to over-purification and to the want of sufficient density in the gas. Some of the most experienced gas engineers in London have told us that there was no trouble with naphthaline until the ordeal of official tests was established. Then it was, with increased energy in the purifying departments, and with heavier bills for oxide of iron and lime, that the "cat," or a blast of steam, had to be sent, every few weeks, through the mains leading out of the works. "Send out a little sulphuretted hydrogen," we hear, "and there will be no trouble with naphthaline." Of this we are not sure, but most gas engineers appear to be agreed that "rich" gas seldom, if ever, drops naphthaline. The Western Gas Company, who make only cannel gas, are never, or rather their engineer, Mr. Pritchard, is never troubled with naphthaline; indeed, from his own experience, he would never know what that troublesome substance really is. So at other works, it is understood that a few thousand feet of cannel gas sent through a main obstructed with naphthaline will clear it out completely, and a little Wigan, or Methyl cannel, or, best of all, a few hundredweight of Boghead, will effectually clear any pipe in which naphthaline has formed. One of the most observing gas engineers in London informs us, too, that naphthaline is particularly liable to form where very small coal or "slack" is used for gas making, and that with large coal there is much less trouble.

We have followed the purification from ammonia by water, that from sulphuretted hydrogen by oxide of iron or lime, and that from carbonic acid also by lime. In each case the removal of the offensive or debilitating matter should be complete, as with thorough exposure not a trace is left. But nothing, we believe, has been found commercially adequate to the removal of bi-sulphide of carbon from gas. From this compound the sulphur is only given up in burning, and with the consequent formation of sulphurous acid. A great deal of research and ingenuity have been expended in the attempt to remove this the last stronghold of sulphur in gas, and a year or two ago, many were led to believe that a Rev. Mr. Bowditch had really effected what was wanted by passing the gas over red-hot lime. We have not, however, heard much of this plan lately, and we are, therefore inclined to suppose that it has does not answered any practical purpose. But, after all, what the presence of bi-sulphide of carbon in gas really amount to? One of the ablest chemists in London, Mr. Versmann, already so well-known that we need hardly say he was for several years the valued assistant of Professor Graham, made a report last year to Mr. Robert Jones, the engineer of the Commercial Gasworks, on the presence of bi-sulphide of carbon in the gas made by those and other works. As the question is one of much interest among gas engineers we feel warranted in entering somewhat fully upon Mr.

Versmann's report. We may first give his own description of the means he adopted for ascertaining the exact amount of sulphuretted carbon.

"The usual way of determining the sulphur of the bi-sulphide of carbon, is to burn the gas, thereby producing sulphurous acid, which is collected, converted into sulphuric acid, and then estimated as sulphate of barytes. The only difficulty in this process is the complete absorption of the sulphurous acid, which was secured by the following arrangement:—

"A small air and gas-burner was placed inside a very spacious glass-retort open at the bottom, and afterwards closed by dilute ammonia, contained in a suitable glass-vessel. The retort was then connected with two Woolf's bottles, the first of which contained a solution of ammonia, and the second a solution of iodine in iodide of potassium; the gaseous products of combustion were forced through these liquids by means of a strong air-current produced by a water-aspirator, and thus absorbed.

"The solution of iodine was used merely in case some of the sulphurous acid escaping unabsorbed by the ammonia; but it was found, in all these experiments, that not a trace of it could be detected in the second bottle.

"The sulphurous acid, combined with the ammonia to sulphite of ammonia, was then converted into sulphuric acid by a solution of iodine in iodide of potassium, precipitated by chloride of barium, and weighed as sulphate of barytes.

"This apparatus was connected with the neck of the retort; but a similar one was in communication with the body of the retort, by means of a glass-tube passing through the dilute ammonia into the body of the retort. In order to be sure of a constant pressure of the gas, and thus allowing the operation to go on safely for a length of time, a small, delicate regulator was placed between the experimental meter and the burner, by which arrangement a certain maximum of pressure could not be exceeded; this was the more requisite, because the variation in pressure in the experiments made at your works, was necessarily very considerable; and without this regulator, the combustion might take place too quickly, the resulting carbonic acid not being drawn off in the same ratio, and might ultimately extinguish the flame."

Mr. Versmann then gives the results of experiments extending over 629 hours, or upwards of 26 days, and made upon 236 cubic feet of the Commercial Company's gas, in which the average grains of free sulphur found in each 100 cubic feet of gas was 2·99. In other short experiments, burning only 5½ cubic feet of gas, the average was 6·35 grains per 100 cubic feet. Like experiments upon the Chartered Company's gas gave an average of 9·41 grains.

Mr. Versmann then goes on to say that:—

"The variation in these results appears, at first sight, considerable, and it may be difficult to find a precise explanation; but the subsequent calculations will show that even the largest quantity is comparatively so small that the difference becomes very insignificant indeed.

"The formation of bisulphide of carbon greatly depends upon—1st. The dampness of the coals, because in very damp coals all sulphur will most probably be converted into sulphuretted hydrogen; 2ndly. The degree of heat to which the coals are exposed; and 3rdly. Upon the quantity of sulphur present in the coals.

"It is evident, therefore, that experiments made at various times, and made with gas of different works, must lead to somewhat different results; and I think that the uniformity in these experiments is by far greater than could have been anticipated.

"In proceeding to the practical view of the question, i.e., whether this amount of sulphur may possibly become in any way injurious or obnoxious to persons inhaling the atmosphere of places where the gas is burnt, we must enter the dry field of calculation. Numbers always speak for themselves, and are at least open to contradiction.

"100 cubic feet of gas are found to contain 2·99 grains, 6·35 grains, and 9·41 grains of sulphur as bisulphide of carbon.

"The specific gravity of your gas is equal to 0·440, and I will assume the gas of the Chartered Gas Company to be of the same specific gravity. 100 cubic feet of air weigh 56,490 grains, and, consequently, 100 cubic feet of gas weigh 56,490 grains × 0·440 = 24,856 grains, which contain 2·99 grains, 6·35 grains, and 9·41 grains of sulphur respectively, corresponding to 0·012, 0·026, and 0·038 per cent. by weight of sulphur, or 10,000 parts by weight of gas contain 1·2, 2·6, and 3·8 parts by weight of sulphur respectively. Or, if we compare the relative proportions by volume, we arrive at even smaller numbers, in consequence of the specific gravity of the bisulphide of carbon vapours being considerably high, viz., 2·66. I speak here of the vapours of bisulphide of carbon, and not of that of sulphur, because it will be more correct to compare the volume of the gas with the volume of the first vapour. The sulphur vapours have so high a specific gravity as 6·65; and calculation shows that one volume of bisulphide of carbon consists of half a volume of carbon vapours, and one-third of a volume of sulphur vapours.

"The above quantities of sulphur, 2·99 grains, 6·35 grains, and 9·41 grains, correspond to 3·55 grains, 7·22 grains, and 11·22 grains of bisulphide of carbon.

"As 100 cubic feet of air weigh 56,490 grains, 100 cubic feet of vapour of bisulphide of carbon weigh 56,490 grains × 2·66 = 150,263 grains; and, again, if 150,263 grains have a volume of 100 cubic feet, 3·55 grains, 7·22 grains, and 11·22 grains have a volume of 0·00236, 0·00480, and 0·00747 cubic feet, these fractions of cubic feet of bisulphide of carbon vapours are contained in 100 cubic feet of gas; or, in other words, 10,000 cubic feet of gas contain 0·236, 0·480, or 0·747 cubic feet respectively of vapours of bisulphide of carbon.

"The result of these experiments, then, is that the gas contains in 10,000 parts by weight 1·2, 2·6, and 3·8 parts of sulphur, and 10,000 parts by volume, 0·236, 0·480, and 0·747 parts of bisulphide of carbon; and it may, without hesitation, be affirmed that such a small quantity cannot have the slightest injurious effect, and that, even if the quantity was much larger, it would nevertheless be innocuous.

"To give you a still more convincing demonstration of the infinite smallness of these numbers I will now compare the products of combustion of gas; and here again I shall be supported by the indisputable authority of calculation.

"The principal product of combustion of gas, besides water, is carbonic acid, a gas which does not sustain animal life, being, on the contrary, injurious if inhaled in an excessive quantity.

"It will, therefore, be interesting to find the relative proportions of carbonic and sulphurous acid, formed by combustion of a certain quantity of gas.

"In calculating the quantity of carbonic acid produced in burning gas, we find that 100 volumes form about 50 volumes of carbonic acid. The olefiant gas yields twice its volume, and light carburetted hydrogen its own volume of carbonic acid; assuming the gas to contain in 100 volumes at the average 5 volumes of the former, and 40 volumes of the latter, this would give 50 volumes of carbonic acid, which certainly is below the actual result.

"The bisulphide of carbon, in being burnt, produces sulphurous acid, a gas which is destructive, if present in any sensible quantity, and which it would certainly be very desirable to banish altogether by some practical means.

"In forming sulphurous acid the sulphur combines with two equivalents, or exactly its own weight of oxygen, yielding twice its weight of acid, so that the 2·99 grains, 6·35 grains, and 9·41 grains of sulphur will produce 5·98 grains, 12·70 grains, and 18·82 grains of sulphurous acid.

"In order to compare these quantities with the volume of carbonic acid, it will be necessary to remark that the specific gravity of sulphurous acid is 2·247, and thus to make a calculation as before.

"As 100 cubic feet of acid weigh 56,490 grains, 100 cubic feet of sulphurous acid weigh 56,490 grains × 2·247 = 126,933 grains; and again, if 126,933 grains have a volume of 100 cubic feet, 5·98 grains, 12·70 grains, and 18·82 grains have a volume of 0·0047, 0·0100, and 0·0148 cubic feet.

"These numbers represent, together with about 50 cubic feet of carbonic acid, the products of combustion of 100 cubic feet of gas, or, comparing these proportions in larger numbers, we find that, in burning gas, with every 50,000 cubic feet of carbonic acid, 4·7, 10·12, and 14·8 cubic feet of sulphurous acid are formed, and distributed into the atmosphere.

"The sulphurous acid has certainly far more destructive properties than carbonic acid, although the last does not support combustion or animal life; but it is quite out of the question that these small quantities of sulphurous acid could have any injurious effect upon the human constitution, while the enormous quantities of carbonic acid formed at the same time should have no effect whatever.

"I am of opinion that, before any person could be inconvenienced by these quantities of sulphurous acid, he must have ceased to live, long previously, from the effect of the carbonic acid.

"The fact is, in examining this question, it has generally been neglected to make proper allowance for this circumstance, that all our houses and rooms are so well and constantly ventilated that any dangerous accumulation of gases cannot easily take place.

"It would, indeed, be highly desirable to remove even these traces of bisulphide of carbon from the gas, because we naturally wish to have as few impurities as possible in the atmosphere, and we are quite justified in doing our utmost to get rid of them; but I very much question whether the removal of bisulphide of carbon from the gas would be the first and most important point, if we were seriously bent upon ameliorating the atmosphere of our houses, especially in large towns.

"I think far too much importance has been given to this subject, most likely from no extensive experiments having been made, or proper comparison drawn with other causes tending to impair the state of our atmosphere.

"Before concluding these remarks I will subjoin a parallel example, which I trust will be as convincing as the former statements. It is well known that our common lucifers are prepared by dipping pieces of wood into melted sulphur, and afterwards into a chemical composition, which upon friction produces ignition. It is somewhat surprising that this branch of industry is almost in a state of infancy in England, when we consider its progress elsewhere; and I have often found that the lucifers in common use here contain two or three times as much sulphur as is required, and even more.

"No one imagines that any serious injury or deterioration of the state of the atmosphere can take place from lighting a lucifer in a room, and yet, when we come to compare the amount of sulphurous acid thus produced, with that resulting from burning a certain quantity of gas, we shall soon find that the danger is in one case as great as in the other.

"I determined, with this view, the quantity of sulphur adhering to a variety of lucifers, taking twelve lucifers, converting the sulphur into sulphuric acid, and determining this as sulphate of barytes. I hereby arrived at the result that a great variety of lucifers have more than one grain of sulphur a piece.

"We may assume that a large lofty room is lighted with four gas burners, each consuming five cubic feet of gas per hour, and that their flames burn for five hours, in order to consume 100 cubic feet of gas, containing 2·99 grains, 6·35 grains, and 9·41 grains of sulphur.

"The same quantity of sulphur would be burnt by lighting during the five hours three, seven, or ten lucifers; and I really do not think that any one could entertain the slightest fear in so doing, although the phosphoric acid simultaneously produced may be perhaps even more in quantity than the sulphurous acid. I am sure that this one instance will suffice to illustrate how unfounded is the apprehension of injury from the effect of the sulphurous acid; and I must say that the quantity of sulphur found in these experiments must be much larger before any reasonable fear could be entertained."

From the purifiers, with which we have occupied ourselves so long, the gas passes through the station meter, except in some works where that instrument is interdicted. At the Pancras station of the Imperial Company there is a single station meter, no longer used, and at the Hackney-road, and, we believe, at the Fulham stations there is no station meter whatever. Neither is there one at the City Gasworks. The Imperial and the City companies measure their gas in the gas holders by noting the rise and fall, thus making the gas holders what they were originally called, gasometers, or measures of gas. Of course measurements by the holder would not be worth the paper on which they were recorded if gas were allowed to flow into and out of the holder at the same time. This we must suppose, therefore, is never permitted in the cases in question, although how Mr. Clark, at the Hackney-road station, manages to separate the supply of and delivery from his monster holder, 200ft. in diameter, 80ft. high, and containing 2,500,000 odd cubic feet of gas, especially in winter and in foggy weather, is more than we can well understand.

We shall here dismiss the meters, partly because, in London, they are almost always made by Mr. Crosley or Mr. Parkinson, and although requiring a certain amount of attention from the gas engineer, are never planned or constructed and seldom repaired by him; and partly because to enter fully upon the subject of meters would occupy almost as much space as we can devote to all the other apparatus employed in gas making. To understand the various meters also would require engravings, which, thus far, we have dispensed with. We may merely note here that the gas enters the meter at a considerably higher temperature than that at which it goes to the holders. At some of the gas works, as at the Horseferry-road station, careful hourly observations of the temperature of the influent and effluent gas and of the air, and also, we believe, of the height of the barometer, have been made for a long series of years, and these afford, perhaps, one of the very best records of London weather extant.

From the meters the gas passes to the holders, which, as engineering constructions, are perhaps the most interesting of all the constituent portions of a great gas works. A gasholder may be compared to an enormous diving-bell, rising and sinking in a great well of water, according to the quantity of gas let into or let out of the holder, through the inlet and outlet pipes entering the well at the bottom and rising above the surface of the water into the interior of the holder itself.

We cannot say exactly how many gasholders there are in London, but we are not far out of the way in stating their collective capacity as about 35,000,000 cubic feet, equal to the contents of a single holder 800ft. in diameter and 70ft. high, or to sixteen holders 200ft. in diameter and 70ft. high, or sixty-four holders each 100ft. in diameter and 70ft. high. The Imperial Company take the lead in large gasholders, not only in London, but, thus far, in the whole world. The great holder at the Hackney-road station is 201ft. in diameter on the lower, and 198ft. 6in. on the upper lift, and "goes out" 80ft., thus containing about 2,500,000 cubic feet of gas. There are a number of smaller holders at the same station, two of which are upwards of 100ft. each in diameter. At the Fulham station of the same company there is one double-lift or telescopic gasholder, 200ft. in diameter and 64ft. high, and, among smaller holders, one of 160ft. diameter. At the Pancras station there are ten gasholders up and one in progress. The largest is 145ft. diameter, and in a single lift of 55ft. The one in progress is 134ft. in diameter, and in a single lift of 55ft. The ten holders already up contain, collectively, 3,326,000 cubic feet of gas, the largest holding 871,000ft., and the smallest 80,000ft.

In the preceding paragraph we have noted the two largest gasholders in the world, as far as the knowledge of English gas engineers extends. The Hackney-road holder was erected in 1857, and that at Fulham, although constructed previously, was originally made with a single lift of about 40ft. The largest gasholder in the world previous to 1857 was believed to be that of the Philadelphia, U.S., Gasworks, at the Point Breeze station in the suburbs of that city. This holder is 160ft. in diameter and 95ft. high, or nearly the height of the three-lift holder of the City Gasworks, the highest in London. In both cases the height of the holder alone, exclusive of the columns, is that given as 95ft. The Philadelphia holder was an expensive structure, the tank being laid in stonework, and carried up to enclose the whole of the holder, massive stone buttresses being erected on the outside.

The Phœnix Company have a holder the third in size in London; to wit: 160ft. in diameter, 70ft. in height, and containing 1,385,000 cubic feet. This was erected in 1855 at Kennington Oval. The company have other holders of moderate size, both in Kennington-lane and in Wellington-street, Blackfriars.

The City Gasworks have eleven holders, one in three lifts, each 32ft. 6in. high, or 97ft. 6in. in all, the bottom lift being 82ft. in diameter. The whole height of this holder is 105ft., and its total capacity upwards of 450,000 cubic feet. Another holder is 100ft. in diameter, but of moderate height, and the rest are much smaller.

The Chartered Company's holders are of moderate size, the largest, in Westminster, containing 620,000 cubic feet.

The Equitable Company have eleven holders, the largest 116ft. in diameter and having two lifts of 33ft. each.

The Commercial Company have four telescopic holders, two being 119ft. in diameter each, and 52ft. high, while the others are 110ft. each by 52ft.

The Great Central Consumers' Company have four telescopic holders each 104ft. in diameter and 50ft. high, the capacity of each being 412,000 cubic feet.

The London Gasworks have, in addition to a number of small holders, two at Nine Elms, each 150ft. in diameter and 60ft. high, and containing each about 1,000,000 cubic feet of gas.

The South Metropolitan Company have four gasholders up and another in progress. The largest erected is 110ft. in diameter and 50ft. high; that now going up is to be 110ft. in diameter and 60ft. high.

The Surrey Consumers' Company have six holders, the largest 108ft. in diameter.

The Western Gasworks have three holders, the largest, put up in 1859, and under Mr. Pritchard's direction, being 150ft. in diameter and 50ft. high.

The Ratcliff Company's holders are of moderate size. We are unable just now to give the sizes of the holders of the Independent Company.

We must reserve, for a concluding article, the important subject of the construction of gasholders, as well as some general notes on the distribution of gas, the condition of the London gas companies, &c.

(*To be continued.*)

Iron-Plates.—The report of the Iron-plate Committee is now in print, although not made public, and from the few words which its chairman, Capt. Sir J. Dalrymple Hay, Bart., M.P., let fall at the meeting of naval architects on Thursday, we are enabled to confirm the statement which we made on the occasion of the trials against Mr Fairbairn's target at Shoeburyness on Shrove-Tuesday, that in reality there is no perceptible difference between the value as a resisting medium of the rolled and hammered plate.—*Army and Navy Gazette.*

The Patent Laws.—The Manchester Patent Law Reform Association has held another meeting for the purpose of developing its views. A sub-committee of the association recently drew up a number of propositions; and at the meeting to which we now refer the chairman (Mr. W. Fairbairn) moved the first proposition which provided for the appointment of a commission of three—a mechanical engineer, a chemist, and a barrister—who, with assistants, should devote all their time to the Patent-office, and receive liberal salaries from the fees. Mr. A. Woodward moved, as an amendment, that the commission should consist of seven—three engineers, three chemists, and a barrister: the engineers, one chemist, and the barrister to deal with mechanical patents; and the chemists, one engineer, and the barrister to deal with patents relating more particularly to chemistry. After a good deal of discussion, in the course of which the chairman stated that one important object of the proposed commission was to restrain applicants for patents which had been granted before from taking out patents, useless both to themselves and to the public, the amendment was negatived, and the original proposition was adopted. The next six propositions—relating to the grant of provisional protection to inventors, and sundry other details respecting the supply of additional evidence of novelty (when required), and the grant of a re-examination to a once-rejected applicant—were taken together, and adopted without discussion. The eighth proposition—that the applicant shall pay reasonable fees for such re-examination—was also adopted. The ninth proposition—that all cases of infringement shall be tried in the first instance in any of the ordinary law courts, before a special jury of gentlemen conversant with the matter in dispute—was also adopted after some further discussion, in which one indignant speaker suggested that an infringement of a patent ought to be made a felony. The tenth proposition, giving a right of appeal to the judges *in banco*, and, if they should not be unanimous, to the Privy Council; the eleventh proposition, permitting a patentee to disclaim in his final specification anything not new or useful which he had included in his provisional specification; and the twelfth and last proposition—substituting one payment of £50 at the end of the fifth for the £150 now payable in the third and seventh years after the grant of a patent—were severally put and adopted. Petitions to the Houses of Lords and Commons, praying for the enactment of a bill founded on the various propositions, were also read and agreed to; and it was resolved that Lord Brougham and Mr. Bazley, M.P., should be requested to present them.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

Thursday, March 27th, 1862.

Mr. F. Campin, President, in the Chair.

"ON RETAINING WALLS."

By Walter Rutt.

The author commenced by remarking upon the impossibility of ascertaining the exact weight or condition of the earth, which rendered it impossible to calculate with mathematical exactness the thickness or form of wall required to sustain it. He then proceeded to consider the various ways in which a retaining wall may fail.

It may yield bodily in three ways.

1st. It may turn over, revolving forward upon the foremost point of its base.

2nd. It may slip forward, while still retaining its erect position.

3rd. The earth may yield to the pressure of the superincumbent weight.

The same three things may occur within the substance of the wall itself, viz:—

1st. A portion of the wall may break loose from the lower part and fall forward.

2nd. The upper part may slide upon the course below it.

3rd. The material of which the wall is composed may be crushed by the pressure.

The effect of the earth upon the wall was then treated of, it being considered that the prism of earth between the wall and the line of rupture had a tendency to slide down the line of rupture as down an inclined plane, thus exerting a pressure upon the wall at one-third of its height parallel to the line of rupture. By setting off a length in this direction to represent the pressure, and a vertical length to represent the weight of the wall, the resultant pressure upon the base is found. If the centre of pressure fall within about three-eighths of the width of the base from its foremost edge, it may be considered a safe proportion. The farther back the centre of gravity of the wall lies the farther back will be the centre of pressure, thus showing the advantage of giving a batter, and especially a curved batter, to the wall. By considering each point in the height of the wall as the base of a distinct wall, it will be seen that the wall may taper off to a point at the top, giving a triangular profile.

To prevent the courses sliding upon one another it is best to lay them square with the batter, sloping slightly downwards towards the back; an inclined base will also prevent the foot of the wall from being pushed forward upon the earth below it. The yielding of the earth below the foundations is a frequent cause of failure, which should be guarded against by extended footings, or, in bad ground, by the use of piles. A very good example of this is seen in the quay wall at Rouen, which stands on a bank of soft mud, the river deepening rapidly in front, and is supported upon a system of piles braced together by transverse timbers.

Thus far walls of uniform section only have been considered; but, by the use of counterforts, the centre of gravity may be thrown further back, and an increased strength be obtained with the same materials. Care must be taken to ensure a perfect bond between them and the body of the wall; or, as in the case of the Old Humber Dock, the latter may be forced forward, leaving the counterforts some feet behind. A still greater advantage is gained by placing the buttresses in front, or by building deep piers at intervals with vertical arches between them, which system has been adopted upon the Hampstead Junction and the Metropolitan Railways.

Another point requiring great attention is drainage. Earth saturated with water not only being heavier, but its natural slope being greatly flattened, its action approximates to that of a dense column of fluid. On the Euston incline of the North-Western Railway the sides of a cutting through the London clay are supported by retaining walls about 25ft. high, having a curved batter; the wall upon one side bulged considerably, in consequence of the accumulation of water behind it; the other one stood firm, the inclination of the strata acting as a natural drain. The failing wall was operated upon by boring through it and inserting drain pipes, reaching 16ft. into the clay, which had the desired effect of letting off the water and preventing any further bulging. To make all sure, cast iron struts were thrown across from one wall to the other. Iron struts are used with great advantage on the North London Railway, and also on the Metropolitan Railway. In the latter case the walls are constructed on the principle of deep piers of brickwork at intervals of 11ft., having vertical brick arches turned between them backed with concrete. They are carried up straight to a height of 15ft. above the rails, where the struts are placed; above this point the face has a batter of 1 in 8, the back being still vertical. The struts are made in two lengths, bolted together in the centre, and stayed with T-irons, which run longitudinally from one to the other. The feet of the piers are retained in position by brick inverts, backed with concrete.

The material employed in retaining walls must necessarily depend upon local consideration, the necessary qualifications being weight and resistance to crushing. Where stone is very abundant dry walls may be used, as is the case in a wall at Rowsley, sustaining an embankment of the Midland Railway extension to Buxton, about 25ft. high. There being a quarry in the immediate neighbourhood, it was built dry, of sandstone grit, 11ft. thick at the bottom, 5ft. 6in. at the top, and with a batter of 1 in 4. Where mortar or cement is used the work must not be exposed to great pressure until it is well set. In the late extension of the Surrey Docks, owing to the sudden lowering of the water, portions of one of the walls (although 20ft. thick in brick and concrete) bulged to such an extent as to necessitate reconstruction.

Concrete, from its cheapness and monolithic character, is a first-rate material for retaining walls: but, as it disintegrates upon exposure to the weather, it should be protected with a facing of brick or stone (good care being taken to ensure a perfect bond), as in the extension of the London Docks, at Shadwell, or by iron piling and plates, as in the Brunswick Wharf, at Blackwall. Mr. Mallet's buckled plates are well adapted for this purpose.

The author concluded his paper with a description of the Blisworth cutting on the North-Western Railway, where a heavy mass of limestone had to be underpinned in order to prevent its forcing out a stratum below it saturated with water.

THE LIVERPOOL LANDING STAGES.

(From the *Liverpool Albion.*)

The object of the present paper is to furnish a few particulars with respect to the great landing-stages, and the works at which they were constructed, and these are illustrative of the ironwork capabilities of Liverpool. For this purpose we shall commence with the Woodside landing-stage—a work which, although not as yet actually completed, is still so nearly so as to have been in regular use for the passenger traffic at that important point for some considerable time past, and is now almost entirely finished. This enormous fabric, which is almost 800ft. long by 80ft. wide, was built at the works of Messrs. Vernon and Son, at Tranmere. It was launched in two sections, the northern moiety being the first, which was launched on the 30th of September, 1861, and successfully floated to, and moored in, its destination in a day or two afterwards; the second, or southern, portion was not launched for some months afterwards, but it also was most happily launched and conveyed to its allotted location, where, having been duly fixed, it was joined to the portion previously placed there. The length and breadth having been given of this immense floating mass, which rises and falls with the tide, and is moored in water deep enough to allow ferry and sea-going steam vessels to come alongside of it at all times, it may be as well to state that it has a deck area amounting to about an acre and a half in extent. It has a total weight of wood and ironwork, without the bridges which connect it with the piers, of 3,500 tons. The weight of the bridges is 500 tons, and the mooring apparatus, as may well be imagined, is also immensely heavy; yet such is the buoyancy of the whole, that it has a draft of only 3ft. of water, and would sustain a dead weight of 100 tons more without sinking more than an inch. The substructure, or floating portion of the work, consists of sixty air-tight pontoons made of malleable iron. Forty-one of these pontoons are 80ft. long and 10ft. wide; six are 80ft. long and 12ft. wide; ten of them are each 101ft. long by 10ft. wide; and three of them are 98ft. long by 10ft. wide; all of them being 5ft. in depth. These pontoons present a uniform straight line along the east or river front, the long ones having their lengthened ends projected towards the pier, for the purpose of receiving and sustaining the ends of the bridges which connect the stage with the shore. The intervening spaces between the pontoons is 5ft. at each end of the stage, and all the others are 6ft. apart. These pontoons are strongly bound together by five lines of box kelsons, running the entire length of the stage. These kelsons, for 500ft. in length, on the northern portion of the stage, are of the following dimensions:—The centre one is 5ft. deep by 3ft. wide, the two intermediate ones are each 4ft. 9in. deep by 3ft. wide, and the two outside ones are each 4ft. deep by 3ft. wide, for the purpose of giving a proper camber to the deck. For 300ft. at the southern portion of the stage these kelsons are each 1ft. less in depth than the others. This portion is for the passenger traffic, the northern and higher portion of the stage being devoted to the goods and heavy traffic. These kelsons, which are securely bolted to the pontoons, give great solidity and strength to the whole. Across the kelsons are laid, on the northern portion, two tiers of deck beams, each 12in. square, of the best red pine, placed 4ft. apart. On the southern or passenger portion there is only one tier of deck beams, of 12in. square, and laid at 3ft. apart. Above these beams is a layer of longitudinal deck planking of yellow pine, 4in. thick; and over this again is a transverse deck planking of yellow pine 2in. thick, except 15ft. on the seaward edge, and the approaches to the different bridges, which are of Sabicu, a very hard wood, to provide against the great tear and wear of those portions of the stage. The whole of the stage is surrounded by a fence of movable iron stanchions, fitted into sockets, and connected with each other by two lines of guard chains. The outer side of the stage is protected by wood rubbers of fenders, sustained by massive chains suspended by bollards or timber-heads, which are 8ft. or 9ft. apart.

This important floating stage is connected with the shore by means of three bridges, one at the north and one at the south end of the stage, with a third in the middle. This latter, which is not in the contract with Messrs. Vernon and Son, and is not yet completed, is to be on the principle of a floating gangway, connecting itself with the inner basin, and acting on a series of inclined planes, partly built and partly excavated out of the rock. It is intended for the heavy portion of the traffic. The other two bridges are placed in their intended sites, and are 496ft. from centre to centre apart from each other. These latter are each 150ft. long, 41ft. 6in. wide, and each has a double roadway, together with two outside footpaths protected by stancheons and handrails. The fixed bridges, as these may be called, were put together upon a strong framework of timber, constructed upon four of the 101ft. long pontoons belonging to the stage, and, when completed, were floated to their respective destinations, at a convenient height of the tide, and at once shipped on to the axles provided for fixing them at the shore and stage ends. Each bridge, on its floating raft or platform of pontoons, was hauled out at the top of a very high tide, and when brought to its place, so as to stand exactly over the axles previously prepared to receive it, the receding tide, in about an hour, lowered the whole sufficiently to ship the bridge on the shore end. The instant this was accomplished water was introduced by pumps and syphons as speedily as possible into the opposite ends of the pontoons, by which that end of the platform was lowered until the bridge was shipped at that end in a similar manner as it had been at the other. The connection between the stage and the shore was thus permanently effected, and the bridge was fixed in its resting place in a moment. Each of these two bridges consists of three box girders, which run the whole of their length, and their decks are laid on cross double T-girders, placed 4ft. 6in. apart. The bridges are stiffened by transverse arched box girders; and their roadway or deck, like that of the stage, is of two thicknesses, the upper one being of Sabicu wood. The projecting ends of the pontoons under the north and south bridges are to be decked over, as stages for the use of small boats. The materials of which this vast stage and its complementary bridges are composed consists of about 2,500 tons of iron, and 80,000 cubic feet of woodwork. The construction of so complicated a fabric has, it may be readily assumed, called for all the energies of the firm to whom the work was entrusted—Messrs. Vernon and Son, Tranmere.

Having traced the fabrication of the mighty structure, and seen it launched in the most satisfactory style, a few words may be appropriately expended in conveying an idea of the extensive and costly machinery employed in its construction. The size and general situation of Messrs. Vernon's building yard have been already indicated, but it is desirable to go a little more into particulars. The northern end of the yard is occupied by a large shed which serves as workshops. It is 240ft. long by 100ft. wide. In this shed are placed the smiths' fires, together with a steam engine of sufficient size and power to carry on the manufacture of all kinds of structures to which malleable iron is applicable; and leaving under cover a large space in which to prepare work for bridge-building, or for the construction of barges, pontoons, or tanks. Exterior and parallel to the shed referred to, placed in the open yard, is a travelling platform, 250ft. in length, with a span of about 40ft., used chiefly for the purpose of putting together bridges, or other undertakings which require material of a heavy character for their construction. The tools fitted up and in use in the large workshop shed are numerous and important. Among other implements they include a powerful steam-rivetting machine, which is capable of rivetting 2,000 rivet bolts each day; several punching and cutting machines of large applicable capacity and power; rolling machines for bending or flattening plates or bars of iron; and, though last mentioned, certainly not least interesting, a punching and cutting machine, which has a self-acting cable on each side—one for punching, the other for shearing. In this machine the tables are moved by the action of screw shafts, worked by a pall-wheel and eccentric, a spur-wheel and other mechanical contrivances, connected with the main shaft of the machine. The working value of this implement may be estimated from the fact that it is capable of punching three holes at each stroke, in such a perfectly regulated manner as to dispense with the necessity for templates, executing the work much more perfectly than it can be done by an ordinary machine. In rapidity, too, as well as in superiority of operation it is not less remarkable, being capable of turning out fully four times as much work as can be done by an ordinary punching machine; still further to enhance its mechanical value, it should be stated that while one side of it is being used for punching, the other can be at the same time used for shearing.

On the same premises there is now in course of construction a new landing-stage, intended for the low-water basin at Birkenhead. This floating wharf is to be 1,039ft. 6in. long by 35ft. wide for a length of 370ft. at each end, and 50ft. wide for the remainder of its stretch. When completed, this stage will be supported on sixty-five wrought iron pontoons. Of these forty-six will be 33ft. 6in. long, by 10ft. wide and 5ft. deep; nineteen will be 48ft. 6in. by 10ft. wide, at an average depth of 5ft. 9in. As in the Woodside stage, these pontoons will be firmly secured in their places relatively to each other by five longitudinal lines of box kelsons running from end to end of the stage. The kelsons will, as in the already-mentioned case, be of regulated, though unequal heights, to give the requisite amount of camber to the deck of the stage. Over the kelsons will be fixed the deck beams, and upon these again two thicknesses of pine deck planking, the undermost being 4in. thick, and running longitudinally; the upper placed transversely, and 2in. thick. When completed, this stage will displace about 2,400 tons, and will draw about 3ft. 3in. of water. The area of its deck will be about an acre; and it will require an additional load of about 60 tons to immerse it 1in. more than when unloaded. As in the other cases referred to, this stage, when ready, will be launched in sections, which, after being floated round, will be put together in the low-water basin. Here it will be connected with the quay by two bridges, each about 150ft. in length. These will be placed on the inner side of the stage, and will occupy and work in a recess formed for the purpose in the masonry of the dock wall.

As in building the other great landing-stages, namely, the Prince's and Woodside, vast mechanical appliances and facilities are indispensable for carrying on so great a work; and these are to be found here in abundance. Under cover of the large workshop shed, previously referred to, twelve platforms are laid out for the construction at one time of twelve of the pontoons designed for the low-water basin stage. Each of these platforms rests on railway trucks, of immense proportions; and as each pontoon is completed and proved, the trucks on which it has been built are hauled out and brought under a large doubled-jibbed travelling crane at some distance to the eastward of the shed. From the arrangement and power of this crane, it at once takes up the pontoon, places it upon the weighing machine, and when weighed, conveys it to its destination along a railway constructed on a stage which runs the whole length of the intended landing-stage. In this case the first journey which it will have to make will be upwards of 1,000ft.; but of course the length of the journey will be diminished at each succeeding trip, as the successive pontoons are deposited in their respectively allotted places. The kelsons are also conveyed in massive and ponderous lengths by the same travelling crane, and by it lowered upon the pontoons in the positions they are intended ultimately to occupy; and where they are to be fixed permanently as a portion of the structure. In proof of the capacity of the establishment, it may be sufficient to state that, in this yard, within comparatively a few years, the great landing-stage, 1,000ft. in length by 80ft. wide, now moored off the Prince's-pier, was built; here, also, the new landing-stage moored at Woodside-ferry was constructed; and here numerous workmen are now busy in the construction of the low-water basin stage. Here, also, were built several barges for the East India Railway Company; and also a large ironwork fabric for the Taradale viaduct, on the Victorian railways in Australia; and, to complete the list, it may be also stated that several of the barges for Mr. Bourne's train were built in this yard.

LARGE PUMPING ENGINES.

The Haigh Foundry Company, whose works are near Wigan, have, within the last month, erected a Cornish pumping engine with a cylinder 100in. in diameter and with a stroke of 10ft., at the Targo Lead Mines, near Rhyl, in Flintshire. At Mostyn, about ten miles distant, is an engine erected, in 1852, by the former proprietors of the Haigh Foundry for Lord Mostyn, at his colliery at Mostyn. This engine, which has been constantly at work for nearly ten years, is direct acting and condensing, on Bull's principle. The cylinder is 100in. diameter, and works a stroke of 14ft.; it has a wrought-iron steam jacket. The piston-rod, which is 10in. diameter, is connected direct with the pump-rods through a wrought-iron cross-head. The ends of the cross-head form slide blocks, and work in cast-iron slides, built into the walls of the cylinder pillar. The balance beams are made of wrought-iron plates, &c., and are 42ft. long and 6ft. deep in the centre; they are connected with the main pump rods, at a distance of about 35ft. below the cross-head, by two wooden connecting rods having wrought-iron straps and brass steps. The beams are loaded, at their outer end, with cast-iron blocks, weighing altogether about 30 tons, to compensate for the superfluous weight of the pump-rods, which are necessarily heavier than the column of water. The air-pump, cold water-pump, feed-pump, and tappet-rods, are worked from a wrought-iron centre in these beams.

The engine is raising a column of water equal to 24in. diameter, from a depth of about 250 yards, by means of three plunger-pumps, each lift of about 65 yards, and two bucket-pumps, side by side, with a lift of about 55 yards. Owing to the bad quality of the water, the plungers, clacks, and buckets are made of brass, and the working barrels are also lined with brass. All the pump-stocks are faced iron to iron, and the joints are formed by a little tar, without any other packing. The pumps and boilers were all made at the Haigh Foundry. The engine usually works at a speed of from three to four strokes per minute, but it has worked with ease at a speed of 6 strokes, when the quantity of water has been such as to call for this additional speed.

The Electric and International Telegraph Company's new submarine cable, for connecting England with the South of Ireland, has been successfully laid between the coasts of Pembroke and Wexford, in perfect working order. The cable, manufactured by Glass, Elliott, and Co., is 63 miles in length, contains four conducting wires, insulated with gutta-percha and other materials on the latest improved methods, and is protected by 12 heavy iron strands, the total weight being 6½ tons per mile. The entire cable is coated with a composition (Bright and Clark's patent) for the purpose of protecting the iron from corrosion and decay.

The Proposed New Atlantic Telegraph.—The following letter from Mr. T. W. Stears, of Hull, relative to this project, and to submarine cables generally, has appeared in the *Electrician*, and may afford some interest:—"Sir,—As there now appears to be a probability of a new cable being laid across the Atlantic, it is highly important that the conducting wire should be made of copper, free from carbon. Much has been advanced with respect to the best mode of insulating, but no notice appears to have been taken of the carbon in the copper conducting medium. I find, in testing a portion of the former Atlantic cable, that the conducting wire contains a larger quantity of carbon than is usually met with in the best copper wire. It must be apparent to practical electricians that a greater resistance is offered to the passage of the current by a copper wire containing carbon than to a conducting medium manufactured from electro deposited copper, which entirely frees it from carbon, and I should strongly recommend that in future all submarine conducting wires be made of copper guaranteed free from carbon. The expense of obtaining it would be trifling compared with the advantage gained in so momentous an undertaking. A cable made with pure conducting wire offers several advantages, viz., less battery power would be required to overcome the resistance, the size of the wire would be five per cent. less; this would, of course, reduce the induction five per cent., and lastly, the electric current having a superior conducting medium to pass through, currents of such high tension would not be required, and there would be less escape through the insulating body." Mr. Cyrus Field, well known in connection with the Atlantic telegraph project, left Liverpool on Saturday for New York.

The Exhibition.—"To-day the passage for carts at the central entrance will, according to the printed announcements on the walls of the building, be closed; and we are informed that the whole of the space will be boarded over before to-morrow evening. Meanwhile a deep, square well has been sunk, and bricked at the sides, for the pendulum of Mr. Benson's great clock to swing in; and at each corner of this shaft, some few feet removed, is a solid piece of groundwork for the support of the huge piece of mechanism, which will rest on iron columns. The upper portions of the same work, separated by the space of the picture-gallery and by a considerable height above, are going on well. There is an opening in the roof of the upper chamber, appropriated to photography, through which on Saturday might have been witnessed the operation of fixing the dial. This object, which had been executed in Magnus's enamelled slate, from designs furnished at the South Kensington School of Art, measures upwards of 9ft. in diameter. The scaffolding at present hides it from view without; but this obstacle is in course of removal, and the effect will shortly be seen. The mechanical communication between the exterior dial and the works of the clock, in the very heart of the building, is a triumph of ingenuity. Though the rods and pulleys will all have to be carried over a glass roof, they will scarcely be discernible from the framework which they will traverse. While observing the progress of the clock front from the photographic gallery, we may mention that this apartment is being rapidly prepared for its purpose, and that signs are not wanting of attractions which will possibly overcome the disadvantageous position of this department, located, as it is, at the summit of a most formidable ascent."—*Daily Telegraph*, 31st March, 1862.

THE NEW FILE FACTORY AT MANCHESTER.

The *Manchester Examiner* gives an account of the opening, on Thursday week, of the works of the Manchester Patent File Machine and File Manufacturing Company, Limited, in Lime Bank-street, Ardwick. They are the first in England in which files have been cut and perfected by machinery, though, from the time of Prince Rupert, who patented an improved method of manufacturing files in the year 1671, down to 1860, no less than 45 or 50 patents have been taken out in England alone to attain this end, and numerous inventions in France, Belgium, Prussia, and America have been making efforts in a similar direction. The patents owned by the new company are the two known as "Preston and Macgregor's," and one as Francis Preston's, for forging, cutting, and shaping files. The works cover a considerable space of ground, and the several buildings, which form a square, are traversed by a tramway throughout. Ryder's patent forging machines are used in the smithy, together with a rolling machine, patented by Mr. Preston seven years ago, for rolling and fluting bayonets, and now adapted to the rolling of half-round and other files. The files are prepared for cutting by means of Oddy and Oldfield's grinding machines. The machine used in the cutting-room, as perfected by Mr. Preston, has all the movements of the human hand and arm from the elbow, even to imitating the sinews of the wrist. By this mechanism a slight elasticity is given to the chisel, though the latter is rigidly held in an iron holder, which accommodates itself to any uneven surface that the file may present. The machine gives a zigzag or wavy surface to the teeth, and thus completely imitates the appearance of the hand-made files. In the hardening room the files are subjected to the new process of immersion in a bath of red-hot lead, which prevents over heating of the steel. The files are next immersed in salt and water in the customary manner, scoured, and oiled. Machine-made files are not only the cheapest, but have an admitted superiority over those made by hand, because the whole number of teeth are equal in depth, and consequently the whole face of the file is available for use. The company consists of 80 shareholders, chiefly engaged in the machine trade. The capital embarked is £20,000. Women and boys to the number of 100 have found employment in this new branch of manufacture.

A somewhat painful interest attaches to the commencement of such an undertaking in Manchester, from the fact that some three years ago Mr. Preston's machinery was inspected by the Master Cutler and Mayor of Sheffield, and other competent judges, who testified to the efficiency and advantages of the invention, and yet the introduction of it into Sheffield, hitherto the seat of the trade, has up to the time been prevented through the "reign of terror" established in that town by operatives. It has, therefore, been determined to work the invention in Manchester.

At five o'clock about 80 gentlemen sat down to an excellent dinner in the works, provided by Messrs. Jennison. Mr. Thomas Barton, jun., presided; and there were present the Mayor of Manchester, Mr. Fairbairn, Mr. Alderman Curtis, Messrs. S. Jackson, T. Jessop, T. B. Turton, and W. Matthews, of Sheffield; A. Lees, of Oldham; I. Tatham, of Rochdale; S. Moore, of Liverpool, &c. The Mayor of Manchester, in responding to the toast of the "Mayor and Corporation of Manchester," said that it was always gratifying when a new industry was introduced into Manchester, and he was pleased to find this in the formation of the company for the manufacture of files by mechanism. It was gratifying on account of the employment it would give, perhaps, to persons who were prevented just now from following their own occupation. Though the company was "limited," he hoped it was not limited in its extent of business, or in its usefulness to the labouring classes. Mr. Fairbairn proposed "The Prosperity of the Patent File Machine and File Manufacturing Company (Limited)." During a period of half a century he had exercised the profession of a mechanic and engineer, and he could assure the audience that during the whole of that time he had never been more gratified than on that day, when he had seen work done by machinery which had been hitherto done by hand, and in a style equal to the closest manipulations of the human hand. He did not doubt the success of the company; and he was satisfied that the gentlemen who were present from Sheffield would not be doing their duty to that town until they manufactured files by machinery. It was a striking example of the power of machinery that the machines for making the files were capable of performing the wave motion in the same way as the human hand did; though he did not think there was any superiority in the files which had the wave. Mr. Fairbairn concluded by proposing the toast, which was drunk with enthusiasm, and was responded to by Mr. F. Preston and Mr. F. Jewsbury.—Mr. Alderman Curtis, in responding to the toast of "The Engineers and Machinists," said he was of opinion that the wave in the file was an advantage, and that the attainment of that peculiarity by the company's machines would tend to its success. Several other toasts followed.—The workpeople were entertained at the same time in a room below.

THE AMERICAN IRON PLATED VESSELS.

The *Scientific American* contains illustrations of the now world-renowned iron-plated craft 'yclept the Monitor and the Merrimac, or, more correctly, the Virginia, the name given by the Confederates to a vessel which they secured some time ago from the Federal navy. We copy the illustrations and append the following descriptions of both vessels, beginning with the Monitor.

The upper section of the vessel is in the form of a flat-bottomed scow, with sharp ends and vertical sides, 5ft. deep, 174ft. long, and 41ft. 4in. wide. The central portion of the bottom is cut out for a length of 124ft. and a width of 34ft., to communicate with the lower section, which is attached to the bottom of the scow, and which extends down with inclined sides to a depth of 7ft. 6in. The lower section is built of iron, the plates being ½in. in thickness. The upper section is built very strongly of wood and iron, the vertical sides being of solid oak 30in. in thickness, covered by 1in. rolled iron plates to the thickness of 6in. The propeller and rudder, being under the projecting end of the upper section of the vessel, are securely protected from shot.

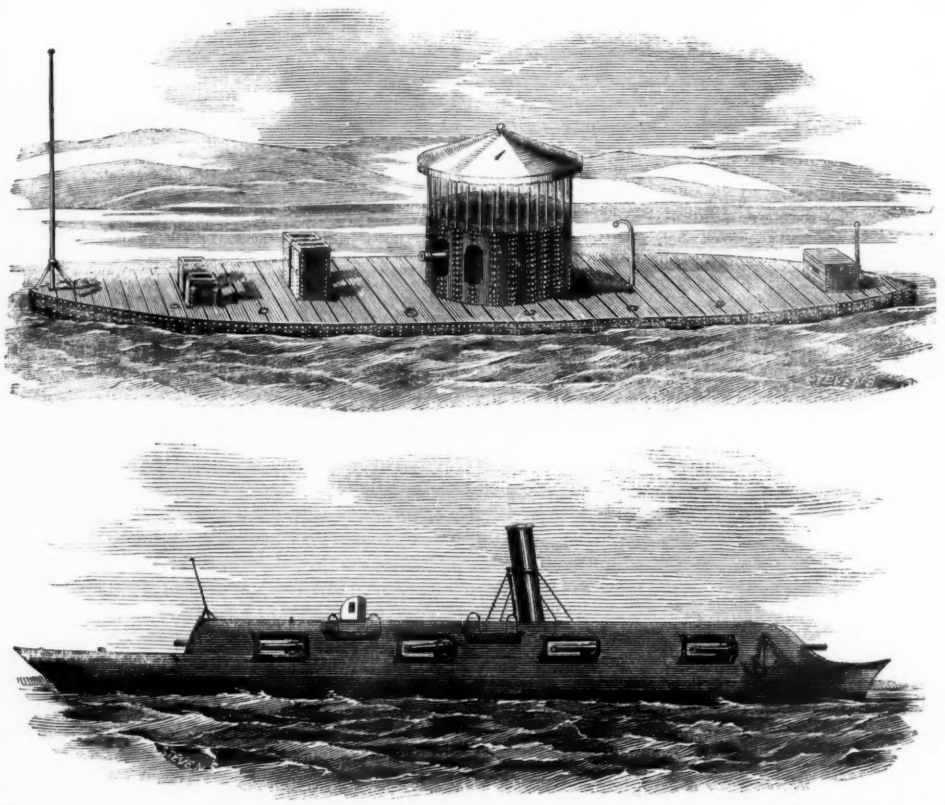
The principal novelty of this vessel is the cylindrical revolving turret in which the guns are placed. This is formed of rolled 1in. iron plates bolted together to the thickness of 8in.; its internal diameter is 20ft., and it is 9ft. high. It rests at its lower edge on a smooth, flat ring of composition metal, but when in action the principal portion of its weight is sustained by a central shaft, about which it revolves; a massive wedge being driven below the step of the shaft on such occasion to raise it, and thus cause it to bear up the turret. A large spur wheel upon the shaft is connected by a train of gearing with a small steam engine, which supplies the power for turning the turret.

Two 11-in. guns are placed within the turret in position precisely parallel with each other, on smooth ways, or slides; a clamp being arranged upon the sides of the ways for adjusting the friction and taking up the recoil in such distance as may be desired.

The turret is pierced in different places with four holes for the insertion telescopes, and just outside of the holes reflectors are fixed to bend the ray of light which comes in a direction parallel with the guns through the axis of the telescope, which is crossed by a vertical thread of spider's web through the line of collimation. The sailing-master takes his position in the turret, with his eye to the telescope and his hand upon the wheel that governs the motion of the small engine, and turns the turret so as to keep the guns always directed with absolute precision to the object against which the fire is directed. A scale is also arranged for adjusting the elevation of the guns with similar engineering precision, and it would seem that the firing should be directed with unprecedented accuracy.

Upon the sides of the turret that has the port holes through which the guns are discharged the thickness is increased by an additional plating 3in. in thickness; making the sides of the turret which will be presented to the enemy 11in. No cannon shot or bolt has ever yet been driven through such a mass of wrought iron.

THE MONITOR AND THE MERRIMAC.



The illustration represents the battery as ready for sea. In preparing for action the awning over the turret is removed and the square smoke stacks as well as the shorter pipes, through which air is drawn into the vessel, are taken down. The small square tower at the bow is the wheelhouse in which the steersman stands. It is made of bars or beams of iron 9in. by 12in., interlocked at the corners.

Of the Merrimac the *Scientific American* says:—"Our engraving was made from a sketch drawn by one of the mechanics who worked on the vessel when it was being iron plated. It will be remembered that the Merrimac was one of our first-class war vessels, which was partially burned and then sunk at the time that the Gosport Navy-yard was destroyed to prevent it from falling into the hands of the rebels. She was a fine screw frigate, of 3,200 tons burthen, carrying forty large guns. The rebels, after considerable effort, succeeded in raising her, and have plated her with railroad rails inclined at a sharp angle. This armour, in the recent severe trial, seems to have afforded very efficient protection against the heaviest artillery at very short range. The mechanic who made the sketch described her armament as consisting of 11-in. guns, and two 100-pounder Armstrong guns. In regard to the Armstrongs he was probably mistaken, as it is understood that all of those weapons that have been made were made for the British Government. He said that she had a sharp steel projection at the bow for the purpose of piercing the side of vessels; and in this he was correct, as it was with this projection that the Cumberland was pierced and sunk."

THE RAILWAY WAGON BUILT IN ELEVEN HOURS.

We have been favoured by Mr. Wrigley, of the firm of Fothergill, Wrigley, and Smith, consulting engineers, Manchester, with the following notes, made by that gentleman, of the progress of the recent interesting experiment at the works of Mr. Ashbury, at Openshaw, near Manchester.

Details of the materials used, the time occupied, and the progress of the work in the several departments, in the entire completion of a first-class covered goods wagon, 16ft. long by 8ft. wide, with double sliding doors on each side, and 3ft. 6in. forged wrought iron wheels:—

Woodwork for the Wagon.—The whole of the timber required for the framing was cut out of five logs of East India Moulmein teak, in 43 min., and the boards for the out and inside sheeting, roof, and flooring, numbering 213 pieces, were cut out of deals in 1 hour and 26 min. The planing, mortising, tennoning, grooving, and boring was all completed by machinery in 2 hours 46 min. The body of the wagon, consisting of 305 distinct pieces of timber, including the fixing thereto of all the iron work necessary in its construction, was completely finished, painted, and varnished at 6.20 p.m., by the united labour of 38 carpenters, working collectively 257½ hours.

Work in Iron Forge.—The refinery was charged with 25 cwt. of pig iron at 7.15 a.m. for the tyre bars, and at 8.40 was tapped out; at 8.53 the puddling furnace was charged with the refined iron and the first tyre bloom, and was under the hammer at 9.40; at 10.15 all the tyre blooms were out, finished at 11.15, and charged in the mill furnace at 11.20. The first tyre bar was under the rollers at 12.10 p.m., and the four tyre bars rolled, cut to length, and bent at 12.31, the first tyre bar being sent into the smithy for welding at 12.15 p.m. The puddling furnace was charged at 7.15 a.m. with pig iron for axles, wheel rims, and spokes, and the bar iron required for the work. The axle blooms were charged in furnace at 9.50, and the first axle was forged at 11.15, and the second at 11.30. The first bar of small iron was rolled and sent into the smithy at 9.15 a.m. 79 bars were required, consisting of 30 different sizes, involving 15 changes in the small mill rolls to produce them; in addition to which the wheel rim bars and forgings for spokes were made, thus completing all the malleable iron work required from the forge at 12.55 p.m., and weighing net 3½ tons, having occupied 5 hours and 40 min., with the labour of 111 men and boys, working collectively 368 hours 35 min., during which time the ordinary work of the forge was going on as usual.

Smiths' Work.—The first bar of rolled iron from the forge was received in the smithy at 9.17 a.m.; the first bar for wheel rims at 9.28; the first forgings for spokes at 9.15. The first wheel rim was bent and the first spoke welded in at 9.51, and the first wheel skeleton was bossed and completed at 11.46, and the four skeleton wheels were finished at 12.20 p.m. The first tyre was welded at 12.39, and the remaining three tyres were all welded and blocked at 12.50. There were 342 bolts and nuts, of various sizes and lengths, forged and screwed complete in 2½ hours, by the combined labour of 38 men and boys, working collectively 41½ hours. The whole of the wrought iron work required for the body of the wagon, consisting of axle-guards, draw-bars, buffers, with solid forged heads, right angle and diagonal knees, corner plates, break work, coupling, and safety chains, &c. &c., numbering 171 different pieces, were completed at 2.45 p.m., by the combined labour of 78 men, working collectively 118 hours.

Work in Turning Shop.—The first axle was received from forge at 11.20 a.m., and the second at 11.35, and both were turned and the key beds grooved at 3.5 p.m. The first skeleton wheel was turned up, the boss bored out, and key bed cut at 1.27; the four skeletons were finished being turned, bored, and key grooved at 2.29. The first tyre was bored out and shrunk on to its wheel at 1.49. The first pair of wheels were ready with their tyres on, drilled, rivetted, and drawn on their axle at 3.12; were in the lathe at 3.14, and commenced turning the tyres at 3.19. The second pair of wheels were tyred, drilled, rivetted, and drawn on their axle at 4.14; put into the lathe at 4.16, and commenced turning at 4.21. The last pair of wheels and axles were taken out of the lathe finished at 6.16. The work in this department having occupied the time of 63 men and boys collectively 31 hours 34 min. The buffer bars, with solid forged heads, together with all the small work, was turned and fitted by 4 boys in 2½ collective hours.

Foundry Work.—All the necessary castings, numbering 32, were completed by 6 men and 3 boys, their united time being 10½ hours.

Fitting-shop.—The axle boxes, &c., were completed, and 522 holes drilled in wrought and cast-iron, varying from ¼in. to 2½in. diameter, which, together with the remaining work connected with this department, was completed at 2.35, with the combined labour of 17 men and boys, working collectively 177½ hours.

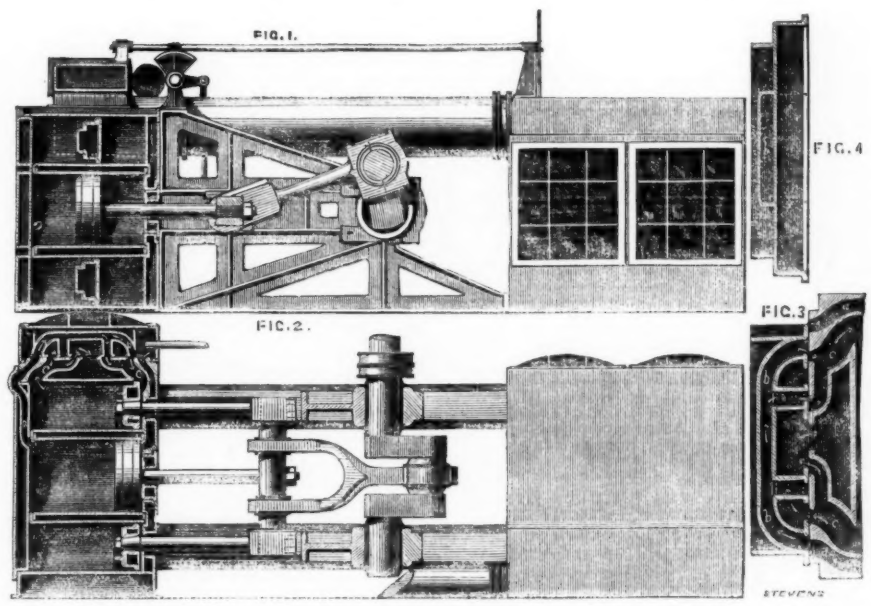
Completion of the Wagon.—The last pair of wheels and axle were put under the wagon and finished at 6.35, the vehicle having occupied in its construction from the raw materials of timber and pig-iron, 11 hours and 20 minutes. The workmanship in every detail was most unexceptionable.

The wagon train which took the wagon to London started twenty-five minutes afterwards (at 7 p.m.), and arrived in the metropolis at 6.10 a.m., on the following morning, with 37 loaded wagons, having picked up 13 on the road. The new wagon was placed on a bogie truck, and was drawn by horses from King's-cross station to the Exhibition, arriving there at ten o'clock, and at twelve o'clock noon was safely lodged in its place in the Exhibition.

The New Material "Adamas."—The substance "Adamas," noticed in The Engineer upwards of two years ago, is now being extensively applied to a variety of purposes. It consists of silicate of magnesia, calcined, moulded, and baked to any required shape. At Messrs. Grissell's foundry a 4-ft. fan, making 1,000 turns a minute, has been running on Adamas bearings ten hours daily for a considerable time. A frame, representing a section of a throstle, has been prepared for the Exhibition, and in which the spindles make 6,000 revolutions a minute in Adamas bearings, and in every case the surfaces remain perfectly cool.

Bronze Guns in America.—At the Rogers Locomotive Works, in Paterson, N. J., experiments are being made in a peculiar mode of casting bronze guns; and we are glad to find them likely to prove successful. Mr. Morris from Pittsburgh, who has had large experience in the casting of the celebrated iron Columbiads for heavy fortification guns, is superintending the experiments. He is now turning his attention to applying the principle to the casting of bronze guns. These have hitherto been cast solid, and the entire amount of metal of whatever calibre bored out afterward, thereby not only making much waste, but taking a vast amount of labour, and, what is worse, producing a gun which, on account of its softness, is very soon destroyed, more especially if rifled and using a winged or conical projectile. Those guns cast for Mr. Morris are cast hollow, with what is known as the "circulating water core." This consists of a double tube, one within the other, the outer one being coated with some kind of loam and sand in the usual manner of making cores; and the inner one, being smaller, leaves a space between its exterior surface and the interior surface of the outer one. The inner tube does not quite reach to the bottom of the other, but leaves a space for a return passage. Water is conveyed during the casting and cooling of the gun into the mouth of the outer tube, which forces its way toward the bottom, and returning rises and escapes in a hot condition. Some twenty-five feet head is used for this injection water. The mould is also different from the ordinary loam or the dry sand mould. It is composed of a mixture of Kaolin clay, quartz and mica, the whole, when in combination, forming a perfectly fire-proof, and, at the same time, a very porous mould, leaving a free egress for the pent-up gases. This is, of itself, a desideratum in good casting. The result of all this is a homogeneousness in the metal, and therefore a greater capacity to bear strain—a harder surface for the abrading action of the cone shot, and a greater strength in proportion to its weight.—*American paper.*

JAMES HUMPHREYS' STEAM ENGINES.



This invention, by James Humphreys, of Tower-hill, relates to improvements in the slide valves, and in the arrangement of the parts of compound steam engines. The first part of the invention consists of a novel description of slide valve applicable to compound engines, whereby, with great simplicity of construction, considerable economy is effected in the transmission of the steam from the high-pressure to the low-pressure cylinder. The valve is a treble-ported slide valve; the laps at the extreme end of the valve cut off from, and supply to, the small cylinder the high-pressure steam from the boiler. The steam, after having acted on the piston of the small cyliinder, is conveyed through a passage, forming part of the valve, into the large cylinder, which it enters and leaves for the condenser by the inner portion of the valve, which portion is an ordinary double-ported slide-valve.

The second part of the invention consists of improvements in the arrangement of the parts of compound engines, whereby great simplicity and accessibility are obtained. These engines may be vertical, but, arranged horizontally, are particularly adapted for driving the screw.

The small cylinder for the high-pressure steam is placed within the large cylinder, so that the outer piston is an annulus; this annulus has two rods, and the small piston has one rod; these three rods are attached to a cross-head working in guides, forming part of the main A frames of the engine; from this cross-head a connecting-rod, with a wide fork at the cross-head end, is attached to the crank-pin. The eccentrics and their rods for working the slides are placed outside the outer bearing of the main shaft.

Fig. 1 is a longitudinal section of the engine; Fig. 2 is a horizontal section, showing the arrangement of the piston rods, the cross-head and connecting-rod, and also the slide valve; Figs. 3 and 4 are enlarged views of the slide valve, Fig. 4 being a transverse section. The steam is admitted to the high-pressure cylinder through the passages *a*, *a*, and is conveyed from it through the passage *b*, *b*, forming part of the valve, into the expansion cylinder through the ports *c*, *c*.

THE BREAKING STRAIN OF THE HARTLEY BEAM.

(From the *Mining Journal*.)

Our readers will remember the able document which we published in the journal of February 8th, comprising the calculations of Mr. J. J. Atkinson, inspector of mines in South Durham, on the breaking strain of the Hartley beam. The subject is one of very great importance, and one that has yet to be investigated in a thorough and searching manner. Shortly after the publication of Mr. Atkinson's calculation, Mr. Clark, a well-known ironfounder at Elswick, near Newcastle, instituted a series of experiments on the strength of cast iron bars laid horizontally on bearances 3ft. apart and loaded in the middle. In a letter on the subject he says:—"The whole of the bars were cast horizontally and at the same temperature, from one ladle, and, of course, would be of the same quality. Two bars of each size were cast, of which I give the average:—Bar 1in. by 1in., bearings 3ft. apart, breaking strain 672 lb., deflection 88-hundredths. Bar 1in. by 2in., bearances 3ft. apart, breaking strain 2,352 lb., deflection 43-hundredths. Bar 1in. by 4in., bearances 3ft. apart, breaking strain 9,072 lb., deflection 27-hundredths. Now, supposing we take the bar, 1in. by 4in., on 3ft. bearances, for illustration, and present it as follows:—

w = 9,072 lb., the breaking strain.
l = 3ft., the length.
d sq. = 16in., the square of depth.
b = 1in., the breadth, or thickness.

And let the beam, of which the breaking strain is required, be:—

W = the breaking strain required.
L = the length of beam in feet.
D sq. = the square of the depth in inches.
B = the breadth, or thickness, in inches.

Hence we have the following rule to enable us to ascertain the breaking strain of beams of a rectangular form:—

Rule.—$\frac{w\ l \times B\ D\ sq.}{L \times b\ d\ sq.}$ = W L × B D sq. ; or W = the weight or breaking strain.

"If proportional results cannot be obtained from the above it must be the increased mass of the iron or contraction, perhaps both—over neither of which we have entire control." Mr. Clark further states that he does not agree with the witness examined at the inquest, that an open casting is as good or strong as a close casting. "In almost all cases where cast iron has been tested, with a view to obtain the greatest amount of strength, whether to meet tensile, torsional, lateral, or other strains, the results have been in favour of castings made under pressure, or cast vertically. That a casting will break with a less load in the winter or frosty season is quite true, more especially where there is a greater strain on one part of the beam than another—by contraction. And such contraction will continue its operation from the time it is cast, at a heat of 2,079 deg. Fah. to a temperature of 75 deg., or summer heat, and will further exercise its opposing influence down to 30 deg. Fah., winter or frosty season. With respect to the vertical ribs coming down the depth of the beam, and apart from the boss or centre, I think this is in favour of its construction rather than the contrary, both in point of strength and contraction. The ribs could not possibly impoverish the casting where the fracture has taken place, for this reason—that the first part of any casting to impoverish any other part is the thin and lightest part, which, becoming solid first, supplies itself in the shrinkage from its adjacent thicker part, and so on until the whole casting has lost its fluidity.

In reply to these calculations Mr. Atkinson writes to Mr. Clark:—"Adopting your notation for beams supported at both ends and loaded in the middle, we should have the breaking strain, in that case, proportional to $\frac{B\ D^2}{L}$, where B is the breadth and D the depth, both in inches, and L the length in feet. And hence, for beams supported at both ends and loaded in the middle, if C be a constant to be found by experiment, and W the breaking strain in pounds, we should have—

$$W = \frac{C\ B D^2}{L}.$$

And hence, also,

$$C = \frac{W\ L}{B\ D^2}.$$

Giving, by the experiments you mention, the following values for the constant, C:—

1st.—The 1-in. square bar, $\frac{672 \times 3}{1 \times 1} = C = 2016.$*

2nd.—The bar 1in. wide and 2in. deep, $\frac{2352 \times 3}{1 \times 2^2} = C = 1764.$

3rd.—The bar 1in. wide and 4in. deep, $\frac{9072 \times 3}{1 \times 4^2} = C = 1701.$

Giving an average value of 1827 for C, which is the constant for beams supported at the ends and loaded in the middle; but this constant is exactly four times the value of the constant to be used for beams fixed at one end and loaded at the other; and, if we presume that the Hartley beam had been strained by the entire pressure of the steam and vacuum in the cylinder from the sticking of the bucket or spears at the outer end of the beam, it comes into the position of a beam fixed at one end and loaded at the other, taking the line of fracture as the fixed end of the beam, which was 18ft. from the centre of the cylinder; so that, by your experiments, we should have, for the breaking strain to be applied at the cylinder, 18ft. from the line of fracture—

$$W = \frac{456\frac{3}{4} \times 9^2 \times 11{\cdot}868}{18} =$$

In lieu of—

$$W = \frac{500 \times 9^2 11{\cdot}868}{18} =$$

as adopted by me, where $456\frac{3}{4} = \frac{1827}{4}$ as per your experiments.

* This experiment gives $\frac{2016}{4} = 504$, in lieu of my constant of 500.

Marine Batteries.—Thick Armour or Armour in Sheets.—We understand that the navy department expresses a decided preference for thick plates of iron armour for ships in preference to several strata of thin plates of the same aggregate thickness. The European practice would seem to confirm this view of the case. But the most obvious facts and principles are all to the contrary. The elaborate experiments of Mr. Stevens show that while the pile of thin plates may be more *indented*, the solid plate of equal thickness is most shattered and weakened by a ball of given force. The thin plates bend individually, and the inner plates are hardly weakened at all; but the whole of the thick plate must either give way altogether or be weakened in every part. Its fracture is irregular, and generally greatest on the back side; and the effect, as a whole, is more destructive. The same effects were fully illustrated in the late engagement—the first engagement of two iron-clad vessels—at Fortress Monroe. While the turret of the Monitor, composed of 8 layers, each an inch thick, was only indented 2⅛in. by a shot striking square and flat upon it, one of the solid bars or plates, 9in. thick and 12in. deep, forming a part of her pilot-house, was completely broken in two by a similar shot, and opened ⅜in. on the back side. Thus 8in. of thin plates stood better than 9in. of solid iron. This was due, in some degree, to the connection of the thin plates with the surrounding mass, while the solid plate had only its individual strength. And this leads to another view of the subject. When the armour of ships is composed merely of blocks, pinned to the frame, and having no lateral connection, it adds no strength to the structure, but, on the contrary, it adds its immense weight, which is constantly tending to strain and fracture the other parts of the vessel, especially at sea. The loosening of the solid plates of the Warrior and La Gloire, and the straining and leaking of the vessels due to it, have already been sources of immense trouble and expense. But when the armour is composed of layers of thin plates, breaking joints, the whole structure is in effect one continuous plate, forming a girder of immense strength. The armour thus serves the double purpose of giving the vessel extraordinary strength, and of better resisting the enemy's projectiles. But there is one more consideration in favour of thin plates. Their cost is very much less than that of thick plates. The former are turned out rapidly by our ordinary rolling machinery. The latter cannot be made of the dimensions desired by more than one or two mills, if at all, in this country. 2-in. plates cost 50 per cent. more than boiler iron, and the cost of 4-in. and 5-in. plates increases in a much larger proportion. The 6¾-in. armour of the Stevens Battery, composed of thin layers, would cost considerably less than the 4½-in. solid plates of the Warrior, beside being, according to the actual trials, a vastly better protection against shot, and the very backbone of the vessel instead of mere dead weight. —*New York Times.*

SOCIETY OF ARTS.

March 19th, 1862.

Mr. Alderman Mechi in the Chair.

ON THE SEWERING OF TOWNS AND DRAINING OF HOUSES.

By Robert Rawlinson, C.E., F.G.S., &c. &c. &c., Member of the Sanitary Commission sent out by her Majesty's Government to the Army in the Crimea.

(*Concluded from page* 197.)

Dr. Stenhouse pointed out the true uses of charcoal in 1853. I commenced the use of charcoal for sewer ventilation about the year 1858; and Dr. Letheby and Mr. Haywood commenced their elaborate and valuable experiments also in 1858. I think I may claim to have been one of the first, if not absolutely the first, to apply the use of charcoal for disinfecting the sewage gases of an entire town, upon a general plan, as part of a sewerage system. I may instance Worksop, Buxton, and West Ham.

Cesspools may be ventilated through charcoal with advantage, where they cannot be abolished entirely, which is the only safe remedy. At the County Hospital, Winchester, a large cesspool, some eight feet diameter, is ventilated through a covering of charcoal. The arch covering of the cesspool was removed; a wire-work basket, about 10ft. square, supported on iron framework, covers the entire area of the cesspool, and this is filled with charcoal, broken fine (like peas) to a depth of 12in. There is a roof over the charcoal to prevent its being wetted by rain, and the whole is walled in so as to leave a clear passage round. It is reported to answer fully—there is certainly no nuisance from cesspool gases at this point.

The following are details of sewerage works executed:—

CARLISLE.

The "drainage area" of the district sewered is about 2,000 statute acres.

The main outlet sewer for the entire area is 3ft. 9in. by 2ft. 6in. The sewer is laid with a gradient of 1 in 700. The outlet is extended to the centre of the river Eden, so as to deliver the sewage into the water of the river in the driest weather. The main sewer, and the low-lying portions of the city, may be relieved by flood outlets, of the drainage of 1,930 statute acres.

The "drainage areas" of the several "flood outlets" may be described as under:—

	Areas in acres.
1. Swift's-lane	330
2. Bitt's-bank	50
3. Castle-mill	170
4. Dow-beck and Millbourn	750
5. Paddon beck and Newtown	630
Total area in statute acres	1,930

The surface was most carefully considered, and all available means were used to prevent damage or inconvenience from local storms and flood waters. The main sewers and secondary branches are built of bricks, moulded to the sectional form required for each sewer, and set in engine-ground hydraulic mortar.

Cast iron pipes were used in crossing under rivers and watercourses, and for the main low-water outlet. The means of flushing from surface waters are full and ample. Flushing-valves or sluices are provided on the Caldew, the Eden, Mill-beck, &c., and from a flushing-chamber in English-street (the highest part of the city) the sewers in twenty-eight streets in every direction may be flushed.

The sewers are designed to remove all sewage refuse without pumping. This will be accomplished completely at all ordinary times. An extraordinary flood may block the outlet, and a long-continued rain may then, for a short time, fill the lower sewers, simply because the surface waters impede all action; at such time the largest sewers would be filled, and, for a time, their delivery would be impeded. There have been as heavy floods in the district since the completion of the works as any previously recorded, causing no injury to the sewers. There has been local flooding, but no one blames the sewers as the cause.

The following are details of expenditure:—

Brick Sewers.

Size of Sewer.	Length in yards.	Average cost per yard.	£ s. d.	£ s. d.
ft. in. ft. in.		s. d.		
3 9 by 2 6	2,285	29 1½	3,326 19 10	
3 4½ ,, 2 3	1,093½	24 8	2,455 6 8	
3 0 ,, 2 0	1,385¾	21 6	1,491 16 2	
2 3 ,, 1 6	3,209	16 6	2,644 0 11	
Total length of brick sewers.	8,873 yds.		Cost	9,918 3 7

Earthenware Pipe Sewers.

ft. in.	Yards.	Cost. s. d.	£ s. d.	£ s. d.
1 6	646	9 7	310 2 4	
1 3	4,352	8 5½	1,812 6 4	
1 0	6,509	6 8	2,167 11 9	
0 9	2,509	4 10	608 18 0	
0 6	168	3 10	32 4 0	
Total length of earthenware pipe sewers	14,184 yds.		Cost	4,961 2 5

Cast Iron Sewers.

ft. in.	Yards.	Cost. s. d.	£ s. d.	£ s. d.
2 3	297	61 3½	910 3 2	
1 6	677	29 0	981 6 9	
1 0	48	18 2	43 10 9	
Total length of cast iron sewers	1,022 yds.		Cost	1,935 0
				£16,844 6 8

Summary of Sewers.

Length in yds.			£ s. d.
Brick sewers	8,873	Total cost	9,918 3 7
Earthenware pipe sewers ..	14,184	Total cost	4,961 2 5
Cast iron sewers	1,022	Total cost	1,935 0 8
Total length	24,079		16,814 6 8

Man-holes.

	No.	Average cost. £ s. d.	£ s. d.	£ s. d.
On brick sewers	67	21 4 7	1,422 7 7	
On earthenware sewers ..	60	7 1 1¼	423 8 0	
On cast iron sewers	4	9 1 11	36 7 8	
Total man-holes ..	131		Cost	1,882 3 3

Lamp-holes.

	No.	Average cost. s. d.	£ s. d.	£ s. d.
On brick sewers	18	34 6½	31 1 9	
On earthenware sewers ..	79	37 11½	149 18 6	
On cast iron sewers	2	65 3	6 10 6	
Total lamp-holes ..	99		Cost	187 10 9
Gullies	366	59 0		1,086 2 0
Flood outlets				445 16 9½
Flushing valves and sluices				341 14 6
Crossing rivers, and sundry expenses				747 3 7½
				21,504 17 7
Engineer-in-Chief				1,150 0 0
H. McKie, Resident Surveyor, and Inspectors of Brickwork, &c.				505 9 0
Incidental charges, say				150 0 0
				23,310 6 7

Rateable Value .. £60,378 7 9 } Annual rate in the pound required to repay principal and interest in thirty years, 6d.
Number of houses about 6,838 }

The cost of draining "self-contained" houses, including one water closet, was ... ... about £6 2 1

The same, without a water-closet, about £5 6 4
The cost of draining "tenement houses" with one water-closet for each house, taken on an average of 71 tenements, was, per tenement £1 6 7
The cost of draining "tenement houses" without water-closets, taken on an average of 66 tenements, was, per tenement £1 10 0

Where a water-closet has not been used, a cess-pit has been drained, and the drain is laid at a greater depth, involving larger cost. Where a water-closet has been used, the cess-pit has been filled up.

All cess-pits should be abolished, as nuisances, which draining only ameliorates, but does not cure.

WORKSOP.

General Description of Works.

The outlet-works consist of six trenches about 200ft. long, 3ft. deep, and 18in. wide at the bottom, with side slopes of one to one. These trenches are provided with sluice arrangements at each end, to allow of the sewage being diverted, as may be required, either for cleansing the trenches or for other purposes.

At the termination of the outlet sewer provision has been made for passing lime-water, or other disinfecting fluid, into the sewage, and movable screens, for intercepting solid matter, have been placed in the trenches. Two outlets for filtered sewage-water are provided into the river Ryton. The area sewered is about 400 statute acres.

Worksop Main Sewerage Works.—Particulars of Cost.

Description of Works.	Quantities.		Average cost per yard.	Cost.	Amount.
	Cubic yards.	Cubic yards.	£ s. d.	£ s. d.	£ s. d.
Brick Sewers:—					
2ft. 0in. diameter. 9 in. thick	64	..	0 19 9½	63 5 3	
2ft. 3in. by 1ft. 6in. 4½in. „	950	..	0 13 8	648 17 1	
Total brick sewers	..	1,014	..	..	712 2 4
Earthenware Pipe Sewers:—					
15in. diameter	2,695	..	0 5 3	970 0 4	
12in. do.	4,084	..	0 4 6½	929 14 0	
9in. do.	3,537	..	0 3 2	560 2 3	
Total earthenware pipe sewers	..	11,316	..	..	2,469 16 7
Cast Iron Pipe Sewers, for crossing canals and rivers, including cost of retaining walls, puddle, pitching, &c.:—					
15in. diameter	69	..	2 13 5½	184 7 8	
12in. do.	18	..	3 5 2	58 13 0	
9in. do.	12	..	1 13 0	19 16 0	
Total cast iron pipes	..	99	..	..	262 16 8
Total length of sewers	..	12,429, or 7 miles 109 yards.			
	Number.		Each.		
Manholes	75	..	6 15 6	508 2 9	
Lampholes	48	..	2 1 0½	98 9 9	
Gullies, with drains complete	134	..	2 1 11½	285 3 8	
Three flushing chambers and three overflows	6	..	4 13 8½	28 2 3	
Ventilating shafts	51	..	1 16 6½	93 4 3	
					1,013 2 8
Outlet works complete				..	257 1 4
Timber and concrete in trenches				57 15 4	
Disc plugs and fixing				7 17 0	
Making connections with old sewers, &c.				18 3 11	
Assistance in levelling, and sundry expenses				13 12 10	
					97 9 1
Land and compensation				..	331 19 6
Rent of pipe-yards, and sundry expenses				..	3 16 4
Advertising and stationery, &c.				..	28 13 9
Law expenses				..	20 19 9
R. Rawlinson, Engineer				394 3 0	
W. McLansborough, Resident Engineer—salary, office-rent, and expenses				279 18 7	
					674 1 7
			Total cost		5,871 19 7

N.B.—Earthenware pipes, 15in. in diameter, were delivered at Worksop at 11d. per lineal foot; 2s. 9d. per yard.

The sewer from Bridge-street to opposite Beaver-place is of brick-egg-shaped, 2ft. 3in. by 1ft. 6in. At the termination of the brick sewer an overflow into the river Ryton is provided, and from this point to the outlet works the sewer is formed of 15-in. earthenware pipes, cast iron pipes of the same diameter being laid across the river and mill stream. The outlet sewer has a fall of 1 in 600. This outlet serves for the entire district. The sewers are formed principally of stoneware pipes of 15in., 12in., and 9in. diameter. The manholes and lampholes are furnished with movable covers to admit of the sewers being examined. The ventilating shafts are fitted with charcoal filters, through which the sewer gases are passed, and thereby oxidised. Seventy-five manholes, forty-eight lamp-holes, and fifty-one ventilating sewers are provided on the sewers.

Manholes throughout the entire system are provided with grooves for flushing sluices, and, in addition to these arrangements, flushing tanks have been constructed at the upper ends of the sewers. Connections, for flushing purposes, have also been made with the open drain or water-course in Chesterfield-road, and with the canal near Eastgate.

136 gullies (including five for storm waters) are fixed within the district. The gullies are double-trapped, and are so constructed as to prevent road dirt and solid substances passing into the sewers. Two overflows for storm waters have been provided near Beaver-place, and one for Low-town main.

Sewers are laid under the Chesterfield Canal at two points, and over and under the river Ryton, and the canal feeder at seven points. In all cases the crossings have been made with cast iron pipes of 15in., 12in., or 9in. diameter.

The site on which Worksop is built presents several natural and artificial difficulties to cheap sewerage works. The valley is flat and liable to rain floods; the river had to be crossed several times, as also the canal on one side, and the canal feeder on the other. The outlet works are simple in plan and economical in cost. Expensive tanks have been avoided, and the cheapest, but most effectual, means for intercepting and removing any solid, flocculent, or discolouring matter have been adopted. The experience of two summers has shown that these works are efficient.

The proper place for liquid sewage, however, is the land, and the best filter is vegetable soil under full cultivation; but when the sewage is so used at Worksop the existing outlet works will be necessary, as it is advisable to intercept any floating solids and to irrigate with the fluid above.

The entire of the sewage of Worksop may be carried on and over the land below the outlet works very cheaply by contour conduits, and be distributed by surface irrigation. A small outlay on such works, and intelligent management in irrigating and growing appropriate grasses, will prove beneficial to the farmer.

The entire system of sewers in Worksop is fully ventilated by special arrangements for this purpose at fifty-one places, and these include all upper ends of sewers. The estimated cost of the works was £6,000; the actual cost, including all contingencies, was £5,871.

BUXTON.

Description of Sewerage Works.

Outlets.

Two outlets for sewage have been formed into the river Wye; one near Wye Bridge, and the other opposite Duke's Drive. The outlet sewers are so arranged with regard to levels as to allow of the whole of the sewage being applied, by gravitation, in irrigating the land in the valley of the Wye.

Sewers, &c.

The district for sewerage purposes has been divided into two "drainage areas," the main sewer for each sub-district being formed of 15-in. stoneware pipes.

In many portions of the town the sewer excavations were made, wholly or partially, in limestone rock. In such cases the trenches were excavated 6in. below the proposed level of the sewer, and a properly prepared bed was formed for the pipes by filling in the trench with clay, gravel, or sifted earth. Manholes and lampholes have been provided at all the changes of direction or alteration in gradient of the sewers. Flushing chambers have been constructed at the upper ends of the sewers, and provision has also been made for flushing from the baths and from the river.

The sewers from "High Buxton" have gradients of about 1 in 10. Overflows into the river Wye, for relieving the sewers during heavy rains, have been formed at river crossings and other suitable points.

Ample means have been provided for ventilating the sewers by about thirty shafts furnished with charcoal filters.

My estimate for the public sewerage works of the district was £3,203. The actual cost of the works as carried out was £3,107 6s. 10d.

Sewerage Works.—Particulars of Cost.

Earthenware Pipes.	Quantity.	Average Cost.	Amount.
	Lineal yards.	£ s. d.	£ s. d.
15in. diameter	1,599	0 8 8	657 11 9
12in. do.	2,522	0 6 0	756 19 2
9in. do.	2,151	0 4 6	483 10 8
Total Length of Sewers.	6,263		
	Number.		
Manholes	45	11 11 0	520 17 4
Lampholes	35	5 11 0	196 1 9
Gullies	20	3 2 0	62 0 0
Cast iron pipes for crossing river outlet works and sundry works in connection with sewers—Compensation, &c.	—	—	46 1 2
Engineering and Superintendence.	—	—	384 5 0
			£3,107 6 10

Mr. John Law Hunter, borough surveyor, has given me the following information as to drainage in Wigan:—

The average cost of draining cottages of about £3 or £4 rental has been at an average of £1 1 0
Ditto ditto £7 or £8 rental £1 11 0
Ditto ditto £14 or £15 rental £1 13 6

4,228 houses have been drained at a total cost of £8,796 19s. 10d., or an average cost, per house, of £2 1s. 4d.

In draining 4,228 houses, 36,960 lineal yards of earthenware pipes have been used, being an average of 8¾ yards per house. The earthenware pipes used are from 9in to 4in. internal diameter.

Many of the drains have been in use several years, and there have not been any complaints of choking or stoppages.

Water-closets are not in general use in Wigan, but cess-pits, yards, stables, and house sinks are drained. A general use of earthenware pipe drains prevents rats living in the sewers and drains. They have neither food nor mean of shelter.

DISTRICT OF WEST HAM, ESSEX.

Public Sewerage Works.

The parish of West Ham consists of the sub-districts of Stratford, West Ham, and Plaistow, and comprises an area of about 4,735 statute acres.

Population about 35,000, but is rapidly increasing. Annual rateable value, £135,000. The entire area is low and flat. The lowest surface area is near Hallsville, and is about 4ft. above Ordnance datum.

The highest surface area is near Forest-gate, and is about 45ft. above Ordnance datum. The difference of level within the parish is, therefore, about 41ft.

A considerable portion of the parish is marsh, protected, by artificial embankments, from tidal waters and land floods, which rise to a height of from 6ft. to 10ft. above the surface of the land.

This marsh land is intersected by ditches, and is under the jurisdiction of the Havering and Dagenham Commissioners of Sewers.

The distance from the outlet works to the end of the sewer near Forest-gate is about three and a half miles; at Bow Bridge two and a half miles; in Romford-road two miles and three-quarters; in Barking-road one mile and three-quarters; and in the Lilliput-road, Victoria Docks, one mile and a half.

The outlet works consist of a pumping establishment and a low water, or relieving flood-water sewer.

The pumping establishment is erected on land purchased by the Local Board at Canning-town, and consists of an engine house, boiler house, coal store, workshop, and engine chimney, with pumping wells, outlet wells, and outlet pipes.

Two condensing engines (of 40-horse power each), having 34-in. cylinders, and 6ft. stroke, have been provided and fixed. Each engine works two pumps of 48in. diameter, and 3ft. stroke. The two engines are capable of lifting 30,000,000* gallons in twenty-four hours. The pumps are so arranged as only to lift to the level of the water in the river; the lowest lift is 8ft., the highest lift is 22ft.

The inlet and outlet pipes, to and from each set of pumps, are 30in. diameter, having screw-down valves complete. Self-closing flap-valves are fixed on the outlet pipes at the river wall.

A low water or relieving flood-water outlet has been formed at Bow-creek, near Barking-road station. The river Lea at this point is nearly 4ft. lower at low water of spring tides than the bed of the river opposite the pumping works. This outlet, which is self-acting, discharges the flood-water for several hours each day without pumping. In the outlet well adjoining the river two self-closing flap-valves, similar to those at the pumping outlets, have been fixed, and, as a precautionary measure, one screw-down sluice has been placed in the man-hole in Barking-road.

The larger main sewers are formed of brickwork; smaller sewers are of stoneware pipes. Cast iron pipes have been used for crossing navigable rivers, and also for crossing marsh drains, and for the main outlets. Brick sewers are "egg-shaped" on section, and vary in size from 5ft. 3in. by 3ft. 6in. to 2ft. by 1ft. 4in. The whole of the brickwork is set in the best blue lias hydraulic mortar. Stoneware pipes are circular on section, and have half socket joints. Cast iron pipes are circular on section, and are formed with flanch or socket joints. 24,227 lineal yards of brick sewers, 27,698 yards of stoneware pipe sewers, and 210 yards of cast iron pipes, making a total of 52,135 lineal yards, or 29 miles 1,095 yards have been constructed and laid within the district.

The sewers, throughout the district, have been designed with a view of obtaining the best practicable gradients, more especially for tributaries. In some cases, however, it has been necessary to lay the mains with a fall of not more than one in 3,520, or 18in. per mile.

The sewers, on plan, have been laid in straight lines; and, on section, with regular gradients. At each change in direction, or alteration of gradient, a man-hole or lamp-hole has been constructed, affording means for inspecting, and, when necessary, also for cleansing the sewers.

The main outlet sewers in Canning-town have been laid level, and the inverts are formed of cast iron, to allow of their being laid and formed under water.

Considerable difficulties were experienced in the construction of the sewers in some portions of the district, arising from loose, wet, spongy, and other unfavourable descriptions of subsoil, and from other causes. Upwards of three miles of main sewers have been laid with cast iron inverts, at or near the level of low water of spring tides, at the Barking-road outlet.

About 9,000 junctions for branch sewers and house drains have been provided on the main and tributary sewers. A careful account has been kept of these junctions, and has been placed in the hands of the surveyor to the board.

The main sewer crossings, under three branches of the river Lea, consist of cast iron pipes of 2ft. 6in. and 2ft. diameter. At each end of these cast iron pipes under the rivers a manhole is constructed with screw-down sluices, which may be put down in case of injury to the pipes under the rivers, and thus prevent flooding in the low districts.

The river crossings were executed by Mr. Munday in a manner perfectly satisfactory to myself, and highly creditable to the contractor. By staging over the rivers, jointing the pipes, dredging the lines of mains, and lowering each entire length of pipe to its position, stoppage of traffic was rendered unnecessary, and claims for compensation, which might otherwise have arisen, were, by these arrangements, prevented.

Main and branch sewers have been constructed under the North Woolwich, the Barking and Tilbury, and Eastern Counties Railways, in eight separate places. The railway companies and their engineers afforded every facility for executing the works, and the crossings were completed without accident or stoppage of traffic.

On the sewers, as executed, there are 468 man-holes, or means of access from the surface to the sewers for examination, for flushing, and, when requisite, for cleansing; and 197 lamp-holes for means of inspection, making, on an average of the entire length, one opening to the sewers from the surface of street or road, at about each 78 lineal yards. Man-holes have step-irons, flushing grooves, and movable iron covers complete. Lamp-holes have movable iron covers. There are 251 ventilating shafts provided on the sewers. These shafts are so arranged as to prevent road-drift falling into the sewers and impeding the flow. Sewer gases are passed through wire baskets containing charcoal, and, by this means, are rendered innoxious. 718 gullies have been fixed within the districts. The gullies are so constructed as to prevent solid or other improper substances passing into the sewers.

Flushing arrangements are of three classes:—First, by the admission of water into the sewers through sluices, hose pipes, or valves, second, by screwing down fixed sluices built in certain manholes, allowing the sewage water to accumulate, and suddenly raising the sluice; and, third, by inserting loose paddles in the grooves provided in nearly all the man-holes. Thirteen flushing valves and forty-two flushing sluices are fixed in the sewers. By one or other of these arrangements the whole of the sewers within the district may be flushed. About 310ft. in length of river wall has been put in, bounding the land belonging to the Local Board. This wall is constructed of brick and concrete, coped with stone, and is sound, firm, and calculated to be enduring. A wharf has been formed, at which coals for the engines are landed, but there is space for other traffic.

ALNWICK.

First Class House.—Rental £40 per Annum.

Water Supply.	Price not Fixed.	Price Fixed.	Total Cost Fixed.
	s. d.	s. d.	£ s. d.
143 lineal feet of 1 inch galvanised tube	0 7½	0 10½	6 5 1
56 „ ¾ „	0 5½	0 8½	2 4 8
34 „ ½ „	0 4½	0 7½	1 1 8
16in. of lead pipe for water closet pan	0 10	..	0 0 10
3in. of india rubber tubing for ditto	1 1	..	0 1 1
1 ¾-in. self-closing ferrule cock for ditto	7 4	..	0 7 4
1 1-in. elbow ferrule with union joint	3 10	..	0 3 10
1 1-in. elbow piece	1 6½	..	0 1 6½
2 ¾-in. „	1 0	..	0 2 0
5 ¼-in. „	0 7½	..	0 3 1½
1 1-in. socket piece	1 1	..	0 1 1
2 ¾-in. „	0 8	..	0 1 4
2 ½-in. „	0 6	..	0 1 0
1 1 to ¾-in taper piece	1 1	..	0 1 1
1 1-in. T-piece	1 7	..	0 1 7
2 1 to ¼-in. T-pieces	1 7	..	0 3 2
1 1-in. stop-cock	7 11	0 6	0 8 5
1 stop-cock case	4 6	1 6	0 6 0
1 1-in. screw plug, 9d.; 1 ½-in. do., 4½d.	1 1½	-	0 1 1
1 ½-in. bib tap	2 10	0 6	0 3 4½
			11 18 11½
Sewerage.			
211 lineal feet of 6-in earthenware pipe	0 5½	Price varies according to depth.	
68 „ 4-in. „	0 4		
6 „ 6 to 4-in. junction pipe	1 6		
3 „ 6 to 6-in. „	1 6		12 0 9
1 „ 6 to 4-in. taper pipe	1 4		
2 „ 6-in. bend pipe	1 6		
1 water closet pan and fan old seat refixed	8 6	17 0	0 17 0
3 earthenware yard sinks	6 0	9 6	1 8 6
2 6-in. bell traps	2 6	8 6	0 17 0
Sewerage	..	..	15 2 3
Water	..	..	11 18 11½
Total	..	..	27 0 2½

* 30,000,000 gallons, equal to 300,000,000 lb., or 133,928 tons.

Second Class House.—Rental £15 per Annum.

Water Supply.	Price not fixed.	Price for fixing.	Total Cost Fixed.
	s. d.	s. d.	£ s. d
6 lineal feet of ½-in. galvanised tube	0 4½	0 3	0 3 9
72 ,, ½-in. ,, ...	0 5½	0 3	2 9 6
16in. lead pipe for water-closet pan	0 10	..	0 0 10
3in. india-rubber tubing for ditto	1 1	..	0 1 1
1 ½-in. self-closing ferrule cock for ditto. ..	7 4	..	0 7 4
1 ½-in. elbow ferrule, with union joint ..	2 3½	..	0 2 3½
3 ½-in. elbow pieces	1 0	..	0 3 0
2 ½-in. ,, ...	0 7½	..	0 1 3
7 ½-in. socket pieces..	0 8	..	0 4 8
3 ½-in. ,, ...	0 6	..	0 1 6
1 ½ to ½-in T-piece	1 2	..	0 1 2
1 ½-in. bib tap	3 4	0 6	0 3 10
1 ½-in. stop cock	5 2	0 6	0 5 8
1 stop cock case	4 6	1 6	0 6 0
			4 11 10½
Sewerage.			
47 lineal feet of 6-in. earthenware pipe ..	0 5½	Price varies according to depth.	
12 ,, 4-in. ,, ..	0 4		
7 ,, 6 to 6-in. junction pipes ..	1 6		
2 ,, 6-in. bend pipe	1 6		4 0 1
1 ,, 4-in. bend pipe	1 0		
5 ,, 4 to 6-in. taper pipe	1 4		
3 earthenware sinks	6 0	3 6	1 8 6
2 6-in. bell traps, with earthenware dishes	2 6	5 0	0 10 0
1 water-closet pan and fan, with new seat	8 6	14 0	1 2 6
1 ash-pit, filled up and repaved	5 0	..	0 5 0
Additional clay puddle in passage		..	0 5 0
Sewerage		..	7 11 1
Water		..	4 11 10½
Total		..	12 2 11½

Third Class House.—Rental £7 per Annum.

Water Supply.	Price not Fixed.	Price for Fixing.	Total Cost Fixed.
	s. d.	s. d.	£ s. d.
10 lineal feet of ¾-in. galvanised tube ..	0 5½	0 3	0 6 10½
14 ,, ½-in. ,, ..	0 4½	0 3	0 8 9
12in. of ½-in. lead pipe for water closet pan	0 10	.	0 0 10
3in. of india-rubber tubing for ditto	1 1	..	0 1 1
1 ½-in. self-closing ferrule cock for do. ..	7 4	..	0 7 4
1 ½-in. elbow ferrule, with union joint ..	1 6½	..	0 1 6½
1 ½-in. ,, ,, ..	2 3½	..	0 2 3½
1 ¾-in. socket piece	0 8	..	0 0 8
2 ½-in. elbow pieces..	0 7½	..	0 1 3
3 ½-in. socket pieces..	0 6	..	0 1 6
1 ½-in. bib cock	3 4	0 6	0 3 10
1 ½-in. stop-cock	5 2	0 6	0 5 8
1 ½-in. stop-cock	3 6	0 6	0 4 0
2 stop-cock covers	4 6	1 6	0 12 0
			2 17 7½
Sewerage.			
32 lineal feet of 6-in. earthenware pipe ..	0 5½	Price varies according to depth.	
14 ,, 4-in. ,, ..	0 4		
1 ,, 6-in. syphon	4 6		2 6 7
1 ,, 6 to 6-in. junction pipe ..	1 6		
2 ,, 4 to 6-in. taper pipe	1 4		
1 ,, 6-in. bend	1 6		
1 kitchen sink	4 6	0	0 9 6
1 4-in. bell trap for ditto	1 6		0 1 6
1 earthenware sink, basin, and syphon ..	6 0	3 6	0 9 6
1 water closet pan and fan, old seat	8 6	8 6	0 17 0
1 6-in. bell trap	2 6	6 0	0 8 6
Waste pipe to kitchen sink		..	0 6 0
Ash pit filled up and repaved		..	0 5 0
Sewerage		..	5 4 4
Water		..	2 17 7½
Total		..	8 1 11½

West Ham.—Particulars of Cost.

			Amount.	Total.
Brick Sewers.				
Ft.	In.	Ft. In.	Yds. Yds.	£ s. d. £ s. d.
5	3 by	3 6	1,117 ..	3,901 6 10
4	6 ,,	3 0	2,562 ..	7,476 4 0
3	9 ,,	2 6	1,463 ..	4,085 9 3
3	0 ,,	2 0	7,588 ..	12,376 7 11
2	6 ,,	1 8	3,182 ..	5,566 7 7
2	3 ,,	1 6	8,731 ..	9,156 17 11
2	0 ,,	1 4	84 ..	59 15 6
Total Brick Sewers			.. 24,227	.. 42,622 9 0
Earthenware Pipe Sewers.				
15 inches diameter			10,646 ..	6,671 14 11
12 ,, ,, ...			16,564 ..	7,001 2 10
9 ,, ,, ...			488 ..	142 12 7
Total earthenware pipe sewers ..			.. 27,698	.. 13,875 10 4
Cast-iron pipes for river crossings, &c.			.. 210	
Total length of sewers .. .. or 19 miles 1,095 yards			.. 52,135	
			No. No.	
Manholes and ventilating shafts ..			222 ..	3,455 5 4
Manholes			236 ..	3,160 4 3
Lampholes and ventilating shafts..			15 ..	97 8 3
Lampholes			18 ..	1,008 9 8
			665	7,721 7 6
Gullies and pipes fixed complete ..			.. 718	.. 3,185 14 5
Outlet works, pipes, valves, &c.			..	1,754 14 5
River wall, wharf, and roads at engine-house, and repairing roads			..	2,077 9 2
Engine-house, boiler-house, chimney and other works in connection therewith			..	5,008 6 10
River crossings			..	1,644 6 7
Engines, boilers, and pumps			..	3,978 9 10
				82,553 8 1
Cost of Works.				
Engineering and superintendence			6 161 9 8	
Land and compensation, and law charges			2,999 8 8	
Coals and tallow, &c., for engines			303 5 3	
				9,464 3 7
Total cost			..	92,022 11

N.B.—This amount includes purchase of implements, tools, and materials in the hands of the Local Board.

Cost of Private or House Drainage Works.

Alnwick.

The cost of house drainage works necessarily depends, in a great measure, upon the position of the premises drained with regard to the main sewer; the length of drains required, the depth at which they are laid, and the character of the subsoil.

The following particulars are given as the average cost of house drainage works in the towns named:—

	£ s. d.
Houses of £40 rental, with one water-closet, cost about	15 3 3
Houses of £15 rental, with one water-closet, cost about	7 11 1
Houses of £7 rental, with one water-closet, cost about	5 4 4

The length of drain to each house in Alnwick, taken on an average of 516 houses, is 25½ yards.

The following list of loans, sanctioned under the Public Health Act (1848) and the Local Government Act (1858), will show to some extent the progress that has been made in carrying out sanitary works in England during the last twelve years:—

		£	s.	d.
1850	15th June to 31st December	41,665	0	0
1851	1st January to 31st December	103,706	0	0
1852	,, ,,	246,470	0	0
1853	,, ,,	500,740	0	0
1854	,, ,,	599,893	0	0
1855	,, ,,	424,126	6	3
1856	,, ,,	522,703	16	5
1857	,, ,,	312,612	11	0
1858	,, 1st September	204,261	13	0
		£2,956,178	6	8

Amount of loans sanctioned under the Local Government Act:—

		£	s.	d.
1858,	1st September to 12th August, 1859	260,905	13	0
1859,	12th August to 21st August, 1860	280,259	7	4
1860,	21st August to 1st August, 1861	356,192	0	0
1861,	1st August to 1st March, 1862	129,998	0	0
		£1,027,355	0	4
		2,956,178	6	8
		1,027,355	0	4
		£3,983,533	7	0

This amount has been borrowed by 178 towns or districts.

Improvement in social and in sanitary matters has made rapid progress of late. Within the last half century land drainage and town sewage have ripened into sciences. From rude beginnings, insignificant in extent, and often injurious in their effects, they have become of the first importance. The introduction of machinery to make land drain pipes and town sewerage pipes gave a forward movement to civilisation. Land, by judicious draining and improved cultivation, is frequently doubled in value, and town sewerage, with other social regulations, frequently prolong human life from 5 to 50 per cent. as compared with previous rates in the same districts, and, within my own knowledge, house property throughout a whole town is reputed to have been increased 25 per cent. in value by such works. Agues and typhoid fevers are reduced or entirely banished. John Howard, by his labours, has shown to the world what could be done for gaols and for criminals; Edwin Chadwick for town sewage, and Florence Nightingale for camps, barracks, and hospitals.

With respect to the beneficial effects of sanitary measures Sir G. C. Lewis, in moving the army estimates, said—"There have been a large number of improvements introduced for the purpose of bettering the moral and sanitary condition of the private soldier. In the first place, there has been a great improvement in barracks; and I am happy to say that these improvements in barracks have not been unattended with important results. I will read for the committee some statistical returns, which I believe to be authentic, and which will show a marked improvement as regards the rate of mortality in the army. The returns are taken for two periods for an average of six years—1830-36, and 1854-60, giving the number per thousand. The annual mortality of the household cavalry from 1830 to 1836 was at the rate of 14 per 1,000; in the latter period it was only 5 per 1,000. In other cavalry it was at the first period 15 per 1,000; in the latter only 6 per 1,000. Royal Artillery, 15 per 1,000 in the first period; in the latter only 7 per 1,000. Foot Guards, 21 per 1,000 in the former period; and only 9 in the latter. The Infantry of the Line 17 per 1,000 in the former period; and only 8 per 1,000 in the latter. The returns for the colonies, of all forces, for the same periods, showed that for the former—namely, from 1830 to 1836—the mortality at Gibraltar was 22 per 1,000; but in the latter period only 9. Malta showed a diminution from 18 to 14 per 1,000; Ionian Islands, from 27 to 9 per 1,000; Bermuda, 35 to 11 per 1,000; Canada, 20 to 10 per 1,000; Jamaica, from 128 to 17; Ceylon, from 74 to 27. These are great results, and they are owing to the changes made in the sanitary condition of the army."

Since the year 1840 great and beneficial sanitary improvements have been effected in English towns. An annual mortality of 44 in the 1,000 has been reduced to 27 and 30 to 20 and even as low as 15. Human life has more value in England than in any other country in the world, entirely due to better sanitary arrangements.

STATEMENT,

Showing the Population, Number of Houses, Length of Sewers, Number of Manholes, Lampholes, and Gullies, and the Total Cost of the Public Sewerage Works in the several Towns named; together with the Amount and Rate in the £ required per Annum to Repay the Principal and Interest in Thirty Years.

Works devised and completed by Robert Rawlinson, Civil Engineer.

Towns.	Population.	Number of houses.	Total length of sewers.	Number of manholes.	Number of lampholes.	Number of gullies.	Total Cost of Works. Amount.	Per house.	Per head.	Amount per Annum to Repay Principal and Interest in Thirty Years. Total.	Per house.	Per head.	Rate in the £ per ann.
			Yards.				£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Alnwick	7,016	947	11,132	54	23	140	4,327 18 10	4 11 4	0 12 4	230 5 10	0 5 3	0 0 8½	0 0 5
Berwick	10,067	1,451	7,995	40	51	128	5,649 1 4	3 17 10	0 11 3	326 14 0	0 4 5½	0 0 7½	0 0 8½
Carlisle	26,310	4,113	24,079	131	99	366	23,310 6 7	5 13 4	0 17 8	1,348 2 3	0 6 6½	0 1 0½	0 0 6
Chorley	12,684	2,337	13,205	79	47	282	10,546 4 7	4 10 3	0 16 8	609 19 8	0 5 2½	0 0 11½	0 0 6
Lancaster	14,604	2,698	12,820	126	118	288	9,245 5 7	3 8 6	0 12 8	534 13 9	0 3 11½	0 0 8½	0 0 4½
Morpeth	4,066	580	7,171	22	..	82	2,720 0 9	4 13 9	0 13 3	157 6 2	0 5 3½	0 0 9	0 0 6
Ormskirk	5,548	942	6,839	28	..	72	2,982 8 7	3 3 4	0 10 9	172 9 8	0 3 7½	0 0 7½	0 0 4
Penrith	6,668	1,344	7,152	15	99	48	3,109 0 0	2 2 11	0 9 4	179 16 1	0 2 5½	0 0 6½	0 0 3
Tynemouth	29,170	4,478	17,871	122	154	509	12,404 18 5	2 15 4	0 8 6	717 6 5	0 3 2	0 0 6	0 0 5
Worksop	7,020	1,567	12,429	81	48	130	5,871 19 7	3 14 11	0 16 9	339 12 0	0 4 4	0 0 11½	0 0 6
Totals	123,183	20,457	120,693	698	641	2,101	80,168 3 3	..	..	4,636 7 10	..	..	..
Averages	..	..	..	..	..	..	..	3 18 4½	0 13 0	..	0 4 6½ Nearly.	0 0 9 Nearly.	0 0 5 Nearly.

Average length of main sewer per house = 5·9 yards.

N.B.—Population to houses about six to one; private works, such as house drains, yard sinks, soil pans, &c., cost about equal rates to the above; that is, it is found from experience that the cost of private works of drainage, and of water supply fittings, is about equal to the cost of public works of sewerage and water supply.

PARTICULARS OF SEWERS AS EXECUTED IN THE CITY AND TOWNS NAMED.

	Depth to invert of sewer.	Thickness of brickwork	Number of bricks per lineal yard.	Average cost of sewers per lineal yard. Birmingham	Buxton (in Rock).	Carlisle.	Chorley.	Tynemouth.	West Ham.	Worksop.
Brick sewers:—	ft. in.	ft. in.		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
4ft. 6in. by 3ft. 0in.	10 0	0 9	432	1 11 6	..	..	..	..	2 3 3	..
3ft. 9in. by 2ft. 6in.	10 0	0 9	384	1 8 0	..	1 2 6	1 14 2	..	1 18 1	..
3ft. 0in. by 2ft. 0in.	10 0	0 9	304	1 6 0	..	1 2 6	1 5 5	..	1 8 8	..
2ft. 3in. by 1ft. 6in.	10 0	0 9	248	0 19 0	..	0 18 6	1 4 8	1 5 6	1 3 9	0 19 9
1ft. 6in. diameter	10 0	0 9	208	0 18 0	..	0 16 0	0 17 6	..	..	..
3ft. 9in. by 2ft. 6in.	10 0	0 4½	172	0 17 0	..	..	..	..	..	..
3ft. 0in. by 2ft. 0in.	10 0	0 4½	136	0 16 0	..	0 17 6	..	..	0 19 8	..
2ft. 3in. by 1ft. 6in.	10 0	0 4½	112	0 12 0	..	0 15 0	0 11 10	0 18 6	0 17 6	0 13 8
1ft. 6in. diameter	10 0	0 4½	88	0 10 0	..	0 14 0	0 10 11	..	..	..
Earthenware pipe sewers:—										
15in. diameter	10 0	..	..	0 9 4	0 11 3	0 9 6	0 9 10	0 9 2	0 11 10	0 5 9
12in. do.	10 0	..	..	0 7 8	0 10 4	0 7 9	0 8 2	0 7 5	0 9 4	0 4 6
9in. do.	10 0	..	..	0 6 5	0 9 0	0 5 9	0 5 4	0 5 7	0 7 3	0 3 9

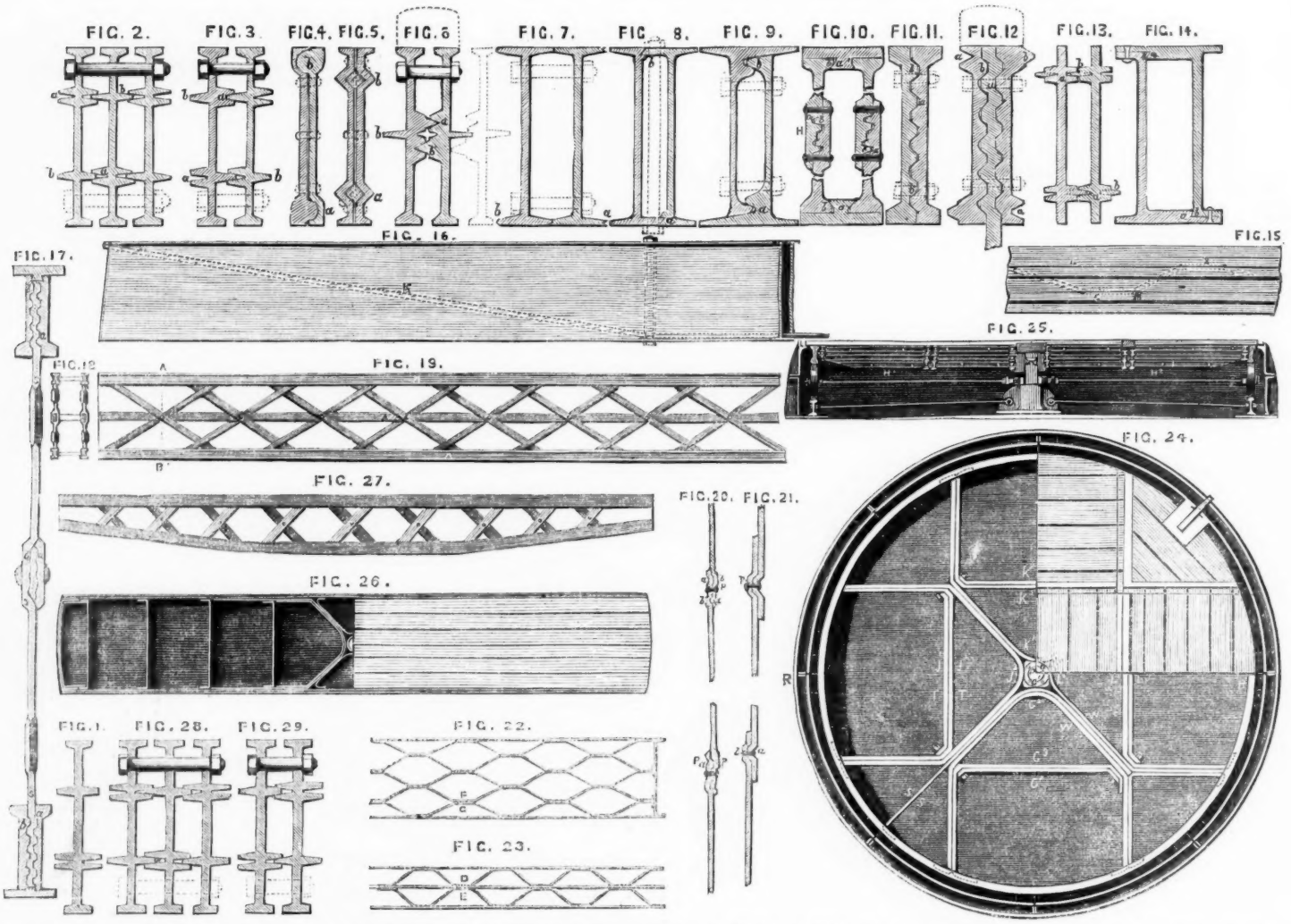
QUESTIONS AND ANSWERS RELATIVE TO SEWERAGE WORKS IN THE TOWNS NAMED.—March, 1862.

Questions.	Alnwick.	Berwick-on-Tweed.	Buxton.	Carlisle.	Lancaster.	Worthing.
What is the average annual expenditure incurred below the surface of the streets in cleansing the sewers?	Nothing.	From £10 to £12.	Nothing has been expended.	None.	£4 in four years, or £1 per annum.	Nothing. Works executed in 1854.
The number of sewers choked per annum, if any, and the causes of stoppage?	About 20 house-drains per annum. Sand, dish-cloths, and sticks.	Four or five, from offals of animals, ashes, sand, gravel, &c.	None.	Not more than 2 or 3 per cent. in 9-in. pipe sewers, owing to flat gradients and backing up of floods. Direct stoppages are caused by improper substances being passed into the drains.	Average five at blank ends. Main sewers never stopped.	None.
Have you any complaints of sewage injuriously affecting fish in the river or stream into which it is passed?	No.	No.	No.	No. Any complaints on this head have been in consequence of an overflow from the sleeper dipping tanks of a railway company passing into the sewers. Waste creosote.	No.	The sewage does not go into a river or stream, but out to sea.
Average annual cost of flushing sewers, if any?	£2 per annum.	Flushed occasionally by the Surveyor or his assistant, but at no additional cost to the Board.	They have only been flushed once during the last year.	Water given by Water Company. Flushing and maintenance of sluices attended to by scavengers.	£5 (labour only).	About £13.
Do the sewers generally serve the purposes intended.	Yes, if properly used.	Yes.	The main sewers are all in good order and work well.	Yes.	Yes.	Yes.

It has been said, "As are the people so will be the government," but my experience leads me to the conclusion that bad government necessarily makes a bad people. Temptation is the parent of vice, and opportunity the broad road leading to destruction. A little leaven of evil leavens the whole mass. Lord Shaftesbury, through the entire of his most valuable life, has appreciated the facts stated, and has devoted himself to teaching, by example and by precept, to preventing as well as to reforming. His "Common Lodging Houses Act" has probably done more good than any other law of modern times, by removing temptation, and, therefore, preventing evil. Before the passing of this act there was no check to vice in its most disgusting forms. I only indicate that which I have seen, and cannot, consistently with the decencies of society, openly described. I can only say that our civilisation resembled those volcanic regions where the internal fires of destruction made the earth tremble beneath the feet of the dwellers on the treacherous surface—a sudden outbreak might at any time take place, and overwhelm all in ruin.

Social improvement must begin in the upper circles of society that it may descend in precept, and be enforced by example. Our own good Queen Victoria understands this. The great and wise Prince we have recently lost, and whom we so deeply mourn, fully understood this. The deep-thinking, far-seeing ruler, who sits on the Imperial throne of France, appreciates the fact. In the International Exhibition of 1851 the model cottages of Prince Albert probably worked more human good, by encouraging home improvements, than all the glitter of precious stones, the wealth of jewellery

BAINES' GIRDERS.



and the subtle refinements of art. The poor are utterly powerless to help themselves in matters of sanitary improvement. They cannot build their own houses, but must inhabit such as are provided by others. They cannot make the laws, neither can they administer such laws as are made. If the laws are wise they receive the benefits, if otherwise, they suffer. Social science, as it is termed, must be administered by the State, and this Lord Brougham fully understands. It will be an evil day for society when Government divests itself of all excutive power in social and sanitary matters. Freedom is a glorious thing, but license, to initiate and work evil against the general body of society for private gain, is neither a safe nor a desirable state of freedom. A state which can tolerate cesspools, beerhouses, gin palaces, and can license dancing saloons, must bear with vice, crime, lunacy, and pauperism in excess.

Wise Imperial laws are required, and honest and intellectual administration nationally and locally to secure sanitary progress, and the greatest amount of political contentment, commercial properity, health, and social comfort to a nation.

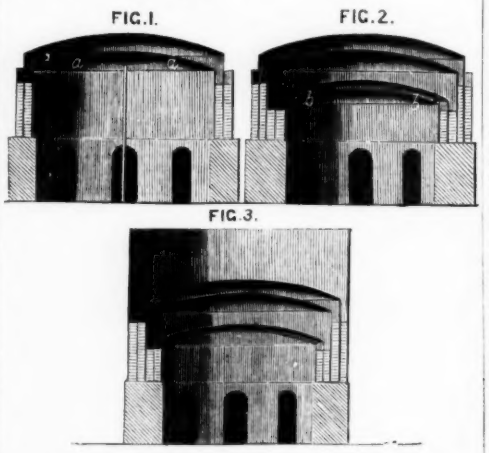
BAINES' CONSTRUCTION OF GIRDERS AND FRAMES, &c.

In the forms or sections of plates used in the construction of these frames or compound girders, the invention of William Baines, of Smethwick, one part of each is male and another part female; by bringing these parts together they become inserted, and being secured by bolts or rivets, effect a vertical union and continuous bearing, branching or extending where required; and in constructing the movable parts of railway turntables, the plates are bent and formed into suitable parts or segments, and secured in their respective places by bolts or rivets, thus constituting one entire frame forming its necessary cross girders, which can be produced to suit any angle for any number of roads upon the table.

Fig. 1 is a section of the girder plate. The parts marked *a* are grooves or channels rolled or otherwise formed, which are termed female; the parts marked *b* are ribs or projections, termed male; and when two or more of these plates are united, as shown in Figs. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 20, and 21, these ribs or projections become inserted in the grooves or channels of the adjoining plate, and thus mutually strengthen and support each other, and will be found suitable for general purposes; and where length is required the plates break joints with each other. Fig 10 is a section of girder, two plates deep, united at H, H; Figs. 20 and 21 are sections of girders three plates deep, united at P, P, intended for positions where greater strength is required. Fig. 15 is a plan of girder formed of two plates, with lateral projections and hollows formed on their sides at intervals, as shown at dotted line, where L is inserted into the plate M at *s*, and M is inserted into the plate L at X. These projections and hollows give the same support to each other as described in the preceding figures, and their form is obtained by indentations and projections in the rolls by which they are made; Fig. 16 is a side elevation of part of a truss girder; the dotted lines K indicate the tension rod; Fig. 8 is a cross section of the same; Fig. 19 is a side elevation of part of a lattice girder. The plates A^1, A^2, and A^3, are on the improved girders, and the ends and middle of the diagonal cross bars or laths are to be heated and subjected to a suitable die under pressure, to make them fit and conform to the male and female parts of the longitudinal bars A^1, A^2, and A^3, which are secured by the aid of bolts or rivets; Fig. 17 is a cross section on an enlarged scale. The parts marked *a* respectively are the grooves which are termed female, and the various parts marked *b* are the male parts. The bars S are securely held by them, whereby the strain is taken off the rivets or fastenings. Fig. 18 is an end view, showing that two or more of these girders may be combined together. Figs. 22 and 23 are girders or frames constituted of a series of the improved plates, which are bent and formed branching to and from, and so arranged that the male and female parts will come in contact with each other side by side at intervals, and being secured by bolts or rivets, become vertically united by the parts fitting each other; the plates breaking joints, a continuous bearing is obtained. This kind of bearing or frame is intended to form the skeleton or supports of decks, platforms, bridges, floors of buildings, and similar purposes. Fig. 28 is a section at D, E; Fig. 29 is a section at F, G. Fig. 24 is a plan of a railway turntable; the skeleton frame of the upper or revolving part of which is made of the improved plates, which are bent and formed into suitable parts or segments, and secured by the aid of bolts or rivets; g^1, g^2, g^3, and g^4, are plates formed and bent into one part or segment; j^1, j^2, and j^3, form another or second part; k^1, k^2, and k^3, form the third part; and l^1, l^2, and l^3, form the fourth part. Fig. 28 is a section through the various parts marked W, W; Fig. 29 is a section through the various parts marked T, T; Fig. 25 is a section through R, R; H^1, and H^2, are side views of the improved girder; Fig. 26 is a single road turntable, also formed of the improved girders, intended for turning engine and tender; Fig. 27 is a side elevation of the same. The cross bars or laths are made to conform as described in Fig. 19.

GYE'S GASOMETERS AND TANKS.

The objects of this invention, by Frederick Gye, of the Royal Italian Opera, Covent Garden, are improvements in constructing gasometers and gasometer tanks. For this purpose he constructs a gasometer tank in such manner as to render available much of the central space of land now covered or occupied by the tank of a gasometer. The tank for a gasometer, according to the invention, is made double at the outer circumference to receive the water or fluid employed, the interior space being left free for use when roofed or closed in air and gas tight.



Instead of placing a gasholder tank on the surface or below the surface of the ground, Mr. Gye erects a circular wall of brickwork or a circular framework of iron or other suitable material. This circular erection may be perforated with arched or other openings of a height convenient to admit men or materials being carried through them. The breadth of this wall or erection is to be sufficient to admit of a double or ring gas-holder tank being placed on its upper surface, the tank being of sufficient width to admit of the working therein of a single or double, that is, a telescope gasholder, as is indicated by Fig. 1. The space extending from one side of the interior tank to the other is to be roofed over, as at *a*, *a*, that is, the circular space included in and surrounded by the inner ring of the tank is to be roofed over. It will be seen that there is then a covered circular apartment approached by the openings through the circular wall or structure below. The roof of this apartment may, if necessary, be conveniently supported by a central column with radiating struts (umbrella-like) or by a series of columns or otherwise. Should the gasholder outside and above require support when exhausted of its gas, which is often the case, small studs may be placed in different parts of and upon the roof below, so as to afford a general and divided support to the gasholder when it has fallen to its lowest point. Suppose it should be wished to use a portion of this reclaimed space for the purposes of storing gas, that is, to construct another gasholder therein, Mr. Gye proceeds thus.—He builds the lower circular wall somewhat wider than before, in fact sufficiently wide to admit of two ring tanks being built upon its upper surface, by placing a third circular side of a tank thereon. This third or inmost ring will, however, be only one-half the height of the other two, and when the space between it and the next or middle concentric ring is filled with water it will form a proper receptacle for the reception of a gasholder equal to the depth of the inmost ring, or equal to one-half the height of the outer gasholder; this will be understood by reference to Fig. 2. The space (now reduced) contained within this inmost ring must also be roofed over, as at *b*, *b*, and there will still remain below an unoccupied covered space available for the stowage of coals, coke, or other material, or for other uses. The domes of the gasholders and roofs may be so constructed as not to require any interior supports, as shown in Fig. 1.

This invention is also applicable when constructing gasometers the tanks of which are built below the level of the surrounding ground, and for which an excavation has been made, only in that case it would be necessary to descend by an inclined plane, or other means, in order to enter the enclosed covered space under the gasometers. In order that the interior, or lower gas-holder, shall work properly, it is necessary that the space between its exterior and the roof above it shall be connected with the outer atmosphere, so that, as it falls when delivering its gas into the mains, the space above it shall be readily supplied with air, which air will be again expelled as the gasometer is re-filled with gas. An objection might be raised that, by adopting the most advantageous form of this invention, that is, the lifting out of the ground and placing on a wall so great a superficial area of material, the action of the wind might be found very inconvenient. In order to remedy this evil, and at the same time to effect what may be a further improvement in the construction of gas-holder and tanks, the outer ring of the tank may be made of a height equal, or nearly so, to the greatest height to which the outer gas-holder will rise when completely filled with gas, and on the inside surface of this outer ring is placed either the wheels or the guide rods necessary to the steady working of the holder. It would not be necessary to make this extended tank, that is, the portion above the water line, of continuous sheets or plates of metal, it may be made of a sort of skeleton or open work only; care must be taken that it be of sufficient continuity to shield the gas-holder from the violent action of the wind. This construction will be readily understood by reference to Fig. 3.

America and the Exhibition.—The United States Government having made no appropriation towards the cost of fitting up the American portion of the Exhibition, an effort is being made among the Americans in London to make up £1,000 for the purpose. A considerable sum has already been secured. Mr. Freeman H. Morse, United States Consul, of 67, Gracechurch-street, is treasurer of the fund.

TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

D. M. I. *is certainly candid, but, we fear, a little daft.*

J. A. D.—*We fear your subject is beyond your ability to deal with it.*

R. F.—*You cannot make for your own use, and without license, any object covered by provisional protection or patent.*

Medicus.—*An advertisement would doubtless bring you applications from a number of makers of such machines. We know of none, however.*

J. J. B.—*We know of no other than Barran's cup surfaced boiler, and we believe they are manufactured by Messrs. Gardiner and Maclatosh, of New Cross.*

R. L. *is mistaken; our correspondent wished for a rule giving the* length *of governor arms, not their "height." The rule is correct as far as it goes, but it is incompletely stated.*

A. C.—*Does your lever weigh only* 49½*lb. when attached to the joint, and weighed with the steelyard attached at the centre of the stud on the valve? If so a weight of* 26*lb.* 39½*in. from the joint will give* 484*lb. nearly per square inch on the valve.*

An Old Subscriber.—*Steam of* 30*lb. per square inch flows into the atmosphere with a velocity of* 1,643*ft. per second. You can easily calculate from that the quantity of steam that would escape through the holes, and find from a table of steam how much water would be required to raise it. Steam jets in furnaces are wasteful.*

ORDNANCE.

(To the Editor of The Engineer.)

Sir,—In one of the clauses of "Artillerist's" letter against the Armstrong gun, which appeared in your impression of this week, he speaks of solid shot guns of 95 cwt., "which only the iron-plated ships" can carry. It is a pity that a letter, otherwise so well written, should be weakened by such an assertion. Most men-of-war are capable, and indeed do, mount a solid 68-pounder. Even gunboats can, and have done so. Plug.

March 28th, 1862.

SCREW, PADDLE, AND RUDDER SUPERSEDED.

(To the Editor of the Engineer.)

Sir,—In your last week's number, under the above heading, I was surprised to find certain remarks from a "Mr. M. A. Soul" (who is a total stranger to me), upon my advertisement in The Engineer. I cannot in any way account for so unwarrantable an interference in my business on his part. His request, that you would state that he is neither directly nor indirectly connected with "the affair," is as absurd as though I were to ask you to state that I was neither directly nor indirectly connected with "Baring Brothers." Fredk. A. Fryer.

3, Leadenhall-street, April 3, 1862.

STEAM CULTURE.

(To the Editor of The Engineer.)

Sir,—In The Engineer of the 28th inst. Mr. James Howard makes the broad assertion that engines going over the land, and drawing their own implements after them, consume four times the quantity of fuel and water that a stationary engine with wire rope requires to perform the same quantity of work. Will Mr. H. allow me to inquire if this occurs on all occasions, and under all circumstances? Will a tractor absorb as much of its own power while travelling over a hard stubble or clover ley as it would on a fallow? is it necessary, in order to cultivate by steam, to draw implements at four miles an hour? Would not half that speed do equally well, causing fewer casualties, and less wear and tear to the implements and the legs of the assistants? Are we to understand that all traction engines are to come under the same category—all bad?—all monstrous consumers of an indefinite quantity of coal and water? Really Mr. Howard has arrived at a conclusion by a very short cut. A traction engine, like a cart-horse, may be pushed on to such a speed as to have no power wherewith to work implements; and any argument in the matter ought to be based upon the proper use of the engine, and a speed given which is rational, and suited to the particular purpose. But, even at four miles an hour, facts and experiments contradict Mr. H.'s statement. One instance will suffice. At Chester, three years ago, Mr. Fowler competed with Mr. Boydell for the prize in the same field. Mr. Fowler's engine drew four ploughs, with 80 lb. of steam in 7in. cylinders, 150 strokes a minute; so that it may be fairly calculated that his engine was working up to 20-horse power. Mr. Boydell drew six ploughs at an equal speed, with steam at 70 lb., the cylinders of the same size, and the revolutions nearly the same.

Are we then to understand that Mr. Boydell's engine worked up to 80-horse power?—for, by engineering rules, the fourfold consumption of fuel and water would of course give that result.

The writer, and no doubt those who would fairly use steam for the cultivation of the soil, will feel obliged for some enlightenment in these matters. Robert Blackburn.

MEETINGS NEXT WEEK.

Institution of Civil Engineers.—Tuesday, April 8th, at 8 p.m. Discussion upon the papers by Mr. Brunlees and Captain Galton, "On Railway Accidents."

Society of Arts.—Wednesday, at 8 p.m., "On the Decoration of the International Exhibition Building," by J. Gregory Crace.

Society of Engineers.—Monday, at 7 p.m. Discussion on Mr. Parsey's paper "On Trussed Beams."

Civil and Mechanical Engineers' Society.—Thursday, 7.30 p.m., "On Single and Continuous Straight Girders," by Mr. Francis Campin, C.E., President.

Advertisements cannot be guaranteed insertion unless delivered before eight o'clock on Thursday evening in each week. The charge for four lines and under is half-a-crown; each line afterwards, sixpence. The line averages nine words; blocks are charged the same rate for the space they fill. All single advertisements from the country must be accompanied by stamps in payment.

Letters relating to the advertisement and publishing department of this paper are to be addressed to the publisher, Mr. Bernard Luxton; *all other letters and communications to be addressed to the Editor of* The Engineer, *163, Strand, London, W.C.*

THE ENGINEER.

FRIDAY, APRIL 4, 1862.

THE ARMSTRONG GUN.

The *Times* insists that the exploits of the Confederate steamer Merrimac (or Virginia, as she is really named by the Confederates) have reduced the effective strength of our own navy to two ships of war, or at the most to those few fighting ships which are heavily plated with iron. It may not be easy to refute this conclusion, but it is certain that, for any purpose of attack upon iron-plated ships, the fate of the Cumberland and Congress involves the fate also of every one of our Armstrong guns. If there be any exception it must be the 150 lb. smooth-bore Armstrong, which is being persistently magnified into a 300-pounder, merely for the reason that it is intended to throw a bolt of that weight from it when, and only when, it shall have been rifled for the purpose, and presuming the gun does not burst in the attempt. A battery of 7in. Armstrongs, throwing 110 lb. shot, might shower away all day upon a properly plated ship without doing it much harm, for it has been incontestibly proved by the War Office authorities that, at the range at which naval actions are sure to be fought, the 68 lb. smooth bore guns have much greater destructive power than the Armstrongs, even when firing wrought iron shot. If wrought iron puddled steel, or Bessemer or other steel shot, truly formed and having but a slight windage, were fired from a 68-pounder gun, the effect upon the iron plates struck would be even greater than with the present 8in. cast iron shot ¼in. or more smaller than the bore of the gun, and often breaking to pieces upon the object struck. But the Merrimac and Monitor, which hammered away at each other with so little effect, mounted still heavier guns, the last named vessel mounting two of a pattern in great favour in the American navy, to wit:—11in. Dahlgren guns, throwing 184 lb. wrought iron shot. Now, as it has been proved by trial that the Armstrongs are inferior in power to the 68 lb. smooth bores, and as even 11in. smooth bores produced so little effect upon a cheaply-built iron plated ship, what could the Armstrong have done? Nothing at all, unless a shot could, now and then, have been got into the enemy's port holes. The conclusion is obvious that much heavier guns are required, and Sir Cornewall Lewis stated in the House, only the other night, that Sir William Armstrong had only that day brought forward a proposal for the manufacture of a gun capable of throwing a round shot of 300 lb. or a rifled bolt of 600 lb. This gun, of course, will be a wrought iron gun. But what are we really to expect from large wrought iron guns? The mediæval engineers made enormous wrought iron bombards, one of which, 19in. or so in the bore, lies a wreck on the top of Edinburgh Castle. These bombards appear to have burst in almost every instance. In 1840 or thereabouts Messrs. Fawcett, Preston, and Co., we believe—at any rate a Liverpool firm—made a large wrought iron gun for the United States' Government. It was named the Peacemaker, and was placed on board the Princeton, whose machinery was planned by the now famous Swede, Captain Ericsson, the engineer, who, with Mr. Braithwaite, built the Novelty for the Liverpool and Manchester contest, and who has brought forth novelties ever since. Well, the Peacemaker was loaded and fired, and exploded on the spot, killing the United States' Secretary of War, and two or three other Government officials, who had assembled to witness the trial. Then we had Mr. Nasmyth's wrought iron gun, which broke down; Mr. Mallet's mortar followed, and that gave out also; then came the great Mersey gun, which soon showed symptoms of unsoundness; and others of the same material were found, on trial, not to answer. At last, Lord Derby's Government gave us the monopoly of the Armstrong gun. The smaller sizes may have held together tolerably well, saving the vent pieces, which appear to fail in all the Armstrongs, but the larger ones, as is becoming pretty well known, require very careful handling to avoid accidents, and for their own safety, as well as that of the gunners, the less often they are fired the better. They do not generally go all at once, but several have "started" in the coils, during the first trials, and the whole experience with them thus far shows that they are liable to early infirmity. The so called 300-pounder gun, made at great cost, and with a smooth bore to take a 156 lb. shot, has only fired a few rounds, and yet Sir William proposes to go on in the construction of still larger guns upon the same system, with all its uncertainties. Mr. Lynall Thomas' large wrought iron gun which threw its shot upwards of 10,000 yards, or 5¾ miles, the greatest range, probably, ever attained, lies burst in two in Woolwich Arsenal, Mr. Whitworth's guns have burst, and it is extremely doubtful whether any known plan of forging wrought iron guns of great size can be depended upon. Even if they do not burst, the chase, as long as it is made of wrought iron, and finely grooved, must wear rapidly, and a visit to Woolwich will soon convince any one how great are the difficulties in this respect. So far, we have confined our remarks upon the Armstrong gun chiefly to the body of the gun itself. But the breech-screw and vent-piece appear to be constantly failing, and if Sir William casts aside his breech-loading system and takes up the old plan of muzzle-loading, as he appears to be doing, we shall have very little to show for the enormous sums which that gentleman's career has cost the nation. It needs no Sir William Armstrong, come from Elswick, to teach us how to make wrought iron muzzle-loading guns, provided only we keep clear of the "shunt" plan with its excessive windage.

The Americans have for a long time made 11in. guns weighing 135 cwt., and, we believe, they have proved very successful. If the War Office authorities are not yet prepared to forge their guns out of the solid from perfectly homogeneous steely-iron ingots which can be produced at less than £7 10s. a ton, they might, at least, invite the ironmasters to produce large cast iron ordnance from the best cold blast irons. The Americans have cast 22-ton guns with 12in. and 15in. bores, throwing, the one a 425 lb. rifled shot, and the other a solid ball of the same weight. These were cast hollow and with provision for cooling the metal with great uniformity throughout the whole mass. Our stake in the matter of ordnance is too great to allow ourselves to be tied down by the prejudices if not the interests of a single man, who has never yet produced a really powerful gun. Before closing this article we would observe that Mr. Whitworth's 80-pounder, fired with 14 lb. of powder, sent its shot entirely through the 4½in. vertical iron plates on the sides of the Trusty, nearly two years ago. We note this fact here as bearing upon what we said, last week, of the Armstrong and Whitworth guns, to the effect that neither had ever sent a shot through a 5in. plate inclined at an angle. This is perfectly true, but the Whitworth gun, offering but little resistance to the escaping shot, has the most nearly approached such an exploit.

THE BESSEMER METAL.

The general notion of steel, up to within a very recent period, if not at present, has been that it was a brittle material, weldable only with difficulty, if at all. If we define steel as a metal which may be melted and poured, without "chilling," into an iron mould, and, more especially, as capable of being hardened by being first heated and then plunged into water, steel is now made direct from pig iron, too, having nearly the ductility of copper. To be more precise, we should say that the steel in question can be drawn or indented only by the application of great force, but that under no force is it brittle. In the approaching Exhibition, Messrs. Bessemer and Co. will exhibit this metal in a wonderful variety of shapes; and, taking everything into account, no surprise need be felt if these results of the atmospheric process of steel and iron making, direct from the pig, are ranked as first, in respect of important novelty, among all the other articles exhibited, and as marking more strongly than anything else the progress of the useful arts since the great display of 1851. Besides samples of the ores, the pig, the coal, and the ganister, upon which the process is conducted or directly depends, there will be ingots of the cast metal, and bars, plates, and shapes into which like ingots have been hammered or rolled. There will be large round bars twisted cold into a short length of huge cable, there will be others tied into knots and coiled into fantastic shapes, all without the application of fire, and without a flaw of any kind. There will be a circular saw 85in. in diameter and $\frac{1}{10}$in. thick; there will be cut nails of all sizes, down to tacks of which 200 or 300 go to the ounce; there will be cutlery and pens, and articles in great variety, representing some of the most useful and peculiar purposes to which steel can be applied. Then there will be steel tyres rolled from a single ingot, boiler-plates, steel girders, files, machinist's tools, &c. And besides these, there will be shown a claret jug drawn cold (or with the exception only of annealing) from a single flat plate of Bessemer metal, without seam and without weld, a trooper's helmet made in the same way from a single plate, and other articles illustrating the wonderful ductility and homogeniety of the metal under notice.

To produce a metal possessing such qualities from English pig iron in twenty minutes is no ordinary achievement, and in 1851 such a result would have been thought miraculous. Now, it is an every-day performance at some of the greatest iron and steel works in this country and on the Continent. We have mentioned, from time to time, the great firms which have adopted the atmospheric process, and thus prepared themselves for the ultimate abandonment of the puddling, refining, and cementing processes. In Sweden, with the best iron to begin with, the Bessemer metal has for four years or more been produced direct from the blast furnace, and at a cost hardly one-fourth greater than that of the pig iron itself.

Those who believe that every great invention is, like the steam engine, the result of accumulated improvements, all in the same direction, may well regard the Bessemer process with interest. Mechanically, although not commercially, it has already effected a complete revolution in the manufacture of iron and steel, so much so, that those who have adopted it are receiving £40 and £50 a ton for steel which costs them less than £10, and which would successfully compete, even at the same price, with steel quoted at £60 or £70. Yet the process of converting crude melted iron into steel by simply blowing air through it for a quarter of an hour or twenty minutes, and without any fuel other than that first required to melt the iron, was, as far as the past six years have shown, the sole conception of one man. It is wonderful, with such a great accomplished fact, that Mr. Bessemer's right to the whole process has never been disproved, and never disputed, except upon a trumpery pretence that Martien's process—perfectly impracticable in itself, and only intended, in case it had worked, for the partial purification of iron preparatory to puddling—contained the essential features of Bessemer's practice. Martien's patent, it may be noted, was taken out one month only before Bessemer's, and Mr. Bessemer's specification bears abundant internal evidence that he had previously conducted many practical experiments upon an extensive scale to determine the practicability and utility of his mode of treating iron, whereas, the process of Martien, the foreigner, being in itself impracticable, could hardly have been tried at all.

The impetus which the atmospheric process has now acquired in its introduction on the great scale has, doubtless, tempted a few to break through Mr. Bessemer's patent if possible. It is not for us to defend it, but in a letter upon the subject, which appears elsewhere in our present number, and emanating from a gentleman who has every means for knowing the truth, such false metallurgical doctrines are laid down that we feel bound to reply to some of them. So far as the letter attempts to make out that the patent in question is invalid in consequence, as is alleged, of one or two untenable descriptions or claims, we can only say that any one must be sadly ignorant of British patent law who does not understand what are the rights and opportunities for disclaimer. Mr. Bessemer has described and claimed practicable modes of carrying out his invention, and if he have (although we may say at once there is no proof whatever to that effect) described or claimed impracticable modes of working it, he has only to disclaim them, one of the most important clauses of the Patent Law Amendment Act having been framed expressly to meet such cases.

To the first objection of "W.S.P.," that melted iron cannot be rendered malleable by passing steam through it, for the alleged reason that steam would consolidate the iron, we may reply that, as described, the steam was to be admitted to the iron while in a crucible and surrounded by a heat sufficient to keep the iron in the fluid state, in any case until it was decarbonised. Mr. Bessemer's specification, of Oct. 17th, 1855, however, which is a chapter on metallurgy worth reading, anticipates this difficulty, as on the 11th and 12th folios it alludes particularly to the effect of steam upon melted iron, and recommends that steam be used only in the earlier stage of the process which should be completed with air. In practice, it is found more convenient and economical to employ air alone, but there is nothing impracticable in the use of steam, especially if highly superheated, as has been proved by experiments which we believe "W. S. P." can easily repeat.

Next, "W. S. P." informs us that, if some of the melted pig iron (other than "spiegel eisen," or iron containing about 6 per cent. or 7 per cent. of manganese in combination), be taken from the finery or cupola, and added to the nearly decarbonised charge in the converting vessel, a metal without malleability will be the result. Now, malleable steel is being almost constantly made in Sheffield by the atmospheric process without the addition of "spiegel eisen," or of iron containing any notable quantity of manganese whatever, a portion of gray iron being taken from the melting furnace and added towards the close of the converting process, to restore the right proportion of carbon where nearly the whole has been previously burnt out. "W. S. P." should see to this. Besides, the exact proportion of manganese in spiegel eisen is not essential in any case; and, what is more, one-third, at least, of all the pig

irons known contain manganese in a proportion varying from ½ to 11 per cent. Without denying that an addition of "spiegel eisen" may be desirable in some cases, there is another mineral, known as "Franklinite," and containing nearly equal proportions of iron, zinc, and manganese, which has been practically found to be superior to "spiegel eisen" in any case. In no case is spiegel eisen indispensable, and good malleable metal may be and is made by adding, towards the close of the process, a portion of No. 1 gray pig iron without manganese, and direct from the melting furnace.

As for "W. S. P.'s" third point, it need only be said that solid carbonaceous matters, as pig iron rich in carbon, *are* taken up by the decarbonised metal in the converting vessel, the proof being open to any who like to try it for themselves. So, too, it has been found in practice that the almost indestructible moulds formed by an equal admixture of loam and certain carbonaceous matters, when used for founding articles in mild steel, recarbonise the steel to such an extent that mild steel castings cannot be made in them, and the charcoal mixed moulds have had, in consequence, to be abandoned.

As to "W. S. P.'s" fourth objection, he misrepresents Mr. Bessemer's patent of Oct. 17th, 1855, which states that the steam (if used at all) should be used at the beginning of the process, and for about one-third of its duration. As for the next point, that of forcing steam through melted cast iron until it became malleable, Mr. Bessemer can easily disclaim it, if there be any necessity therefor.

As for "W. S. P.'s" allusion to the patent of February, 1856, the attempt to make out that the carbon in cast iron is what might be described in a specification as "fuel" is only straining a technical point, without in the least attaining the object in view, and the attempt, moreover, only confounds "W. S. P." in his previous statement that decarbonised iron would not combine with fresh carbonaceous matter. "W. S. P.'s" conclusions under this head are so illogical, too, that any one who cares to examine them may readily perceive their fallacy.

Martien's process, as we have already shown, has no bearing on the case. The patent, in itself, is untenable; and as it was not published until six months after Mr. Bessemer's patent, it could not, even had it been abandoned by Mr. Martien, have served as a hint to Mr. Bessemer in arranging the details of his process, which *is* practicable. The whole letter of "W. S. P.," filled as it is with false conclusions and containing certain misrepresentations, would be unworthy of its author, even did it not bear evidence of an unscrupulous determination to make flaws where none existed, in order, if possible, to carry off the fruits of the genius and industry of others. If, as we have reason to suspect, this letter is the forerunner of an organised attempt to despoil Mr. Bessemer of his right, he will be neglectful of the duty which he owes to his licensees, now including the most extensive iron and steel firms in the world, if he does not resist his opponents up to an appeal to the House of Lords.

Petroleum.—A deputation from some of the principal fire insurance companies in the metropolis lately waited upon the Lord Mayor, at the Justice-room of the Mansion-house, with a view of bringing under his notice a subject fraught, as they believed, with danger in an incalculable degree to life and property on and about the river Thames. Mr. Lovell, secretary to the Phœnix Insurance Company, said they had sought the interview to call particular attention to a new product which was being very largely imported into this country, and particularly the metropolis, which, from what they had learnt, was likely to be still more largely imported, and which contained an element of danger unknown to any other substance. He alluded to the American material usually called petroleum, or rock oil, and sometimes by other names. It was in the highest degree combustible, and threw off an inflammable explosive vapour at ordinary temperature, and even at a very low temperature. On Thursday, which was a cold wet day, it ignited on a light being held to it an inch from the surface. It floated upon, and would not mix with, water, and therefore water would not extinguish it. It was exceedingly volatile, and spread rapidly over the surface of water, burning fiercely when ignited. From statistics in the possession of the fire offices, it appeared that there were now lying at one wharf alone on the Thames, 7,000 casks, containing 210,000 gallons of this extremely inflammable oil; at another place 3,000 barrels, each barrel containing 46 gallons. The question was whether his lordship, as a conservator of the Thames, or in his capacity as a magistrate, could do anything to prevent the introduction of this inflammable and very dangerous substance in any dock or wharf in communication with the river Thames, or, indeed, in any other than isolated places. The Lord Mayor said, as chairman of the Board of Conservators of the Thames, he had no judicial functions, but as chief magistrate of the city of London, if they brought before him a case where there was any great quantity of this material deposited within his jurisdiction, it would probably be competent for him to interfere in the public interest, because there could be no doubt whatever, if what Mr. Lovell had said was an accurate representation of the facts that the knowledge of such great quantities of inflammable matter being stored in any particular place would naturally excite terror in the minds of the people whenever the circumstance became known, and that on the authority of Lord Campbell in "the Queen v. Lister and Biggs" (Crown Cases Reserved), the law would justify a prosecution. Mr. Lovell said the deputation had taken the opinions of Dr. Letheby, Mr. Miller, of King's College, and Mr. Warrington, of Apothecaries'-hall, with regard to the substance in question. Dr. Letheby reported to them that—"The raw petroleum gives of inflammable vapour at ordinary temperature, and this is explosive when mixed with atmospheric air, and will fire at a distance of an inch and a half from the surface of the liquid. The specific gravity of the liquid is 808·6, water being 1,000, and it boils at 212, rising to 266 of Fah." Mr. Miller stated that "the brown sample labelled 'crude' when poured into a shallow dish, of a temperature of 60 Fah. takes fire on the approach of a light, the vapour taking fire at an inch or more from the surface of the liquid. This crude oil is somewhat lighter than water, and consequently floats upon it. When poured upon water at 60 deg., it takes fire on the approach of a light to within about an inch of the surface and burns with great violence. If a teaspoonful of the oil be poured upon a saucer full of water five inches across, on setting fire to it the heat evolved as it burns is sufficient to make the water boil briskly at the surface. I have no hesitation in saying that I do consider such storage in the highest degree dangerous for the causes above-mentioned, and I think that stringent measures should be at once taken to prevent it." Again, Mr. Warrington reported that—"Raw petroleum has a specific gravity 812, and gives off inflammable vapour continuously at the ordinary temperature of the atmosphere—58 to 60 deg. In these experiments the lighted match was held about half an inch above the surface of the liquid under trial. As both fluids are lighter than water, and are not mixable with it, they will necessarily float upon its surface without any modification of their properties."

MISCELLANEA.

The West Somerset Railway, fifteen miles in length, was opened on the 27th ult.

The indictment of Mr. Train's Westminster Bridge-road tramway, as a nuisance, comes up on Monday next before the Surrey Assizes at Kingston.

A new steam fire engine, just completed by Messrs. Shand and Mason for the London Fire Engine Establishment, was tried on Wednesday at the New River Head.

It is understood that orders are in course of transmission to all the dockyards throughout the United Kingdom to suspend any further operations upon wooden ships.

The wharfingers on the Surrey side have attended before the Embankment Commission to remonstrate against the construction of a solid embankment on the south side of the Thames.

The Demerara Railway, 15 miles long, earned £22,294 last year. The company are endeavouring to raise additional capital to complete the road to Mahaica, making the whole length from Georgetown 20½ miles.

The traffic receipts of railways in the kingdom amounted, for the week ending the 22nd of March, on 10,124 miles, to £470.187, and for the corresponding week of last year, on 9.875 miles, to £492,344, showing an increase of 249 miles and a decrease of £22,157.

The new Cunard steamship Scotia made her official trip on Monday. She was loaded to the average load line, and performed the distance between the Bell Buoy and the North-West Lightship at the rate of 15 knots, or upwards of 17 statute miles per hour.

The models, showing the parts of the Armstrong gun in detail, and the mode of making it, and which were fully completed at Woolwich ready for carriage to South Kensington, will not be placed in the Exhibition. The order to this effect reached Woolwich last Saturday.

Messrs. Humphrys and Tennant are making three pairs of their compound engines for the Peninsular and Oriental Company. One pair of 500-horse power will have, besides the high pressure cylinders, 104-in. low pressure cylinders, laid horizontally instead of being placed upright as in the Mooltan.

On Saturday last one of the shafts of Seaham Pit, in Durham, and over 1,500ft. deep, became completely blocked up in consequence of a cage getting out of the guides. More than 300 men and boys were in the pit at the time, but as there was a drift into an adjoining colliery every soul was brought safely to bank in a few minutes.

One of Bray's traction engines has been employed during the week in moving heavy machinery, &c., to the Exhibition. Among these is a 33-ton locomotive from the London and North-Western Railway, ingots and a shaft of Krupp's steel, the latter weighing 18 tons, &c. French, Austrian, and Prussian locomotives are being moved also by Bray's engine from the docks to the Exhibition.

In the case of the late fatal accident on the North Kent Railway the jury returned the following special verdict:—"Accidental death; and it is the unanimous opinion of the jury that the accident is attributed to the imperfect state of the permanent way at and near the spot where it occurred, and the jury recommend the immediate attention of the company to the state of the trenails and sleepers."

The Naval Committee has introduced a Bill in the United States Congress providing for the construction of an iron-clad steamer of 6,000 tons burden, to be used only as a ram, and appropriating 1,000,000 dols. for this, and also 13,000,000 dols. for iron-clad gunboats. The Bill also appropriates 700,000 dols. for Stevens' battery, and 500,000 dols. for the extension of Washington Navy-yard, by erecting machinery to roll and forge plates for armour-clad ships.

The remaining portion of the large projecting iron stem or prow of the Achilles, 50, iron vessel, building at Chatham, has been successfully fixed in its place. The stem is of great strength, weighing upwards of 20 tons, and was forged at the Thames Ironworks, Blackwall. It is made to project some distance from the vessel, especially below the water line, and when used as a ram in running down any hostile ship the Achilles will strike her antagonist below the water, by which it is believed that the greatest and speediest amount of injury will be inflicted.

Considerable surprise has been expressed in naval circles at Portsmouth at the statement of Lord C. Paget, in reply to Mr. Osborne, in the House of Commons on Monday evening, that a ship was now being built on Captain Coles' cupola plan. It is well known that all that has been done is the preparation of drawings. Private builders have been invited to tender for her construction, but beyond this nothing whatever has been done. It is believed even that the firms who intend tendering have not yet sent their communications in to the Admiralty.

The Peninsular and Oriental Company's steamer Ripon, lately lengthened 25ft. at the bows, has made a trial trip in Stokes Bay. All the latest improvements have been adapted to her engines by Messrs. Ravenhill and Salkeld, and she has been fitted with feathering paddle-wheels and new boilers, and also with a superheating apparatus and surface condensers. The speed obtained, on an average of four runs, was 12·387 knots, with 20 lb. of steam, 21 revolutions, and the very good vacuum of 29in. The nominal horse-power of her engines is 450, worked up to 2,009 during the trial. On the last trial trip of the Ripon, in 1854, her speed was a little over 10 knots; but, although so great an improvement has been made in this respect, it is not expected that her consumption of coal will be more than two-thirds or three-fourths of her former average.

The following appointments of naval engineers have been made since our last:—Archibald Bain, chief engineer, additional, to the Asia, for gunboats at Haslar; William N. Correy, chief engineer, additional, to the Asia, for the Duke of Wellington; Charles A. Dwyer, chief engineer, additional, to the Cumberland, for the Orion; Robert L. Owen, second-class assistant-engineer, to the Termagant; Benjamin Carr, first-class assistant-engineer, to the Blenheim, for the Britomart; R. W. Tapp, first-class assistant-engineer, to the Magicienne; William Etherington, confirmed as second-class assistant-engineer in the Medina; Benjamin Carr, first-class assistant-engineer, to the Magicienne, *vice* Pillar, appointed to the Indus as supernumerary; George Bartlett, second-class assistant-engineer, to the Magicienne; and R. Winter, supernumerary in the Asia, is promoted to first-class assistant-engineer.

The Metropolitan Railway is advancing rapidly. This week the miners employed by Mr. Jay, the contractor, finished the last piece of the mining operations in the Bagnigge-wells-road, and all that now remains to be done is the putting in of one length of brickwork. During the past few weeks great progress has been made in the execution of the work. The whole of the bridges between King's-cross and Acton-street, Gray's-inn-road, have been completed, as well as the whole of the brickwork. The excavations at the bottom of Frederick-street are now nearly completed for the commencement of the Finsbury Junction Railway. A great deal of the ironwork that is to be used in turning the Fleet ditch has arrived, and within a short time that great undertaking will be completed. The walls of the chief station in Victoria-street are being rapidly erected, and there can be little doubt but that the line and stations will be completed within the specified time.

A few days since the boiler employed at the *Western Times* office, in Exeter, ruptured below the water line, and the boiling water, in its escape, caused the death of a girl who happened to be in the boiler-room at the time. The rupture was about 20in. long, and nowhere exceeded ¾in. in width, the boiler remaining otherwise uninjured and undisturbed. Mr. Bodley, an engineer, gave evidence at the coroner's inquest, that the fissure was at the corner of the *angle-iron*. The other parts of the boiler were in fair working condition. The plate was corroded round the edge of the angle-iron into a peculiar kind of groove, and the line of fracture was exactly in a line with this groove. The least thickness was about one-sixteenth of an inch. The way he accounted for that groove was from the expansion of the cylindrical part on the plate end, the end of the boiler being flat like a drum. Within a quarter of an inch of the fracture the boiler was of the right thickness. It was not an explosion but a rupture. The jury returned a verdict of "Accidental death."

SEWING MACHINES.

(*Concluded from page* 198.)

The apparatus now generally used for holding the material to be stitched is a bent bar or its equivalent, called a presser foot, which in most machines is held down upon the material and the table which supports the latter by means of a spring, so that the presser yields to admit the passage of different thicknesses of fabric. For this improvement we are indebted to the successive inventions described in the patents issued to Fisher and Gibbons (1844), Magnin (1848), Thomas and Marsh (1849), and Hughes (1852). In the machines invented before 1844 the fabrics to be stit hed or ornamented were held in a vertical position between two cylinders, as in Duncan's machine (1804), or they were secured in a frame or holder (that is clamped), as in Newton and Archbold's machine (1841). In Bostwick's machine (1844) the fabric was passed between toothed wheels—an arrangement which resembles to a certain extent the wheel-feed now in use. In Fisher and Gibbons' machine (1844) the fabric was kept stretched in a horizontal position over two bars, one at each side of the needle. Instead of these two bars a flat surface or table was first described in Magnin's patent (1848), and upon it the cloth was held by means of a circular nipple, which pressed the cloth upon the tab'e during the passage of the needle into and back out of the cloth, and which was raised to allow the cloth to be moved in any direction required. The yielding pressure now so common is first described in Thomas and Marsh's patent (1849) for a tambouring machine. In it two springs are described and shown, one for raising the foot or presser, and a second acted upon by a cam for keeping the foot down. This second spring yields slightly to accommodate different thicknesses of fabric. Instead of two springs, only one is now generally used, and this merely for holding down the foot or presser. Also in many machines this spring is so adjusted that the amount of pressure may be varied at pleasure, a heavy pressure being required for heavy work, and a light pressure for light work. As a spring for holding down the presser foot is not used in some machines, it cannot be regarded as an essential part of the combination. The chief objection against it is, that the foot does not readily and easily admit under it seams and thicker portions of the fabric. The cloth generally requires to be pulled or assisted in sewing over a seam, and there is a risk of bending and breaking the needle, also the stitches are likely to vary in length. An improvement in this portion of the machine appears desirable. The vibrating spring presser acting in combination with a feeding apparatus below the work-table has been proposed and frequently tried, but with only partial success. It introduces additional machinery, and produces no better result than the noisy, and in many other respects objectionable, top-feed. If the advantages of the present stationary top-presser and the top-feed could be combined, the change would add greatly to the value of the machine.

The mode of moving the cloth or the feed used in the first sewing machines was by hand, or by two rollers, from one of which the cloth was wound to the other, or by a frame or baster plate, to which the cloth was permanently attached. In Magnin's (1848) and Thomas and Marsh's (1849) machines the cloth had to be moved by hand, though in the latter it was held as at present. Hence the regularity and uniformity of the stitching depended altogether upon the care and skill of the operator. In Duncan's machine (1804) the cloth could be moved in any direction, and to any distance required for producing long or short stitches, by means of rollers placed in a sliding frame. Cloth rollers, sliding horizontally and longitudinally in frames, were also employed in Fisher and Gibbons' machine (1844). In Howe's machine (1846) the work was attached to a baster plate, which was either straight or curved according to the kind of seam required. These methods were, however, defective. When the cloth was moved by hand the stitches were not uniform in length; when it was moved by means of rollers or a baster-plate, curves and angles could not be formed (as the sewing progressed) with that regularity and rapidity which was necessary to make the machine sufficiently profitable. These defects were remedied in two of the machines introduced into England by Charles Morey in 1849 In his No. 3 machine the cloth was fastened upon pins projecting from a wheel which revolved and carried forward the cloth, step by step, as required for making stitches of uniform length. In Morey's No. 4 machine the cloth was moved by means of a serrated roughened plate, which moved back and forward below the cloth. Whilst the needle was in the cloth the latter could not move, and the feed bar made its backward movement; and when the needle was out of the cloth, the teeth or rough surface of the bar caught and carried the cloth forward. The distance traversed by this feed-bar, and consequently the length of stitch, was regulated as at present, by an adjustable stop at the end of the feed-bar. The transition from the two modes of moving the cloth described in this patent to the wheel feed and the four-motion feed now used in almost all sewing machines was natural and easy. Both these latter modes were first used in American machines introduced into this country in 1852. The machines shown at the Exhibition in Hyde Park were not made upon this improved model; in them the apparatus for moving the cloth, the mode of moving the shuttle, and other details, were so defective that none like them have ever been used in Great Britain. The mode of moving the cloth by means of the needle was invented in the United States in 1847, and was patented in this country in 1853. It is now used in two varieties of machines which make the double-thread chain stitch. This arrangement possesses one advantage: it simplifies the machine. It is objectionable, however, on account of the strain upon the needle, and the tendency in some kinds of fabrics to enlarge the hole formed by the needle. The top-feed as used in Thomas's and several other machines has neither of these drawbacks, and is generally acknowledged to be the best for stitching over seams and for turning corners rapidly. It was first patented in 1853 (W. F. Thomas, April 27th, 1853). One modification of the top-feed, which has for several years been in common use in France, deserves notice. The apparatus for moving the presser foot is so arranged that without reversing the direction in which the machine is working (a plan very recently introduced into some machines now on sale in England), or without turning the fabric by the hand, the work is carried in any direction, and angles and curves are formed readily by turning the feeding apparatus. This plan appears to be better, though the machinery is necessarily more complicated than the double action of the feeding apparatus now common in England and America in machines for bootmakers, tailors, &c.

We may here state as a fact interesting to the public generally, and especially to inventors, that during the past four years (1858 to 1861 inclusive) upwards of £20,000 have been expended in the United States in litigation regarding the very simple apparatus now used for moving the cloth in sewing machines. So essential to the perfection of the machine is this improvement considered to be, and so valuable to the manufacturers who claim the original patents. We commend the fact to the notice of those who imagine that the American system of preliminary examination of patent claims would, if introduced into this country, diminish the number or lessen the cost of our patent suits.

In all sewing machines, whether using one or more threads, some kind of apparatus for producing a tension or drag upon the thread is indispensable. This tension can be obtained by only two modes, either by friction or pressure upon the thread itself, or upon the spool or bobbin which carries it. In either case, the mechanical contrivances required are so simple and obvious that they are scarcely susceptible of improvement, and have no history. The chief objection against obtaining tension by friction or pressure upon the bobbin is that it varies with the diameter of the bobbin. Probably the best method of overcoming this difficulty is to apply pressure by a spring acting directly upon the thread on the bobbin, and as the pressure of this spring (when properly adjusted) diminishes as the leverage decreases, the drag upon the thread is uniform. Another method is to pass the thread around a pulley, and to apply tension to this pulley. As the drag occasioned by the weight of the bobbin is very slight, compared with the tension upon this intermediate pulley, the whole tension upon the thread is very nearly uniform. In most machines tension is produced by the second method, that is, by pressure or friction upon the thread itself. To this arrangement the obvious objection is that it flattens and wears the thread, and

when the latter has to pass between two surfaces or through any small opening, irregularities and knots in the thread cause irregular work and the breaking of the thread. This objection is, however, of little value, and is constantly becoming of less importance, as cotton, silk, and linen thread are now made much more uniform in thickness and stronger and smoother than before the introduction of sewing machines, and improvements are being always made in their manufacture.

The advantages of a uniform tension, and the difficulty of obtaining it, are most obvious in machines making the lock or shuttle stitch; but into the details of improvements made in this portion of the machine we need not now enter.

Besides the apparatus for preventing the thread running off the bobbin too rapidly, a contrivance is required for taking up the slack thread and tightening the stitch. In machines using only one thread, this object is generally effected by the hook or its equivalent which takes and opens the loop. One stitch is tightened by the formation of the succeeding stitch. The same method is adopted in some shuttle machines which employ either a hook or its equivalent solely for this purpose, or which use a hook for effecting at the same time the formation and tightening of the stitch. In most shuttle machines a separate contrivance is introduced in connection with the needle carrier to take up and tighten the upper thread. None of them, however, deserve special notice in a review of machines which is necessarily general. They are all merely modifications of the lifting rod patented by Howe (1846) for taking up the thread through the eye of the needle, and are similar in operation to the pull given by the human hand in sewing.

As only one variety of single-thread sewing machines is sold at present in Great Britain, we do not think it necessary to examine the hundreds of methods proposed for making the tambour or chain-stitch. Though Duncan's tambouring machine was patented in England in 1804, and though the demand for machines of this class is considerable, none are manufactured at present in Great Britain. All now sold in this country are imported from the United States. The stitch in these machines is made by a revolving hook, which takes the thread from the needle, opens the loop, and keeps it open until the needle again descends through the fabric and through the open loop. The combination of an eye-pointed needle, with a hook for forming a tambour or chain-stitch, was first patented in England, in 1841, by Newton and Archbold; the revolving looper (used in Willcox and Gibbs' machine) was introduced in 1857, and it is so simple in construction, and so well adapted for high speed, that it cannot be surpassed or equalled: in principle it is perfect.

In machines making the two-thread chain-stitch the lower thread is used direct from the ordinary reels or bobbins, and a loop of it is passed through the loop of the upper thread by means of a curved or straight eye-pointed needle or its equivalent. The original patentees of the machine making this kind of stitch were Fisher and Gibbons (Dec. 7th, 1844). Many varieties of it are now in the market. As the seam produced is remarkably strong and elastic, machines of this class are better adapted for many kinds of work than those using less thread; they are also well fitted for embroidering and ornamental purposes; they can be made and sold at very moderate prices, and may be worked at a very high speed. But as they consume unnecessarily a large quantity of thread, and make a seam which is unsightly in appearance, and liable to rip when one stitch is broken, they are unsuited for common use. They are defective in principle, and, as other classes of sewing machines are improved, they are likely to become less popular as sewing machines, and may come to be used merely as embroidering machines.

In machines making the lock stitch the lower thread is carried in a movable or stationary shuttle, thus making two classes of lock-stitch machines. Many different sizes and forms of shuttles have been tried since Fisher and Gibbons first patented their machine, with a double-pointed shuttle (1841); but all now in use are similar in principle to Howe's (1846), and the differences in their construction are of secondary importance. In Howe's, Singer's, Thomas's, Simpson's, Finkles', &c., machines, the shuttle is a semi-cylindrical case, pointed at one end and nearly flat at the other. Inside this case the reel is placed longitudinally, and tension is applied to both reel and thread, but chiefly to the latter, by passing it through holes in the sides of the case. Different modes of carrying and driving the shuttle have been proposed and adopted; the most common method is by a cam on the main shaft, or by a crank and connecting rod. To make stitches on this principle a shuttle case, a reel, a shuttle driver or carrier, a shuttle race, and some apparatus for giving motion to the shuttle, are indispensable. Besides the large number of pieces required to make the stitch, this arrangement has another and greater drawback, namely, only a small quantity of thread can be used in the shuttle at a time, and the motion given to it, being reciprocating, is likely to cause noise. These objections cannot be altogether and permanently removed, either by superior workmanship or improvements in details. Shuttles are necessarily limited in size by the power required to drive them, by the extra wear and noise which would not be admissible for many purposes, and by the friction on the loop of the upper thread. These defects appear to be inherent in machines with movable shuttles, and manufacturers must soon reach the limit of improvements upon them. Shuttles larger than those now used, simpler means of driving them, and better methods of giving tension to the shuttle thread may be introduced; but in all machines of this class there must be a considerable loss of time in taking out, filling, threading, and replacing the shuttle.

Machines using a stationary shuttle or bobbin undoubtedly possess most advantages. The rotating bobbin, similar to that used in lace machines, is simpler in construction, cheaper, more durable, easier to fill and to place in the machine, and holds a larger quantity of thread than the reciprocating shuttle; and less power is required to draw the upper thread over and around the bobbin than to drive the shuttle backwards and forwards. Fewer pieces are needed, there is no reciprocating motion, and the machine is, therefore, simpler in construction and easier and quieter in its movements. The needle does not pause or rest during its stroke; the hook which carries the upper thread around the lower one serves also to tighten the stitch; and no lifting rod or take up is required as in shuttle machines. Hence bobbin machines, as we may call them, are unrivalled for durability, quietness of action, speed, and excellence of work. Those hitherto constructed upon this principle have not been adapted for stitching leather and similar heavy materials. To this rule there may be exceptions (such as Jackson's machine, illustrated in The Engineer of August 24th, 1860 (vol. x., p. 126), but the capabilities of such exceptional machines have not been proved by experiments so lengthened and varied as to gain the confidence of the public.

LETTERS TO THE EDITOR.

We do not hold ourselves responsible for the opinions of our Correspondents.)

THE BESSEMER PROCESS.

Sir,—As this process seems to attract at present a great deal of notice, it may interest parties wishing to adopt it to learn how the question of patent rights really stands as regards the pneumatic process, and I have, therefore, briefly reviewed these matters, and now proceed to give my deductions therefrom.

In his patent, No. 2,321, dated 17th October, 1855, Bessemer claims the forcing of currents of air, or of steam, or of air and steam into and among the particles of molten crude iron, or of re-melted pig or refined iron until the metal so treated is thereby rendered malleable, and has acquired other properties common to cast steel, and still retaining the fluid state of such metal. The patentee here claims to make crude iron malleable by forcing air, or steam, or air and steam jointly, amongst the molten particles of the crude iron. Now, it can be clearly shown that one of these methods, viz., that in which steam alone is employed, wholly fails, for the effect of the application of steam is to consolidate melted crude iron long before this crude iron has been so far decarbonised as to become malleable, and it is neither rendered malleable, nor is it brought into such a state as to possess other properties common to cast steel, neither does it still retain the fluid state. Therefore, one of the patentee's methods being impracticable his patent is void.

In the same patent Bessemer states that if, during his process, "too much carbon has been driven off, an addition may be made of some melted iron from the cupola or finery." Now, it can be shown that the addition of melted iron from the cupola or finery to the decarbonised metal wholly destroys its malleability, so that the ingots or castings made from this mixture crack to pieces when it is attempted to roll or hammer them into bars. When, however, a pure alloy of iron and manganese containing also carbon, such as is known in commerce as spiegel eisen, is added to the decarbonised metal, then the mixture is rendered perfectly malleable and ductile. Now, the patentee has here either in ignorance claimed the use of ordinary cast iron to recarbonise his decarbonised metal, taking it for granted that it would answer the purpose intended without destroying the malleability of the mixture, or he has neglected to specify the fact that only one kind of cast iron, viz., spiegel eisen, being an alloy of iron and manganese, will recarbonise the metal and confer upon it ductility under the hammer. On the former supposition the patentee's claim fails, because he has claimed the addition of cast iron in general, whilst in fact, only one particular variety of cast iron can be successfully used, and which is a special alloy of manganese and iron; and on the second supposition his claim is void, because he has not specified the one particular and remarkable variety of cast iron which alone can be successfully employed in the patented process to recarbonise his metal.

In patent No. 2,678, dated 7th December, 1855, Bessemer claims "the recarbonisation of his decarbonised crude iron, and the preparing it for foundry purposes by forcing into the decarbonised metal carbonaceous gases, or carbonaceous matters;" and he states that by the use of solid carbonaceous matters forced beneath the surface of the decarbonised crude iron the said decarbonised crude iron may be recarbonised, and a very pure quality of foundry iron may be thus obtained. Now, actual experiments show that neither the forcing of carbonaceous gas amongst the particles of melted decarbonised crude iron, nor the forcing of solid carbonaceous matters, such as billets of dry wood, underneath the surface of the said decarbonised crude iron, does in the least degree recarbonise the metal, or bring it into the state of foundry iron. The patentee, therefore, has distinctly claimed two methods of recarbonising his decarbonised metal, both of which fail wholly to effect the object he has in view. Therefore this patent also is void.

Moreover, the patentee states "that, if steam be used alone towards the close of the decarbonising process, a great difficulty is experienced in maintaining the requisite heat and fluidity of the iron, which is apt to assume a pasty condition." Now the fact is that it is impossible to employ steam at all towards the close of the operation, for the action of the steam is to consolidate the metal instantaneously, and the practice of the patentee, who does not employ steam at all, clearly indicates that it does not answer, though he professes in his patent that its use assists in the removal of sulphur from the iron. Finding out that his claim, in the patent of 17th October, 1855, to make crude iron malleable by forcing steam through it was untenable, and, in practice, impossible, the patentee endeavours to qualify this fatal error by stating, in his patent of 7th December, 1855, that he prefers to use steam only during the earlier part of his process. This afterthought merely confirms the invalidity of both these patents. Also, with strange inconsistency, the patentee, in his sixth claim in patent of 7th December, 1855, actually claims the forcing of steam through melted crude iron until the metal so treated is converted into malleable iron whilst still retaining a fluid state, and which is claiming to practise that which is impossible: so on this ground, also, the patent is void.

In his patent, dated 12th February, 1856, Bessemer merely claims what he had already claimed in his untenable patents of 17th October and 7th December, 1855, confining himself, however, to the use of air only in his process, and endeavouring to stamp a novelty upon the claim, by stating that he has discovered that the air thus forced into the crude iron produces a vivid combustion, and therefore intense heat, so that no fuel but the iron and carbon of the iron itself is required in order to keep the iron fluid till the operation is completed. That the patentee was previously quite aware of this vivid combustion is palpable from his description of it in his specification of the 17th October and 7th December, 1855, so that it could have been no novelty to him at 12th February, 1856. He also claims to carry his invention out without the use of fuel for re-heating, or continuing to heat the crude molten metal, whereas the fact is that he employs the carbon of the iron, and towards the close of the operation the iron itself, as the fuel, which continues to heat the iron, so that at last the iron, in its malleable state, is heated so as to be in a liquid and molten state, and by prolonging the process the whole of the iron may be consumed as fuel, with a constantly increasing development of heat. Crude iron is carbonaceous matter, and when burnt it is, to all intents and purposes, fuel. To have been valid, the patentee's claim should have been for continuing and maintaining the heat requisite to retain steel or malleable iron in a liquid state, with no other fuel than the carbon and iron operated upon, and the oxygen of the atmosphere. Moreover, in his specification of 17th October, 1855, Bessemer distinctly states that he does not confine himself to the precise details he has therein given of his invention, but that all he claims is the forcing of air, or of steam, or of both, jointly, into and among the particles of crude molten iron, until the metal thus treated is rendered malleable; and he does not add that he requires, or that he does not require, fuel for this purpose, more or less than that supplied by the combustion of the iron and carbon, so that in effect the claim here is either for using fuel, or not using fuel, as the operator may think fit; and in his patent of 12th February, 1856, the patentee merely claims one of these methods, viz., that which employs no other fuel than that of the iron and its carbon. Therefore if, as has been shown, the patents of 17th October and 7th December, 1855, are void, the patent of 12th February, 1856, which is a mere partial repetition of that of 17th October, 1855, is necessarily also void, and Bessemer's subsequent patents, built upon the same defective foundation, are alike invalidated.

Martien's claim, also, of 15th September, 1855, for forcing air or steam, or both jointly, amongst the particles of molten crude iron prior to the congelation of the said liquid or melted metal in the form of pigs or otherwise is, of course, precisely Bessemer's claim of 17th October, 1855. Continued for a short time Martien's process would slightly purify and decarbonise the crude iron, and it might be moulded into pigs. By a longer continuation of his process the crude iron would be first steelified and then reduced to the state of malleable iron prior to congelation, and would then be fitted not to mould into pigs, but otherwise into ingots.

Bessemer's claims, therefore, are not original, and in his specifications he has claimed what is impracticable, so that they are manifestly invalid and untenable.

W. S. P.

Collieries in the United Kingdom.—The number of collieries in the United Kingdom is stated, in the latest published returns, to be 2,949, and the quantity of coals raised annually 72 million tons. Of that number 2,020 are in England, 443 in Wales, 413 in Scotland, and 73 in Ireland. Of that quantity Northumberland and Durham, from 283 mines, raised 16 million tons; Lancashire, from 381 mines, 10⅝ million; York, from 383 mines, 8¼ million; Stafford and Worcestershire, from 549 mines, 6⅛ million; Derby, Nottingham, Leicester, and Warwick, from 205 mines, 5⅜ million; Shropshire and Cheshire, from 94 mines, 1½ million; Gloucester, Somerset, and Devon, from 97 mines, 1½ million; and Cumberland, from 28 mines, 1 million tons. Of the 443 in Wales 81 mines in the northern districts produced 1⅝ million tons; and 362, in the southern portion of the principality, 9½ million tons. The estimated value, at the pits, of the whole produce of these 2,949 mines is set down at 17½ million sterling.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

2893. Pierre André, Jean Francois Pline-Faurie, and Joseph Pierre Richard, Bordeaux, France, "Improvements in machinery or apparatus for preparing or manufacturing fuel."—*Petition recorded 18th November*, 1861.

3165. John Platt and William Richardson, Oldham, Lancashire, "Improvements in machinery or apparatus commonly called 'gins' for cleaning cotton from seeds."—*Petition recorded 17th December*, 1861.

35. Henry Davis Pochin, Salford, Lancashire, "Improvements in the manufacture of resin, soap, or size."—*Petition recorded 4th January*, 1862.

93. William Edward Gedge, Wellington-street, Strand, London, "Improved means or apparatus for gaining or acquiring motive power."—A communication from Hugus Sarrazin, Passage de Petites Ecuries, Paris.—*Petition recorded 13th January*, 1862.

145. Andrew Lamb, Southampton, and John White, West Cowes, Isle of Wight, "Improvements in lifeboats."—*Petition recorded 20th January*, 1862.

235. William Clark, Chancery-lane, London, "Improvements in the disintegration and bleaching of textile materials for the manufacture of paper."—A communication from Jean Baptiste Michel Auguste Siry, Boulevart St. Martin, Paris.—*Petition recorded 29th January*, 1862.

257. Hermann Schattes, Hesse Cassel, "Improvements in the manufacture or construction of gas meters."—*Petition recorded 31st January*, 1862.

279. William Clark, Chancery-lane, London, "Improvements in machinery or apparatus for the manufacture of fe-tooned edging or material"—A communication from Jean Joseph Basset, Boulevart St. Martin, Paris.—*Petition recorded 1st February*, 1862.

289. Thomas Mosson Meekins, LL.D., Chancery-lane, London, "The production of a projectile and explosive force to be used in instruments of war, for an electric-gas-gun and electric-gas-shell, for a method of using the recoil of weapons for the purpose of increasing the pressure of elastic fluids, for the production of a projectile, force for a method of rapidly loading weapons at the breech, and of a motive force to be used in an electric-gas engine or other engines."—*Petition recorded 4th February*, 1862.

328. John Lloyd, Donnington, Shropshire, "Improvements in buffers for engines and carriages on railways."—*Petition recorded 7th February*, 1862.

347. William Clark, Chancery-lane, London, "Improvements in reflectors."—A communiction from Louis Jacques Château, Boulevart St. Martin, Paris.

349. William Clark, Chancery-lane, London, "Improvements in refining cast iron, wrought, and other malleable iron, and in the cementation of iron."—A communication from Messrs. Louis Joseph Frederic Marguerette and Alfred Laloueë de Sourdeval, Boulevart St. Martin, Paris.—*Petitions recorded 10th February*, 1862.

389. George Crisp Burrows, Stoke Holy Cross, Norfolk, "Improvements in lounges, seats, or other apparatus for sitting or reclining on, which improvements are also applicable to rocking horses."—*Petition recorded 13th February*, 1862.

435. Charles Thomas Marzetti and John Watson, Vine-street, Minories, London, "Improvements in machinery or apparatus for raising, lowering, and otherwise moving or disposing casks and other bodies."—*Petition recorded 17th February*, 1862.

459. James Spence, Liverpool, "Improved apparatus for transhipping and discharging grain and other substances, and for weighing, screening, and fanning such grain and substances during such transhipment and discharge."—Partly a communication from Thomas Richardson, New York, U.S.

467. William McAdam and William Chrystal, Glasgow, Lanarkshire, N.B., "Improvements in sheaves or pulleys, journals, bushes, and other similar bearing or rubbing surfaces."—*Petitions recorded 21st February*, 1862.

469. Horace Chavasse, Timothy Morris, and George Battison Haines, Birmingham, "An improvement or improvements in the manufacture and ornamentation of metallic bedsteads, part of which is also applicable to other articles."

471. William Henry Ross, Liverpool, "Improvements in the manufacture of sugar."—A communication from Edward Beanes, Havannah, Cuba.—*Petitions recorded 22nd February*, 1862.

489. Richard Waller, Baker-street, Portman-square, London, "Improvements in machinery and apparatus for joining leather and flexible and textile materials, and for the manufacture of boots and shoes and other coverings for the feet."—*Petition recorded 24th February*, 1862.

499. John Carnaby, Skinner-street, London, "Improvements in turning, managing, and regulating the taps and valves of gas pipes."—*Petition recorded 25th February*, 1862.

516. Alfred Green, Rose Cottage, North-road, Forest-hill, Lewisham, Kent, "Improvements in the method of, and apparatus for, bordering paper envelopes and cards with black or coloured borders."

519. George Rees, Goswell-road, Clerkenwell, London, "Improvements in the construction of marine sub-ways."—*Petitions recorded 26th February*, 1862.

551. Richard Archibald Brooman, Fleet-street, London, "Improvements in the manufacture of hats and bonnets."—A communication from Messrs. Louis Pierre Quenot and Henry Joseph Lebargy, Paris.—*Petition recorded 28th February*, 1862.

555. James Sim, Aberdeen, N.B., "Improvements in the construction of gas meters."

556. Henry Charles Muller, Russell-place, New North-road, London, "Improvements in the manufacture of imitation bear skin caps."

559. Pierre Joseph Guyet, Paris, "Improvements in taps or valves."—*Petitions recorded 1st March*, 1862.

578. Thomas Tillam, Church-street, Deptford-green, Kent, "An improved method of purifying gas."—*Petition recorded 3rd March*, 1862.

583. John Gjers, Middlesborough, North Riding, Yorkshire, "A material or sand for the formation of moulds for casting iron and for other like purposes."

586. James Ellis, Petersham, Surrey, "Improvements in hooks and swivels for fastening chains of all sizes, and for other similar purposes."

592. George Hallen Cottam and Henry Richard Cottam, St. Pancras Ironworks, Old St. Pancras-road, London, "Improvements in horticultural buildings, and other glazed structures."—*Petitions recorded 4th March*, 1862.

595. John Sidebottom, Harewood, near Mottram, Cheshire, "Improvements in fire-arms and ordnance, and in projectiles."

597. John Somervill and Robert Miller Somervill, Netherfield, Westmoreland, and Marius Blanc, Birmingham, "Certain improvements in the manufacture of boots and shoes."

599. John Chubb, St. Paul's Church-yard, London, and Henry Mortimer Burton, John's-place, Holland street, Southwark, Surrey, "Improvements in apparatus for displaying or exhibiting jewellery and other valuable articles in glass cases."

601. Edward Partington, Heap Bridge, Lancashire, "Certain improvements in the method of cleansing and preparing rags or other materials used in the manufacture of paper, and in machinery or apparatus connected therewith."

603. William Edward Newton, Chancery-lane, London, "An improved process and apparatus for reducing wood, straw, and other vegetable substances to pulp for the manufacture of paper."—A communication from John Reynolds, New York U.S.—*Petitions recorded 5th March*, 1862.

607. John George Shipley, Regent-street, London, "Improvements in bridle-heads, reins, and bits."

609. Thomas Farrimond, Manchester, "An improved safety cage for mines."

613. Thomas Ball, William Ball, and John Wilkins, Broadway, Nottingham, "Improvements in the manufacture of warp fabrics in warp machines."

616. Richard Restell, Croydon, Surrey, "Improvements in apparatuses for connecting and disconnecting carriages and engines on railways, as also signal lines between guard and driver."

617. Thomas Henton Wood, Blackweir, Glamorganshire, "Improvements in apparatus employed in the manufacture of artificial fuel."—*Petitions recorded 7th March*, 1862.

621. George Edmonson, Queenwood, Southampton, "Improvements in washing machines."

623. William Paterson, William A. Sanderson, and Robert Sanderson, jun., Gala Mills, Galashiels, Selkirk, N.B., "Improvements in finishing woven fabrics."

627. William Noy Wilkins, St. John's-wood, London, "Improvements in the manufacture of pigments for oil and water colours."

629. Samuel Grice, Birmingham, "An improvement or improvements in propellers for propelling ships and boats and other vessels."

631. William Palmer, Bell House, Southweald, Essex, "Improvements in the manufacture of candles."

633. Frederic Newton Gisborne, Adelaide-place, London Bridge, and Henry Wickens, Tokenhouse-yard, Bank, London, "Improvements in the means of indicating the presence of fire-damp or choke-damp in mines, and of dispersing fire damp, and also of telegraphing in mines."

635. Francis Robert Newton and Hiram Cole, Esher-street, Westminster, "An apparatus for indicating and measuring the flow of liquid."—*Petitions recorded 8th March*, 1862.

637. Marc Antoine Francois Menons, Rue de l'Echiquier, Paris, "Improvements in breech loading fire arms."—A communication from Sallouna Dahdah, St. Maur, France.

641. William Parker and George Henry Batman, Copmanthorpe, Yorkshire, "Improvements in steam engines."

643. William John Bennett, Millbank-street, Westminster, "An improved solution or preparation to be used with Portland and other cements for the production of artificial stone, or for building purposes."

645. William Samuel Nosworthy, Coleman-street, London, "Improvements in upright and horizontal pianofortes."
647. Jean Baptiste Gabriel Marie Frederic Piret, Boulevart St. Martin, Paris, "Improvements in lubricating apparatus."
649. Michael Henry, Fleet-street, London, "An improvement in preparing books and eyes for sale or consumption."—A communication from the Société Gingembre et Damiron, Paris.—*Petitions recorded* 10*th March*, 1862.
651. Robert Peacock, Manchester, "Improvements in the manufacture of window blinds."
653. Edward Parfit, Drury-lane, London, "A watch protector."
655. Edward Humphrys, Deptford, Kent, "Improvements in steam engines."
657. Edwin Gillard Camp, Bristol, "Improvements in brushes or apparatus for brushing."
659. Henry Baynes, Clement's-lane, London, "An improvement in bankers' cheque books."
661. Richard Smith, Glasgow, Lanarkshire, N.B., "Improvements in telegraph posts."
663. William Clark, Chancery-lane, London, "Improvements in apparatus for effecting submarine operations."—A communication from Olivier Ilon, Boulevart St. Martin, Paris.—*Petitions recorded* 11*th March*, 1862.
664. Alphonse Irene Le Mire de Normandy, Odin Lodge, King's-road, Clapham Park, Surrey, "An improved method of connecting gas and other pipes."
667. William Henry Latham and Frederick Cartwright Ward Latham, Bolton, Lancashire, "Certain improvements in machinery or apparatus for perforating and numbering paper or other substances to be employed as 'tickets,' or where other 'counter registration' is required."
669. Archibald Watson, Glasgow, Lanarkshire, N.B., "Improvements in hot-pressing apparatus."
671. William Conyers, Leeds Bridge, Leeds, Yorkshire, "Improvements in currying leather."
675. William Clark, Chancery-lane, London, "Improvements in the manufacture of coloured inks."—A communication from Annet Jacques Nadaud, Boulevart St. Martin, Paris.
677. John Edwin Grindale, Oxford-street, London, "Improvements in photographic cameras, and in the mode of fixing the lens therein."
679. William Edward Newton, Chancery-lane, London, "Improvements in the manufacture of cartridges."—A communication from Elam Potter and Julius Pomeroy, New York, U.S.—*Petitions recorded* 12*th March*, 1862.
688. John Howard and John Bullough, Accrington, Lancashire, "Improvements in warping and beaming machines."
691. Richard Archibald Brooman, Fleet-street, London, "Improvements in apparatuses for measuring and regulating the flow and pressure of gas, parts of which are applicable to hydraulic receivers and to steam generators."—A communication from Jean Claude Garnier, Paris.
709. John Kent, Hyson-green, Nottingham, "Improvements in cleansing and bleaching."—Partly a communication from Theodor Schnebely, Moscow, Russia.—*Petitions recorded* 13*th March*, 1862.
706. Ludwig Gallee, Bernard-street, and Maximilian Zingler, Granville-street, London, "Improvements in manufacturing articles from ivory and bone."
708. Alexander John Paterson, Edinburgh, "Improvements in the construction of electric telegraph cables."—*Petitions recorded* 14*th March*, 1862.
712. William Clark, Chancery-lane, London, "An improved brake for railroad carriages."—A communication from Augustine Irel Ambler, Roseline Nancy Ambler, and Warwick Martin, Milwaukee, Wisconsin, U.S.
720. Henry Young Darracott Scott, Brompton Barracks, near Chatham, Kent, "Improvements in the manufacture of cement."
722. John Avery, Mark-lane, London, "Improvements in purifying coal."—A communication from John Reed, New York, U.S.
724. James Robey, Hereford-road North, London, "Improvements in manufacturing and refining sugar, and in apparatus employed therein."
726. John Tomlinson Pendlebury and Thomas Pendlebury, Bury, Lancashire, "An improved form of lubricator."—*Petitions recorded* 15*th March*, 1862.
730. William Bury Lord, Plymouth, Devonshire, and Frederic Hughes Gilbart, Brixton, Surrey, "Improved means or apparatus for raising, lowering, and releasing ships' boats or other heavy bodies."
732. William Bowser, Glasgow, Lanarkshire, N.B., "Improvements in ships' fire hearths or boiling and cooking apparatus."
734. John Weems and William Weems, Johnstone, Renfrewshire, N.B., "Improvements in apparatus for indicating the pressure or quantity, and in regulating the discharge of fluids."
736. William Barford, Peterborough, Northamptonshire, "Improvements in rollers for rolling land."
738. George Tomlinson Bousfield, Loughborough Park, Brixton, Surrey, "Improvements in cranks for driving sewing machines and other machinery."—A communication from Turner Williams, Providence, Rhode Island, U.S.
740. James Hicks, Hatton-garden, London, "Improvements in mercurial barometers."
744. Thomas Myers, Brighton, Sussex, "Improvements in meters for measuring water, gas, or other fluids."—*Petitions recorded* 17*th March*, 1862.
748. Marc Antoine Francois Mennons, Rue de l'Echiquier, Paris, "An improved needle threading apparatus."—A communication from Jules Fouquet, Rue de Vaux, Vitry-le-Francois, France.
752. William Tongue, Bradford, Yorkshire, "Improvements in machinery and in processes for preparing, heckling, dressing, and combing flax, hemp, silk, and other fibrous materials."
756. Joseph Anthony Ronketti, Northampton-road, Clerkenwell, London, "Improvements in meteorological instruments and thermometers."
758. Samuel Slack, West-street, New Sneiton, Sneiton, Nottinghamshire, "Improvements in the manufacture of stockings and other fabrics in circular knitting machines."
760. Richard Archibald Brooman, Fleet-street, London, "Improvements in the manufacture of barytes and barytic products, and the application of these substances in the manufacture of sugar and other uses."—A communication from Alfred Delaune, Paris.—*Petitions recorded* 18*th March*, 1862.
762. Alfred Krupp, Essen, Rhenish Prussia, "Certain improvements in the method of manufacturing shafts for steam boats and other purposes."
764. Spendlove Desborough, Noble-street, St. Martin's-le-Grand, London, "Improvements in the manufacture or construction of sewing or other needles."
766. Sampson Moore, Liverpool, "Certain improvements in machinery for compressing and cutting tobacco."
768. Richard Archibald Brooman, Fleet-street, London, "Improvements in re-producing or in producing copies of guipure, lace, embroidery, and other like articles."—A communication from Rosalie Clementine Tillard, Paris.
770. Richard Archibald Brooman, Fleet-street, London, "Improvements in apparatuses for drawing in and paying out chain cables, applicable to windlasses and capstans."—A communication from Jean Salette, Marseilles, France.—*Petitions recorded* 19*th March*, 1862.
776. Robert Martin Roberts, Kensington, Middlesex, "Improvements in obtaining and applying motive power."—*Petition recorded* 20*th March*, 1862.

Invention Protected for Six Months by the Deposit of a Complete Specification.

818. Marc Antoine Francois Mennons, Rue de l'Echiquier, Paris, "Certain improvements in machinery for the production of ornamental stitching or embroidery."—A communication from Paul Nicolas Legris, Jallaucourt, Delme, France.—*Deposited and recorded* 24*th March*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

705. Mark Firth, Sheffield, Yorkshire.—A communication from E. T. Jones, Montreal.—Dated 26th March, 1859.
708. Matthew Andrew Muir and James McIlwham, Glasgow, Lanarkshire, N.B.—Dated 24th March, 1859.
781. John William Kelly, Ennis, Clare Ireland.—Dated 29th March, 1859.
785. Isaac Speight, Glandford Briggs, Lincolnshire.—Dated 29th March, 1859.
775. Thomas Carr, Pebington, Cheshire.—Dated 29th March, 1859.
785. Thomas Taylor, Vere-street, London.—Dated 29th March, 1859.
798. Cowper Phipps Coles Southsea, Hampshire.—Dated 30th March, 1859.
805. Thomas Ivory, Edinburgh.—Dated 31st March, 1859.
809. Samuel Stephen Bateson, Pelham-street, Mayfair, London.—Dated 31st March 1859.
836. Joseph Eccles, Blackburn, Lancashire.—Dated 4th April, 1859.
780. William Mossman, Cumming-street, Pentonville, Clerkenwell, London.—Dated 29th March, 1859.
809. Alfred Vincent Newton, Chancery-lane, London.—A communication from H. C. Sergeant, United States. Dated 30th March, 1859.
851. Leonard Brierley and Henry Gerring, Birmingham.—Dated 5th April, 1859.

Patents on which the Stamp Duty of £100 has been paid.

664. John Henry Johnson, Lincoln's-inn fields, London.—A communication from Jean Jacques Alexandre Lallier, Enveux, and Francois Jules Vignaud, Paris.—Dated 26th March, 1855.
699. William Tytherleigh, Birmingham.—Dated 26th March, 1855.
703. John McKinnell, Glasgow, Lanarkshire, N.B.—Dated 26th March, 1855.

Notices to Proceed.

830. James Moore Clements, Birmingham, "Improvements in the making or manufacturing of certain parts of garments for either sex, likewise in the manner of preparing the same for sale, as also an improved button, to be attached to garments without sewing."
2893. Pierre André, Jean Francois Pline Faurie, and Joseph Pierre Richard, Bordeaux, France, "Improvements in machinery or apparatus for preparing or manufacturing fuel."
2895. Martin Dadd Rogers, Bow-lane Cottages, St. Leonard's-road, Bromley, London, "An improved chain cable stopper or controller."—*Petitions recorded* 18*th November*, 1861.
2904. Jesse Lee, Church Gate, Leicester, "Improvements in the construction of the wheels of traction engines, and in the mode of adaptation to such engines."—*Petition recorded* 19*th November*, 1861.
2915. Joseph Cooper Crockford, Chapel-row, Exmouth-street, Clerkenwell, London, "An improved mode of fastening doors, and for other similar purposes."
2916. William Podmore Baylis, Lloyds, Madeley, Shropshire, "Improvements applicable to buildings in order to facilitate the extinguishing of any conflagration which may happen therein."
2917. Francis Puls, Francis-terrace, Hackney-wick, London, "Improvements in treating fatty and oily matters."—*Petitions recorded* 20*th November*, 1861.
2923. James Harrow Jeffs, Tottenham-court-road, London, "Improvements in the manufacture of collars, shirt-fronts, cuffs, hats, bonnets, vests, and other articles of wearing apparel."
2928. William Edward Newton, Chancery-lane, London, "Improvements in rotary engines."—A communication from John Benjamin Root, New York, U.S.—*Petitions recorded* 21*st November*, 1861.
2931. Alfred Fernandez Yarrow, Arundel-square, Barnsbury, and James Brackebridge Hilditch, Barnsbury-villas, London, "Improvements in locomotive steam carriages for common roads."
2933. Renil De Clercq and Emile Chazelles, Brussels, Belgium, "Improvements in apparatus for raising and supplying water to boilers, and for other purposes."
2939. William Evans, Commercial-road East, London, "Improvements in obtaining motive power by machinery."—*Petitions recorded* 22*nd November*, 1861.
2944. John Weems, Johnstone, Renfrewshire, N.B., "Improvements in the manufacture of metallic tubes, and in coating or plating metals."
2948. William Bray, Abinger-road, Lower-road, Deptford, Kent, "An improved locomotive apparatus, particularly adapted to agricultural purposes."
2950. Feodor De Wylde, Great College street, Camden-town, London, "Improvements in paper-making machinery."—A communication from Luis Dupont, Nancy, France.—*Petitions recorded* 23*rd November*, 1861.
2952. Jean Baptiste Hulard and Louis Guillaume Poupel, Paris, "An improved process for hardening stones and plaster of Paris, and making them impervious to water."
2957. William Burgess, Newgate-street, London, "Improvements in reaping and mowing machines."
2960. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in machinery or apparatus for shelling and cleaning rice and other grain."—A communication from Wellington Lee, New York, U.S.
2964. Phineas Cowan, Barnes, Surrey, "A mode of utilising the waste heat of furnaces used in re-burning animal charcoal."—*Petitions recorded* 27*th November*, 1861.
2969. Robert Harcourt, Birmingham, "An improvement or improvements in fastening knobs to doors, drawers, and other articles, and in connecting knobs to spindles."—*Petition recorded* 28*th November*, 1861.
2981. François Frédéric Bumarcin, Boulevard de Strasbourg, Paris, "Improvements in machines for crushing and pounding stones, ore, and other materials."
2989. Alfred Vincent Newton, Chancery-lane, London, "Improvements in mowing and reaping machinery."—A communication from William Van Anden, New York, U.S.
2991. William Clark, Chancery-lane, London, "Improvements in the construction of parts of electric telegraph bell apparatus, and in apparatus used in making the same."—A communication from Pierre Désiré Prud'homme, Boulevart St. Martin, Paris.
2994. Michael Henry, Fleet-street, London, "Improvements in the manufacture of soap, and the preparation of materials for the purpose."—A communication from Louis Marie Théophile Riot, Boulevart St. Martin, Paris.
2995. William Rowan, Belfast, Antrim, "Improvements in machines for heckling and scutching flax and other vegetable fibres."—*Petitions recorded* 27*th November*, 1861.
3006. Benjamin Pitt, Great Carter-lane, and James John Shedlock, Wendale-villas, Earl's-court, Kensington, London, "Improvements in cocks or valves for the passage of fluids."—*Petition recorded* 28*th November*, 1861.
3011. Samuel Tonks and Job Brookes, West Bromwich, Staffordshire, "Improvements in steam boiler furnaces, and in setting certain kinds of steam boilers."—*Petition recorded* 29*th November*, 1861.
3018. John William Gibson, Hammersmith Ironworks, Dublin, "Improvements in ordinance, applicable also to small arms."—*Petition recorded* 30*th November*, 1861.
3040. Henry George Hacker, Woodford Bridge, Essex, "Improvements in machinery for the manufacture of chenille and other circular pile fabrics."
3042. Robert Kennedy and James Armstrong, Lisburn, Ireland, "An improved arrangement of driving gear."—*Petitions recorded* 4*th December*, 1861.
3055. Michael Henry, Fleet-street, London, "Improvements in printing and ornamenting textile fabrics, paper hangings, and other materials, and in surfaces and apparatus for such purposes."—A communication from Alexandre Adrien Desprémane, Boulevart St. Martin, Paris.—*Petition recorded* 5*th December*, 1861.
3057. William Clark, Chancery-lane, London, "Improvements in gloves."—A communication from Alfred Alexander Abdon Cressent, Boulevard St. Martin, Paris.—*Petition recorded* 9*th December*, 1861.
3063. Joseph Antoine Jean Redier, South-street, Finsbury, London, "Some improvements in pocket watches."
3034. Victor Léon Daguzen, South-street, Finsbury, London, "Improvements in the method of paving roads and other places."—*Petitions recorded* 10*th December*, 1861.
3120. Joseph Dominique John, South Island-place, Clapham-road, Surrey, "Improvements in locomotive engines, parts of which improvements are also applicable to marine and stationary engines."—*Petition recorded* 12*th December* 1861.
3196. William Clark, Chancery-lane, London, "Improvements in apparatus for the manufacture of matches."—A communication from Messrs. Francis Lavallée and Francis Lavallée, jun., Paris.—*Petition recorded* 20*th December*, 1861.
3227. George Henry Birkbeck, Southampton-buildings, Chancery-lane, London, "Improvements in the arrangement of traction and connecting apparatus for railway carriages and trains."—A communication from M. Claude Arnoux, Paris.—*Petition recorded* 24*th December*, 1861.
3239. Thomas Silver, Philadelphia, U.S., "Improvements in apparatus for governing or regulating the speed of steam and other engines."—*Petition recorded* 27*th December*, 1861.
3271. William Edward Newton, Chancery-lane, London, "Improved apparatus for boring rocks and other mineral substances."—A communication from Emanuel Lisbet, Rue St. Sébastien, Paris.—*Petition recorded* 31*st December*, 1861.
35. Henry Davis Pochin, Salford, Lancashire, "Improvements in the manufacture of rosin, soap, or size."—*Petition recorded* 4*th January*, 1862.
189. Charles Godfrey Hall, Regent street, London, "Improvements in the manufacture of boots, shoes, and leggings."—*Petition recorded* 24*th January*, 1862.
425. James Coomber, Belfast, "Improvements in machinery for winding cops, and in the treatment of cops for warps and other purposes."—*Petitions recorded* 11*th February*, 1862.
537. James Tangye, Birmingham, "An improvement or improvements in hydraulic lifting jacks."—*Petitions recorded* 27*th February*, 1862.
544. Pierre Destaing Azemar, Paris, "An improved mechanical arrangement for the winding up and the setting of the hands of watches by means of the knob of the pendant."—*Petition recorded* 28*th February*, 1862.
555. James Sim, Aberdeen, N.B., "Improvements in the construction of gas meters."—*Petition recorded* 1*st March*, 1862.
603. William Edward Newton, Chancery-lane, "An improved process and apparatus for reducing wood, straw, and other vegetable substances to pulp, for the manufacture of paper."—A communication from John Reynolds, New York, U.S.—*Petition recorded* 5*th March*, 1862.
610. Joseph Revill, Dukinfield, Cheshire, "Improvements in securing the rails of railways and tramways to the chairs."
617. Thomas Henton Wood, Blackweir, Glamorganshire, "Improvements in apparatus employed in the manufacture of artificial fuel."—*Petitions recorded* 7*th March*, 1862.
627. William Noy Wilkins, St. John's Wood, Middlesex, "Improvements in the manufacture of pigments for oil and water colours."—*Petition recorded* 8*th March*, 1862.
650. Henry Herman Kromschroeder, Princess-terrace, Regent's Park, London, "Improvements in gas meters."—*Petition recorded* 10*th March*, 1862.
752. William Tongue, Bradford, Yorkshire, "Improvements in machinery and in processes for preparing, heckling, dressing, and combing flax, hemp, silk, and other fibrous materials."—*Petitions recorded* 13*th March*, 1862.

And notice is hereby given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days after the date of the *Gazette* (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 29th March, 1862.

1931. 6*s.* 7*d.*; 2039, 1*s.* 1*d.*; 2040, 3*d.*; 2041, 8*d.*; 2042, 6*d.*; 2043, 2*s.* 4*d.*; 2044, 3*d.*; 2045, 9*d.*; 2046, 9*d.*; 2047, 1*s.*; 2048, 5*d.*; 2049, 3*d.*; 2050, 3*d.*; 2051, 3*d.*; 2052, 3*d.*; 2053, 3*d.*; 2054, 3*d.*; 2055, 3*d.*; 2056, 9*d.*; 2057, 3*d.*; 2058, 4*d.*; 2059, 4*d.*; 2060, 3*d.*; 2061, 9*d.*; 2062, 3*d.*; 2063, 9*d.*; 2064, 8*d.*; 2065, 7*d.*; 2066, 8*d.*; 2067, 3*d.*; 2068, 3*d.*; 2069, 1*s.* 4*d.*; 2070, 3*d.*; 2071, 7*d.*; 2072, 11*d.*; 2073, 6*d.*; 2074, 4*d.*; 2075, 6*d.*; 2076, 3*d.*; 2077, 3*d.*; 2078, 1*s.* 3*d.*; 2079, 9*d.*; 2081, 3*d.*; 2082, 3*d.*; 2083, 4*d.*; 2084, 3*d.*; 2085, 3*d.*; 2086, 7*d.*; 2087, 3*d.*; 2088, 9*d.*; 2089, 7*d.*; 2090, 3*d.*; 2091, 3*d.*; 2092, 4*d.*; 2093, 1*s.*; 2094, 3*d.*; 2095, 3*d.*; 2096, 3*d.*; 2097, 3*d.*; 2098, 3*d.*; 2099, 6*d.*; 2100, 7*d.*; 2101, 9*d.*; 2102, 10*d.*; 2103, 3*d.*; 2104, 10*d.*; 2105, 3*d.*; 2106, 3*d.*; 2107, 6*d.*; 2108, 7*d.*; 2109, 7*d.*; 2110, 3*d.*; 2111, 3*d.*; 2112, 3*d.*; 2113, 7*d.*; 2114, 4*d.*; 2115, 10*d.*; 2116, 10*d.*

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5*s.* must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for The Engineer, *at the office of her Majesty's Commissioners of Patents.*

Class 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2278. R. Fell, *Kingsland*, "*Motive power.*"—*Dated* 13*th September*, 1861.

This invention consists in obtaining motive power by means of compressed air acting on water through cylinders and pistons, or acting directly from a hot air chamber in the driving cylinders.—*Not proceeded with.*

2296. G. Hawksley, *Bromley-by Bow*, "*Traction and locomotive engines.*"—*Dated* 14*th September*, 1861.

In order that traction and locomotive engines may be rendered more capable of turning and passing round curves, the driving wheels are actuated in the following manner:—The two driving wheels of a traction or locomotive engine are fixed on separate axes, and the ends of those axes are received into and freely turned within the nave of a toothed wheel. On the axis of each driving wheel is a bevelled toothed wheel; these bevelled wheels gear into the opposite sides of one or more, and, by preference, more than one, bevelled toothed wheels, the axes of which are carried by the toothed wheel, into the nave of which the ends of the two axes of the two driving wheels pass. Motion is given to this toothed wheel by means of a cog wheel or pinion on an axis driven by the engines. By these means so long as it is desired that the traction or locomotive engine shall be propelled in a straight line, the two driving wheels will be actuated by the bevel wheels equally, but when it is desired that the traction or locomotive engine should turn, then the driving wheel, which, for the time being, will perform in the outer or larger curve, will be turned more quickly than the other driving wheel which is to perform in the inner or smaller curve.—*Not proceeded with.*

2303. J. Reeves, *America*, "*Electro-magnetic engines for obtaining and applying motive power.*"—*Dated* 16*th September* 1861.

This invention has for its object improvements in the combination and arrangement of the several parts of electro-magnetic engines, and these improvements apply, more particularly, to that arrangement of apparatus for which a patent was granted to the present patentee the 22nd day of February, 1861 (No 449). The present improvements in electro-magnetic engines consists in supporting a slotted ring or wheel on studs projecting from the fixed plate which supports the apparatus; and on this slotted ring or wheel holders are placed through which the wires from the galvanic battery and helices pass and are brought in contact with another ring or wheel formed of non-conducting material with spaces in the rim which hold conductors. This ring or wheel is attached to the driving wheel, and when in motion makes and breaks contact continually between the wires from the galvanic battery and the helices. The surface of the ring or wheel for making and breaking contact is prepared with sand, emery, or other suitable material, so as to cause friction, and thus rub and clean the ends of the wires as they pass over it from the "fuse" or "glaze" produced by the action of the electro current when in contact, by which arrangement a great obstacle is removed which has hitherto existed, and has prevented the full power of the battery from reaching the helices. A lever is employed to change the position of the slotted ring before mentioned, and with it the wires which pass to the wheel or ring which makes and breaks contact with the galvanic battery, and by this means the patentee regulates the speed and reverses the direction of the engine to produce a backward or forward motion as required.

2305. W. J. Hesketh *and* D. Parsell, *Saundersfoot, Pembroke*, "*Steam boilers and furnaces.*"—*Dated* 16*th September*, 1861.

This invention cannot be described without reference to the drawings.—*Not proceeded with.*

2321. J. Lee *and* B. D. Taplin, *Lincoln*, "*Traction engines.*"—*Dated* 17*th September*, 1861.

In constructing traction engines according to this invention the patentees employ a boiler similar to an ordinary locomotive boiler. In front of the fire box end of the boiler is a platform on which the engine driver and steersman stand; this platform is supported by the leading or guiding pair of wheels, the axle of the hinder or driving pair of wheels being placed below the crank shaft of the engine; this latter shaft is above the top or body part of the boiler, and is driven by engines contained in the smoke box of the boiler. On one end of the crank shaft are two pinions of different diameters; these pinions are loose on the shaft, but either of them can be made fast upon it by means of a clutch; for this purpose a slot is formed in the portion of the shaft which passes through the pinions, and in this slot is a bar capable of being moved to and fro; one end of this bar is connected to a collar capable of sliding endwise on the axle, and around the periphery of this collar a groove is formed to receive a fork on the end of one arm of a lever, the other arm forming a handle by means of which the lever may be turned on its centre, and the bar thus moved to and fro. On the other end of the bar is a projection which projects up out of the slot; this projection can enter recesses formed in the pinions. The pinions are separated from each other by a collar, through which a slot or recess is also formed to receive the projection. When both pinions are desired to be loose on the shaft, the bar is by the lever moved so that the projection upon it is received into the recess in the collar, the collar being made sufficiently broad for the purpose. When it is desired to make either of the pinions fast on the shaft the bar is moved so that a portion of the projection upon it enters the recess in the pinion it is desired to make fast. On the axle of the hinder or driving wheels are two toothed wheels of different diameters into which the two pinions gear, the smaller pinion gearing with the larger toothed wheel, and the larger pinion with the smaller toothed wheel; the driving wheels can thus be driven at two different speeds by making one or other of the pinions fast on the shaft. Each of the leading or guiding wheels turns on a pin or short axis which itself projects from a vertical axis; these vertical axes turn in bearings at each end of a bar or beam which passes transversely across the engine below the platform in front of the fire box. The vertical axes have arms connected to them which, by links, are connected to the ends of two arms of equal length fixed on an upright shaft or axis which is situated at the front of the platform on which the steersman stands; on the upper end of this shaft is a toothed wheel into which a pinion on the axis of a hand wheel gears, and this hand wheel can be worked by the steersman on the platform.

2329. A. J. Beer, *Canterbury*, "*Valves of steam and other motive engines.*"—*Dated* 18*th September*, 1861.

This invention relates to a means of reducing the pressure of steam on the slide valves of engines, and thereby reducing the friction of the working surfaces, and consists in constructing on the back of the slide valve a shallow cylinder, which communicates with the interior of the exhaust port of the valve by means of a small hole. In this cylinder is fitted a piston, which is secured to the face of the back plate, and is provided with suitable metallic or other packing, so as to form a steam-tight joint in the shallow cylinder. The face of the back plate rests upon antifriction wheels or rollers, which are placed by the sides or ends of the valve in the steam chest. Steam being admitted to the steam chest will act with the same pressure on the back of the back plate as is due to the area of the piston in the shallow cylinder, and the back plate being supported on the antifriction rollers, and properly balanced in the steam chest, the friction of the working parts or faces of the valve and ports will be considerably diminished.—*Not proceeded with.*

Class 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2244. G. H. Birkbeck, *Southampton-buildings, Chancery-lane, London*, "*Saddles.*"—*A communication.*—*Dated* 7*th September*, 1861.

This invention consists in so constructing the frames or bodies of saddles as to render them more elastic and pliable than heretofore, thus affording more comfortable and convenient seat to the rider, and causing less discomfort to the horse or other animal. The frame or body of the saddle is composed of a number of plates, and other forms of iron, steel, or other metal, jointed or connected together to give strength and solidity to the saddle, the articulation of the several divisions of the frame so joined together giving freedom of action to all parts of the saddle when in use, thus causing

a uniform distribution of the load at each movement or change in the position of the rider.

2249. A. Fryer, *St. Ann's Retreat, Sutton, Lancashire, "Propellers."—Dated 9th September*, 1861.

This invention consists in constructing and applying propellers for propelling vessels by having a piston rod or piston rods, or pairs of piston rods, made to work at the stern or at the sides, or at such other parts of the vessel as may in practice be found convenient, in such manner that a prolonged part of each piston rod, or a suitable additional rod or tube attached thereto, projects into the water. To the end of the part so projecting is attached the apparatus, and so constructed that an effective surface of sufficiently large extent is presented to the action of the water when the piston or pistons is or are making their outward thrust, and the vessel is thereby pushed or propelled forwards, and, when the piston or pistons is or are drawn back, a small extent of surface is presented in a suitable form to the action of the water, so that a small resistance is offered by it to the outward motion of the piston or pistons.

2259. R. Restell, *Croydon, "Connecting and disconnecting engines and tenders to and from trains."—Dated 11th September*, 1861.

The object of this invention is to enable the driver of the engine to connect and disconnect the engine and tender to and from the train at will without leaving his place on the engine. The invention consists in attaching to the engine or to the tender a stirrup, which is hinged to a plate, a rod from which passes through the frame, and is connected to an ordinary draw spring; or the plate may be fixed. The stirrup has fitted to it, and depending from it, a weighted V-shaped bar, while a similarly shaped bar is connected by loops to the upper surface of the stirrup; this latter bar has attached to it a cord, strap, or chain which is carried to some part of the engine within reach of the driver. The carriage to come next to the engine and tender is fitted with an ordinary draw hook. The operation is as follows:—Supposing the driver requires to connect, he first raises the stirrup by means of the cord or chain, causes his engine to press up against the carriage, and lowers the stirrup over the draw hook, into which the weight connected to the under part of the stirrup causes it to descend and become engaged. To connect the coupling chains it is necessary an attendant should hook them on, but there is no necessity for him to enter between the rails, as the hooking on should be performed outside the rails on each side. But to enable the driver, should he require to disconnect the coupling chains as well as the central coupling, the inventor hinges on to a plate bolted to the engine or tender a weighted hook to receive one end of the coupling chain, and he attaches a line, cord, or chain to the hook in such manner that, on the hook being pulled up, the chain will be liberated. He employs a separate hook for each coupling chain. To disconnect the central coupling, the driver checks or stops his engine, and presses it up against the train; or allows the train to press up against it, until the stirrup is pushed sufficiently back into the hook to enable it to be raised out of and freed from the hook; the driver then raises it out of the hook, and the disconnection is effected.—*Not proceeded with.*

2261. J. Bowns, *Earlestown, Lancaster, "Railway wheels and railway brakes."—Dated 11th September*, 1861.

In constructing railway wheels according to one part of this invention, the exterior of the tire is made as heretofore, with a projecting flange; the interior of the tire is made with a dovetail projection, extending all round the inner face of the tyre; the spokes of the wheel are composed of two discs or rings of wrought iron or steel, one being on one side of the wheel and the other on the other side. The rings are divided radially into segments, and the central portion of each segment is cut away to lighten the wheel; the larger or outer circumference of each of the segments is turned up at an angle to fit into the dovetailed projection on the inside of the tyre; the smaller or inner circumference of each of the segments of rings is also turned up to fit in recesses on each side of the boss, and the segments are connected to the boss by means of rivets or bolts passing through the boss and through the segments. The outer edges of the segments on the opposite sides of the wheel are drawn towards each other by bolts and nuts, and are thus caused to nip the dovetailed projection on the inside of the tyre on each side of the wheel; a ring of metal is placed between the heads of the bolts and nuts and the segments; these rings are also divided radially into two or more parts, and the faces of the rings, which are against the segments, are made to fit to them. The diameter of the rings which act as spokes is a little less than the inner diameter of the tyre, so that the tyre can expand or contract freely. In constructing railway brakes according to this invention, the wooden blocks which are to be pressed against the wheel are each supported at their centre by a rod or pin supported by means of links from the framing of the carriages; each rod passes across the carriage and serves to support two wooden blocks, one on each side of the carriage, and the rods thus serve to keep the blocks at an equal distance from each other. The blocks are capable of turning on the rods, so that when one face of the block is worn away, the block may be turned round and another face of the block be turned towards the wheel. The rods which support the wooden blocks are connected by means of rods or links with the shorter arm of the brake lever, and, when the rods are pressed by the brake lever towards the wheel, the blocks being able to turn on the rods or pins, adapt themselves to the wheel, whether the carriage is heavily laden or not, which is not the case when the wooden blocks are supported and actuated in the ordinary manner.

2266. A. Turner, *Leicester, "Apparatus for enabling the guards and drivers of railway trains to communicate with each other."—Dated 12th September*, 1861.

This invention relates to a novel arrangement of rods, levers, and connecting links which will enable a man at one end of a train to make signals to another man at the further end of the train, either by striking a bell, acting on a dial, or index, or otherwise.—*Not proceeded with.*

2272. W. Davis, *Birmingham, "Apparatus for the prevention of accidents to vehicles drawn by affrighted horses."—Dated 13th September*, 1861.

One part of this invention consists of a metal plate having a series of bolts or studs about an inch and a half in length projecting from its surface; this plate is attached to the inside end of the hub of a wheel of an ordinary vehicle, and in connection with these two flat pieces of metal, of a desired length slightly tapered, are rivetted or otherwise held together upon their surfaces; in the shortest of these pieces there is a slot which acts as a slide, and at the end of the other piece there is a clip in the form of a prong, the sides of which are secured at their respective ends for the purpose of uniting the same with the axle between the wheel and body of the vehicle, its proximity to the hub of the wheel being determined in proportion to the projections upon the metal plate. Near to that end of the piece of metal which clips the axle there is a movable joint, and a flat spring, which said spring is affixed to and works upon the sides of both pieces of metal, and also serves to keep the two pieces in a proper position. When there is great pressure exerted upon the spring, it has a tendency to displace itself, and to obviate this liability the patentee uses an india-rubber ring, which passes over both pieces of metal, holds the end of its spring, and regulates its elasticity. The action of this part of the invention may be stated thus:—When connected with a vehicle, and not in use, it retains an upright position; the upper end of the longest piece of metal has a hook or other arrangement for holding the reins; when the horse is affrighted, it is necessary to pass down the shortest piece of metal, the lower end of which comes in immediate contact with the bolts or studs upon the metal plate, simultaneously acting upon the flat spring and movable joint, thus forcing the upper part of the apparatus backward, through which the reins are then tightened in an unusual degree. The other part of the invention consists of a circular metal ring, having teeth similar to a cog-wheel; the said ring is fixed upon the inside end of the hub of the wheel nearest the body of the vehicle, and in connection with this ring there is a metal tube, having a slot near its upper end; between the slot and upper end inside the tube there is a strong spiral spring which acts upon a rod or sliding bolt inserted into the other end of the tube; at the outside end of the said rod there is a piece of flat metal of a triangular shape, a part of which is serrated, and in conjunction with this tube there is a movable joint clip and spring of the form described in the first part of this invention; a hook or other receptacle for the reins is affixed at the other end of the metal tube. The action of the apparatus may be stated thus:—When the sliding rod is not in use, the spring is depressed; but when in use, the rod being released from the slot, the spring elongating itself presses the rod downwards, the toothed end of which comes in contact with the serrated ring upon the hub of the wheel, at once acting upon the movable joint and spring, and forcing backwards the upper end of the metal tube, through which great force is exerted upon the mouth of the horse.

2290. J. Lea, *Widnes Dock, near Warrington, "Self-acting signals for railways."—Dated 14th September*, 1861.

This invention is carried into effect as follows:—At the entrance to the tunnel or other position the inventor places a switch lever at the inside of one of the rails, and connects by a rod and levers to a revolving signal, and at the terminus of the tunnel or other position he places another switch lever, which is also connected by a rod, levers, and a long wire with the aforesaid revolving signal. When the foremost wheel of the engine or carriage is about to enter the tunnel, or pass the position where the signal is stationed, it comes in contact with the first switch lever, and causes the signal to turn and give notice that an engine or train has passed that spot, and when the said foremost wheel has arrived at the terminus of the tunnel, or any other required place, it comes in contact with the other switch lever, and returns the signal to its original position, thus showing that the distance has been traversed in safety, and that there is nothing in the way.—*Not proceeded with.*

2292. F. Burnett, *St. Mary-axe, London, "Automatic electric signals."—Dated 14th September*, 1861.

The patentee claims the application of an automatic electric button of partly solid form, composed of the materials most suitable to obtain the desired end, these buttons containing plates of metal suitable to complete the circuit of electricity (which system the patentee prefers to breaking it up, though both can be made available to the purpose), the same buttons to be used on railways acted on by the flange of the wheels or otherwise, in conjunction with an indicator with bell and numbers permitting of organised signals and code to make known the passage, stoppage, or return of trains; also to light the electric light in tunnels or elsewhere, to give roadside signals, to signal to stations the cause and nature of accidents or stopping, or for any other cognate purpose for railroads and railways.

2297. W. E. Newton, *Chancery-lane London, "Apparatus to be adapted to carriages for the purpose of checking or arresting their progress on inclines &c."—A communication.—Dated 14th September*, 1861.

In railroad carriages, trucks, or wagons in which the running wheels are usually keyed fast on to the axle which rotates in suitable bearings, a strong ratchet barrel is keyed, or otherwise secured, on the rotating axle, and one, two, or more palls are mounted on a transverse shaft, or attached to a strong beam, which is secured to the under framing of the carriage. These palls are capable of being lifted up away from the ratchet barrel when out of use, and, if it be required to check the progress of the train, they may be instantaneously lowered, so as to take into the ratchet teeth of the barrel, and thereby prevent the axle-tree from rotating; the wheels will thereby be stopped, and by rubbing on the surface of the rails will create such an amount of friction as will quickly stop the train.—*Not proceeded with.*

2304. T. Meriton, *Hamburgh, "Steering apparatus."—Dated 16th September*, 1861.

This invention cannot be described without reference to the drawings.

2309. A. M. Skinner, *Belfast, Ireland, "Propelling ships, boats, and other vessels."—A communication.—Dated 16th September*, 1861.

This invention consists in propelling ships, boats, and other vessels, by means of a new propeller, working on a vertical axis, and placed within the timbers, one on each side of the midship section of the ship. The centre of the propeller is circular, and solidly constructed of wood and iron, with a transverse opening to admit of an iron or strong wooden blade or float traversing to and fro. Its axis is vertical, terminating in a conical point working in an iron cup resting on the bottom of the ship, being placed eccentrically within an immovable elliptical iron ring above and below, so that, as the propeller revolves on its axis, the blade or float traverses to and fro through the transverse opening, in consequence of its edges moving round in contact with the inside of the elliptical ring, the blade or float acting like an oar in the water being wholly or partially immersed, according to the trim of the ship; the blade or float is hung on suspension bars, and traverses to and fro with little or no friction. The propellers, of which there are two, one on each side of the ship, are placed at the centre of oscillation, and low down in the ship; they cannot be lifted out of water by the pitching and rolling of the ship. When the blade or float is fully exposed, it has a direct propelling power under circumstances in which slip is prevented by the side of the ship.—*Not proceeded with.*

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2223. M. A. F. Mennons, *Paris, "Ribbon looms."—A communication.—Dated 6th September*, 1861.

This invention cannot be described without reference to the drawings. The patentee claims the application to jacquard-bar and other ribbon looms of double sets of reeds, healds, and rollers, so constructed and arranged as to permit the simultaneous manufacture under the eye of the weaver of double superposed pieces of the tissue.

2231. J. Brown, *Burnley, Lancashire, "Power looms."—Dated 6th September*, 1861.

This invention relates, First, to the "check strap" of that portion of the loom known as the "picking motion," and employed in looms to limit the movement of the picker, and is designed to diminish the wear of the "pickers" consequent upon their sudden stoppage and concussion upon such strap. The improvement consists in the novel employment and use of a suitably formed strip of india-rubber, or other elastic medium, at one end of the check strap, and so arranged that, when the picker comes into sudden contact with the "strap," the elasticity of the india-rubber diminishes the force of the picker upon the strap, and prevents injury to the "picker," which would otherwise occur. The Second part of the invention relates to the heddles or harness of looms, and consists in furnishing or covering the surface of the rods between which the "healds" are distended with india-rubber, so that, as the healds rise and fall during weaving, the strain thereof may be diminished or equalised by the interposition of the elastic substance, thereby rendering the "healds" more durable.

2232. W. Wilde, *Bury, "Slubbing frames and roving frames."—Dated 6th September*, 1861.

This invention consists in the novel use of a long tube or collar extending upwards from a rail beneath the "copping rail" to that part of the spindle close beneath the "flyer;" the spindle passing through the tube is thereby steadied. The improvement consists in the use of this peculiar elongated form of "collar," in contradistinction to any of shorter description, which do not afford support to the spindle closely beneath the flyer, such being a material advantage.

2237. W. Ainsworth, E. Heap, W. Fielding, *and* E. Openshaw, *Adlington, Lancashire, "Power looms."—Dated 7th September*, 1861.

This invention relates, principally, to that description of power looms wherein the shuttle-boxes rise and fall for the purpose of altering the colour or description of weft, and consists in a novel method of governing the rise and fall of such shuttle-boxes, and constitutes the First part of these improvements. The Second part of the invention relates to a novel method of reversing the action of the pattern chain and its drum by which the shuttle-boxes are actuated. Thirdly, the invention relates to a novel method of varying the number of "picks" of the shuttle.

2253. R. A. Brooman, *Fleet-street, London, "Producing mixed coloured woollen and other threads."—A communication.—Dated 9th September*, 1861.

In the spinning of filamentous substances, in order to produce mixed coloured and other thread, each shade or colour is dyed separately; the different coloured filaments are afterwards united and passed through preparing and spinning machines. Notwithstanding the greatest care to equalise the mixture of the colours, especially when they are opposite, such as black and white, there form and remain in the thread veins or stripes different from the ground. The object of this invention is to overcome this defect. The invention consists in dyeing or printing the filaments with "chinage" or marks of colours, by any suitable means, upon part of their length in sections, and in one or more colours before being made into thread.

2267. M. A. F. Mennons, *Paris, "Machinery for the production of Valenciennes, Chantilly, Brussels, and other similar laces."—A communication.—Dated 12th September*, 1861.

The essential objects to be obtained by this invention in the mechanical production of real lace are, First, the means of rendering each thread independent, that is to say, capable of passing from right to left, of changing with one of its neighbours, or of remaining stationary, as required, so as to form the twists of which the fabric is composed. Secondly, the means of causing one or several threads to cross a given number of others for the purpose of producing certain ornamental effects in passing alternately above and below each corresponding thread by a single motion, either to right or left. The invention cannot be described without reference to the drawings.

2269. W. W. Clay, *Nottingham, "Knitting machinery."—Dated 12th September*, 1861.

This invention cannot be described without reference to the drawings.

2275. P. Dubrule, *Tourcoing, France, "Apparatus for manufacturing figured or ornamental stuffs with treadle power looms."—Dated 13th September*, 1861.

This invention cannot be described without reference to the drawings.

2291. J. King *and* J. Sutcliffe, *Rochdale, "Spinning and doubling."—Dated 14th September*, 1861.

This invention cannot be described without reference to the drawings.

Class 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

2274. W. H. Delamare, *Hackney-road, "Machine for purifying and peeling corn."—Dated 13th September*, 1861.

This invention consists in the removal of the husks from corn, and the cleaning of the same, by introducing it between the two roughened operating surfaces of a revolving cylinder or cone, and a stationary case or cover enclosing the cylinder.

2279. R. A. Brooman, *Fleet-street, London, "Machines for weighing and measuring corn and other grain."—A communication.—Dated 13th September*, 1861.

This invention cannot be described without reference to the drawings.

2302. W. E. Gedge, *Wellington-street, Strand, London, "Apparatus for drying grain."—A communication.—Dated 16th September*, 1861.

This apparatus, which will dry every sort of grain or seed, whether germinating or not, as well as coffee, rice, and other produce, and which acts without the aid of any mechanism, may be placed between two floors or storeys. From the upper storey the grain is poured into a hopper or funnel, and after passing from cone to cone, moving by its own weight, it escapes at the lower store through a shoot, which, by means of a small trap, regulates the rapidity of its passage through the apparatus. The "drying column," which may be specially arranged for each kind of grain or seed by bringing the cones nearer to each other, or placing them further apart, and giving greater dimensions to the apparatus, is within reach of everybody, and is constructed of sheet iron; it is easily transported from place to place, and its reasonable price will permit small agriculturists, as well as corn and seed merchants, to use it with advantage. The grain issuing from the apparatus in a heated state, it is prudent to pass it into a ventilator, and allow it to remain some hours on the floor before piling into heaps, where it will preserve, as in dry seasons, without further manipulation.

Class 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

2271. J. Oliver, *Longtown, Cumberland, "Bricks, pipes, and tiles."—Dated 13th September*, 1861.

This invention is carried out as follows:—Upon a suitable frame is mounted a hopper in which the clay is placed in a raw state, and the bottom of the said hopper forms a grating. In the said hopper are a number of tilt hammers, fixed on the extreme ends of levers, working on a shaft mounted on the said frame, and operated upon by cogs on a revolving drum, which depress the short ends of the said levers, and give motion to the tilt hammers in the hopper, by which means the clay and any small stones that are in it, are pounded, crushed, and forced through the said grating into a chamber under the said hopper. In the front of the said chamber is a spout or aperture through which the prepared clay is driven out on to a table, by means of a horizontal hammer connected with an eccentric communicating alternate motion to the same; and a knife is fixed in front of the said spout for dividing the clay to the required breadth for the mould. The said machine for preparing the clay may be worked by horse or steam power. The pressing machine may be on the same frame as the hopper, or on a detached frame, in either case it will receive the clay direct from the spout of the hopper on to a block. Over the said block slides a mould, in which the bricks are formed under pressure of a punch or die connected to a powerful lever near its fulcrum. The said lever is weighted at its extreme end, and is also connected by a chain to the end of a second lever, suspended from which is a treadle for lifting the said punch. The said mould is lifted up by means of a crank lever operated upon by a treadle, and cuts off the required quantity of clay which is pressed into a heap by the action of the punch. Pipes and tiles can also be made by using dies and moulds suitable for those purposes.—*Not proceeded with.*

2273. W. Furlar, *Turnham-green, Middlesex, "Sash fastenings."—Dated 13th September*, 1861.

These improvements in sash fastenings consist in forming the ordinary lever catch (which is fastened on the upper sash) with a projection or stud, by preference of a V or diamond shape, which (when the lever is moved under the locking plate) comes in front of an arm carried by a screw nut on a thumb screw attached to the lower sash, so that, by turning the screw, a V or other shaped recess on the arm acts on the V or other shaped stud on the lever, and thus draws and secures the two parts of the window firmly together, by which all noise from the shaking of the parts will be prevented, and such fastenings will be more secure from being unfastened from the outside than heretofore.

2276. R. Smith, *Hornsey*, B. Brookes, *King's-cross, and* J. Smith, *Tottenham, "Roof and other lights."—Dated 13th September*, 1861.

As the frames of roof lights are at present formed, when the putty used to secure the glass to the frame cracks or separates either from the glass or frame, so as to admit water, that water may fall at once on to and injure objects beneath them. The object of these improvements is to remedy this evil, and for this purpose the patentees form the bars and other parts where they support the glass with longitudinal recesses or gutters, over which the edges of the glass are laid, and the glass is then retained by putty in the usual way, or by other suitable holding means. When from any cause the putty or other holding means admits water through it, such water, after passing under the edges of the glass, in place of dropping at once therefrom, will be received into the longitudinal recesses or gutters, and by them may be conducted to suitable channels or receivers.

Class 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

2284. W. E. Newton, *Chancery-lane, London, "Guns."—A communication.—Dated 13th September*, 1861.

This invention consists in a certain novel construction, arrangement, and movement of parts by which separate movable metallic cartridge chambers charged with powder and ball are successively and at regular intervals dropped from a hopper opposite to and held tightly in contact with a gun barrel of corresponding calibre. These metallic cartridge chambers are firmly secured in a substantial stock, and, after being fired, they are discharged from below, while the necessary preparations and movements are being made for the reception from the hopper of the next loaded cartridge chamber in succession. By this arrangement a constant firing from the cartridge chambers through the barrel may take place by the simple act of turning a crank.

2307. G. Fay, *Great Portland-street, London, "Sights for rifles."—Dated 16th September*, 1861.

Provisional protection has not been granted for this invention.

Class 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

2289. W. Wheatstone, *Conduit-street, Hanover-square, London, "Concertinas."—Dated 14th September*, 1861.

These improvements have for their object the accomplishment of the following desiderata:—First, a more convenient method of supporting the instrument, and of actuating the bellows while using it, whereby the third and fourth finger of each hand of the player can be released from the necessity at present existing of their employment in that duty, so that they may be used in conjunction with the other two fingers of each hand in operating upon the finger stud or keys, thus affording greatly increased facilities in manipulating upon the instrument. Secondly, a more convenient position of the whole series of finger studs in the tops of concertinas and similar instruments, which will enable the performer to act upon them in a manner less cramped and restricted than at present. Thirdly, an extensive enlargement of the compass of the scales or series of notes to which such instruments have hitherto been confined, without increasing the dimensions or materially augmenting the weight thereof. Fourthly, a great extension of the scale or compass of duet concertinas. Fifthly, the production of an improved quality of tone by giving additional solidity to certain portions of the instruments.

2301. M. Rae, *Manchester, "Lamps."—Dated 16th September*, 1861.

This invention consists in causing a current of air to impinge against the the flame of a lamp by means of a lamp, taper, light, or other heat-producing agent placed within or under a tube or tubes communicating with the burner, which, on being lighted or heated, causes an upward current of air, that, coming in contact with the flame of the lamp, produces a white light. This lamp the patentee calls the ventilator lamp.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

The Week's Demand for Finished Iron: *Demand for Canada, Russia, and France: American Prospects: Stone Fortifications v. Armour-Plated Monitors*—Pig Iron Trade: *Advancing Prices for Certain Hematite Samples*—General Manufacturing Trades: *Continued Slight Improvement: Activity in Best Locks: Good Demand for Steam and other Fittings*—Specimens of Iron and Hardwares for the Exhibition.

The slightly improved condition of the iron trade at certain of the leading houses, which we reported last week, has been quite sustained since that date. The demand for Canada is now being felt by certain of such houses; on account of Russia, also, there is a little movement; and France continues to afford orders for firms of but little, as well as those of considerable trade distinction. Specifications on account of France were on offer in Wolverhampton on Wednesday. Their description shows that not alone the Government of that country, but also the general French consumer, is appreciating the superior advantages offered by the British over the French ironmaster. Small lots of hoops and bars are being sought for here as well as the descriptions generally in demand at the Government dockyards. The home demand is still only very limited in this district, excepting for best boiler, girder, and ship plates. In most of these descriptions of the first-class brands there is as good an inquiry as can be expected, whilst the great manufacturing centres are in the position in which Manchester, for instance, now is, with not half of her factory operatives working full time—upwards of 8,000 totally unemployed, and the number so circumstanced, increasing by nearly 1,000 a week. The tone of the trade is quite equal, if not of a more satisfactory character than that which pervaded it last week. The extraordinary expenses incurred by the Federal Government have strengthened the conviction that the civil war in that country cannot last much longer, and the exploits of the Merrimac and Monitor, and the discussion at home

which these exploits have occasioned, have convinced the iron-masters that their trade will be considerably promoted by the superior advantages, as compared with stone fortifications, of floating defences in which plates of iron will form the leading constructive material.

The sales of pigs in the week have been few, excepting in some exceptional instances. Singularly enough, in those instances, makers demand an advance of prices upon their last week's rates of from 1s. to 2s. a ton. The leading pig transactions of the week have been in the Workington brands. The producers of this iron have just revised their list of prices, and are now demanding the increase named. At that advance they are very firm, and are declining orders at prices which, in the early part of last week, would have been readily accepted. Notwithstanding this rise there have been firms of the first class in the finished iron trade who, in the past few days, have doubled their orders for these pigs. The lowest price now taken by the producers of the hematite iron referred is £3 7s. per ton. Messrs. Schneider and Hannay are full of orders for their pigs, which are quoted at £3 5s. Of this make of red iron the consumption is larger in this district than of any other. South Staffordshire pigs are slightly declining in demand, and the make is being proportionately reduced. In certain cases also, where the best pigs of this district were being produced, cinder iron is now being made. This latter circumstance, however, is due as much to the necessities of the makers preventing them from readily obtaining a supply of the raw material as from the larger demand for the inferior description.

The general manufacturing trades are not much altered upon the week. The tin plate and japanned warehouses are experiencing but little demand in comparison with what is usual at this season. The London demand in the home market, and the Canada and the French in the foreign, are sending the best orders. Certain of the producers of first-class locks continue very busy. In Wolverhampton Messrs. Chubb are increasing the number of their workpeople, yet are unable to get the orders out of hand with the required rapidity.

In gas, and water, and steam fittings, Messrs. Fell and Co., of Wolverhampton, are busy, notwithstanding that they have recently greatly increased their mechanical appliances. In force pumps (improved rotary and otherwise) and in water-closets they are also doing a good trade. The tube makers and edge tool manufacturers are tolerably active. The fancy trades are suffering depression. The specimens of the iron and hardwares of this district destined for the International Exhibition are being sent away, or are being rapidly proceeded with.

From the Earl of Dudley's works, at Round Oak, some interesting specimens have been sent, showing the superior quality, durability, and strength of their manufactured iron. Amongst these are several specimens of 3-in., 2-in., and 1-in. rods, twisted into the shape of a Staffordshire knot whilst cold; a 27ft. rail, similar to those used by the London and North-Western Railway, twisted whilst cold in corkscrew form; an 8ft. rail, similarly twisted, the twist being about 6in.; boiler plates capable of standing a pressure of 51·3 tons to the square inch; various specimens of cold blast, puddled steel, and other varieties of iron, have also been contributed. Messrs. Hill and Smith, of Hart's Hill, send some specimens of self-acting iron grates, and ordinary gates and hurdles. Messrs. Watkins and Keep, of Stourbridge, supply anvils, ploughshares, spades, and other edge tools. Messrs. Cochrane, of Woodside Ironworks, contribute various specimens of ironwork. Messrs. Tinsley and Wright, of Tipton, anchors and chains. Mr. R. P. Parkes, of Tipton, chains. Mr. G. H. Daley, Dudley, chains. Mr. John Finch, Dudley, fenders, and Messrs. Wood, of the Eye Waste, varieties of chains. The japanned, tin plate, and *papier mache* houses will be fairly represented in the firm of Messrs. Griffiths and Browett, of Birmingham, who, however, will not of course be the only exhibitors of that class of goods; but he is the only one to whose wares our space will allow us to refer to. His case has just been on show to a select circle. To an uninstructed eye innumerable dishes, tea and coffee pots, cruet frames, salt cellars, and other portions of a table service, had all the appearance of good, bright, substantial electro-plated wares. Nor was the illusion dissipated when the visitor was bidden to observe that each article was really stamped, or "spun," or "raised" out of a sheet of block tin, without a single seam or the aid of the least particle of "solder." This is one of the great merits of modern Birmingham tin ware. Under the ingenious manipulation of Birmingham workmen there is no conceivable form into which a sheet of tin plate cannot be worked. A marvellous proof of this was afforded by the exhibition of a perfectly shaped bottle, and also of an extinguisher, each made without joint or seam out of a single flat piece of the metal. Not only was the collection pervaded by this remarkable mechanical skill, but the design of the various articles, and the tasteful character of the ornament applied to them, showed that wonderful progress has been made in this direction since 1851. We recollect visiting the same show-room just before the last Exhibition, and if the difference now observable characterises all classes of Birmingham goods, as we believe it does, then Birmingham will have no cause to fear any competition to which it may be subjected at Kensington. The same remark applies to the ornamentation of the metal and paper trays exhibited. By a skilful adaptation of a recent patent Messrs. Griffith and Browett are able to produce, at ludicrously low prices, articles of this kind, which, ten years ago, would have been almost unattainable at any price.

The advance here noted in these goods will be equally marked in regard to locks, and keys, and iron safes, in which Wolverhampton will more than maintain its wide reputation.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

The Commercial Depression: *Continued Decline of Railway Traffic*—State of Trade at Sheffield, Leeds, &c.—Traction Engines and other Machinery for the Exhibition—Steam Threshing Machinery: *Committal for Manslaughter*—Limited Liability at Liverpool—Mersey Steel and Iron Company: *Another Contribution for the Exhibition*—Mersey Docks and Harbour Board—Wakefield Water Supply—State of Employment at Manchester—Minerals, &c., for the Exhibition from the Coatbridge District—Glasgow Association of Assistant Engineers—Model of the Warrior—Clyde Shipbuilding.

The gravity of the present commercial depression is fully indicated by the serious decrease of traffic on the great railway systems accommodating the manufacturing districts. In the first twelve weeks of this year the London and North-Western has receded to £889,276 as compared with £933,817 last year; the Midland to £451,001 as compared with £428,474 last year; the North Eastern to £392,251 as compared with £424,398 last year; the Lancashire and Yorkshire to £361,799 as compared with £411,442 last year; and the Great Northern to £287,835 as compared with £307,546 last year. On the other hand, lines which derive part of their revenues from the agricultural interest have pretty well maintained their ground, the Eastern Counties advancing from £273,6..8 to £274,937, and the Great Western from £526,417 to £529,528. Glasgow, too, seems to hold on its career of progress in spite of every obstacle, the Caledonian having advanced from £111,463 to £116,807.

Although the general trade of Sheffield does not show increased animation, the edge tool business continues moderately good for country markets. Some of the joiners' tool and engineers' tool manufacturers also state that their orders are satisfactory. The large steel and file houses are doing rather more, but the accounts from continental markets are not very encouraging. The Derbyshire iron trade continues dull. The Leeds Chamber of Commerce observes with regard to the iron, machine, and machine tool trades of that town and district:—"The iron trade has slightly improved during the last month, especially in better classes of iron, the makers of which are well supplied with orders, the approach of spring causing a greater demand for iron for constructive purposes, as bridges, roofs, &c. The machine and machine tool trades are fairly employed, though orders are not plentiful; they are, however, mostly working full time. The locomotive builders are very busy, and have orders which will keep them so for some time to come. The demand for steam ploughs continues. The cut nail trade remains without alteration."

Mr. Burrell, of the St. Nicholas Works, Thetford, Norfolk, will contribute a powerful traction engine, with slippers, &c., complete, a steam threshing and dressing machine, a portable engine, and a powerful locomotive to the machinery annexe of the International Exhibition. Mr. Burrell's contribution was to leave this week. With a view to economise space a stage is to be erected for two of the machines, as room on the ground floor can only be allowed for the other two. The largest traction engine yet made by Mr. Burrell was sent to Russia in the course of last summer.

A singular case has been tried before the Market Harborough magistrates, in which William Bloxsom and Martin Bloxsom, of Gilmorton, engineers, and Henry Butcher, of Foxton, machinist, were charged with manslaughter. It appears that Butcher had a steam threshing machine which would not perform its work properly, so he arranged with the Bloxsoms to make him a new one, and to lend him one until the new one was ready. He received the last one from Bloxsoms on Oct. 29, and worked it until the time of the explosion. On Jan. 11 the engine was taken to a field stackyard of Mr. Ed. Dunmore, of Stonton Wyville, when the boiler was filled ready for work. On Monday they commenced work, but not for long, as they were obliged to stop, the pump which feeds the boiler with water being found to leak. The joint was wrapped with hards, but the leakage again occurred, and they were obliged to stop a second and a third time, and while stopping the third time the boiler exploded, killed four men and wounded five others, out of the thirteen who were at work with it. An inquest was opened on January 15, and adjourned until the 29th, and then further adjourned until February 27th, as Butcher was so severely scalded he could not attend before that time. At the end of the inquest, after sitting eleven hours, the jury could not agree as to the meaning of the words "culpable negligence," which, according to the law laid down by the coroner, was manslaughter. Seven would not agree to this, and as there was no chance of the jury being unanimous, the coroner merely received and entered the verdict as given, and left it to be taken up by the magistrates if they thought proper. On the case being brought before the magistrates Mr. Haxby, of Leicester, defended the Bloxsoms, and objected to Martin Bloxsom being charged, as he was not in partnership with his father, nor had he been since 1855. Martin Bloxsom's name was therefore struck out. The evidence given was the same as at the inquest. It was proved that the water gauge-glass was broken, the water gauge cock was out of repair, and the pump would not work. The fire-box of the engine had also several flaws in it. The safety valve had been locked, if it was not locked at the time of the explosion. The magistrates committed both defendants for trial, but bail was allowed—Bloxsom himself in £100, and two sureties in £50 each; Butcher in £40 and one surety in £40.

The principle of limited liability sanctioned three or four years since by the Legislature as regards joint stock undertakings seems to have received its full development in Liverpool. Thus the following concerns are returned as still in operation in that great centre of commerce:—Liverpool Ice Company, for the manufacture and sale of ice and freezing apparatus, capital £4,000; Liverpool Zoological Gardens Company, for providing recreation and rational amusement for the public, capital £10,000; Delta Tin Mining Company, for searching for, raising, and selling tin and other ores at Branwell, in Cornwall, capital £5,000; Birkenhead Music Hall Company, for purchasing land and erecting a music hall thereon, capital £6,000; Pen Machno Slate Company, for purchasing and working the Machno slate quarries in Carnarvonshire, capital £20,000; Birkenhead Street Railway Company, for conveying passengers and goods on tramways, capital £15,000; Liverpool Road and Railway Omnibus Company, for omnibus conveyance in Liverpool and its neighbourhood, either on the common roads or tramways, capital £60,000; Birkenhead Proprietary School Company, for establishing a local college, capital £5,000; Glenchass Mining Company, to purchase the interest of a former company of that name in certain mines in the Isle of Man and to work them, capital £15,000; Liverpool Hotel Company, for erecting an hotel and music hall, and carrying on the business of hotel and tavern keepers, capital £200,000; Oriental Baths Company, for constructing public baths, capital £10,000; Mount Vernon Volunteer Parade Ground, for acquiring land for the purpose of exercise grounds for the use of the Volunteers in Liverpool, capital £13,000; Mersey Soap Company, for making soap, capital £10,000; Ballincollig Royal Gunpowder Mills Company, for manufacturing gunpowder, capital £100,000; Liverpool and Manchester Tar and Turpentine Distillery, and Patent Enamelled Cloth Company, for making tar, turpentine, oil, &c., and manufacturing patent leather cloths, capital £50,000; Cherez Copper Mining Company, for working mines of that name near Monceras, Portugal, capital £8,000; Birkenhead, Flintshire, and Holyhead Junction Railway Company, for making a railway from Birkenhead to join the Chester and Holyhead line between Queen's Ferry and Connah's Quay, capital £150,000; Brado United Mining Company, for acquiring and working certain mines in the Isle of Man, capital £25,000; Liverpool India Rubber Company, for manufacturing articles from caoutchouc, capital £25,000; Patent Glue and Gelatine Company, for the manufacture of those articles, capital £10,000; Liverpool Farming Company, for purchasing, breeding, and fattening cattle, sheep, pigs, and poultry, capital £5,000; British and South Carolina Steamship Company, for steam communication between Liverpool and Charleston, capital £200,000; Santa Barbara Gold Mining Company, for purchasing and working the Pari gold mine, in Brazil, capital £60,000; Borough Carriage Works Company, for carrying on the business of coach builders, trimmers, and repairers, capital £3,000; Liverpool Tobacco Warehouse Company, for providing a warehouse for the storage and manipulation of tobacco and other merchandise, capital £70,000; and the Liverpool Loan Company, for lending money and discounting bills, capital £200,000.

The Mersey Steel and Iron Company despatched another gigantic wrought-iron crank shaft on Friday to the International Exhibition. The shaft was 30ft. in length by 20in. in diameter, and had two crank blanks. Each of these measured 5ft. on the shaft, and was 4ft. 4in. in depth; the distance from centre to centre of the crank space or blanks was 10ft., the blanks being so cut out as to give a 4ft. 4in.-stroke. This great forging, which weighed about 25 tons, was manufactured to the order of Messrs. Maudslay, of London, who will show it at the Exhibition.

The Mersey Docks and Harbour Board, at their last meeting, determined not to admit petroleum or earth-oil into their warehouses. The board agreed to accept the tender of Messrs. J. Trains and Co., to supply 5,000 gallons of olive oil for the use of the lighthouses, at 4s. 6d. per gallon. Mr. Boult said petroleum could be bought for 2s. per gallon, and he believed it was as good as any olive oil which could be purchased. There was less smell from it, less smoke, and less nuisance in every way. He suggested that it should be tried. Mr. Graves observed that the great bulk of the lighthouses in England and France were lighted with colza oil, the price of which was 2s. 3d. per gallon. Mr. Mondel rejoined that the colza oil was tried some time since, but the engineer and marine surveyor reported that it did serious injury to the reflectors. It was agreed to erect two sheds on the south side of Coburg dock, at a cost of £3,100, for the use of the steamers of Messrs. G. H. Fletcher and Co., trading between Liverpool and Spain.

It appears, after all, that the vexed question of the water supply at Wakefield is not yet settled, a public meeting of the inhabitants having negatived the proposition that the corporation shall purchase the rights, &c. of the local Waterworks Company.

Capt. Palin, chief constable of Manchester, reports as follows as to the state of the machinists and foundries of that city:—Total number of machinists, 47; working full time with all hands, 14; working full time with a portion of their hands, 21; working short time, 10; stopped altogether, 2. Total number of foundries, 24; working full time with all hands, 6; working full time with a portion of their hands, 15; working short time, 3. Employment generally does not improve at Manchester, upwards of 7,000 persons being wholly out of work out of a total of 47,500 reported upon, while about 15,000 more are on short time.

Several boxes of minerals and samples of the manufactures of the Coat-bridge district have been dispatched to the International Exhibition. Among these are some fine specimens of malleable iron; also a large polished section of black band ironstone, 18in. thick; and a polished section of the Drumpeller splint coal from the Dundyvan Ironworks. This ironstone, it is well known, produces the finest iron, and no coal is better adapted than the splint for smelting it in the furnaces. Besides these, some excellent specimens of pig iron have also been forwarded from some of the other works.

The Glasgow Association of Assistant-Engineers held its second annual conversazione last week. Two rooms were occupied for the display of drawings, models, photographs, stereographs, microscopes, &c. Among the articles exhibited were an interesting series of models of locomotive engines, marine engines, &c. At supper the chair was occupied by the president, Mr. W. R. Copeland, supported by Mr. W. Neilson, Mr. J. M. Gale, &c. Mr. Russell, one of the vice-presidents, discharged the duties of croupier, and was supported by Messrs. Rankine, Foulis, &c.

A model of the Warrior, intended to be shown in the International Exhibition, has been completed at the Thames Iron Shipbuilding Works, Blackwall. The model, the preparation of which has occupied many months, will be exhibited under a glass case, and will no doubt be regarded with great interest by all who have devoted attention to naval architecture.

In connection with Clyde shipbuilding it may be stated that Messrs G. and J. Thomson, of Govan, have launched a large paddle steamer, for the Dundalk Steam Packet Company. The Emerald Isle (as the vessel is named) is of 900 tons burthen and 300 horse power, her dimensions being 240ft. in length, by 28ft. beam, and 16ft. deep. The engines, furnished by Messrs. Thomson, are of oscillating construction, with surface condensers, feathering paddles, and all recent appliances. The Dundalk Steam Packet Company have already a fine fleet, and this last accession from the Clyde will keep up the reputation of the company. The Emerald Isle will be commanded by Capt. Williams, and will be placed on the Dundalk and Liverpool station.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

	£ s. d.	Dis. p. cs.
IRON, English Bar and Bolt:—		
in London ..... per tn	5 15 0	3
in Wales ..... „	5 0 0	„
in Liverpool ..... „	5 10 0	„
Staffordshire Bars .. „	7 0 0	1
Sheet, Single ..... „	8 10 0	„
Ditto, Double ..... „	10 0 0	„
Hoop ..... „	8 0 0	„
Rod, round ..... „	7 0 0	„
Nail Rod, sq. ..... „	7 5 0	„
SHEETING IRON, Staffordsh. Bars „	7 0 0	2
Sheet, Single ..... „	8 10 0	„
Double ..... „	10 5 0	„
Hoop ..... „	8 5 0	„
Rod, Round ..... „	7 0 0	„
Nail Rod, Square .. „	7 0 0	„
IRON, Rails, in Wales, cash „	5 5 0	nett
„ „ 6 months „	5 7 6	„
Old, to cut up „	0 0 0	„
Railway Chairs, in Wales „	4 0 0	„
„ in Clyde „	3 15 0	„
Pig No. 1, in Clyde .... „	2 11 6	„
3-5ths No. 1 & 2-5ths No. 3 ..... } „	2 11 6	„
No. 1, in Wales ..... „	3 10 0	„
No. 1, in Tyne and Tees „	2 12 0	„
Ditto, Forge ..... „	2 9 0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom. } „	2 10 0	„
Welsh Forge Pig (all Mine), at the Port .. } „	3 5 0	„
Acadian Pig, Charcoal.. „	7 10 0	„
Scotch Pig, No. 1, in London ..... } „	0 0 0	„

	£ s. d.	Dis. p. cs.
IRON, Swedish, Indian assortments ..... } per tn	11 5 0	2
Russian CCSD to arrive „	16 0 0	„
STEEL, Swedish keg, bath. „	18 10 0	2½
Ditto, rolled ..... „	18 0 0	„
Faggot ..... „	17 0 0	„
SPELTER, on the spot .. „	18 10 0	nett
To arrive ..... „	18 12 6	„
Hard, remelted ..... „	17 0 0	„
ZINC, in sheets ..... „	23 0 0	„
COPPER, Tile, 14 to 28 lb. „	93 0 0	2½
Tough Cake ..... „	98 0 0	„
Sheathing and Bolts ..per lb.	0 0 11	„
Sheets ..... „	0 0 11	„
Bottoms ..... „	0 0 11½	„
Old ..... „	0 0 9	„
Yellow Metal ..... „	0 0 9	„
Barrs ..... „	100 0 0	„
Russian ..... do. „	0 0 0	„
LEAD, British Pig ..... „	20 5 0	„
Spanish ..... „	19 0 0	„
W. B. ..... „	21 5 0	„
Sheet ..... „	21 5 0	„
TIN, English Block, nom. „	117 0 0	„
Bar „ „	118 0 0	„
Refined „ „	122 0 0	„
Foreign Banca ..... „	124 0 0	„
Straits ..... „	117 0 0	„
TIN PLATES, Char coal, IC..... } per box	1 9 0	„
Ditto IX ..... „	1 15 0	„
Coke, IC ..... „	1 3 6	„
Ditto IX ..... „	1 8 6	„
Do. at Newport, 1s. per box less	—	„
Do. at L'pool, 6d. „	—	„
CANADA Plates .... per tn	12 0 0	2
QUICKSILVER ..... per lb	0	

Rails have been rather dull of sale during the week, and price is not so strong.

Scotch Pig Iron.—A large business having been done during the past week; prices have advanced fully 1s. per ton, and the market closed firm yesterday at 51s. 7½d. for cash, Mixed Nos. Warrants, in Glasgow.

Spelter is quiet at £18 10s. on the spot.

Copper dull.

Lead.—But little doing.

Tin.—A reduction of £3 per ton on common English was announced today, but refined remains as before. Banca quoted £124, and Straits £117 per ton.

Tin Plates are easier. Good coke IC may be had 22s. per box.

April 3rd, 1862. Moate and Co., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Teak	15 10	17 0	15 0	18 0
Quebec, red pine ..	3 10	4 10	3 8	4 0
yellow pine..	3 0	4 0	3 0	4 15
St. John, N.B., yel.	3 5	5 10	3 0	5 10
Quebec, oak, white	5 0	5 10	5 0	5 10
birch	3 10	4 0	4 15	0 0
Memel..	0 0	0 0	0 0	0 0
elm	3 10	4 15	3 10	4 15
Dantzic, oak	5 10	6 0	5 10	6 0
fir	2 15	3 10	3 0	4 0
Memel, fir	3 10	4 0	3 10	4 0
Riga	3 5	3 10	3 10	3 15
Swedish	2 15	3 0	2 15	3 0
Nova Scotia, Quebec red pine	5 0	6 0	5 0	6 0
yellow pine	5 0	6 0	5 0	6 0
red pine	0 0	0 0	0 0	0 0
Lathwood, Dantzic	6 0	6 10	6 0	7 0
St. Petersburg	8 0	8 10	9 0	9 10
Deals, per C., 12 ft. by 3 by 9 in.				
Quebec, white spruce	13 0	18 0	15 0	19 0
St. John, white spruce	13 0	16 0	15 0	17 10

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Yel. pine, per reduced C.				
Canada, 1st quality	17 0	18 10	17 10	19 0
2nd do ...	13 0	13 10	13 0	13 0
Archangel, yellow	13 0	13 10	14 0	15 0
St. Petersbg, yel...	12 0	12 10	13 10	13 10
Finland.....	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	15 0
Gothenburg, yel...	10 0	11 10	10 0	13 0
white	9 10	10 0	9 10	11 0
Gefle, yellow	10 0	11 0	11 0	12 10
Soderhamn	10 0	10 10	11 0	14 10
Christiania, per C.				
12 ft by 3 by 9 in.....yellow	22 0	25 0	22 0	24 0
Deck plank, Dantz. per 40 ft. 3 in.	0 14	1 4	0 14	1 4
Staves, per standard M				
Quebec, pipe	70 0	75 0	80 0	85 0
puncheon	16 0	18 0	16 0	18 0
Baltic, crown pipe	160 0	170 0	170 0	180 0

SCOTCH PIG IRON REPORT.

		s.	d.	
No. 1	Gartsherrie	58	0	f.o.b Glasgow.
„ 1	G.M.B.	50	9	„ do.
„ 3	Do.	49	9	„ do.
M. Nos.	Do.	50	3	„ do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths „ 3 .. G.M.B.	Cash prompt	51	9	per ton.
	1 mo. open	52	0	do.
	2 mos. „	52	1½	do.
	„ „	52	3	do.

MANUFACTURED IRON.

	£ s. d.
Bars, Govan	7 0 0
„ Common	6 10 0
Drumpellier, Common	6 10 0
Do. Best	7 10 0
Plates and Sheets	10 0 0
Rails	7 0 0
Pipes	4 17 6
Chairs	4 0 0

Glasgow, 2nd April, 1862.

New life has been infused into the pig iron market, and a spirited demand has sprung up both for speculation and consumption. From the closing price of this day week, 51s. cash, we have steadily advanced to 51s. 6d., at which there are now buyers, sellers 51s. 7½d.

The local demand is improving, and the shipments have hitherto been far beyond those of the corresponding period of last year. Freights are now getting easier again, and, doubtless, the export returns will continue to show a steady increase.

Shipments last week were 11,284 tons against 10,169 tons in the corresponding week of last year.

Shaw, Thomson, and Moore, Metal Brokers.

THE GASWORKS OF LONDON.

(Concluded from page 206.)

THE dimensions, already given, of the great gasholders in London afford a strong contrast with those of the vessels first set up for the storage of gas. From a valuable paper on gasholders, read some years ago by Mr. Alfred Williams before the Society of Engineers, it appears that the gasholder, or gasometer, constructed in 1803 by Mr. Murdoch at the Soho Works of Messrs. Boulton and Watt, was 8ft. in diameter and 6ft. high. Not long afterwards, when some progress was being made in the introduction of gas for lighting towns, Sir Humphrey Davy, who, notwithstanding his great genius, was among the first to sneer at the most important applications of chemistry to the practical purposes of life, contemptuously asked Mr. Clegg if he intended to use the dome of St. Paul's for a gasholder. The latter, in replying that he hoped to see the day when such vessels would not be much smaller than the great dome, could hardly have foreseen how gasholders of even far greater bulk would ultimately be required. The dome of St. Paul's is 145ft. in external diameter, while already the Liverpool Gasworks are about to be enlarged by the construction of a gasholder 240ft. in diameter, 70ft. high, and containing upwards of 3,100,000 cubic feet of gas. For some years, too, the Imperial Company have contemplated the erection of a holder 300ft. in diameter.

For many years gasholders were regarded as dangerous, it being supposed either that gas was, by itself, explosive, or that it could become mixed in the holder with such a quantity of air as would render the combination explosive. It is now pretty well known that gas by itself is no more explosive than pump water, and it is evident that air cannot enter a vessel in which gas is compressed while its elasticity is greater than that of air. If a hole were knocked through the side of a gasholder gas would escape, but as long as the pressure, generally equal to 5in. of water, was maintained no air could enter. But not long after the time (1813) when the Chartered Gasworks went into operation a deputation, headed by Sir J. Banks, visited them to report upon the apparatus used, and, among other recommendations to Parliament, was one that the gasholders should not be made of a capacity greater than 6,000 cubic feet, and that they should be enclosed in strong brick buildings. The walls which formerly enclosed one of the earlier holders are still standing at the Horseferry-road station. Mr. Clegg was among the first, in the case of the Chester and the Birmingham Gasworks, to erect holders in the open air, and he did so in the face of much popular outcry against the supposed danger of such a practice.

Preparatory to the construction of a gasholder it is necessary to provide a tank of sufficient size for its reception, and to make the tank thoroughly water-tight. The first tanks, for holders of small size, were generally made of wood, and were the work of the brewers' vat makers, who guaranteed their duration for a term of years. Wood was not applicable, however, beyond a certain moderate size of tank, and the tanks are now always made either of brick, stone, or iron. In one case, at Chester, Mr. Clegg excavated a tank in solid rock.

Gasholders being now always made circular, on account of that form containing the most gas with the least amount of iron in the sides, the tank is a circular pit, 2ft. or more larger, in its internal diameter, than the holder itself. The depth of the tank is about the same as that of the holder where the latter is in a single lift. The telescopic arrangement, now generally adopted for large holders, permits of the use of a tank of only one-half or one-third the depth of the holder, according as two or three lifts may be used. It is not customary to excavate the pit to the full depth over the whole surface of the bottom, the full depth being requisite only next the wall forming the tank. A large conical mass of earth, carefully puddled over with clay, is generally left in the centre of the tank, except in very marshy soil. This cone or "core" is useful also in supporting the top of the holder when all the gas is out. In firm blue clay it is not always necessary to puddle the surface of the cone, but otherwise from 18in. to 2ft. of good clay puddling is generally requisite. Occasionally, however, concrete and even brickwork is employed for facing the cone, while in some instances a hurdling or wattling of stakes and osiers is employed for the same purpose.

The tank wall must be of a strength dependent upon the nature of the ground, as well as upon the depth and diameter of the tank. At the Great Central Gasworks, the tanks, 105ft. 9in. in internal diameter and 26ft. 6in. deep, are 3½ bricks or 31½in. thick at the bottom, exclusive of the spread of the footings, and fall off by three offsets of half a brick each to 18in. at the top. The new tank at the South Metropolitan works, about 112ft. in diameter and 31ft. deep, in ground full of water, is 4½ bricks, or 40½in. thick at the bottom, the wall being successively taken in, half a brick at a time, until a thickness of 18in. is reached at the top. Heavy counterforts are also employed around the walls of nearly all gasholder tanks, these counterforts serving also to support the columns which retain the holder in place and guide it up and down. In some of the best made tanks three or four courses of brickwork above and below each set-off are laid in cement, and hoop iron is applied as a bond at each set-off. The bricks, always of a hard durable quality, should be laid, as far as possible, in continuous courses, strong hydraulic mortar being generally employed, although cement is sometimes used at an additional cost. The impervious facing of the cone should generally be continued under the footing of the brickwork and united to water-tight backing of some kind, as clay puddle, around the outside of the wall. Stones or other supports should be built in at the bottom of the wall to take the edge of the holder when down.

Mr. Alfred Williams, who has had much experience of gasholder tanks and gasholders, recommends a trial of concrete blocks in the construction of the former. Such blocks have been successfully used in river walls, as at Thames Ditton and Woolwich, and would cost hardly one half as much as brickwork.

The tanks of two of the single lift holders at the Pancras station of the Imperial Company are each 55ft. deep. At the Hackney-road station the tank of the great holder is 204ft. in internal diameter and 41ft. 6in. deep, the wall being carried up in cement for its whole height. Upwards of 2,000,000 bricks and 5,000 cubic feet of stone were used in the construction of this tank. The site was that of a pond and the clay was about 35ft. below the surface. The whole cost of the gasholder, including the tank, was upwards of £40,000 of which a large part must have been required for the tank alone. The large gasholder at Kennington-oval, which cost not far from £15,000, has a tank about 162ft. in diameter and 36ft. deep, the cost of which was in round numbers, £6,000, the holder and columns costing about £9,000. Mr. Croll's estimate for the Great Central tanks, already described, was £2,351 each, there being four placed close together.

A considerable number of iron tanks are met with at the various gasworks of London. One at the City Gasworks, about 85ft. in diameter and 33ft. deep, is annular, the inner ring being 75ft. or 80ft. in diameter, well filled in with concrete and strongly hooped with wrought iron bars. It depends upon the size of a tank whether it is cheaper to remove the whole body of earth to the bottom, paving the latter with iron plates, or to open out a circular trench only and plate it on both sides. In the case of the tank at the City Gasworks, the latter course was adopted, the trench being opened out about 6ft. wide all the way down, the sides being planked and shored as the excavation went on. Iron plates for gasholder tanks are commonly cast in sizes of about 5ft. by 3ft., the lower tiers of plates being made of a thickness corresponding to the depth of the tank, say 1¼in. for 30ft., while the upper plates are about ⅝in. thick. Each plate is stiffened by stout ribs on the back, and each tier of plates is bound together by a hoop or band of wrought iron, those near the bottom of the tank being perhaps 5in. by 1¼in. The plates are cast with 3in. flanges, caulked with iron cement. The latter substance is so much used about gasworks that we may as well give here the usual proportions for its composition. To 16 parts (by weight) of clean cast iron borings are added 2 parts of sal ammoniac, and one part of flour sulphur. These are mixed dry, and, when required for use, one part of the mixture is added to 20 parts of clean cast iron borings, and worked up in a proper quantity of water. A little grindstone sludge mixed with the cement, improves it.

As for the construction of gasholders we can hardly do better than reproduce the particulars of the large holder at Kennington-oval, erected by the Horsley Iron Company, of Tipton, under the direction of Mr. Innes, engineer to the Phœnix Gas Company.

The lower lift is 160ft. in diameter, and the upper lift 157ft. 9in., the "grip" of the lower lift being 9in. wide and 15in. deep, and the cup at the bottom of the upper holder also 9in. wide and 15in. deep. The holder is guided upon sixteen columns, each formed of boiler iron, and each 73ft. high from stone base to cap. These columns are about 32ft. 8in. apart from centre to centre, the diameter, or distance between the centres of two opposite columns, as measured across the tank, being 166ft. 9in. The distance across the tank, from face to face of guide iron, is 161ft. 4in.

The columns are 3ft. 3in. in diameter at the base, 3ft. 2in. at the middle of their height, and 2ft. 8in. at top. They are formed of tiers of plates averaging about 6ft. high, and having three plates in the circumference of each tier. The lower two tiers or rings of plates are of ⅜in. iron, all the others being ¼in. At the bottom of each column is an angle iron ring, 4in. by 3in. by ⅜in., this ring being rivetted to the column and held to the cast iron base below by sixteen bolts ¾in. in diameter. Each column (the cast iron base of the column) is tied down by four bolts, there being in all 64 tie-down bolts, each 16ft. long and 2¼in. in diameter. Where they pass through the tie-down plate, which is built into the brickwork of the tank the bolts are made square for a few inches. Cottars 3in. by ⅜in. go through the lower ends of the bolts under the tie-down plate. The base castings forming the bottom of the columns are 9in. high, 5ft. 6in. by 4ft. 9in. square on the sole, and of a good thickness of iron. Outside of these are castings of ⅜in. metal, forming a plinth and moulding, the whole averaging 2ft. 6in. high. A Doric capital in ⅜in. metal is fitted also to the top of each column. The tops of the columns are tied together by two rods, each 2in. in diameter, and at the middle of their height they are tied together by two rods, each 1¼in. in diameter, 992 lineal feet of each diameter of tie rod being employed for tieing the columns together. The usual practice, as our readers will be aware, is to employ cast iron columns with heavy cast iron girders between them. For the latter there is really no occasion whatever, all the support afforded by girders being equally obtainable by means of tie rods.

On the inner face of each column, and descending, also, to the bottom of the tank, is a T-shaped guide of cast-iron, each guide being 109ft. high from the bottom of the tank to the top of the column. These guides are 6in. wide on the face, the rib projecting 6in. also, and are cast 1¼in. thick throughout.

Around the lower edge of the lower lift is a cast-iron curb, made in two portions. The one is a cast angle iron, 7in. by 6in., and of ⅞in. metal. This being cast to the right curve is applied on the inner side of the holder, the 7in. side being upright and the 6in. side projecting horizontally outwards. A corresponding cast channel-iron, 6½in. high, 4in. wide, and ⅝in. metal, is then applied to the outside of the holder. The respective portions being cast in segments about 12ft. long are put on so as to break joint with each other, and are bolted together through the holder, and also by their bottom flanges, ⅝-in. bolts being used.

The grip is made with 3-in. by 2½-in. angle iron in 18ft. lengths, with lapping pieces of the same section, and 3ft. long at the joints. The top of the grip is made of ⅜-in. plates cut in segments of the greatest length of which the iron would admit, and 7in. wide all round. These segments are put together with butt plates on the joints, each 6in. long. The dipping portion of the grip is made of ¼in. plate, edged on both sides at the bottom with 2in. by ⅜in. half round iron.

The top tier of plates next the grip, and the bottom tier next the curb of the lower holder, are ¼in. thick and 2ft. 6in. wide. The next contiguous tiers, one above and one below, are of ¼in. iron, and about 2ft. wide. The next contiguous tiers are of No. 12 gauge, all the others being of No. 14 gauge. On the inside of the lower lift, and at positions corresponding to the columns outside, vertica stiffening plates, 2ft. wide and 5/16in. thick, are put in for the whole height. The sides of the lift are stiffened b forty-eight vertical Memel timbers 6in. by 3in. in section These are arranged as follows:—Sixteen pairs 4ft. apart a placed on the inside of the lift, one pair opposite eac column, and the rest of the timbers or stays are arranged so as to come in intermediate between each pair. These timbers are securely bolted to the grip at the top, and to the curb at the bottom, and also with two ⅝in. bolts to each tier of plates in the sides of lift.

The lower lift is guided by sixteen 5in. cast iron rollers, 6in. wide, attached by plate iron brackets to the bottom curb, and by the same number of 12in. rolls at the top, each 6in. wide on the face and having a flange 3in. deep on one side.

The upper lift of the holder has a top curb made with angle iron, 6in. by 3½in. by ⅜in., with lapping pieces 3ft. long at the joints, and connected to a ring of ⅜in. plate iron, 21in. wide, forming a portion of the top of the holder. The sides of the upper lift are ¼in. thick next to the curb and the cup, the next contiguous tiers of plates being 5/16in. thick, and all the others of No. 12 gauge. The cup is made precisely the same as the grip of the lower holder, the same sections of iron being used throughout. The sides of the upper lift are stiffened by thirty-two Memel timbers, sixteen being placed so as to come opposite the columns outside, and the rest intermediate between them. The timbers opposite the columns are 12in. by 3in. in section, and are each fastened by a pair of angle irons 4in. by 3in. by ⅜in. The intermediate stiffening timbers are 9in. by 3in. Gusset stays of 3in. by 3in. by ⅜in. angle iron extend also from the angle irons, holding the 12in. by 3in. timbers, diagonally inwards and upwards to the inner edge of the curb plate in the top of the holder.

The top of the holder next to the ⅜in. curb plate, is ¼in. thick, the next interior ring of plates being ⅜in., the next No. 10 gauge, and all the others in the centre, of No. 12 iron. The top was laid out to be perfectly flat, but the slight stretching of the plates occasioned by rivetting over a surface of nearly half an acre in extent, drew the iron up in the centre to a height of 4ft. or 5ft., the present form of the top being that of a segment of an immense sphere.

A man-hole 5ft. in diameter in the clear, and 6in. high, is made in the top of the holder. The rim is made of ¼in plates, with 2½in. by ⅜in angle iron, and the top also of ¼in. plate, held down by ⅝in. bolts placed 3in. from centre to centre, the joint being made with a hemp gasket and red lead.

The upper lift is guided within the lower lift by small rollers attached to the lower outer edge of the cup, and by sixteen wheels 3ft. in diameter, mounted on large standards on the top of the curb.

All the joints of the plates were caulked with two strands of whip-cord laid in on opposite sides of the rivets. All the plates and wrought iron work were thoroughly coated with raw linseed oil, the joints being furthermore coated with a mixture of red lead and oil. The whole of the holder, both inside and out, was afterwards painted with two coats of red lead mixed in equal quantities of boiled and raw linseed oil, and the work afterwards proved with compressed air.

Holders with flat tops have been adopted in several cases of late, but it has been more customary to form the roof to a portion of a sphere, and to truss it with struts and tie rods. The roof of the great holder near the Hackney-road is stiffened in this way. Even when the holder contains more or less gas, so that the roof is supported clear of the ground below, the pressure of the gas, equal to from 200 to 250 tons under the roof of a large holder, would seem to require some amount of strengthening in the roof. When down, a flat roof can rest on a timber framing so as to avoid sagging, while, with a trussed roof with a boss in the centre, the support is generally upon the cone of earth left in the tank, a stone coping or iron plate being put in to take the bearing.

The earlier gasholders, of small dimensions, required to be counterweighted, but with the large holders now made no counterweights are necessary. On the contrary, iron has to be added to obtain the proper pressure of the holder upon the gas. The general weight or pressure of the large London gasholders is equal to 5in. of water over the whole surface. The Phœnix Company's holder, which we have described, weighs 250 tons 18 cwt., of which 207 tons 13 cwt. are wrought, and 43 tons 5 cwt. are cast-iron. The total weight of holder and columns, guides, and all ironwork, is 429 tons 18 cwt., of which 291 tons 19 cwt. is wrought, and 137 tons 19 cwt. cast iron. The great holder near the Hackney-road is said to "throw" at a pressure equal to 8½in. of water when filled. The total ironwork in this holder is about 1,500 tons, there being a peristyle of Doric and Corinthian columns, rising from twenty-four pedestals, each weighing 5 tons, and cast in a single piece.

An excellent holder, 150ft. in diameter, and rising, by two lifts, to a height of 50ft., was erected last year at the Western Gasworks, under the direction of the Company's engineer, Mr. Pritchard. The upper curb of the top lift is made of ⅜-in. and ⅝-in. plate iron, so as to form, with the sides and top of the holder, an annular box 18in. deep and 2ft. wide all around. No truss is used in the roof. The joints throughout the holder were put together on painted tape. The whole cost of the holder and tank was under £12,000, including all connections. It is, we are told, more difficult to secure tightness in a holder intended for cannel gas than for ordinary gas; but Mr. Pritchard's holder, which contains only cannel gas, has remained perfectly tight.

Almost all large gasholders are now made in two lifts, upon the telescopic plan. This plan greatly diminishes

the cost of the tank, which need be hardly more than half as deep as would be necessary if the whole depth of the holder were in a single lift. On the other hand, the cup of a double lift holder is more or less liable to leak, and especially liable to freeze up in winter.

In the valuable paper already referred to as read by Mr. Williams to the Society of Engineers, he gave the sizes and cost of a number of gasholders as follows:—

The two holders erected in 1853 at the Commercial Gasworks have brick tanks, and have each two lifts, the outer or lower lift being 122ft. in diameter and 24ft. 6in. high, while the upper lift is 119ft. 4in. in diameter and 26ft. high. The capacity of each is 580,000 cubic feet, the pressure equal to 3¼in. of water. The cost of the two holders was £17,056 14s. 8d., equal to £8,528 each. These holders have flat crowns without trussing. Two other holders erected at the same works, the one in 1850 and the other in 1852, were each 102ft. in diameter on the lower and 100ft. on the upper lift, each lift being 26ft. high. The capacity of each is 416,000 cubic feet, and the pressure 5in. of water. One of these holders cost, including brick tank, £4,900, and the other £5,350. A single lift holder with brick tank, belonging to the Imperial Company, is 157ft. in diameter and 40ft. high, holds 730,000 cubic feet of gas under 5in. pressure, and cost £11,400. It was put up in 1853. A telescopic holder belonging to the Phœnix Company, 150ft. in diameter, 37ft. high, and holding 630,000ft., cost £12,500, of which the brick tank cost £4,000. This was erected in 1847. The holder of the Crystal Palace District Gasworks, at Sydenham, is telescopic, and works in a brick tank. The lower lift is 62ft. 6in. in diameter, and 18ft. 6in. deep. The upper lift is 60ft. in diameter and 20ft. high. The capacity is 113,300 cubic feet, and the pressure 7½in. The cost, erected in 1854, was £3,230.

From the gasholders the gas passes through the governors to the mains. The governor is made like a small gasholder, but to the movable part is attached a conical valve in the inlet pipe. Thus, as the pressure increases, and the small holder of the governor rises, the conical valve shuts off a portion of the incoming gas.

The mains, which are laid 2ft. or 3ft. below the surface of the ground, are always made with socket joints, caulked with yarn with about 2in. of lead over it. A 36in. main is about ¾in. thick, except at the socket, where the thickness may be 1¼in. or 1½in. thick to give strength to withstand caulking. A 24in. main is hardly more than ½in. thick. The smaller mains are not far from ⅜in. thick.

It would be interesting here to enter upon the question of the flow of gas through mains, but our space does not permit.

The condition of the London gas companies in 1859 and the four preceding years was made public in 1860 through the labours of a select committee on the supply of gas to the metropolis. From the particulars then elicited we have prepared the following:—

Name of Company.	Capital 1859.	Capital paid up 1859.	Debenture debt.	Dividend per cent. 1859.
Chartered	£900,000	£660,000	nil.	8
City of London... ...	300,000	300,000	„	6
Commercial	320,000	273,210	14,600	6
Equitable	200,000	200,000	69,750	6
Great Central	200,000	172,160	66,000	5
Imperial	1,300,000	934,705	149,000	9
Independent	120,000	120,000	30,000	5
Ratcliff	100,000	100,000	nil.	5
Western	300,000	205,000	39,000	7
London	556,789	550,228	82,280	4·6
Phœnix	540,000	468,000	nil.	8
Surrey Consumers' ...	150,000	132,538	34,500	8
South Metropolitan ...	200,000	152,000	nil.	9
Totals	£5,186,789	4,267,841	485,130	

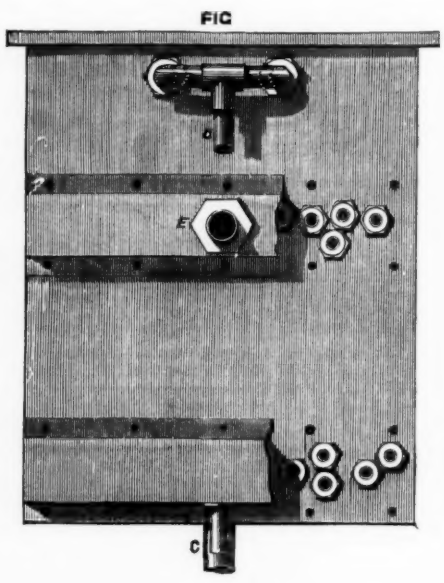
Since 1859, the profits of the London gas companies have increased, and some of those then dividing 5 or 6 per cent. are now paying 10 per cent. The coal carbonised by the Chartered Company, at their three stations, in 1859, was 116,554 tons.

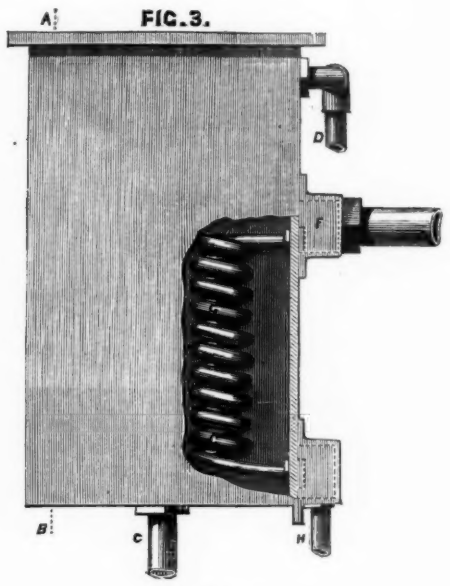
Young America and Old England.—Hobbs, the celebrated locksmith, was astonished at seeing over a shop in London, "Established 1762," and exclaimed, "If I were going to open a shop I would write over it, 'Established yesterday.'"

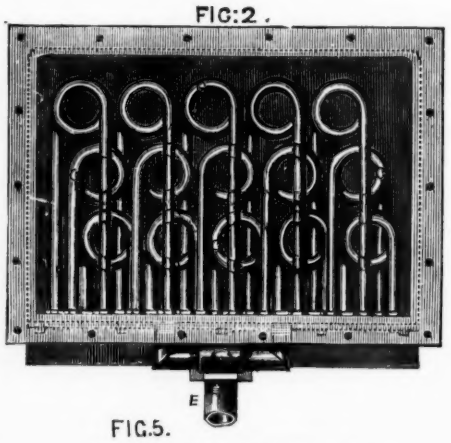
Iron-Plated Ships.—On Friday, the workmen at Portsmouth received orders to cut down the Royal Sovereign, 131 guns, and convert her into a 12-gun shield ship, on Captain Coles's principle. The Black Prince and the Royal Alfred are also preparing to be plated at Portsmouth. The Bulwark, 91-gun line-of-battle ship, on the stocks at Chatham, is also to be turned into an iron-plated frigate; and so will the Belvidera, 51 guns, in course of construction at the same place. It is said that several other three-deckers will be cut down and plated.

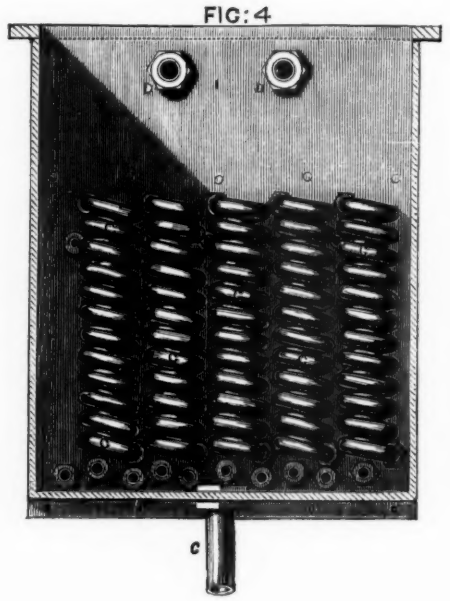
Naval Engineers.—The following appointments of naval engineers have been made since our last:—Robert J. Wemyss, acting chief engineer, late of the Pelorus, to the Indus, as supernumerary; James Gillies and Robert J. Hay, supernumeraries in the Asia, promoted to chief engineers; Augustus Leitch, confirmed as second-class assistant-engineer, in the Impérieuse; E. Tappin, R. Roots, W. W. Watts, and W. H. Phillips, acting second-class assistant-engineers, supernumeraries in the Asia, to the Impérieuse, as supernumeraries; W. Fraser, J. Taylor (C), A. Hutchinson, and R. Jarvis, supernumeraries in the Cumberland, to the Impérieuse, as supernumeraries; W. H. Kent, J. Slack, D. Crichton (B), and G. J. Johnson, supernumeraries in the Fisgard, to the Impérieuse, as supernumeraries. Admiralty:—Thomas F. Hight, supernumerary in the Fisgard, confirmed as first-class assistant-engineer; Daniel A. Cochrane and W. E. Shingleton, second-class assistant-engineers, to the Asia, as supernumeraries; Frederick W. Brown, chief engineer to the Tribune, vice Barber, superseded from ill health; Henry Williams, confirmed as chief engineer; P. Butler, engineer to the Fisgard, for the Columbine; G. F. Bell, engineer to the Zebra; T. F. Hight, first-class assistant-engineer to the Cumberland, for the Herring; T. Baldwin, first-class assistant-engineer to the Zebra; H. Birch, first-class assistant-engineer to the Indus, for the Shamrock; E. Eckersley, first-class assistant engineer to the Hawke, for the Lark; W. C. Batty, acting first-class assistant-engineer to the Cumberland, for the Spanker; J. H. Bray and Frederick Hallet, acting second-class assistant-engineers to the Zebra; J. M'Milan, acting second class assistant-engineer, to the Cumberland, for the Resistance.

SELBY'S SURFACE CONDENSERS.













This invention, by George T. Selby, of Smethwick, consists in making the tubes of condensers of a spiral or worm form for the whole or part of their length instead of straight, as heretofore. The spiral or worm form will admit of expansion and contraction in the length of the tube without affecting the joints, where the ends of the tubes are fixed tight and fast in the plates or sides of the cistern of the condenser. Fig. 1 is a front view, Fig. 2 a plan, Fig. 3 a side view, and Fig. 4 a transverse section through the line A, B, of a surface condenser fitted with tubes according to the invention. C is a pipe by which cold water enters the condenser; D is the exit pipe for the same; E is a pipe by which the exhaust steam from the engine enters the chamber F, and thence passes to the spiral tubes G, G; H is a pipe by which the water is drawn off by an air-pump in the ordinary manner.

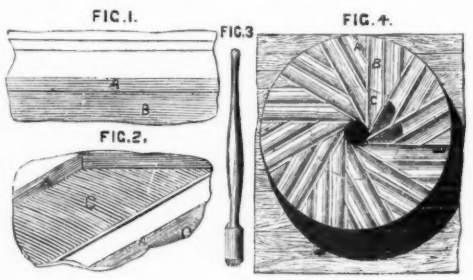
The ends of the spiral tubes are bent and fixed into the side plates of the shell or frame of the condenser instead of being turned up and down so as to fix them into the top and bottom of the condenser. A spiral tube arranged in this manner is shown at Fig. 5; the tubes may, however, be turned into a flat spiral or worm form, as shown at Fig. 6. The ends of the tubes are fastened by means of nuts, each end being threaded far enough to pass through the plate and receive another nut. Under either or both of these nuts a washer of leather, india-rubber, or some other similar substance is placed in order the more effectually to make the joint tight.

CHILDS' MODE OF DRESSING MILLSTONES.

These improvements in setting millstones are by A. B. Childs, of New Oxford-street. Figs. 1 and 2 are sections of the stone, showing the dressing; Fig. 3 is a view of the plane or instrument, with which the dressing is executed, or put upon the grinding surface of the stone; Fig. 4 is a view of the stone, completely dressed for work, a portion of the fine lines, however, only being shown. The following is the manner of preparing and dressing the stone:—The face of the stone is laid out according to the usual known modes of dressing, and the deep furrows may be allowed to remain when the improved dressing is to be executed, or put upon a stone which has been previously dressed.

The first operation is to cleanse the surface of the stone by applying thereto the following composition, to wit: a quarter of a pound of saltpetre, a quarter of a pound of tartaric acid, and half a pound of common salt dissolved in one gallon of vinegar, and well mixed together. Pipeclay and emery mixed together are then used to polish the stone, planing out the furrows as true as possible; and at two-thirds of the way up the inclined plane of the furrow at A the crack or grinding surface is commenced. When the whole of the face has been thus polished as smoothly as possible, the tool now described is used. This tool is composed of one or more diamonds inserted in a bit or handle, and when two or more diamonds are used they are to be firmly set in a row at equal distances apart. The furrows or cracks A and B are produced by running with adequate force the points or diamonds over the face of the stone where the lines are intended to be cut, and such operation may be conveniently performed by running the tool containing the diamond along the edge of a straight ruler. The curved lines, as represented at C, C, C, are made by working the same diamond points by the side of a curved ruler. The width of the space separating the lines upon the grinding surface of the stone is regulated by holding the points more or less diagonally across the line of motion.

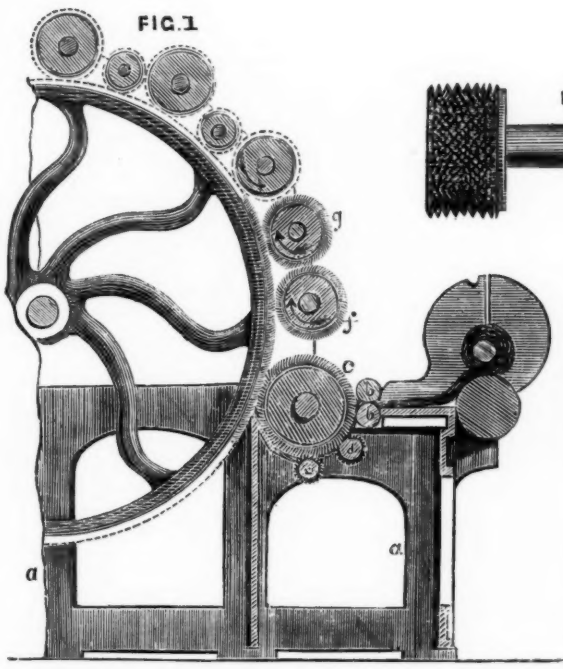
In order to show the precise nature of the improvements it may be as well to explain the ordinary modes of dressing millstones. In the ordinary mode the pick being brought down upon the face of the stone produces the stellated fracture, and thereby weakens or disintegrates the stone as far as the fracture extends, and the edges of the crack which have been thus weakened by the blow from the pick soon crumbles away, and the particles thus detached are thrown out and wear the face of the stone. Those disadvantages are prevented by the present improvements in dressing millstones.



The line cut by the diamond upon a glossy surface, which has never been detonated or disintegrated by a blow from a pick is clear and distinct, having its edges sharp and fine. Millstones will be more perfect when dressed again, according to this invention, as the diamond will cut below the bruises occasioned by the old mode of dressing with a pick.

In the old mode of dressing with a pick the furrow is rough and nearly flat at the bottom, whereas furrows cut with the diamond are smooth, having the side upon which the grain rises a regular smooth inclined plane. The passage of the grain to the face is uniformly checked by the lines at A, where the bran is taken off, and there is no crushing contact of the stone with the wheat, as the sharp edges of the cracks or small lines cut or shave up the grain, and the flour comes from the stone with all its nutrition. There is no perceptible moisture generated in the operation of grinding with millstones, dressed according to this process, and the sprouts are clean and dry, which may be attributed to the fact that the grain is kept back or in towards the eye by the retarding curved lines until well ground, and while the motion is less rapid, and, consequently, less liable to heat. When the flour has reached the extreme of the breast circle it is rapidly thrown from the stone with few, if any, inequalities to retard its egress, and it will be found that much less power is required for grinding when this mode of dress is employed to produce the same amount of a superior article of flour.

WILLIAMS AND PARKINSON'S CARDING ENGINES.



This invention, by Peter Williams, of Salford, and Thomas Parkinson, of Bury, is designed for the purpose of separating the dirt and extraneous matter contained in cotton and other substances before passing through the carding engine. The improvement consists, first, in the novel application of one or more rollers beneath the "licker-in," such rollers having their surfaces subdivided by grooves in the line of circumference, and transversely in the line of axis, so as to form teeth or projections thereupon, which act upon the cotton passing between them and the "licker-in" in such a manner as to disengage and separate the impurities therefrom, which fall into a receptacle provided for the purpose.

Secondly, the improvement consists in the novel application and use of an extra card roller or cylinder placed before the usual first top card roller, and so driven as to cause it to take the cotton from the main cylinder. The cotton is then taken from the extra roller by the usual first card roller, and fed on to the main cylinder, by which arrangement a further separation of the dirt is effected, and the cotton passes thus cleansed through the carding engine as usual, and by this means is more thoroughly carded.

Fig. 1 represents a sectional view of that portion of the carding engine to which the invention is applied; Fig. 2 is a side view, showing the arrangement of gearing for actuating the extra rollers; and Fig. 3 is a detached view of a portion of one of the extra rollers as employed beneath the "licker-in," showing the serrated or toothed surface of such rollers.

In Fig. 1 *a*, *a*, is the framing of the machine, and *b*, *b*, the feeding rollers delivering the cotton to the "licker-in;" *c* and *d*, *d*, are the extra rollers beneath the "licker-in," the teeth or serrations of which act upon the cotton passing between them and the "licker-in" in such a manner as to cause the cleansing of the cotton by loosening, separating, and disengaging the leafy and other impure particles therefrom. The extra card cylinders *f* and *g*, forming the second part of the invention, effect a further cleansing and combing of the cotton. The roller *f* is driven in the direction indicated by the arrow, and in such a manner as continually to strip the whole of the cotton from the main cylinder A; the extra card cylinder *g* (rotating as indicated by the arrow) then takes the cotton from the cylinder *f*, and passes it again on to the main cylinder, which extra process further and materially assists the carding of the cotton before it passes through the subsequent operations of the machine, which are conducted in the usual manner.

CHASE'S APPARATUS FOR FEEDING BOILERS.

M. Giffard's Injector, as constructed previously to this invention by W. L. Chase, of Philadelphia, U.S., although admirably adapted to force water into boilers, cannot be relied upon to draw water from a level much below that of the Injector; hence its employment has been limited in practice to cases in which the level of the water from which the Injector is supplied is not more than about 5ft. perpendicularly below the Injector.

The object of this invention is to enable the Injector to be employed to draw water from much greater depths, and thus to extend its application to many cases in which it could not previously be used with success unless a lifting pump, or some other means, were used in connection with it to raise the water to the level from which it could draw the water with certainty.

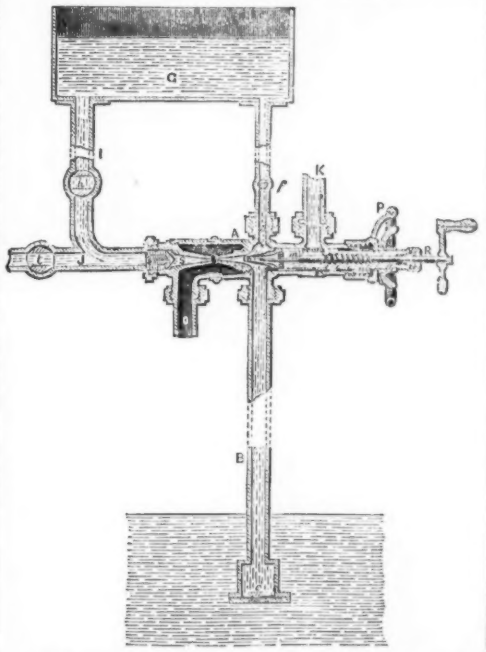
When the "Giffard Injector" is in successful operation, the suction pipe from the steam nozzle to the source from which the water is supplied is filled with water, hence the steam jet acts upon dense water; when, however, the working of the apparatus is stopped by shutting off the steam, the water in the suction-pipe runs back to the level of the supply, leaving the suction-pipe full of air; hence, when steam is again turned on, the steam jet, instead of acting upon dense water, acts upon expansible air; and if the level of the supply is much below that of the Injector the steam-jet cannot wholly exhaust the air from the suction-pipe, and the water will not rise to the level of the steam-jet.

The object of the first part of this invention is to obviate this difficulty, and it consists in combining a Giffard Injector and the suction-pipe thereof with a valve located in the said suction-pipe in such a position that it prevents the reflux of the water from the suction-pipe when the steam is shut off from the apparatus.

The object of the second part of this invention is to permit the suction-pipe to be filled with water, or "primed," up the end of the steam nozzle, so that when the steam-jet is put in operation it shall begin to act immediately upon dense water. This part of this invention consists in combining the Giffard Injector, the suction-pipe thereof, and the reflux valve before mentioned, with a priming nozzle fitted with a cock or valve, the combination being such that the suction pipe can be primed through the priming nozzle, and that the latter can then be closed.

The object of the third part of this invention is to procure a supply of water for priming the suction pipe by the operation of the Injector, and it consists in combining the second part of this invention with a tank by means of a branch pipe leading from the discharge pipe of the Injector, which branch pipe is fitted with a cock or valve, so that the tank may be replenished with water by the Injector itself.

The apparatus represented in the illustration embodies the invention. The Giffard Injector A is connected with the source of supply by means of the suction pipe B, which is enlarged at its lower end to form a chamber for a self-acting flap valve *c*, which is below the water level and opens upwards; hence, whenever the operation of the Injector is stopped, this valve closes by its weight, and prevents the reflux of water from the suction pipe. The priming nozzle *e* is in this instance formed upon the Injector itself, and it is fitted with a cock *f*, by which it can be closed. As the supply of priming water is, in this instance, taken from a tank, the priming nozzle is connected with the tank G by means of a pipe, in which the stop-cock *f* is located. The tank is combined with the Injector by means of a branch pipe I leading from the discharge pipe J, and the branch pipe and discharge pipe are both fitted with cocks, so that the Injector may be used to replenish the tank, or to force water through the discharge pipe to a steam boiler, as desired, by putting the Injector in connection with the one, and closing the connection with the other. K is the steam pipe leading from the boiler; *m* is the perforated tube through which the steam passes to the steam nozzle *n*; O is the overflow pipe: *s* is the check valve to prevent the reflux of water from the discharge pipe when the Injector is not working; P is the hand wheel for setting the steam nozzle, and R is the screw rod for regulating the flow of steam through the steam nozzle.

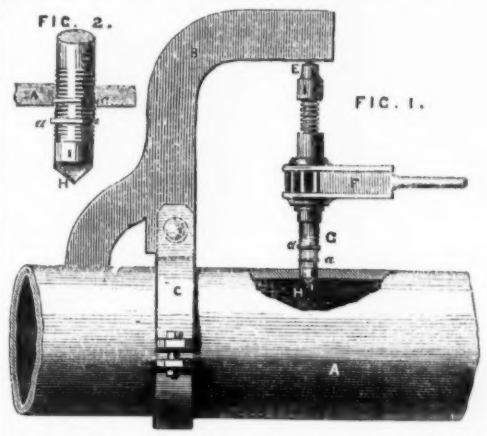


In order to put the above described apparatus into operation the tank should be filled with water, the priming cock should then be opened to permit water to flow through the priming nozzle into the suction pipe, and as the reflux valve *c* at the bottom of the suction pipe prevents the escape of water from the suction pipe, the latter can be entirely filled with water up to the steam nozzle. As soon as the suction pipe is full steam may be turned on into the Injector, and then the priming cock should be closed. As the suction pipe is thus filled with water up to the steam nozzle, the steam jet will begin to act immediately upon dense water, and the apparatus will proceed to draw water through the suction pipe. Instead of using a tank to supply priming water, the latter may be poured in by hand, or a supply may be obtained by connecting the priming nozzle with the boiler, which is to be fed by the Injector by means of a pipe which enters the boiler either above or below the water level therein. In the former case the priming water will be furnished by the condensation of steam from the boiler, and in the latter case the water taken directly from the boiler will be used for priming. The position of the priming nozzle is not a matter of importance provided the arrangement be such that the suction pipe can be filled; thus, for example, the priming nozzle can be placed upon the suction pipe between the body of the Injector and the reflux valve, provided a pipe be applied to the nozzle and be extended sufficiently high to enable the suction pipe to be filled by supplying water through said pipe. In the illustration is represented a stop-cock *t* in the discharge pipe J to cut off the connection with the boiler when the priming tank is to be filled. This stop-cock is unnecessary when a check valve is used between the branch pipe and the boiler to prevent the reflux of water from the latter when the stop-cock leading to the tank is opened.

SOMERVILLE'S APPARATUS FOR DRILLING AND TAPPING MAINS.

This invention, by John Somerville, of Maidstone, relates to a peculiar construction and arrangement of apparatus for drilling and tapping gas and water mains and pipes, whereby the leakage which takes place when performing these operations under ordinary circumstances and by the usual means is obviated.

Fig. 1 represents a complete side elevation of the apparatus in working order, and Fig. 2 is a detail of the drill and tap, showing the india-rubber washers or collars in their respective places A represents the water or gas main to be drilled or perforated; B is the bracket or cramp, which is clamped on to the top of the main by the clip C and bolt and nut D, and having a hole centre-punched in it to receive the pivot E of an ordinary ratchet brace F; G is the tap fitted into the brace, and H is the drill which is fitted into the tap and secured therein by a pin or otherwise; *a*, *a*, are two washers or collars of india-rubber or other suitable material fitted into annular grooves or recesses made in the tap, and I is a circular or short cylindrical piece forming the upper part of the drill, and serving to partially plug the hole and steady the drill therein.



In using this apparatus the pipe is first centre punched at the part to be perforated and the drill is then applied and rotated in the ordinary manner by the ratchet brace F, or otherwise. A hole is thus drilled, and as the drill proceeds the cylindrical part I enters therein, so as to effectually prevent any leakage and keep the drill steady after its point has penetrated the main, at the same time preventing it from breaking through too soon or until the hole is perfect and ready to receive the tap. As soon as the drill has entirely passed into the main the tap G follows up and commences to cut the thread. As the cutting of the thread proceeds, and just before the part I has entered the main, the first of the india-rubber or other washers or collars *a* enters the hole, and being slightly larger than the hole, it effectually plugs it, and being compressed therein, prevents any escape of gas or water through the slots of the tap. As the tap is turned the washer or collar is carried with it and passes into the main, being immediately followed by the second washer or collar (as shown in Fig. 2), one of such being always in the hole till the entire thread is properly cut, when the tap is withdrawn and the service pipe attached in the usual manner.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

April 10th, 1862.

Mr. James B. Walton, Vice-President, in the chair.

ON SINGLE AND CONTINUOUS STRAIGHT GIRDERS.

By Mr. Francis Campin, President.

There is, perhaps, no era in the history of the constructive arts more clearly defined than that which is distinguished by the introduction of wrought iron as a material for the manufacture of permanent bridges of rigid character, and during the last sixteen years vast strides have been made in the art of bridge construction, designs almost innumerable having been brought before the public, and the number of bridges actually erected having multiplied yearly. The greater number of bridges manufactured of wrought iron depend upon ribs, constructed on the principle of beams or straight girders, as they are technically termed, and it is to the mode of designing, and to the relative practical advantages of certain forms of girders, that I am desirous of directing your attention this evening.

The amount and nature of the strain upon any part of any girder may be calculated to the greatest nicety by means of formulæ deduced from mathematical investigations, which, however, are frequently complicated, and far too intricate to be borne in mind; hence I have made it my study to obtain expressions or geometrical forms for the determination of the dimensions of the various parts of wrought iron girders, of such a character as may be readily remembered and applied without difficulty. I will just explain the nature of my results, and then proceed to consider the practical points of my subject. The ordinary method of determining the direct strain at the centre of a single girder on either flange is sufficiently simple, as it is found, by multiplying the load upon the girder, uniformly distributed by the span given in terms of the depth, and the product by 0·125; thus, suppose we have one girder, 100ft. in span, and 10ft. deep, with a total distributed load of 50 tons, then the span divided by the depth is 10, and the thrust on the upper or pull on the lower flange is $50 \times 10 \times 0{\cdot}125 = 62{\cdot}5$ tons, and taking 4 tons per sectional square inch as safe load on gross section for tension or compression, the area of metal to withstand the above strain will be 15·625 square inches. The next proceeding consists in determining how the metal shall be reduced as we approach the extremities of the girder; it should theoretically diminish as the strain, and practically the nearest convenient approximation to this condition should be adopted. The most ready method of reducing the area in the most common cases will consist in the reduction of the thickness of the metal of which the flanges are composed, according to laws which may be determined by the following expressions:—

Let w = the load per foot run upon the girder, l = the span in feet, d = the depth, and x = the distance from either pier to a point at which it is required to determine the strain upon either flange, then calling S = this strain.

$$S = \frac{w\,x}{2\,d}(x - l).$$

And if w be given in tons, and a = the sectional area of either flange in square inches, then,

$$a = \frac{w\,x}{8\,d}(x - l),$$

which equation gives the form of a parabolic curve. It is, however a matter of observation, that these parts of a parabola, which are at, or contiguous to, the vertex, do not differ widely in contour from a circular arc, and, by adopting proper scales, the curve of strains may be taken as represented by a segment of circular form, which will produce a slight error in excess, and therefore on the safe side

The precaution to be taken is to make the horizontal scale to which the line of girder is plotted as large as possible in proportion to the vertical scale of strains, so as to obtain a parabolic arc of the least vertical depth, the method of thus determining the distribution of metal in the flanges of a plate girder as follows :—

As an example, let us take the case already cited. We had a girder 100ft. in length, uniformly loaded, requiring at the centre a sectional area in each flange, equal to 15·625in., which may with sufficient accuracy for practice be called 16in., it is required to determine the area at every point in the girder. Draw two rectangular co-ordinate axes, the axis of x being horizontal, and that of y being vertical, then upon the axis of x lay off to scale a distance equal to the span of the girder, bisect this distance, and at the bisection draw an ordinate, parallel to the axis of y, and representing to a given scale the area of the flange at the centre of the girder, which in the above case will be 16in.

If it be required to ascertain what area of flange will be required at any given point in the length of the girder, it is simply found by measuring the length of the ordinate to the curve of strain at that point, the result showing the least area that may be used, and practically all that is requisite will consist in measuring ordinates, at points corresponding to the main joints in the flange.

In order to exhibit the advantage gained by the use of the method explained above, I will take an example, and calculate it by the ordinary method.

Let it be supposed that we are required to proportion the girders for a railway bridge of 200ft. span for two lines of railway similar to that erected by Messrs. Fairbairn over the Salt Water River in Australia, of which the weight was 2·268 tons per foot run, and the load 2 tons per foot run. Let us further suppose that the plates of which the flanges are formed will be in lengths of 10ft., then it will be necessary to determine the area of the flanges at every 10ft. for half the girder; it is unnecessary to make the calculations for the whole girder, as the strains are evidently symmetrical with regard to the centre of the span of the girder.

The formula by means of which the required areas will be found is

$$\frac{W}{8\,d}\,x\,(x-l),$$

which in the present case becomes

$$\frac{4{\cdot}268\,x}{8\,d}\,(x-200).$$

And if we assume the best proportion for the depth of the girder, viz., one-twelfth of the span, we have for the sectional area,

$$\frac{4{\cdot}268\,x}{16{\cdot}66\cdot\times 8}\,(x-200)$$
$$= 0{\cdot}032\,x^2 - 6{\cdot}4\cdot x.$$

It now remains to apply this expression, when x = 10ft. the area,

$$= 3{\cdot}2 - 64$$
$$= 60{\cdot}8 \text{ square inches.}$$

It is necessary here to pause to explain the cause of the minus sign: it is due to the fact that the deflection of the girder occurs so as to render its upper surface concave. The disposition of signs is, of course, arbitrary; but the above results from the common practice of algebraic analysis. As we have worked the calculation when x = 10ft., so it must be carried out for the remaining nine values of x, when the required quantities will be obtained.

By the method proposed above the following course will suffice for the attainment of the same object with sufficient accuracy for all practical purposes. The depth of the girder being one-twelfth of the span, it follows that the span in terms of the depth is twelve, and the total distributed load upon the girder is

453·6 tons,

so the area required at the centre for either top or bottom flange is

$$= 0{\cdot}03125\ W.\ l$$
$$= 0{\cdot}03125 \times 453{\cdot}6 \times 12$$
$$= 170{\cdot}1 \text{ square inches.}$$

This area being laid off to scale as above directed, and the circular arc drawn, any other area may immediately be obtained by simple measurement.

There are other practical conveniences attending this mode of calculation, which are perhaps worthy of notice. Suppose, for instance, that, after the calculations have been made, it is determined to alter the length of the plates, and therefore the position of the joints, when the curve is used no fresh calculations are required, as the area of any part of the flange may immediately be found by measurement; whereas, by the former method, the calculations must be recommenced, and in this method also the occurrence of fractional numbers may complicate the process.

I will now pass on to consider the cases of girders which are not merely supported, but rigidly fixed at one or both extremities. Not so much on account of the practical occurrence of such structures shall I devote particular attention to these cases, but because they will be of great value in the subsequent considerations.

If a girder be merely supported at both extremities, and so formed that its ends are vertical, when there is no load upon it, then, when a load is caused to act upon the girder, its ends will be diverted from their former vertical position, as deflection of the structure is produced, the strain produced being a tensile strain upon the lower and a compressive strain upon the upper flange. If, however, the extremities be firmly fixed, then it is evident that no deviation can be produced, but the deflection of the girder can only act by stretching and shortening the metal of the girder, and, as under the circumstances attendant upon the case of a supported girder, the upper extremities of the end plates approach each other, which they are restrained from doing in the fixed girders, it follows that a tensile force is produced on the upper, and a compressive force on the lower flange, in addition to the forces above mentioned as occurring in the girder merely supported. Hence we have in each flange, two forces—one tensile, the other compressive—the one having its maximum value at the centre, and the other its maximum value at the extremities of the girder; hence there will be some intermediate points at which there will be no horizontal strain on either flange, the tensile and compressive forces exactly balancing each other at those points which are called the points of contraflexure, because the curvature of the beam there changes, for up to the point of contraflexure the upper surface of the flange is convex, after which it becomes concave as far as the next point of contraflexure, where it again changes, and becomes convex. The course to be followed in determining the strain upon any part of the girder is simple in principle, and consists in first determining the strains, as if the girder were merely supported, then finding the strain over one point of support, and finding the difference between this and each of the strains previously determined. There is, however, another mode of viewing the question, which is perhaps more convenient than the foregoing, and which is practically more simple and nearly as accurate.

Let us first consider the case of a girder firmly fixed at both extremities, which gives the strongest form that can be adopted. The strains may then be represented by a curve, a segment of a parabola, of which the vertex will be below, and the extremity above the line of girder, which is crossed by the curve of strain at the points of contraflexure; and the area of the curve will represent the sum of all the strains upon this girder. This area will consist of three parts, viz., the central part between the points of contraflexure, which is a segment of a parabola, or of a circle, if the simple method be adopted; and the two areas between the points of contraflexure and those of support, which may, with sufficient accuracy, be regarded as triangles, the curved boundaries being replaced by the straight lines, which will give rise to an error in excess. It is natural that the internal forces which maintain the beam as a whole should so adapt themselves that the strain upon the girder shall be a minimum, which will, of course, be indicated by making the gross area of the curves of strain a minimum; and this being taken as granted, we have a ready means of determining the positions of the points of contraflexure by the rule of trial and error, commencing by assuming some value for the load, the intensity of which does not affect the position referred to; and assuming two values, fractions of the span, and calculating the area of the curve of strains to such values; then taking another pair of values, and repeating the operation until we arrive at two very near values, between which the true value is, when we may assume the near value as that sought. This is the simple theory, and only requires to be once worked to find formulæ for practical use, which, when found by this method, agree very well with the results of the common and complicated process of the infinitesimal calculus, the error being about $\frac{1}{355}$, or $\frac{1}{8}$ per cent of the whole quantity.

By applying the above process to the case of a girder fixed at both extremities, we find that the distance from either point of support to the nearest point of contraflexure under an uniformly distributed load, is equal to the span multiplied by 0·215 nearly, or $\frac{3}{4}$ths of the span nearly, and the girder may be regarded as virtually divided into three pieces; the centre part acts as a girder, simply supported at each end, and of a span equal to the whole span multiplied, by 0·57, being that part of the girder which is included between the two points of contraflexure; hence, to determine the proportions of this part of the structure, we have only to proceed as follows:—Let w = the total load in tons per foot run, l = total span of the girder, d = depth of the girder, then the sectional area of either flange at the centre of the girder will be found from the expression,

$$\frac{w\,l^2}{100\,d}$$

which gives a result very nearly approximating to absolute truth.

This quantity having been laid off to scale upon an ordinate, drawn at right angles to the line of girder, and at the centre of the same, and a circular arc being described to pass through the point thereby formed, and the two points of contraflexure, the area for any other part of the flanges may be found by measurement. Next, with regard to the ends of the girder, as these are symmetrical, we need only consider one of them: it is under the condition of a beam fixed at one end, and free at the other, loaded with an uniform load, and with a concentrated load at its extremity; its length is the span multiplied by 0·215; the uniformly distributed load is w; and the load concentrated at its free extremity is half the total load on the central part of the girder, or w multiplied by 0·285 l; hence the area of either flange over the point of support is found from the expression

$$\frac{w\,l^2}{50\,d}$$

practically.

This area being laid off to scale on an ordinate drawn at right angles to the line of girder over the point of support, and the point thus found being joined with the nearest point of contraflexure by a straight line, the area at any other point, between those of support and contraflexure, may be readily found by measurement.

If a girder be fixed at one extremity, and supported only at the other, then there will be but one point of contraflexure, which by the above method is found to be a quarter of the span, from the fixed extremity of the girder, hence the girder is divided into two parts. Virtually one is as a common beam, supported at each end, and is comprised between the point of contraflexure and the most distant point of support, and is treated like the central part of the girder in the last case, the area of either flange at the centre of this part (not at the centre of the entire girder) being found from the expression

$$\frac{w\,l^2}{57{\cdot}9},$$

and the circular arc described through the point thus found, and through the points of contraflexure and support.

The area of either flange over the fixed end of the girder will be found from the formula

$$\frac{w\,l^2}{32\,d},$$

the straight line being drawn from the end of the ordinate thus determined to the point of contraflexure.

Having found the conditions of strain on girders fixed at one or both ends, we can now find approximately the conditions of any continuous girder by assuming the various spans as fixed under given loads, and equalling the strain over any pier due to the loads on either side of it. Let us take an example in a girder of two spans continuous: it is required to find the maximum areas required for each, let l = length of first span, l' = length of second span. We will first determine the maximum areas for the parts of the girder, adjacent to the centre point of support. The maximum strain will occur over this point when both spans are fully loaded. Let w = total load per foot run, and w' = weight of structure per foot run; let $\frac{l}{x}$ and $\frac{l'}{x'}$ represent the distances of the points of contraflexure from the centre point of support, then the area over that point will be

$$\frac{w\,l^2}{8\,d\,x},$$

calculated from the first span, and

$$\frac{w\,l'^2}{8\,d\,x'},$$

calculated from the second span; hence, as the strains due to each span must equilibrate over the point of support,

$$\frac{w\,l^2}{8\,d\,x} = \frac{w\,l'^2}{8 d x'}$$

Hence,

$$\frac{l^2}{l'^2} = \frac{x}{x'}$$

from which the values of x and x' may be found when l and l' are given; and if y, y', be the distances of the points of contraflexure from the centre point of support,

$$\frac{l}{l'} = \frac{y'}{y}$$

The area may now be found from either of the previous equations, and the lines drawn as usual.

Next let us consider that part of the first span which is to be treated as a girder supported at both ends. The greatest strain will occur here when this span only is fully loaded, the other bearing only its own weight, and all that we need do is to determine the position of the point of contraflexure. Using the above notations we find—

$$w\,l\,y = w'\,l'\,y'$$
$$y = y\ \frac{w'\,l'}{w\,l}$$

which will give the required value.

These expressions, stated as above, are not in themselves absolute; hence it is desirable that I should remind you of the general conditions of the theory, for it is evident that, from the foregoing equations, the ratio $\frac{y}{y'}$ is all that is obtained. For simplicity I will take the first case, as it involves fewest terms. We have—

$$\frac{l}{l'} = \frac{y'}{y}$$

Now let l = 20, and l' = 40, then

$$\frac{y'}{y} = \frac{l}{l'} = \frac{20}{40}$$
$$y = 2\,y',$$

that is to say, whatever y is, y' is twice that quantity. First assume that y' and y are each respectively one-fourth l' and one-fourth l—as they would be if the girder were actually fixed—and then let one diminish and the other increase; so we shall get the right values.

Thus, by the first assumption,

$$y' = 10,\ y = 5.$$

The areas calculated from these quantities would be as 4 to 1 the mean of which is 2·5 times the least, which is the true area Let the areas found on the first assumption be plotted on an ordinate over the point of support, and the lines of strain drawn; then let the distance between the two areas be bisected, and from this point of bisection draw other lines of strain parallel to the first, then it will be seen that the co-efficients for y' = 10, and y = 5 are $\frac{5}{8}$, and 2·5, giving the following results :—

$$10 \times \tfrac{5}{8} = 6{\cdot}25, \text{ and } 5 \times 2{\cdot}5 = 12{\cdot}5,$$

which are the quantities sought.

The same method may apply, obviously, to girders of any number of spans, and I will here repeat that the results will be quite near enough to the truth. As it may appear that the processes above detailed are themselves lengthy, I will beg to quote the formulæ for determining the area of either flange of a three span girder over one pier, by the only correct method formerly known, simplifying the expressions for a symmetrical girder, that is to say, for one of which the end spans are equal.

Let a = the required area, l' and l'' the first and second spans, w'' and w''' the loads per foot run on each span, $m = \frac{l''}{l'}$, then

$$a = \frac{l'^2}{16}\cdot c,$$

in which c is a co-efficient, of which the value is found from the reduced expression—

$$c = \frac{-\,m^3\,w''' + (2\,m+1)\,w'' + 2\,m^3\,(m+1)\,w'}{m^2\,(4\,m^2 + 8\,m + 3)},$$

this equation becoming more complicated as the number of spans increases. It is unnecessary to occupy space by any reference to the other parts of the girder, as the usual methods of proportioning them are sufficiently simple. But I will call your attention to the saving effected *practically* by using continuous instead of single girders, where it is practicable.

This must be determined empirically, as theory is useless, on account of conditions not dependent upon the continuity or otherwise of the girders.

The result arrived at is of course strictly applicable only to those cases from which they are derived, but I have endeavoured to select as examples such works as have been most carefully designed. My mode of procedure is as follows :—

I first assume that the weight of the structure varies as the breadth, and as some power of the span, the depth being proportionate to the latter, so that the weight of any bridge, or rather of the metal contained in it, may be represented by

$$c.\ b.\ l^n.$$

where c is a constant, b the breadth in feet, l the span in feet, and the weight being in tons, it is required to find the values of c and n.

To find these quantities, take two examples in which w, b, l, and w' b' l' respectively represent the weight, breadth, and span.

Then—

$$\frac{w\,b'}{w'\,b} = \left(\frac{l}{l'}\right)^n.$$

Therefore—

$$n = \frac{\log.\ w - \log.\ w' + \log.\ b' - \log.\ b}{\log.\ l' - \log.\ l}$$

This equation being solved for numerous cases, gives as a mean value

$$n = 2{\cdot}25$$

and, for the weight of iron in the bridge,

$$\frac{l\,l^{2{\cdot}25}}{10{,}000}$$

Showing for continuous girders a saving sometimes equal to 25 per cent., but averaging about 18 per cent.

I have now completed my brief account of the simple method which my own experience has induced me to adopt for the calculation of the flanges of continuous girders. My limited space has caused the omission of many points of interest, but I trust that such considerations as I have brought forward have not proved wholly uninteresting, imperfect as they are, when compared with the vast ocean of information of which they form one drop; and if any of my audience find, in that drop, ere it mingles with its fellows and is lost, any particle which may facilitate his labour, then shall I feel amply rewarded for my labour in explaining the facts revealed by the faint light of my own research.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

April 1st, 1862.

J. P. Joule, LL.D., F.R.S., President, in the Chair.

Mr. Alfred Fryer stated that he had recently been making a series of experiments with the oxyhydrogen light, with a view to determine what substance made incandescent produces the greatest amount of light. He operated on various salts of calcium, magnesium, strontium, barium, and also upon some other substances. The best results were obtained from magnesium. The sulphate of magnesia, when baked, yielded a bright light, but was decomposed by the heat; and the sulphurous acid escaping was very unpleasant. Calcined magnesia succeeded the best of all; but when the powder was used the gases blew it away. When the powder was mixed with water, and afterwards dried, the cake was friable; and when the dry powder was pressed in a mould by means of hydraulic pressure, the cake split up into laminæ when subjected to the gases. After many experiments with the materials in different proportions it was found that sulphate of lime one part, and calcined magnesia two parts, mixed with water and modelled into a cake and dried, produced the best results. This, however, is not all that could be desired, as in time the cake becomes cracked and fissured by the gas. The illuminating power is to that of lime, pressure and volume of gas being equal, as 54 is to 27. The experiments have been conducted with oxygen and the coal gas supplied to Manchester. The jet used is a form supplied by Mr. Dancer, a jet of oxygen being surrounded by an annular jet of the coal gas. Mr. Dancer has further improved the jet by allowing the oxygen pipe to project beyond the hydrogen, and by not contracting the aperture of the hydrogen pipe.

Mr. Alfred Fryer exhibited the light which he had explained, and the effect produced was very striking.

Professor Roscoe read the following communication, by Professor Clifton and himself, entitled "On the Effect of Increased Temperature upon the Nature of the Light Emitted by the Vapour of Certain Metals or Metallic Compounds."

In a letter communicated to the *Philosophical Magazine* for January last, we stated that examining, with Steinheil's form of Kirchoff and Bunsen's apparatus, the spectra produced by passing the induction spark over beads of the chlorides and carbonates of lithium and strontium, we had observed an apparent coincidence between the blue lithium line, which is seen only when the vapour of this metal is intensely heated, and the common blue strontium line called Sr δ. We further stated that, on investigating the subject more narrowly by the application of several prisms and a magnifying power of 40, we came to the conclusion that the lithium blue line was somewhat more refrangible than the strontium δ but that two other more refrangible lines were observed to be coincident in both spectra. Having constructed a much more perfect instrument than we at that time possessed, we are now able to express a definite opinion on the subject, and beg to lay a short notice of our observations before the society. Our instrument is in all essential respects similar to the magnificent apparatus employed by Kirchhoff in his recent investigations on the solar spectrum and the spectra of the chemical elements. It consists of a horizontal plane cast iron plate, upon which three of Steinheil's Munich prisms, each having a refracting angle of 60 deg., are placed; and of two tubes fixed into the plate, one being a telescope having a magnifying power of 40, movable with a slow motion-screw about a vertical axis placed in the centre of the plate, and the other being a tube carrying at one end the slit, furnished

with micrometer screw, through which the beam of light passed, and at the other end an object glass for the purpose of rendering the rays parallel. The luminous vapours of the metals under examination were obtained by placing a bead of the chloride or other salt of the metal on a platinum wire, between two platinum electrodes, from which the spark of a powerful induction coil could be passed. In order to obtain a more intense, and therefore a hotter spark than could be got from the coil alone, the coatings of a Leyden jar were placed in connection with electrodes of the secondary current respectively. When this arrangement was carefully adjusted, the two yellow sodium lines were observed to be separated by an apparent interval of two millimetres, as seen at the least distance of distinct vision.

The position of the blue line, or rather blue band of lithium, was then determined with reference to the fixed reflecting scale of Steinheil's instrument, by volatilising the carbonate of lithium in the first place on a platinum wire between platinum electrodes, and secondly on a copper wire between copper electrodes. A bead of pure chloride of strontium was then placed on new platinum and copper wires between two new platinum and copper electrodes, and the position of the blue line Sr δ read off upon the same fixed scale; a difference of one division on the scale was seen to exist between the positions of the two lines, the lithium line being the more refrangible. The salts of the two metals were then placed between the poles at the same time, and both the blue lines were simultaneously seen, separated by a space about equal to that separating the two sodium lines. When experimenting with this complete instrument, we were unable to observe any other blue lines in the pure lithium spectrum than the one above referred to; we have, however, noticed the formation of four new violet lines in the intense strontium spectrum, and we now believe that the other two lithium lines mentioned in our letter to the *Philosophical Magazine* are caused by the presence of the most minute trace of strontium floating in the atmosphere, and derived from a previous experiment. We have convinced ourselves by numerous observations that the currents of air caused by the rapid passage of the electric spark between the electrodes are sufficient to carry over to a second set of electrodes placed at the distance of a few inches, a very perceptible quantity of the materials undergoing volatilisation. The greatest precautions must hence be taken when the spectra of two metals have to be compared; and no separate observations of the two spectra can be relied upon, unless one is made a considerable space of time after the other, and unless all the electrodes which have been once used are exchanged for new ones.

Kirchhoff, in his interesting memoir on the Solar Spectrum and the Spectra of the Chemical Elements,* noticed in the case of the calcium spectrum, that bright lines which were invisible at the temperature of the coal gas flame became visible when the temperature of the incandescent vapour reached that of the intense electric spark.

We have confirmed this observation of Kirchhoff's, and have extended it, inasmuch as we, in the first place, have noticed that a similar change occurs in the spectra of strontium and barium; and, in the second place, that not only new lines appear at the high temperature of the intense spark, but that the broad bands characteristic of the metal or metallic compound at the low temperature of the flame or weak spark, totally disappear at the higher temperature. The new bright lines which supply the part of the broad bands are generally not coincident with any part of the band, sometimes being less and sometimes more refrangible. Thus the broad band in the flame-spectrum of calcium named Ca β, is replaced in the spectrum of the intense calcium-spark by five fine green lines, all of which are less refrangible than any part of the band Ca β; whilst in place of the red or orange band Ca α, three more refrangible red or orange lines are seen. The total disappearance in the spark of a well defined yellow band seen in the calcium spectrum at the lower temperature was strikingly evident. We have assured ourselves by repeated observations that, in like manner, the broad bands produced in the flame-spectra of strontium and barium compounds, and especially Sr α, Sr β, Sr γ, Ba α, Ba β, Ba γ, Ba δ, Ba ι, Ba π, disappear entirely in the spectra of the intense spark, and that new bright non-coincident lines appear. The blue Sr δ line does not alter either in intensity or in position with the alterations of temperature thus effected, but, as has already been stated, four new violet lines appear in the spectrum of strontium at the higher temperature.

If, in the present incomplete condition of this most interesting branch of inquiry, we may be allowed to express an opinion as to the possible cause of the phenomenon of the disappearance of the broad bands and the production of the bright lines, we would suggest that, at the lower temperature of the flame or weak spark, the spectrum observed is produced by the glowing vapour of some compound, probably the oxide, of the difficultly reducible metal; whereas, at the enormously high temperature of the intense electric spark these compounds are split up, and thus the true spectrum of the metal is obtained.

In conclusion, we may add that in none of the spectra of the more easily reducible alkaline metals (potassium, sodium, lithium) can any deviation or disappearance of the maxima of light be noticed on change of temperature.

A paper was read, entitled "Notes on Calorific Phenomena," by C. Dyer, Esq., V.P.

The author states that the essences of matter, their number, and their forms, are only known to us by their observed properties and mutations; that conflicting theories on physics arise from the various interpretations given to the same phenomena; and if unable to reconcile such differences, further inquiry, with that view, may not be improper, whilst the laws of nature rest on debateable grounds. That practically matter, in its aggregate, is found to consist of two sorts or classes—the "ponderable" and the "imponderable"—gravity and elasticity serving to distinguish their respective inherent properties. That as no tests of weight or measure can apply to the latter, its mutations and action on other bodies are the sole means we have of forming any judgment concerning its agency in the laboratory of nature. That the calorific element, or heat, is assumed to be the one "sole imponderable element which pervades matter and space throughout the universe," and it constitutes the elastic forces reacting upon and balan ing the gravitating forces in all other bodies. This elemental state of heat must be taken as distinct from its other three states of sensible, radiating, and specific heat, commonly recognised. That elemental heat is acted upon by mechanical and chemical forces, and the changes which it undergoes from the one to the other conditions of heat, give rise to atmospherical phenomena, known as electrical, magnetical, and optical; as also to the entire range of meteorological changes, as set forth in the paper. That by the mechanical forces of the earth's motion in its orbit and diurnal rotation, acting upon the elemental medium, its equilibrium is disturbed and motions generated which afford rational explanations of the luminous and ordinary electrical and magnetical conditions of the atmosphere, as indicated by their respective meteors. That by the action of chemical forces great mutations of heat are continually going on; for example, the heat which on a vast scale abounds in vapour, is given out as clouds are formed, and accounts for the positive and negative electricity; and also, when redundant, for lightning from thunder clouds. As much heat is evolved above the clouds, where cold prevails, it must become elemental or neutral there, and justifies the inference that it is identical with the electric fluid, as above said. That electricity and magnetism are but diverse actions of one element has been proved, and their action on matter proves their materiality. The mechanical and chemical action of light proves its materiality also; and that light and heat are identical has been clearly established. The plurality of the imponderable elements is, therefore, disproved by the fact that the mutations of the one element fully account for all of the phenomena attributed to several. The gravitating and elastic properties of matter constitute their statical and moving forces, for ever balancing each other. The former of these forces would consolidate the material universe "with lightning speed," but for the reaction of the latter force. There is no reason why the force of gravity should be measured by the established laws of falling bodies, except that experiment has shown the velocities actually attained by them in vacuo. But this vacuum is the absence of air only, not that of the "elastic medium;" and it is this that holds the poise of matter throughout illimitable space.

* Kirchoff on the Solar Spectrum, &c. Translated by H. E. Roscoe Macmillan, Cambridge. 1862.

LETTERS TO THE EDITOR.

We do not hold ourselves responsible for the opinions of our Correspondents.)

THE PNEUMATIC PROCESS.

Sir,—My last week's letter seems to have caused some little alarm respecting the Bessemer monopoly of the pneumatic process. Of the value of the pneumatic process no one now, I believe, entertains any doubt, though at the time when by my writings I first advocated the merits of this process it was the theme of ridicule for both scientific and practical men in every newspaper in Europe. The Great Exhibition will, I have no doubt, be supplied with specimens fully illustrating the wonderful results derived from the use of the pneumatic process in the manufacture of iron and steel. Those, however, who look with astonishment at the progress which has been made must bear in mind that the pneumatic process alone was wholly inadequate to accomplish any of these marvellous improvements, which are due solely to the supplementary process of adding a manganesic alloy to the debased and commercially valueless pneumatised iron, a process discovered by R. Mushet in the year 1856, and which has hitherto been ignored by the parties whose interests lie in concealing the truth from the publi

The question, however, is not now as to the value of the pneumatic process, but as to the patent rights of Mr. Bessemer—whether they are valid or the reverse.

If my metallurgy is unsound, and my reasonings are illogical, my remarks cannot affect Mr. Bessemer's claims, or render an appeal to the House of Lords at all requisite.

If, on the other hand, Mr. Bessemer's claims are not well founded it would be manifestly unjust that the favoured few who obtain licenses should pay royalties to a firm who have no legal right to demand them, and still more unjust is it that the many who can obtain no licenses at all from the monopolists of the pneumatic process should suffer from the *veto* of a patentee who has really no right to grant or withhold licenses. It is now pretty well known, though the fact has been carefully suppressed by Mr. Bessemer, in all his papers, so ostentatiously read before various scientific bodies, that the success of the pneumatic process is solely due to the addition of a metallic compound, consisting essentially of iron and manganese, and containing also carbon and a little silicon, to cast iron, after that cast iron has been decarbonised by the pneumatic process.

It matters not whether the metallic compound is called "spiegel eisen," or "Franklinite iron," or "white pig iron," or "grey pig iron," so long as it consists essentially of iron, manganese, and carbon; and such is the Franklinite iron and the white and grey pig irons used by Mr. Bessemer to recarbonise his metal. And the fact remains the same, that the addition of the cast iron of commerce, either from the cupola or finery, does not answer when added to the decarbonised metal. Let those who drag forward untenable arguments to prop a rickety claim try the effect of adding common pig iron—such, for example, as the Scotch, Welsh, or Staffordshire pig irons—to decarbonised cast iron. Had Franklinite iron been made in Prussia it would have been called "spiegel eisen," for such it is; and had "spiegel eisen" been made in America it would have been called something else than "spiegel eisen;" but it would still have been the one thing needful to the success of the pneumatic process—namely, a metallic compound consisting essentially of iron and manganese, and containing also carbon.

It is one thing to claim to recarbonise pneumatised cast iron and render it fit for foundry purposes, by thrusting billets of wood, or forcing carbonaceous gases below its surface and another matter to alloy cast iron with the pneumatised iron, so as to steelify the latter. The former is an impossibility; the latter a simple and obvious process. The fact remains as I have stated it, and Mr. Bessemer cannot produce foundry iron by the methods he has claimed; so the claim and the patent are void.

As to soft pneumatised iron being recarbonised, by being run into moulds composed of loam and carbonaceous matter, the assertion is too absurd almost to require refutation; but I have no doubt that by the non-practical men who have tried the experiment the remarkable degree of brittleness communicated to malleable iron when cast in loam moulds has been mistaken for recarbonisation.

Whatever is employed to generate and maintain heat by fiery combustion with oxygen is unquestionably fuel, and the iron, carbon, and oxygen consumed in the pneumatic process generate and maintain the most fiery combustion.

If Martien's patent was taken out one month before Bessemer's, how comes it that Martien's patent was, as you assert, not published until six months after Bessemer's patent?

I do not say that Martien's patent is at all tenable; but I think it would stand a trial quite as well as Bessemer's, and it has unquestionably the merit of priority in its favour. The pneumatic discovery is, however, published in Martien's patent, such as it is, and no amount of false reasoning can set this truth aside.

I have no doubt that Mr. Bessemer may make disclaimers, and very necessary they unquestionably are; but how will this help him? What is sauce for the goose is sauce for the gander, and Martien may also disclaim. Let us see what Martien's claim can be fashioned into by the help of disclaimer. Martien's claim now stands thus:—"In place of the gutter being the means of applying streams of air below the fluid iron as it comes from a blast furnace, the bed into which the melted iron is received may be arranged with means for introducing air or steam below the melted iron, and to divide such air or steam into numerous streams, so that the iron may be purified after it has come from the blast furnace, and before the congelation of the liquid metal takes place."

To set himself right by disclaimer, Martien has only 'to say, "I disclaim the use of the gutter for purifying my iron in, and I confine myself to employ the bed or receptacle into which the gutter has conveyed the iron. I disclaim also the use of steam, which I find cannot be employed, and I confine myself to the use of air only. I disclaim likewise the subsequent running of the purified iron into a puddling or other furnace, and puddling and manipulating it therein; because I find that my process, when the cast iron is purified in the bed or receptacle in the manner I have described, after it has flowed from the blast furnace and previous to its congelation, renders the further operation of puddling wholly unnecessary." I am persuaded that were this matter laid before an honest, intelligent jury, they would decide that Martien's claim is the original claim, and Bessemer's a second-hand copy. Martien's own account of the affair is this: Before taking out his process he made experimens at Ebbw Vale Ironworks, where the matter excited very little attention. Martien was accompanied by a "friend," who happened to be likewise a "friend" of Bessemer's. This "friend" had more penetration than the rule of thumb men who witnessed with stupid indifference the first trials of the most wonderful process which any age has brought to light, and when the Ebbw Vale Company gave Martien the cold shoulder the "friend" hastened to communicate to Bessemer the fact that a grand discovery was on the carpet; and the idea once started, it was a race who should first get out his patent, Martien or Bessemer. Martien won the race by a month; but his specification, hastily got up by some other "friend," probably, was a wretched affair, full of absurdities and destitute of clear and perspicuous arrangement. That Bessemer's ideas are derived from Martien's is obvious on perusal of their respective claims. I must still, therefore, hold that the claims of Martien, the "foreigner," are the true and original claims, embodying the pneumatic process, and that, if there are trumpery pretensions upon either side, they do not rest with Martien.

I have no wish to deprive Mr. Bessemer of the fruits of his industry and genius; but I have no relish for paying a license to one man for the use of another person's invention. The pneumatic process is not the fruit of Mr. Bessemer's genius any more than is the subsequent process which perfects the pneumatic process.

Let every man have his due; and if, as is pretty clear, Martien is the original inventor of the pneumatic process, why should he be deprived of the fruits of his genius and industry by Mr. Bessemer?

8th April, 1862. W. S. P.

THE PADDLE, THE SCREW, AND THE HYDRAULIC PROPELLER.

Sir,—In the extract from the paper of Mr. C. G. Gumpel, on the above subject, in your impression of the 7th inst., there are a number of objections taken to the action of both the paddle and the screw as a means of propulsion, on which I should like, with your permission, to offer a few observations

From the desultory and confused manner in which the subject is treated by Mr. Gumpel it will be impossible to follow him in anything like an orderly method, and I shall, therefore, confine my attention to a few of the more prominent points contained in his paper.

First, then, I think it can be shown that Mr. Gumpel has very much exaggerated the defects both of paddle and screw; and at the same time greatly over-estimated the efficiency of the hydraulic propeller he wishes to substitute in their place. He says, "As it is, however, impossible to adjust either the size of the float or its distance from the shaft of the paddle-wheel, so as to gain the greatest efficiency of engine and propeller, it is easily understood that almost in nine cases out of ten the propeller is disproportioned to the power employed and the resistance to be overcome."

Now such a paragraph, coming from the pen of a scientific man, is simply ridiculous. What! Are there no fixed *data*, nothing to guide or govern in such a case? Surely it is in vain that we have got indicators to measure the power of our engines if we are still at a loss to determine either the length of lever or the size of float that is best suited to their respective powers; yet, in justice to Mr. Gumpel, it is but fair to mention that he does not stand alone in such statements; there is another very successful patentee, who writes in this description of his propeller, that "the points to be considered in reference to this question are so numerous and complicated in their bearings upon each other as to defy previous calculation of their effects."

Now, when such crude and loose ideas take possession of men's minds, respecting the present state of steam-propulsion, it is not at all surprising that they should lay hold of wild and ill-digested schemes, and seriously propose them as substitutes for present practice.

Let us now look for a moment at Mr. Gumpel's arrangement of pumps, and institute a comparison between its effects as a propeller and a moderately efficient screw. I shall just take, for that purpose, the Gambia of Aberdeen, a screw vessel whose performances are sufficiently well known to suit my purpose.

Her indicated power is about 300 horse-power, with a capacity of 587 tons gross, diameter of screw 10 feet, and speed a little over 10 knots per hour; this will give an average pressure of about 100 lb. per circular foot to a cylinder of water equal to the area of the fan. If, therefore, the fan were enclosed in a case, it would drive through this cylinder of water 10ft. in diameter with a force equal to 100lb. to the circular foot, at a velocit equal to the speed of the ship, or 10 knots per hour.

Now, suppose Mr. Gumpel's hydraulic propeller to be fitted in a vessel of equal size and power, what results would it be likely to produce? Taking as our guide in this matter the arrangement of pumps he has proposed in his paper, it would be most conveniently disposed of in something like the following way:—Two vertical pumps, acting alternately, drawing up water at the front, and discharging it downwards, again to flow out towards the stern. As he has said nothing of the sizes or proportions of his pumps perhaps the following would fairly represent his idea:—Each pump to have a 6-ft. stroke and a diameter of 5ft. The height of this column of water would require a force of 3 lb. to the square inch to draw it into the barrel of the pump, and if they worked at the speed of eighty-three strokes per minute it would require about the same amount of power indicated by the screw ship Gambia above referred to.

It will be well at this stage of the comparison to note particularly the condition of the two vessels. They are both equal in the amount of power they are expending. In the Gambia this power is applied to screw her fan through the water at the rate of 1,100ft. per minute. If the cylinder of water on which the fan operates afforded a sufficient abutment to propel the ship, then there would be no slip, and she would progress through the water in the same way as if she were drawn forward by a rope wound round a drum at the rate of 1,100ft. per minute, with a constant force equal to 10,000 lb.; but as she makes about 10 per cent. of slip she must, in order to steam 10 knots per hour, screw her fan through the water at a rate upwards of 1,100ft. per minute, and the cylinder of water on which the fan operates will, at the same time, be driven backward at the rate of 100ft. per minute, leaving her an average of 1,000ft. per minute of progressive motion.

On the other hand Mr. Gumpel's vessel has expended 300-horse power in drawing up into her pumps a cylinder of water at the rate of 1,000ft. per minute; supposing, then, that there has been no waste of power in sucking up this cylinder of water into the pumps placed at right angles to the line of motion, she will have as disposable power this cylinder of water 5ft. in diameter, with a gravitating force equal to 3 lb. to the square inch, or 324 lb. to the circular foot—8,100 lb. in whole. The case now stands, Gambia, 10,000; hydraulic, 8,100; in favour of screw, 1,900. But this is not the whole, for we have just seen that the screw, although operating on a cylinder of water 10ft. in diameter, yet making 10 per cent. of slip. Now, as the hydraulic propeller is only 5ft. diameter, or one-fourth the area of the screw, we cannot, therefore, reckon less than 20 per cent. for slip, reducing her 8,100 lb. to 6,480 lb, or a total of 33 per cent. in favour of the screw.

This 33 per cent. is still not all the difference, as there is another very important drawback, of which we have as yet taken no note.

Every experienced engineer will at once admit that to suck up the large quantity of water requisite to fill these pumps, at right angles to the line of direction in which it is flowing with great velocity, must be accompanied with a very serious sacrifice of power; and it must further be borne in mind that this objectionable change of direction takes place twice in every separate charge of the pumps; indeed, I do not believe that Mr. Gumpel will be able by this method to utilise 50 per cent. of the power expended, but I shall be glad if he can show that I have been mistaken. M.

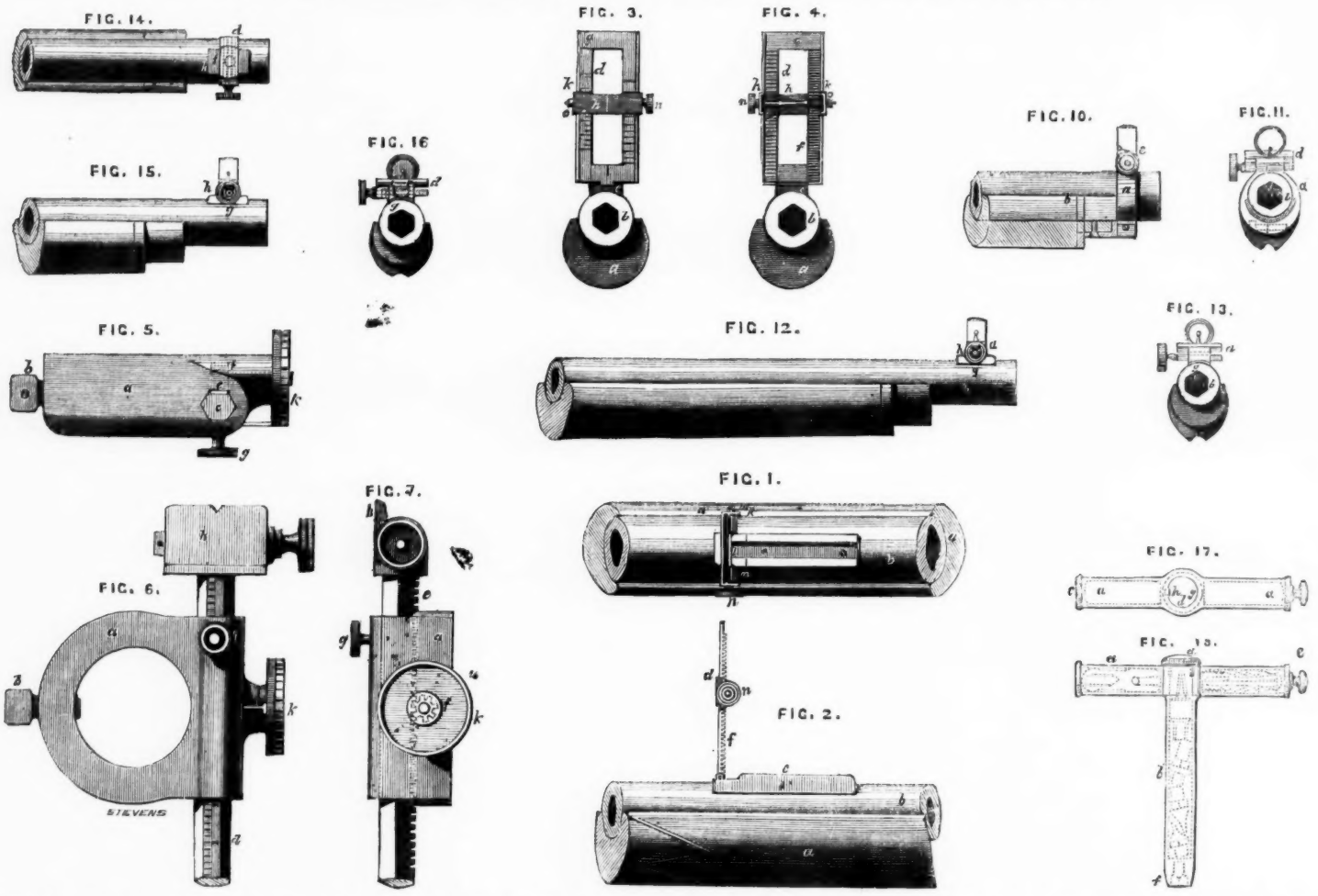
Aberdeen, 19th March, 1862.

ON THE SPEED OF STEAM ENGINES.

Sir,—What is the proper speed of piston a steam engine ought to work at? This question seems to have a peculiar influence upon the throats of our scientific engineers, for, whenever this question is asked, they are sure to be seized with a cough! This was not always the case, and the authorities of former times were much readier with their replies to that question. Tredgold, in his work on the steam engine, furnished a rule in which the speed of the piston is made to increase and diminish as the square root of the length of stroke; and the table for the speed of marine engines adopted by the Admiralty seems to be calculated according to this rule. Mr. Murray, in his treatise on Steam Navigation, calls this rule an arbitrary one; and well he may do so, seeing that the velocity at which the pistons of marine engines are driven in practice are sometimes nearly twice as great as would be sanctioned by the table.

Contradicted by modern practice, and founded on theoretical principles which do not agree with the conditions of the case, the rule of Tredgold has been lost sight of, but no other has been generally adopted in its place, except the "rule of thumb," the particular and

WHITWORTH AND HULSE'S SIGHTS FOR SMALL ARMS AND ORDNANCE.



valued favourite of "practical men." The subject, however, is a very important one, and in our days of economising fuel is deserving of much more attention than has hitherto been paid to it. It is well known that a waterwheel or a windmill give their maximum useful effect at a certain velocity only (which depends on the speed of the medium, water or air, by which they are driven), and that the useful work will be less for the same amount of power expended, if the speed be either greater or smaller than that velocity. From this the inference may fairly be drawn that, there may be a certain speed for the piston of a steam engine (depending on the velocity of the steam rushing out of the boiler, and moving through the various parts of the engine), at which the work performed by the same will be a maximum for a certain quantity of steam or fuel expended.

To show that this inference is a correct one let us consider some extreme cases. If we imagine an engine without friction, and without any load or back-pressure on the piston, we have one extreme, *i.e.*, the highest velocity theoretically possible, and this velocity is equal to the speed at which the steam would rush out of the boiler into a vacuum. The work performed by the engine may be represented by the product of the velocity and the amount of back-pressure on the piston (the sum total of the whole resistance to the motion of the engine being considered equivalent to a certain back-pressure on the piston).

In the case of greatest velocity, just before considered, the work performed by the engine would be zero; for although the velocity is very great, the back-pressure or load on the piston is nothing.

Now, to compare this result with the opposite extreme, we must imagine the load or back-pressure to be the greatest possible, viz., equal to the pressure of the steam in the boiler. In this case we shall have no speed; for the piston being under equal pressure on both sides, will not move at all, and the work of the engine will be zero again.*

Neither of these two extreme cases could be instances of actual practice, but it is evident that in the practical working of an engine the work performed by a given quantity of steam will be less and less as the circumstances approach either of the two extremes, and from this it follows that there must be a certain velocity between the greatest and the smallest possible at which the work performed will be the greatest. This being the case, it is the province of mathematics to ascertain the exact speed for the pistons of steam engines in general use; and to furnish a rule applicable in all cases and every single instance. The following contains the simple mathematical operation which shows that the proper speed for the working of a steam engine is about three-fifths of the velocity with which the steam from the boiler would rush through the engine into the condenser, or into the atmosphere if there be no other condenser, without performing any work at all.

Let us call P the effective working pressure on the piston, viz., the pressure which remains after deducting the back pressure caused by the whole resistance to the motion of the engine p, the total load in the piston, or the weight which may be supposed to be lifted by the engine to a height equal to the length of stroke; v the highest velocity the engine is capable of, and c the speed of piston; the work performed will be $W = p, c$, and the speed of piston at any time will be $c = a\sqrt{P - p}$, a being a constant co-efficient depending on the density of the steam. From this we have

$$p = P - \frac{c^2}{a^2}$$

$$W = P\,c - \frac{c^3}{a^2}$$

For a maximum

$$\frac{d\,w}{d\,c} = P - \frac{3\,c^2}{a^2} = 0$$

$$c = a\sqrt{\tfrac{1}{3}\,P}$$

The highest velocity v, is formed by making $p = o$, from which it follows—

$$v = a\sqrt{P}$$

$$c = \frac{v}{\sqrt{3}} = -\text{about } 0.6\,v.$$

The resistance of friction, although variable with the speed, has been considered constant for the sake of simplicity.

In all instances relating to engines already constructed the greatest possible speed might be found by experiment; and this velocity, once ascertained, the gearing or other mode of taking off the power should be so arranged as to make the working speed about three-fifths of that velocity. In constructing new steam engines a great number of considerations as to the size and proportions of steam passages, valves, &c., will be introduced, into which the present space will not permit us to enter in detail; but, comparing the conclusions here arrived at with our present engineering practice we find that almost all engines work at a great disadvantage by being too slow in their motion. The evil consequences arising from this are very numerous in practice, and the real loss of power caused thereby is far greater than the loss of useful effect, theoretically deducted from the improper speed. The losses are the much talked-of effects of condensation of steam during its expansion in the cylinder. To remedy this the introduction of steam jackets and superheaters have become absolute necessities in modern steam engines; yet nobody can deny that this is only the introduction of new evils to get rid of the old and greater one.

A high speed of piston would to a great extent remedy the evil of condensation in the cylinder, without the introduction of any further complication in our engines. The amount of condensation caused by the alternate heating and cooling of the metal in contact with the steam is a fraction of time, and will consequently diminish as the speed of working increases. We have practical proofs of this in the working of locomotive engines, which very often realise an economy of fuel equal to the best condensing engines, although working without jackets, and without the use of superheated steam, and under the disadvantage of a great back pressure caused by the artificial blast pipe. The only cause of this economy is the great speed, and this ought to be imitated in other engines, and carried out as nearly as practicable to the limits prescribed by theory. When high speeds come into vogue we shall dispense with a vast amount of dead weight. A. B.

* Our engineering authorities who consider the difference of pressure in the boiler and cylinder, as shown by the indicator as an entire loss, seem to forget that the steam would not pass into the cylinder at all if the pressure in both were the same.

WHITWORTH AND HULSE'S SIGHTS FOR SMALL ARMS AND ORDNANCE.

These improvements, by Joseph Whitworth and W. W. Hulse, of Manchester, relate to, first, the adoption of a rack and pinion for elevating the back sights of small arms, or the tangent sight of ordnance. Figs. 1, 2, 3, and 4 show the improvements applied to rifle sights, in which *a* is the stock; *b*, the barrel; *c*, the bed of the sight; *d*, the leaf, having on the surfaces *e*, *e*, the two racks *f*, *f*¹, and on the surfaces *g*, *g*, are marked the angles of elevation and range. The racks *f*, *f*¹, are cut out of the metal of the leaf. The elevating slide *h* has two projections or bearings *k*, *k*, in which the pinion spindle *l*, and pinions *m*, *m*, which are formed out of one piece of pinion wire work. One of these bearings *k* is sufficiently large to allow the pinions *m*, *m*, to be passed through. At one end of the pinion spindle *l* is the handle *n*, and at the other are the two adjusting nuts *o*, *o*; this end of the pinion spindle being screwed to receive them. One only of these racks and pinions may be used, but two racks and pinions are preferred because the slide *h* is raised more evenly than it could be if the action were on one side, as would be the case if one rack only were used; or the rack or racks may be cut on the edges of the leaf, in which case a worm pinion or pinions may be made to work in them, or the rack or racks may be placed on the back surface of the leaf; but the patentees prefer the mode hereinbefore described and shown in Figs. 1, 2, 3, and 4. The steps or elevations ordinarily used in the bed of the back sight are dispensed with for all ranges of one hundred yards and upwards, the bottom cross bar of the leaf being made sufficiently low to allow the sight to be taken with the leaf in the vertical position. For shorter ranges the leaf may be placed in a suitably inclined position. Figs. 5, 6, and 7 show the improvements applicable to the tangent sights of ordnance. *a* is a band fastened to the barrel of the cannon by the screw *b*, and has a projection and hole *c* on one side to receive the tangent stem *d*. The stem *d* is polygonal in cross section, and on one of its sides is cast or fixed the rack *e*, in which the pinion *f* works. A screw *g* is provided for fastening the tangent sight at any elevation it may be placed at. It may be desirable to use also a stem with rack and pinion on the opposite side of the gun, in which case the two pinions might be connected together, so as to raise the two stems simultaneously, and the sliding or fixed sight might be placed midway between the two stems. In raising or lowering the sight *h*, the set screw *g* is released, and the micrometer wheel *k* which is keyed upon the axis of the pinion is turned by hand.

The micrometer wheel may be divided, so as to give a more minute adjustment of elevation than can be done when the stem *d* alone is divided. For this purpose it is convenient to make the pinion of such a diameter that one turn of the micrometer wheel *k* will be equal to one degree or an aliquot portion of one degree of elevation. In some cases, instead of using the band *a*, the stem, with rack and pinion, may be passed through the body of the gun.

Secondly, Figs. 10 and 11 represent the improved mode of attaching the front sight to the nose cap; the band holding the sight is shown at *a*, it encircles the muzzle of the piece, and also takes on to the nose cap, which is recessed or turned down to receive it, the upper edges *b* of the nose cap forming a shoulder to prevent the sight from lateral alteration. The upper surface *c* of the band is formed as a slide to receive the moving slide *d*, which is traversed transversely by a screw and nut or by a rack and pinion. The upper surface of the moving slide *d* is bevelled as shown. If desired, the band may have a rigid instead of the movable sight shown. The band *a* may be attached to the barrel and not to the nose cap, as would be desirable in small arms that are only half stocked.

Figs. 12, 13, 14, 15, and 16, represent the improved front sights, and another mode of attaching them to the barrel. In Figs. 12 and 13, the moving slide *a* carrying the sight works in a straight line across and at right angles with the axis of the barrel *b*. In Figs. 14, 15, and 16, the fixed slide *c* has upper lines or surfaces formed as segments of circles as at *f* struck from back sight as a centre, and its horizontal lines and surfaces are also curved as at *i*. The two curved or circular segments being provided so that the moving slide *e* of the front sight in being adjusted for allowance of wind or other influence, may be retained at an uniform or requisite distance from the back sight, and from the barrel's axis in all the varying positions of adjustment; the slides in either case being adjusted by means of a screw or rack acted upon by a milled head or handle. The beds *g* of the moving slides are made much longer than at present by the prolongations *h*, by which the bed is more firmly soldered to the barrel (by the increase of the soldered surface) than is possible when the bed is made only of the width of the upper slide, as has hitherto been done. The upper surface of the moving slides *a* is made oblique or bevelled towards the muzzle of the piece, as shown at *e*, Fig. 10, so as not to obstruct the sighting at high elevations.

Thirdly, Figs. 17 and 18 represent the improved fitting apparatus. It consists of two tubular stems *a*, *b*, for containing the several small instruments required for repairing and cleaning the rifle, which instruments are held in the stems by screwed stoppers *c*, *d*, *e*. The stem *b* has at the bottom the ordinary square hole *f* to receive the squared heads of the small instruments, or to apply to the nipple, and the stem *a* has a hole *g* in the centre through which the stem *b* is passed so as to form a key. The hole *g* is slightly conical or of any other required form. When conical or cylindrical it has a key or feather *h* fixed at the side. The top part of the stem *b* being made to fit the hole formed in the middle of the tubular stem *a*, so that the two stems may be held firmly together when required to act as a key, and may be easily disconnected by a sharp stroke, so as to be separated, and thus be in a convenient form for carriage. There is a plain hole through the jag *h*, and a screwed hole through the stopper *e*, for the purpose of receiving the pricker *i*, and the other stoppers may be formed in a similar manner if desired.

TO CORRESPONDENTS.

Notice.—*It will be necessary that all Advertisements for our next number should reach our office on Thursday next before seven o'clock, as Friday will be a closed day.*

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

J. B. (Sheffield).—*The pins appear to be of ample strength.*

A Sawyer.—*A good 4-ft. 6-in. saw ought to be safe at 300 revolutions per minute.*

A Subscriber.—*Your best course would be to consult Clark's Railway Machinery.*

Ironsides.—*A note addressed to the secretary of the Iron Plate Commission, Victoria-street, Westminster, will reach him.*

C. R. (Alexandria).—*Messrs. Siebe, of Mason-street, Lambeth, can give you the information you require with reference to ice machines.*

A Filer.—*No reliable information is to be had as to the elasticity of steam at very high temperatures. We think we some time since illustrated the engine to which you refer.*

E. A. B.—*The mode suggested by you of propelling ships by the reaction of water pumped through cylinders placed below has been often proposed and occasionally tried, but without any advantageous result.*

W. N. B.—*A round cylindrical boiler of the size you name would be as economical and much cheaper than the upright boiler you propose. The upright boiler would waste a large proportion of the fuel, and the upper part of the chimney, in the steam space, would corrode.*

J. P.—*We are obliged to you for the information that the term "initial velocity" (we have not given it as "initials") is "scientific slang." Your self-contradictory sentence, "the force or rapidity with which the ball leaves the cannon's mouth," may possibly be an improvement, but you must excuse us if we do not think so.*

J. B.—*The ordinary rule for ascertaining the impact of falling bodies is to multiply the square root of the height of the fall in feet by 8, and to multiply this by the weight of the falling body. Thus your helve hammer falling 1ft. would strike with a force equal to the square root of 1 (which is 1) × 8 × weight of hammer. The effective weight being 2 tons, the force of impact would be 16 tons. For 1½ft. the impact would be 19·65 tons.*

COMPOUND ENGINES.

(To the Editor of the Engineer.)

Sir,—I should feel much obliged to you if you could furnish me with a practical rule for calculating the nominal horse power of combined high and low pressure cylinders, either on Woolf's or McNaught's plan.

Newcastle-on-Tyne, 5th April, 1862. H. L. P.

HUMPHRYS' STEAM ENGINES.

(To the Editor of The Engineer.)

Sir,—Having observed in your last impression an illustration of Humphrys' steam engine for marine purposes, I beg to refer Mr. Humphrys to Specification No. 2962, December, 1858, where he will find my patent for the annular cylinder, in connection with a centre high pressure cylinder, both cylinders being worked by one simple "ported" slide valve, with steam jacket around cylinders to be filled with steam superheated.

Swansea, April 6th, 1862. F. W. Turner.

WROUGHT IRON CANNON.

(To the Editor of The Engineer.)

Sir,—In your paper of 4th inst. an article upon the "Armstrong Gun" states that a wrought iron gun, made by our firm for the Princeton, was loaded, fired, and exploded upon the spot. This is incorrect. The gun in question was forged by the Mersey Steel and Iron Company, finished by us, and was made to replace a similar gun produced in America, which did burst as stated. The gun supplied from here was, we are informed, not long since still in existence in the navy yard at Brooklyn.

Liverpool, 8th April, 1862. Fawcett, Preston, and Co.

THE PATENT OFFICE.

(To the Editor of The Engineer.)

Sir,—The truth of your article of the 14th February on the state of the Great Seal Patent Office library has lately been made painfully evident to me in the course of a rather long search I have had to make there. The want of room, light, and ventilation of these premises make up quite a *ne plus ultra* of discomfort for the visitors and officials.

He would make a bold assertion who would now maintain that the security given by an English patent is worth the money paid for it; so that, in point of fact, this library, excellent as to its management and its contents, is almost the only substantial return made to the public for the large fees required from patentees.

As appears by the report for the year 1860 of the Commissioners of Patents the Attorney and Solicitor-General divide annually a sum of more than £8,000 between themselves as commissioners. There is a surplus income of more than £92,000 per annum, and the surplus of the fee fund applicable to building purposes amounted, at the end of the year 1860, to £92,000. The public, indeed, get a very poor shell for such a fat oyster; and this is in the face of the distinct declaration made during the session of 1852, that the surplus revenue from patents should be devoted to the scientific benefit of the public. It would, perhaps, be too much to expect the Lord Chancellor and the other lawyer commissioners to concern themselves about the health and comfort of the officials and visitors merely; but the very expensive books there are getting daily injured from the present impossibility of keeping them free from dust, and from soiling the hands of those examining them; and this, as a natural consequence, results on the state of the works themselves. F. A. P.

Ipswich, April 5th, 1862.

MEETINGS NEXT WEEK.

Institution of Civil Engineers.—Tuesday, April 15, at 8 p.m. Continued discussion upon "Railway Accidents," by Mr. Brunlees and Captain Galton, R.E.

South Wales Institute of Engineers.—Merthyr Tydfil, Wednesday, at 12 a.m., the following papers, read at former meetings, will be discussed:—Mr. R. Schmidt's, "On Professor Zeuner's diagram for showing the motion of the slide valve;" Mr. Mark Fryar's, "On the sanitary condition of mines;" Mr. Ashcroft's, "On canals, and canal carriage;" Mr. Steel's, "On Giffard's injector." And the following papers read and discussed:—"On indicator diagrams," by Mr. Cope Pearce; "On the selection and treatment of coal for the blast furnace and the cupola," by Mr. Cox; "On puddled steel," by Mr. Parry.

Society of Arts.—No meeting.

Advertisements cannot be guaranteed insertion unless delivered before eight o'clock on Thursday evening in each week. The charge for four lines and under is half-a-crown; each line afterwards, sixpence. The line averages nine words; blocks are charged the same rate for the space they fill. All single advertisements from the country must be accompanied by stamps in payment.

The Engineer *can be had, by order, from any newsagent in town or country, and at the various railway stations; or it can, if preferred, be supplied direct from the office on the following terms:—*

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The Engineer *is registered for transmission abroad.*

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THE ENGINEER.

FRIDAY, APRIL 11, 1862.

IRON PLATES ON THEIR TRIAL.

In the case of Ordnance *v.* Iron Armour Plates, sometime ago decided in favour of the defendants, judgment has this week been reversed on an appeal to a 156-pounder smooth bore gun. On Tuesday afternoon the new Elswick gun, generally known as the "300 pounder Armstrong," was tried at Shoeburyness against the Warrior target, a construction in iron and timber representing the sides of our great plated frigate of that name. The gun, 14ft. long, weighing 12 tons, and firing a round cast iron shot 10½in. in diameter, and weighing 156 lb., was first fired with 40 lb. of powder at a range of 200 yards. In the words of the *Times*:—

"This solved all doubts. With an indescribable crash, that mingled fearfully with the report of the gun, the shot struck upon a comparatively uninjured plate, shattering the iron mass before it into little crumbs of metal, splintering the teak into fibres literally as small as pins, and, though not passing quite through the side, yet bulging and rending the inner skin of the ship in a way that would have rendered it almost impossible to stop the leakage. The second shot (still with a 40 lb. charge) struck close by the side of the first, making the previous damage tenfold worse, if possible. To those who did not actually see the experiments it would be difficult to describe the manner in which the iron opposite the missile was broken into minute fragments like glass; how the teak was so utterly disintegrated that it more resembled tangles of fine twine than even the remains of woodwork; and how, above all, the inner iron skin was ripped into gaps like torn paper. These two shots were quite conclusive as to the power of the gun. Had they struck an iron frigate at the water line no means could have prevented her sinking in half an hour. Still, however, the shot had not gone completely through the side, which it was the great object of the experiments to accomplish. The charge of powder was, therefore, increased from 40 lb. to 50 lb., and the gun levelled at the uppermost plate of the target, which had been left untouched in previous tests. On this plate a white spot was painted to guide the artillerymen, and so true was their aim—so exactly was the centre of the mark struck—that every vestige of the paint was obliterated. With this increased charge the shot passed, not only through armour plate, teak, and inner skin, but buried itself in the massive timbers that support the target, and even loosened the blocks of granite by which the whole is backed up. Had it been the side of the Warrior against which this missile was directed, it would not only have gone through the side, but nearly through the opposite side as well. Another white mark was then made on the lowest plate of the target, and again the artillerymen hit it with the same marvellous precision and with the same result. The shot went through everything, and even the fondest believers in the invulnerability of our present ironsides were obliged to confess that against such artillery, at such ranges, their plates and sides were almost as penetrable as wooden ships are now to the plain old-fashioned long 32's. Of course, after such decisive results, no further experiments were tried; indeed they could not be, as the 156-pounder evidently thought it had done enough for the day, and at the last discharge recoiled so much as to get off its wooden platform and imbed the hind wheels of its carriage in the stiff yet watery clay, for the production of which in the largest quantities at the shortest notice Shoeburyness stands unrivalled. But quite enough had been accomplished, and Admiralty officials and armour shipbuilders could only admit to each other in a kind of confidential dismay, that artillery had at last proved too much for them, and that if invulnerable ships were to be constructed they must begin *de novo*. It was clear to all that the Warrior would not stand the least chance against the new gun, even unrifled."

It will be borne in mind that the work in this case was accomplished, not by using an enormously heavy shot, but by utilising the explosive force of 50 lb. of powder in a single charge. None but an enormously strong gun can withstand such a charge—three times heavier, indeed, than the full service allowance for the 68-pounders. Whether Sir William Armstrong's new gun can resist such charges in regular service remains to be seen, but certain it is that the complete vulnerability of the thickest plates yet in use has been proved beyond doubt, at least if the plates be placed upright, as in the Warrior and La Gloire. The resistance of inclined plates of the same thickness would undoubtedly be still greater, but with inclined plates the weight of iron for covering a given height is correspondingly increased, so that it is doubtful as yet whether anything is gained by inclining the plates as compared with covering the same vertical height with thicker plates of the same total weight. The new Elswick gun, which has acquitted itself so well in a contest with 4½in. plates backed with 20in. of teak and 1in. of iron behind that, is to be rifled to throw a 300 lb. shot. If the charge of powder be then diminished, as it doubtless will be, the efficiency of the gun will then be less, probably, than at present, the friction in the grooves and the reduced charge of powder operating together to give less *vis viva* to the shot. But still heavier and stronger guns will doubtless be produced, and it is even now stated that the Americans are making two wrought iron cannon, each intended to throw 1,100 lb. shot. Sir William Armstrong has proposed a 600-pounder, and Captain Blakely will be satisfied with nothing under a 700-pounder. It is becoming evident, however, that we must alter our rating of guns from pounds of shot to pounds of powder. The American 11in. guns are fired with but 12 lb. of powder, and yet they are called 184-pounders, whereas our 95 cwt. guns fired with 16 lb. of powder rank only as 68-pounders. The trials last Tuesday, at Shoeburyness, proved that the quantity of powder utilised at a discharge is the real measure of efficiency. It would appear that 50 lb. is about the minimum to be depended upon, and whether it be fired behind a 156 lb., or a 300 lb., or a 600 lb. shot can hardly make much difference. In the meantime there is a prospect of a grand reconstruction of everything in the naval service, and it is impossible to say how soon we shall have guns burning 100 lb. of powder at a round and ships plated a foot thick.

THE INTERNATIONAL EXHIBITION.

Eleven years have nearly passed away since the art and industry of the whole world were represented in a single display in London. Another great Exhibition is now about to open in our midst, but under circumstances very different from those which attended the memorable congress of all nations in 1851. Peace was then predominant, but now the discourse and preparation of mankind is most warlike, and in the approaching Exhibition engines and works of offence and defence are likely to occupy a very large share of popular attention. The prevailing military spirit, the great improvements made within the last eleven years in ordnance, and the almost complete revolution in the construction and working of vessels of war, all give to the coming display an interest distinct from that which collected within the great palace in Hyde Park. Happily, however, the arts of peace have not lost ground, and it is not difficult to point out a few notable discoveries and improvements produced since 1851, which have altered, or are likely to alter, the state of society in no small degree. Thus steam ploughing, submarine telegraphs, the sewing machine, and the pneumatic or Bessemer process of iron making, all dating since 1851, command a place among the most valuable achievements of modern science and modern ingenuity. It may be too soon to estimate their full value, indeed that of most of them must be incalculable, but even as they now stand, these inventions and discoveries fill up an ample record of decennial progress. Among works of construction the Great Eastern and the new iron-clad frigates, and, if we care to go from home, the Victoria bridge at Montreal, are all worthy examples of modern constructive skill and energy. Within eleven years, too, we have worked out many valuable details in docks, light-houses, bridges, and piers; we have fish-jointed our railways, and made coal answer the purpose of coke in locomotives. We have greatly increased our resources for working iron in large masses; wood-working machinery has been greatly improved, and its applications extended; printing machinery now works with increased expedition; agricultural machinery has made great progress; and traction engines, steam fire engines, and even steam carriages, are becoming familiar objects.

Our own readers, for whom the objects exhibited in the mechanical and engineering department will naturally possess great interest, are not likely to be disappointed either in the extent or variety, nor, perhaps, in the substantial novelty, of the approaching display. It is hardly to be expected that any striking improvement or great discovery, not already known among engineers and manufacturers, will appear for the first time in the "annexe," but, even here, there is still room for a surprise, and it may be that some obscure contrivance will leap from its place in Class 5, 7, 8, or 10, into the front rank of modern inventions, bringing no end of fame and a fortune to its author.

The western "annexe," covering 4½ acres of ground, is, as is well known, to be the depository of the articles exhibited under the heads of railway plant, including locomotive engines and carriages (Class 5), manufacturing machines and tools (Class 7), machinery in general (Class 8), and civil engineering, architectural, and building contrivances (Class 10). Under these heads upwards of 600 exhibitors have had their space alloted, nearly 200 exhibitors, we believe, having already delivered the greater part or the whole of their contributions. Whether the rest will be in time it is difficult to say: we only know that were we in the place of Mr. D. K. Clark, who is the superintendent of this portion of the Exhibition, we should despair of having it complete within the next fortnight. At present the annexe is in a state of most intelligent confusion, large patches are dug up for foundations for heavy machinery, small locomotives and steam cranes are puffing up and down the quadruple lines of railway, packing cases, timbers and *debris* in great variety are scattered everywhere, and an army of workmen, under the command of a formidable staff of commissioners, superintendents, and exhibitors, is carrying its conquests, foot by foot, over the whole area.

The 50ft. sheds or bays which make up the width of the annexe have each a line of railway, and lines of steam pipe, water pipe, and shafting. The railway is on the level of the floor, the steam and water pipes in a continuous trench or pit below, and the shafting is carried on cast iron columns which rise nearly to the springing of the ribs of the roof. The boiler house, separated from the rest of the building, is at the northern end, and the steam will be taken nearly 1,100ft. away in each of the lines of pipe under the floor of the annexe. At first the Commissioners of the Exhibition limited the steam pressure to 30 lb., but Mr. Clark has fortunately succeeded in obtaining their consent to increase it to 70 lb.

The machinery and other objects are being taken in at the western side of the annexe, the heavier articles, as locomotives, marine engines, and very large forgings, being brought to South Kensington by one of Bray's traction engines. Without this valuable auxiliary the work of delivery would have been much greater, the 33-ton locomotive, for example, sent from Wolverton, requiring 32 horses to take it through the London streets. Bray's engine, however, made an easy job of it, having in one case actually taken 46 tons at a single load. There was, indeed, so much of this kind of work to be done that the engine was kept agoing constantly, until Sir Richard Mayne, anticipating that some inexperienced horse might be thrown into a fit of hysterics at the appearance of the three-wheeled monster, interposed his authority, and limited the working of the engine in the streets of the metropolis to the 13 hours from 8 p.m. to 9 a.m.

At the annexe, Mr. Thompson receives and enters the machinery on arrival, but so arduous has this work proved that Mr. Clark has been compelled, to the partial neglect of some of the duties of his own department, to lend a helping hand. Since Monday morning, however, Mr. Clark has had the assistance of an able deputy, Captain Maynard, who, qualified by the best kind of experience for such a task, has already rendered valuable service.

Among the marine engines to be exhibited will be one of the largest class, intended for one of the great iron-plated frigates now in progress. Messrs. Humphrys and Tennant will also exhibit a pair of large engines for one of the Government ships. Among the marine engines yet in place are a pair of double piston-rod, horizontal engines, with four-bladed screw from the Compagnie des Forges et Chantiers de la Méditerranée at Marseilles. The French department of the annexe, we may observe, is in the north-west corner, including a long stretch on the western side.

The first locomotive in the Exhibition was, we believe, a small four-wheeled outside cylinder tank engine, by Messrs. Manning, Wardle, and Co., of the Boyne Engine Works, Leeds. This engine is highly finished, and decorated with the arms of its native town. By an arrangement with the exhibitors, it is now employed in hauling goods, as they arrive, to the places allotted for their exhibition.

Next is an inside cylinder passenger locomotive from the London and North-Western Railway. It is one of the largest class, built upon Mr. McConnell's plans at Wolverton, having 18-in. cylinders, 24-in. stroke, 7-ft. 6-in. driving wheels, and weighing, with coke and water, 33 tons. The engine is fitted with Giffard's Injector, as is also Messrs. Manning, Wardle, and Co.'s locomotive above noticed, and which has no pumps. Another locomotive in place is one built by Sir W. G. Armstrong and Co., of Elswick. This engine has outside horizontal cylinders 15in. diameter and 22in. stroke, and has four coupled driving wheels 5ft. 7in. in diameter, and a pair of leading wheels. It has heavy

brass pumps, worked from the cross heads, and a donkey pump, also, on the side of the firebox. It is the intention, we presume, to paint this engine where it stands, as it does not appear to be complete in this respect at present.

The Lilleshall Company, in Shropshire, have erected a pair of small blowing engines, which, nevertheless, look large under the roof of the annexe.

The largest lot of machinery which has yet arrived in the annexe is the great sugar mill of Messrs. Mirrlees and Tait, of Glasgow. With the engine, already in place, and without boilers, the whole weight is about 130 tons. The mill has three horizontal rollers, 33in. in diameter and 7ft. long, and will be driven by a high-pressure beam engine, with a 22in. cylinder and 4ft. 6in. stroke. Messrs. W. and A. McOnie will also exhibit a large mill, now in place, and weighing about 70 tons.

The display of engineer's tools promises to be very extensive. The space allotted to English exhibitors in this department is at the southern end of the annexe, near the entrance from the western transept. Messrs. Sharp, Stewart, and Co., of Manchester, have in place a large double head lathe for locomotive driving wheels and other work, and fitted with four stout tool posts for front and back cuts at each end. A slotting drill with single head, and another for connecting rods, &c., are also on the ground. This important tool will rank foremost among the few improvements which have been made in engineers' machinery since 1851. A considerable amount of machinery, including a locomotive, is on its way from the same exhibitors. Messrs. William Muir and Co., of Manchester, have set up a large radial drill, and have a pair of their double grindstones close by. Messrs. J. Hetherington and Sons, of Manchester, have set up a large pillar radial drill, in which the drill can be brought to bear upon almost any point within a complete circle, 12ft. in diameter or thereabouts. A lathe is in place by the side of the drill.

Messrs. Shepherd, Hill, and Co., of Leeds, are getting an extensive lot of tools into place, and Messrs. Maclea and March, and Messrs. J. Buckton and Co., of the same town, have, respectively, a large railway lathe and shaping machine, and a shearing and punching machine in place. Messrs. Crawhall and Campbell, of Glasgow, have also sent in a lot of tools.

Of wood working machinery, Messrs. S. Worssam and Co., of Chelsea, have already sent in a fine contribution. There is a wood-planing machine with the solidity of construction and fineness of finish characteristic of the best class of planing machines for iron. Besides other machinery the same exhibitors send a circular saw, made by Wheatman and Smith, and of the great diameter of 7ft. 1in. Messrs. Greenwood and Batley, of Leeds, Messrs. John McDowall and Son, of Johnstone, and Messrs. J. and T. Young, of Ayr, also have a quantity of wood working machinery in the building.

Messrs. Glen and Ross, of Glasgow, have some of Rigby's hammers in place, and steam hammers are in from Messrs. Thwaites and Carbutt, of Bradford. Messrs. D. Cook and Co., of Glasgow, send a steam rivetting machine in addition to other work.

Of machinery employed in textile manufactures, a moderate amount is in from Mr. George Hodgson, of Bradford, Messrs. William Smith, and Brother, of Heywood, and Messrs. W. Dickinson and Sons, of Blackburn.

Of the vast amount of work going on in the main building, but a small proportion is strictly of a mechanical or engineering interest, and thus, even had we space for its description, we should do better to leave it to other pens than our own. The *Times* has mentioned the attractive display by Mr. Bessemer, in the eastern transept, in the following terms:—

"Mr. Bessemer, whose process for making steel is now fast taking root throughout this country and the Continent, has also a very beautiful trophy court in this transept. It consists of a raised floor approached by wide steps, and surrounded by a very handsome carved screen in polished mahogany, the outer edge of which is surmounted by a fretwork of bronze and rail of burnished steel. This screen is double, and its upper side forms a counter, while in the centre is a very fine glass and mahogany case, the woodwork of which is beautifully carved in bold relief. In this case, secure from rust and damp, will be shown some of the most important of the various applications now made of what is called the Bessemer steel. There will be a crank shaft of a 50-horse engine in one piece, with piston-rods for engines of from 50 to 250-horse power, the powerful screw of a fly press used in the Mint, with a circular saw made from one disc of steel over 7ft. in diameter, with teeth of 10in. in length. There is, however, a larger saw than this shown in another part of the building, made from steel by the old process,* and either of them, turning at the rate of 500 revolutions a minute, would cut through the thickest timber as fast as a man could walk. With these massive examples will be shown smaller ones, such as plates used in boilers, ships, and bridges, raising in regular gradations from one-fiftieth of an inch to nearly 4½in. thick. Specimens of steel wire will also be shown from a thickness too great for a strong man to bend down to the two-hundred and fifth part of an inch in diameter. Among the applications of steel wire will be exhibited several specimens of cotton cards, used in the best carding engines, with steel in round, flat, and square bars of every size. Two important examples of steel ordnance will also be shown, one illustrating a mode of mounting guns without trunnions, the elevation being effected by a screw, and the axles of the wheels admitting of adjustment; the other a 24-pounder, with trunnions forged on it out of one solid ingot of steel. Mr. Bessemer also shows samples of railway bars made of his steel, some few hundred tons of which have already been laid on various lines for trial. He claims for these metals that they will last between four and five times as long as ordinary rails, and that they are not liable to snap in frosty weather, in proof of which is shown a bar bent double during a hard frost by an eminent railway engineer. If these allegations can only be supported Mr. Bessemer need not much trouble himself about other applications of his process, inasmuch as our great railway companies use about 15,000 tons† of rails a year, the average life of a rail on a main line being only ten years, and at important stations as low sometimes as four months."

* The two saws are, we believe, of exactly the same diameter.

† The amount of iron renewed yearly in the railways of the kingdom cannot fall short of 250,000 tons.—Ed. E.

Messrs. Lambert's Tube Works, Walsall.—These well-known works caught fire a few days since, and, but for the resources of the well and steam engine on the premises, would have been completely destroyed. As it was, a single building was burnt down, but the stock of patterns was saved, and the works are again in active operation.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

3062. Frederick Vetterlin, Scarborough-street, Goodman's Fields, Middlesex, "Improvements in breech-loading ordnance, and the projectiles to be used therewith, which may also be applied to small arms."—*Petition recorded 16th December*, 1861.

119. Edward Henry Cradock Monckton, Fineshade, Northamptonshire, "Improvements in apparatus for obtaining and applying motive power."—*Petition recorded 16th January*, 1862.

149. Robert Ogden Doremus and Benn. L. Budd, New York U.S., "Improvements in making cartridges."—*Petition recorded 20th January*, 1862.

188. Timothy Morris and Robert Weare, Birmingham, and Edward Henry Cradock Monckton, Fineshade, Northamptonshire, "Improvements in submarine and other telegraphic communication, and in apparatus connected therewith."—*Petition recorded 24th January*, 1862.

291. Charles Marien Roullier, Paris, "Improvements in the manufacture of straps, bands, chains, and other like articles."—*Petition recorded 4th February*, 1862.

315. Peter Hyde Astley, Matthew's-place, and Crosby Leighton, Manby-grove, Manby Park, Stratford, Essex, "Improvements in the construction of lifeboats, applicable also to ships' boats, gun-boats, and other vessels."—*Petition recorded 6th February*, 1862.

387. Richard Hornsby, jun., Spittlegate Works, Grantham, Lincolnshire "Improvements in apparatus for threshing, elevating, cleansing, and separating grain, and in apparatus for elevating straw."—*Petition recorded 13th February*, 1862.

439. Frederic Barnett, Oxford-street, London, "An improved lamp or lantern for street lighting and other purposes."

441. Nathaniel Symons, Cambridge-street, St. Pancras, Middlesex, "Improvements in steam engines for increasing the powers thereof by a different form of piston, internal top and bottom of cylinder."—*Petitions recorded 19th February*, 1862.

475. George Tomlinson Bousfield, Loughborough Park, Brixton, Surrey, "Improvements in apparatus for elevating hay, straw, and earth."—A communication from Levi Beardsley, Boston, U.S.—*Petition recorded 22nd February*, 1862.

494. Thomas Partridge, sen., Tenby-street, Birmingham, "Improvements in apparatus for printing railway and other tickets or cards."—*Petition recorded 24th February*, 1862.

510. Joseph Whitworth, Manchester, "Improvements in manufacturing and preparing projectiles, and in apparatus to be used for those purposes."—*Petition recorded 27th February*, 1862.

540. Robert Seager, Ipswich, Suffolk, "Improvements in the manufacture of boots and shoes, and in apparatus employed therein."—*Petition recorded 27th February*, 1862.

619. Alexander William Williamson, University College, Middlesex, "Improvements in apparatus for generating steam, or for generating and superheating steam."—*Petition recorded 8th March*, 1862.

648. John Thomas Calow, Staveley, Derbyshire, "An improved safety apparatus applicable to cages or hoists used in mining or lifting machines."—*Petition recorded 10th March*, 1862.

678. Edward Gerard Fitton, Ardwick, Lancashire, "Improvements in machinery for winding yarn or thread on to bobbins or spools."—*Petition recorded 12th March*, 1862.

682. Lucien Vidie, Paris, "Improvements in the construction of aneroid barometers, partly applicable to steam gauges."

684. John Cunningham and Robert Cunningham, Paisley, Renfrewshire, N.B., "An improved ornamental fabric, and improvements in weaving and jacquard apparatus."

685. Godfrey Ermen, Manchester, "An improved receptacle or case for the protection of threads of cotton, silk, or other fibrous substances when in a 'spooled,' 'balled,' or otherwise wound state, or for the reception of 'taps &c.'"

687. James Wadsworth, Salford, near Manchester, "Improvements in the construction and manufacture of movable or adjustable heels for boots and shoes."

689. Edward Thomas Hughes, Chancery-lane, London, "Improvements in furnaces for consuming smoke."—A communication from Napoléon Félix Boruko de Chodzko and Jean Louis Lebeaux, Paris.

691. Michael Henry, Fleet-street, London, "Improvements in stuffing boxes."—A communication from Francisque Million, Boulevart St. Martin, Paris.

693. George Calvert, Islington, Middlesex, "Improvements in castors."

695. Joseph Bennett Howell, Sheffield, "Improvements in the manufacture of chains and chain cables."

697. William Edward Newton, Chancery-lane, London, "An improvement in armour plates for vessels of war."—A communication from Edward Cox, Covington, Kentucky, U.S.

699. Rudolph Schomburg, Cannon-street, London, and Adolph Baldamus, Charlottenburg, Berlin, Prussia, "Improvements in purifying illuminating gas."—*Petitions recorded 13th March*, 1862.

701. Alexandre Quinard, Passage des Petites Ecuries, Paris, "A machine for manufacturing horse-shoe nails."

703. George Henry Birkbeck, Southampton-buildings, Chancery-lane, London, "Improvements in trusses or bandages, and in pessaries to be used therewith when required."—A communication from Louis Polydore Grandcollot, Paris.

704. George Bennet, Manchester-buildings, Westminster, Middlesex, "An improvement in the coating and covering of wrought iron for the purpose of preserving it and preventing oxidation."

705. George Henry Sanborn, Boston, Massachusetts, U.S., "Improvements in gas regulators."—A communication from Henry Norton, Boston, Massachusetts, U.S.

707. George Tomlinson Bousfield, Loughborough Park, Brixton, Surrey, "Improvements in machinery for digging and disintegrating the earth for agricultural purposes."—A communication from Elias Howe, jun., Brooklyn, New York, U.S.

709. Matthew Andrew Muir and James McIlwham, Glasgow, Lanarkshire, N.B., "Improvements in railway sleepers and chairs and in the mode of fixing rails."—*Petitions recorded 14th March*, 1862.

711. Alfred Coles and William Coles, Wych-street, Strand, London, "Improvements in the construction of trusses for cases of hernia."

713. Harry Emanuel, Brook-street, Hanover-square, London, "An improvement in the manufacture of ornaments for personal wear."

715. George Brooks Pettit, New Oxford-street, London, "An improved method of and apparatus for heating water and other liquids, applicable also to the evaporation of liquids."

716. Julien Smaija, Stamford-street, Christchurch, Surrey, "Improvements in bustles and crinolines, and in materials used in their construction."

717. William McAdam, Glasgow, Lanarkshire, N.B., "Improvements in the manufacture of blocks, pulleys, and weights for window sashes and other purposes, and in the mode of applying the same."

719. John Grant, Albion-place, Maidstone, Kent, "Improvements in the construction of portable railways, and in the trucks or carriages to be used thereon."

721. Sublime Napoleon de la Haye de Barbezieres, Paris, "An improved construction of horse-shoe."

723. George Hamilton, Willow-terrace, Islington, Middlesex, "Improvements in tumbler locks."

725. William Pickstone, Radcliffe, Lancashire, "Improvements in the manufacture of piles fabrics."—*Petitions recorded 15th March*, 1862.

727. William Clark, Chancery-lane, London, "Improvements in water meters."—A communication from Mr. Frank Grant Johnson, Brooklyn, King's County, New York, U.S.

731. Louis Pierre Monguel, Rue Vivienne, Paris, "An improved cold vapour generator, which may also be used in the carburation of illuminating gas."

733. George Davies, Serle-street, Lincoln's inn, London, "Improved apparatus for drawing."—A communication from Josephin Soumary, Paris.

737. William Barber, Stockport, Cheshire, "Improvements in the manufacture of hats."

739. John Minton Courtauld, Braintree, Essex, "Improvements in power looms."

741. Ephraim Smith, Carlisle-street, Soho, London, "An improvement in watch keys."

743. Thomas Waller, Conduit-street West, Middlesex, "Improvements in breech-loading fire arms."—A communication from Christopher Tyler, Stephen Wood, Egerton Marcy, and John Wilkinson, New York, U.S.—*Petitions recorded 17th March*, 1862.

747. Marc Antoine Francois Mennons, Rue de l'Echiquier, Paris, "The application to the manufacture of paper pulps of a vegetable product not hitherto used for that purpose."—A communication from Frédéric Thierry Pitoy-Millot, Faubourg St. Pierre, Nancy, Departement de la Meurthe, France.

749. James Banks, Salisbury-street, Adelphi, London, "Improvements in electro-magnetic telegraph printing apparatus or marking instruments, and the instruments or apparatus to be used in connection therewith."

750. Henry Bailly, Salter's Hall-court, Cannon-street, London, "Improvements in the manufacture of paper from wood, and in apparatus used therein."—A communication from Ernest Antreux and Michel and Joseph Cotton, La Rochelle, Lower Charente, France.

751. Thomas Dunn, Windsor Bridge Ironworks, Pendleton, near Manchester, "Improvements in the construction of bridges, roofs, houses, and other structures."

753. Charles Iles, Birmingham, "Improvements in the manufacture of umbrellas and parasols."

755. James Archibald Jaques and John Americus Fanshawe, Tottenham, Middlesex, and Frank Jaques, Droylesden, Lancashire, "Improvements in the construction of elastic surface rollers."

757. James Wright, Bridge-street, Blackfriars, and Henry Wheatcroft, Fore-street, London, "Improvements in apparatus or machinery for lasting and making boots and shoes."

759. Frederick Warner, Crescent, Cripplegate, London, "Improvements in cocks or taps."

761. John Turner Buck, New North-road, Middlesex, "Improvements in instruments and work cases known as 'ladies' companions.'"—*Petitions recorded 18th March*, 1862.

765. Robert Wilson, Patricroft, near Manchester, "Improvements in hydraulic presses, and in machinery or apparatus for raising or forcing fluids."

767. Richard Archibald Brooman, Fleet-street, London, "Improvements in printing and painting upon glass and ceramic wares and upon metallic and mineral substances, also in the preparation of inks and colours for printing and painting."—A communication from Charles Raphaël Maréchal and Cyprien Marie Tessié du Motay, Paris.

769. Richard Archibald Brooman, Fleet-street, London, "Improvements in rotary engines."—A communication from Serkis Balliam, Constantinople, Turkey.

771. John Cumming, Edinburgh, "Improvements in the method of and apparatus for distributing and setting up type."

772. George Meek Todd, Hackney-road, Middlesex, "Improvements in shuttle sewing machines, and the production of a new kind of stitch thereby."—*Petitions recorded 19th March*, 1862.

774. John George Truscott Campbell, Hatcham-terrace, Old Kent-road, Surrey, "Certain improvements in ships' propellers."

778. Edward Field, Buckingham-street, Adelphi, London, "Improvements in apparatus for regulating the flow of gaseous and other fluids."—*Petitions recorded 20th March*, 1862.

788. James Humphreys, Tower-hill, London, "Improvements in steam engines."

790. William Phelps and William Roe Lymbery, Nottingham, "An improved woven fabric, and improvements in machinery for manufacturing the same."

792. William Clark, Chancery-lane, London, "Improvements in sewing machines, which improvements are also partly applicable to other machinery for giving a rotating motion always in the same direction."—A communication from Mr. Charles Rhodes Goodwin, Boulevart St. Martin, Paris.—*Petitions recorded 21st March*, 1862.

794. Thomas Marsh, West Bromwich, Staffordshire, "An improvement or improvements in hames for horses and other draught animals."

796. Evan Owen, Bala, Merionethshire, N.W., "Certain improvements in the hydraulic engines known as 'turbines.'"

798. John Davis, Kennington, Surrey, "Improvements in wind musical instruments."

800. Frederick William Colls, Deptford, Kent, and Peter Haden, Hackney, Middlesex, "Improvements in consuming smoke, and in the apparatus connected therewith."

802. Josiah George Jennings, Holland-street, Blackfriars-road, Surrey, "Improvements in the manufacture of biscuits."

804. Thomas Frederick Hale, Bristol, Gloucestershire, "Improvements in valves."

806. George Hartshorne, jun., and Daniel Grainger Ward, Dudley, Worcestershire, and William Woolley, Tipton, Staffordshire, "Improvements in punching or perforating metal plates or sheets, and in apparatus or machinery to be employed for that purpose."—*Petitions recorded 22nd March*, 1862.

810. Thomas White, Birmingham, "Improvements in the manufacture and ornamentation of nut crackers and lobster crackers."—*Petition recorded 24th March*, 1862.

822. Alfred Fryer, Manchester, "Improvements in the manufacture of sugar, and in separating liquids from sugar and other substances."

824. Theophile Guibal, Rue des Groseillers, Mons, Belgium, "Improvements in the construction of ventilators for the ventilation of mines and furnaces."

828. William Clissold, Dudbridge Works, near Stroud, Gloucestershire, "Improvements in carding engines."—*Petitions recorded 25th March*, 1862.

830. Leo de la Peyrouse, Panton-square, Middlesex, "Improvements in the preservation of animal substances."

832. John Wilson, Glasgow, Lanarkshire, N.B., "Improvements in the apparatus used for and in the method of hot pressing or finishing plaids, shawls, handkerchiefs, and other woven fabrics."

834. William John Taylor, Upper Church-street, King's-road, Chelsea, Middlesex, "An improved method of colouring Portland cement for plain and ornamental plasterer's work on the walls of buildings and other erections."

836. Robert Boby, Bury St. Edmunds, Suffolk, "Improvements in hay-making machines."

838. John Taylor and Charles Henry Minchin, Manchester, "A suspender or improved gallery for supporting the shades of gas or other lights."

840. Robert Griffiths, Mornington-road, Regent's Park, London, "Improvements in weapons of warfare for naval purposes."—*Petitions recorded 26th March*, 1862.

844. William Greenway, Birmingham, "Improvements in the manufacture of bolts for fastening doors, and for other like purposes."

846. Thomas George Greenstreet, Penton-place, Kennington-road, Surrey, "Improvements in window sashes."

848. Richard Edwards, Regent-street, Mile-end, Middlesex, "Improvements in machinery and apparatus for pulverising, stamping, and washing mineral, animal, and vegetable substances."

850. James Lock, Nasington, Northamptonshire, "Improvements in apparatus for raising or elevating straw and crops on to stacks."

854. Robert de Bary, Finsbury-square, London, "Improvements in machinery for the manufacture of cigars."—A communication from Julius De Bary, Offenbach, Hesse Darmstadt.

856. William Edward Gedge, Wellington-street, Strand, London, "Improvements in apparatus for extinguishing fire."—A communication from Gabriel Brasseur, Passage des Petites Ecuries, Paris.

858. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in thrashing machines."—A communication from Auguste Bernard Albaret, Paris.

860. George Henry Birkbeck, Southampton-buildings, Chancery-lane, London, "Improvements in the means of producing imitation mosaics."—A communication from Charles Auguste le Bourg, Paris.—*Petitions recorded 27th March*, 1862.

Inventions Protected for Six Months by the Deposit of a Complete Specification.

847. Frederick Tolhausen, Faubourg Montmartre, Paris, "New or improved cigar-tubes or apparatus for holding and smoking cigars and cigarettes."—A communication from Charles Toussaint, Faubourg Montmartre, Paris.—*Deposited and recorded 27th March*, 1862.

893. Joseph Page Woodbury, Boston, Suffolk, Massachusetts, U.S., "An improvement in arming war vessels."—*Deposited and recorded 31st March*, 1862.

910. Michael Henry, Fleet-street, London, "An improved furnace for treating iron ore."—A communication from Joseph Alexandre Marcel Bonna, Cluis, France.—*Deposited and recorded 1st April*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

832. Michael Coupland, Haggerstone, Middlesex.—Dated 2nd April, 1859.

845. David Blair White, Newcastle-on-Tyne.—Dated 4th April, 1859.

866. Alexander Chaplin, Glasgow, Lanarkshire, N.B.—Dated 7th April, 1859.

1098. James Childs, Windsor House, Putney, Surrey.—Dated 2nd May, 1859.

830. Arthur Paget, Loughborough, Leicestershire.—Dated 2nd April, 1859.

846. Edmund Morewood, Enfield, Middlesex.—Dated 4th April, 1859.

869. James Hadden Young, Great College-street, Camden Town, London.—Dated 9th April, 1859.

1134. John Schofield and William Cudworth, Milnrow, near Rochdale, Lancashire.—Dated 5th May, 1859.

850. Edward Fairbairn, Kirklees Mills, Mirfield, Yorkshire.—Dated 5th April, 1859.

853. George Frederic Chantrell and Edward Dutch, Liverpool.—Dated 5th April, 1859.

862. William Owen, Rotherham, Yorkshire.—A communication.—Dated 6th April, 1859.

873. John Talbot Pitman, Gracechurch-street, London.—A communication.—Dated 8th April, 1859.

883. William Henderson, Alderley Edge, Cheshire.—Dated 8th April, 1859.

935. Jose Luis, Welbeck-street, Cavendish-square, London.—A communication.—Dated 14th April, 1859.

957. William Edward Newton, Chancery-lane, London.—A communication.—Dated 16th April, 1859.

863. Joseph Hooker, Queen-square, Bartholomew-close, and Edward Johnson Tweed, Castle-street, Falcon-square, London.—Dated 6th April, 1859.

881. William Hooper, Mitcham, Surrey.—Dated 8th April, 1859.

933. John Hughes, William Williams, and George Lathom, Brookmoor Works, Brierly Hill, Staffordshire.—Dated 13th April, 1859.

996. Henry Rawson, Leicester.—Dated 20th April, 1859.

Patent on which the Stamp Duty of £100 has been paid.

736. WILLIAM LUND and WILLIAM EDWARD HIPKINS, Fleet-street, London. —Dated 2nd April, 1855.

Erratum.

761. For "instrumente" read "instrument."

Notices to Proceed.

2955. JAMES RONALD, Liverpool, "Improvements in machinery used for spinning hemp, flax, manilla, wool, and other like fibrous material, and for the manufacture of 'topped-up,' 'formed,' or 'laid' thread, twine cord, line, cable, and other cordage."—*Petition recorded 25th November*, 1861.

2993. MAGNUS OHREN, Sydenham, Kent, "An improvement in the manufacture of gas, and the apparatus connected therewith."—*Petition recorded 27th November*, 1861.

3002 PETER SPENCE, Newton Heath, Manchester, "Improvements in the treatment of ores for the manufacture of sulphuric acid, and in apparatus connected therewith."—*Petition recorded 28th November*, 1861.

3008. LOUIS HENRY CHRISTIAN JACOB CARLE Brownlow-street Holborn, London, "Improvements in means or apparatus for indicating and registering the 'score' for billiards and other games."—*Petition recorded 29th November*, 1861.

3025. THOMAS WRIGHT GARDENER TREEBY, Westbourne terrace-villas, Westbourne-square, Paddington, Middlesex, "Improvements in machines for boring holes in rocks and other hard substances."

3030. JAMES LEACH, Bronte-place, East-street, Walworth, Surrey, "Improvements in preparing matters to be used in the manufacture of candles."

3032. JOHN LYON FIELD, Upper Marsh, Lambeth, Surrey, "Improvements in the manufacture of mould candles."

3034. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in artificial teeth."—A communication from Samuel Stockton White, Philadelphia, Pennsylvania, U.S.—*Petitions recorded 3rd December*, 1861.

3037. THOMAS STEAD and WILLIAM HIGHAM, Ashton-under-line, Lancashire, "Improvements in machinery or apparatus for spinning cotton or other fibrous materials."

3044. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in albums or books for containing and showing photographic and other pictures, and in slides for the same."—A communication from Henry Strauss, Paris.

3045. ABRAHAM PULLAN and WILLIAM LAKE, New Cross, Surrey, "Improvements in traction and other engines and other carriages, and in giving motion to ploughs and other agricultural machines."—*Petitions recorded 4th December*, 1861.

3058. JOHN BAYLEY and WILLIAM HENRY BAYLEY, Albion Works, Salford, near Manchester, "Improvements in apparatus for indicating the pressure of steam and gases, the amount of vacuum, the flow of fluids, the weight of materials, and the speed of bodies, either revolving or traversing, and also the employment of aluminium or its alloys in the manufacture of the same."

3060. JOHN DAVID NAPIER, Glasgow, Lanarkshire, N.B., "Improvements in brakes."—A communication from Robert Napier, Newcastle, New South Wales.—*Petitions recorded 6th December*, 1861.

3079. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris. "Improved natatory apparatus."—A communication from Léon Lejuste, Rue de Canteleux, Paris.

3080. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "A new or improved combination of microscopic photographs and lenses, with certain precious stones, or imitations thereof."—A communication from Louis Henri Bouillette and Jean Amable Hyvelin, Michel-le-Comte, Paris.

3082. JOHN FORDRED, Brighton, Sussex, "Improvements in treating linseed oil."—*Petitions recorded 9th December*, 1861.

3106. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "A new or improved method of treating teazles or thistles to be used in the teazling of cloths and stuffs and otherwise."—A communication from Adolphe André Gohin, Vire, France.—*Petition recorded 11th December*, 1861.

3135. ALFRED VINCENT NEWTON, Chancery-lane, London, "An improved arrangement of fire-escape."—A communication from Aaron Shute, Flusning, Queens, New York, U.S.—*Petition recorded 13th December*, 1861.

3164. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improved hoisting apparatus."—A communication from John James Doyle and James Christison, New York, U.S.—*Petition recorded 17th December*, 1861.

3240. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in steam generators, and in fire-bars employed therein."—A communication from Alexandre Friedmann and Emile d'Erlanger, Paris.—*Petition recorded 27th December*, 1861.

3263. THOMAS GREEN and WILLOUGHBY GREEN, Smithfield Ironworks, and ROBERT MATHERS, Trafalgar-street Leeds, Yorkshire, "Improvements in chains for giving motion to chain wheels, and in giving motion to machinery."—*Petition recorded 31st December*, 1861.

119. EDWARD HENRY CRADOCK MONCKTON, Fineshade, Northamptonshire, "Improvements in apparatus for obtaining and applying motive power." —*Petition recorded 16th January*, 1862.

149. ROBERT OGDEN DOREMUS and BERN. LUM BUDD, New York, U.S., "Improvements in making cartridges."—*Petition recorded 20th January*, 1862.

177. JOHN CRESSWELL JOHNSON, Nottingham, "Improvements in the manufacture of twist lace in twist lace machines."—*Petition recorded 23rd January*, 1862.

199. JOHN WRIGHT, Rochester, Kent, "Improvements in constructing works below water."—*Petition recorded 25th January*, 1862.

289. THOMAS MOSSOM MEEKINS, LL.D., Chancery-lane, London, "The production of a projectile and explo-ive force to be used in instruments of war, for an electric gas gun and electric gas shell, for a method of using the recoil of weapons for the purpose of increasing the pressure of elastic fluids for the production of a projectile force, for a method of rapidly loading weapons at the breech, and of a motive force to be used in an electric gas engine or other engines."—*Petition recorded 4th February*, 1862.

340. JAMES DICKSON, Tollington road, Holloway, Middlesex, "Improvements in voltaic apparatus, and in the production of voltaic electricity." —*Petition recorded 10th February*, 1862.

387. RICHARD HOKNSBY, Spittlegate Works, Grantham, Lincolnshire, "Improvements in apparatus for thrashing, elevating, cleansing, and separating grain, and in apparatus for elevating straw."

363. JAMES EDWARD MCCONNELL, Wolverton, Buckinghamshire, "Improvements in railway brakes and in warming railway carriages."

395. WILLIAM GEORGE VALENTIN, Oxford-street, Middlesex, "An improved mode of and apparatus for coking coal."—*Petitions recorded 13th February*, 1862.

475. GEORGE TOMLINSON BOUSFIELD, Loughborough Park, Brixton, Surrey, "Improvements in apparatus for elevating hay, straw, and earth."—A communication from Levi Beardsley, Boston, U.S.—*Petition recorded 22nd February*, 1862.

510. JOSEPH WHITWORTH, Manchester, "Improvements in manufacturing and preparing projectiles, and in apparatus to be used for those purposes." —*Petition recorded 25th February*, 1862.

561. SAM HAGUE, Westwinsted, Litchfield, Connecticut, U.S., "Improvements in machinery or apparatus for raising hammers and stamping with them hot or cold metals."—*Petition recorded 1st March*, 1862.

584. FREDERICK BURNETT HOUGHTON, Clarendon-terrace, Kensington, Surrey, "Improvements in the manufacture of paper."—*Petition recorded 3rd March*, 1862.

599. JOHN CHUBB St. Paul's Churchyard, London, and HENRY MORTIMER BURTON, John's-place, Holland-street, Southwark, "Improvements in apparatus for displaying or exhibiting jewellery and other valuable articles in glass cases."—*Petition recorded 5th March*, 1862.

624. SIDNEY SAMUEL BROMHEAD, Bristol, Gloucestershire, "Improvements in the construction of boxes or receptacles for coals."—*Petition recorded 8th March*, 1862.

632. LUCIEN VIDIE, Paris, "Improvements in the construction of aneroid barometers, partly applicable to steam gauges."

683. JOHN CUNNINGHAM and ROBERT CUNNINGHAM, Paisley, Renfrewshire, N B., "An improved ornamental fabric and improvements in weaving and in Jacquard apparatus."

685. GODFREY ERMEN, Manchester, "An improved receptacle or case for the protection of threads of cotton, silk, or other fibrous substances when a 'spooled,' 'balled,' or otherwise wound state, or for the reception of in 'tapes.'"

700. JOHN KENT, Hyson-green, Nottingham, "Improvements in cleansing and bleaching."—Partly a communication from Theodor Schnebely, Moscow."—*Petitions recorded 13th March*, 1862.

720. HENRY YOUNG DARRACOTT SCOTT, Brompton Barracks, near Chatham, Kent, "Improvements in the manufacture of cement."

722. JOHN AVERY, Mark-lane, London, "Improvements in purifying coal." —A communication from John Reed, New York, U.S.—*Petitions recorded 15th March*, 1862.

727. WILLIAM CLARK, Chancery-lane, London, "Improvements in water meters."—A communication from Mr. Frank Grant Johnson, Brooklyn, King's, New York, U.S.

739 JOHN MINTON COURTAULD, Braintree, Essex, "Improvements in power looms."—*Petitions recorded 17th March*, 1862.

769. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in rotary engines."—A communication from Serkis Ballian, Constantinople.—*Petition recorded 19th March*, 1862.

863. JOSEPH PAGE WOODBURY, Boston, Suffolk, Massachusetts, U.S., "An improvement in arming war vessels."—*Petition recorded 31st March*, 1862.

919. MICHAEL HENRY, Fleet-street, London, "An improved furnace for treating iron ore."—A communication from Joseph Alexandre Marcel Bonne, Cluis, France.—*Petition recorded 1st April*, 1862.

And notice is hereby further given that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days next after the date of the Gazette (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending April 5th, 1862.

2038, 5s. 6d.; 2080, 3d.; 2117, 6d.; 2118, 7d.; 2119, 1s. 6d.; 2120, 7d.; 2121, 3d.; 2123, 10d.; 2124, 3d.; 2125, 9d.; 2126, 3d.; 2127, 3d.; 2128, 3d.; 2129, 3d.; 2130, 9d.; 2131, 3d.; 2132, 10d.; 2133, 3d.; 2134, 3d.; 2135, 10d.; 2137, 3d.; 2138, 3d.; 2139, 7d.; 2140, 3d.; 2141, 7d.; 2142, 9d.; 2143, 1s. 1d.; 2144, 3d.; 2145, 3d.; 2146, 3d.; 2147, 3d.; 2148, 7d.; 2149, 3d.; 2150, 3d.; 2151, 3d.; 2152, 9d.; 2153, 10d.; 2154, 3d.; 2155, 3d.; 2156, 6d.; 2157, 3d.; 2158, 3d.; 2159, 4d.; 2160, 3d.; 2161, 3d.; 2162, 9d.; 2163, 7d.; 2164, 3d.; 2165, 3d.; 2166, 9d.; 2167, 3d.; 2168, 6d.; 2169, 3d.; 2170, 3d.; 2171, 9d.; 2172, 10d.; 2173, 3d.; 2174, 1s.; 2175, 3d.; 2176, 3d.; 2177, 5d.; 2178, 3d.; 2179, 9d.; 2180, 6d.; 2181, 3d.; 2182, 3d.; 2183, 3d.; 2184, 7d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2364. J. FENTON, *Lowmoor, Yorkshire*, "*Causing the water to circulate in steam boilers.*"—*Dated 21st September*, 1861.

This invention consists in imparting an additional amount of heat to a portion of the water at a point intermediate between the water level and the bottom of the boiler. For this purpose the inventor employs a vessel or vessels for containing the portion of water to which additional heat is imparted, which is or are in communication with the water in the boiler at or near both the water line and the lower part of the boiler; the superheated water, following a well-known law, rises to the upper part of the boiler, and is replaced in the superheating vessel or vessels by the comparatively colder water from the lower part of the boiler, when that in its turn becomes superheated, and rises to the upper surface, thus keeping up continuous circulation.—*Not proceeded with.*

2389. J. MUSGRAVE, *Bolton-le-Moors, Lancashire*, "*Certain improvements in the application of steam power.*"—*Dated 25th September*, 1861.

This invention consists in the application of two or more steam cylinders of small diameters, placed in a vertical, horizontal, or diagonal position, and connected direct to a main driving shaft, or to a second motion shaft, thereby entirely dispensing with the large first motion wheels, fly-wheels, large engine house, and heavy foundations now required.—*Not proceeded with.*

2392. R. A. BROOMAN, *Fleet-street, London*, "*Apparatus for letting off water from, and for admitting oil or other lubricating matter into, steam cylinders.*"—*A communication.*—*Dated 25th September*, 1861.

The apparatus for allowing water to escape from steam cylinders is composed of a tube screwed on to the cylinder opening through another tube into a spherical or other suitably shaped chamber in the bottom of which is a valve in the form of a plunger, kept in position to allow of the outlet of water by a spring; the top of the valve is in the form of a cup, in which the tube communicating with the cylinder dips. The valve is open until the admission of steam on one side or other of the piston, as the case may be, issuing through the tube and pressing on the cup, closes the valve, and keeps it closed until the commencement of the return stroke, when any water which may have become condensed escapes, and so on. The apparatus for admitting lubricating matter consists of a cup closed at bottom by a screw valve, and communicating, when the valve is opened, with a chamber into which two tubes lead from the cylinder; one of these tubes, curved upwards, is of larger bore than the other, which is curved downwards, and nearly touches the bottom of the chamber. The working is as follows:—The cup is filled with oil, and the screw valve opened, which allows of the contents entering the chamber; the valve is then screwed down. On steam being admitted above the piston a portion enters the chamber by the larger tube, and, pressing upon the oil, forces it, through the smaller-bored tube, into the cylinder.

2422. J. A. KNIGHT, *Sigmond's-inn, Chancery-lane, London*, "*Steam pumping engines.*"—*A communication.*—*Dated 28th September*, 1861.

This invention relates to a novel or improved mode of arranging and working the valve gear of the steam cylinders of engines for pumping or forcing water. In carrying out the invention two or more steam cylinders are arranged side by side, or in any other convenient position, and the valve gear for working the valve of one cylinder is actuated, or opened and closed, by the movement of the piston of the other or contiguous cylinder It will be found convenient in practice to arrange the working of the pistons in such a manner that, when one piston is at mid or half stroke, the other piston shall be at the end of the stroke. The operation of the valves, and the arrangement of the ports for the induction and eduction steam, are also so contrived that the exhaust of the steam from the cylinder may be arrested at such a point of the stroke as will prevent the pistons from overreaching or striking against the heads of the cylinders. By this means the cranks, eccentrics, and fly-wheels usually employed in steam engines may be dispensed with; and when the engine is applied to pumping engines a more uniform and equal flow of water or other liquid at all points of the stroke is effected.

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2330. G. FERRY, *Hoxton*, "*Anchors.*"—*Dated 18th September*, 1861.

According to this invention the inventor connects the shank of an anchor to the arms by a ball and socket joint or connection, so that the shank may move in various directions, and take various angles or positions with respect to the arms while still remaining connected to them. This can be effected, for example, by forming the shank with a rounded or spherical ball, and fitting and working in a hollow or socket in the crown. He generally forms on the inner side of the crown, or at the throats of the anchor, as many recesses, openings, or grooves as there are arms, and such recesses, openings, or grooves leading into or forming part of the hollow or socket in the crown, so that the shank, when inclined, may fall into one of the said recesses or openings, and bear or rest against the corresponding arm. He prefers to construct the anchor with three fluked-arms.—*Not proceeded with*

2338. E. CLARK, *Chatham-street, Liverpool*, "*Self-acting signals.*"—*Dated 19th September*, 1861.

The object of this invention is to indicate the position of a railway train within a tunnel and its exit therefrom. The inventor proposes to fix at the entrance of a railway tunnel a pendent so placed as to receive an impetus from the funnel of any passing locomotive. This pendent communicates signal by means of one or more wires to the other end (outlet or inlet) of the tunnel. When the ball at the end of the pendent is struck, it is thrown up, and so remains, being invisible to the driver of any coming train. The locomotive continues its course, and on leaving the tunnel the funnel strikes a similar pendent, which, acting on the communicating wires, causes the pendent first struck to resume its normal position, thus showing that the train has passed clear through the tunnel. When the tunnel is of great length, he proposes to place dials one at each end of the tunnel, so marked or figured as to indicate the position of the train in the tunnel. Uprights are placed on the locomotive which touch pendent wires (say at any desired distance) in their passage, each touch producing a corresponding indication on the dials. As the train leaves the tunnel, the funnel of the locomotive acts as before stated, and the uprights acting upon the wires restore the dial hands to their normal position. At night the apparatus at each end of the tunnel will be illuminated.—*Not proceeded with.*

2343. T. SILVER, *Philadelphia, U.S., and* T. MOORE, *Regent-circus, London*, "*Construction of and appliances to steamships and other vessels.*"—*Dated 19th September*, 1861.

The First part of this invention consists in dividing the hulls of the ships by longitudinal bulwarks intersected by transverse partitions. The fore and aft portions are to divide the ship into four tubular sections below, or about, the load line. One longitudinal partition is to be secured to the centre kelson, and the two others to spring from side or sister kelsons. The two longitudinal divisional side partitions are to be carried up to the upper deck, and above the same to form the sides of a hurricane deck. The partitions are to be stiffened with bars of angle iron crossing each other diagonally. The angle irons are to be made in one piece, so as to form a double angle of a channel shape. The thwartship partitions to be stayed with straps or tension rods extending from one side of the vessel to the other. The Second part of the invention consists in facilitating the loading or discharging of coals or cargo by beam travellers or wheels, flanged or otherwise, running in suspended grooves or working to and from rails. These suspended travellers are to be fixed to the beams or decks to raise or lower cargo, and to run the same to and from the hatchways. The Third part of the invention consists in the mode of fixing the machinery and boilers in the side sections of the ships, so as to allow the whole centre section to be free from appliances connected with steam propulsion. The paddle-wheel engines will be connected by a shaft fitted with a pinion on each end gearing into toothed wheels on each engine shaft. The Fourth part of the invention consists in the arrangement of the screw engines, three cylinders to which will be fixed longitudinally. The centre cylinder is to have its piston connected with two connecting rods; by this arrangement the centre piston will do the work of preventing the back lash, for which two cylinders are required under the common working of modern engines. By the arrangement not here described, each set of engines will drive two spur wheels, between which a pinion gears carrying the screw shaft. The Fifth part of the invention consists in working a screw under each quarter of the stern of the ship with paddle-wheels at the side. The Sixth part of the invention consists in steering apparatus. This may be effected in the ordinary manner, or by steam power in combination with a hydraulic cylinder and piston, the latter being for the purpose of maintaining the position in which the rudder may be placed by the power of the steam pistons. The steam pistons may work in fixed vibrating or rotary cylinders, and the whole placed in the most convenient part of a ship to suit requirements, and connected by chains or other suitable contrivances. The Seventh part of the invention consists in making the hot air pipes for warming the ship to serve as fire extinguishers, by attaching flexible hose at proper intervals to smother conflagration by steam. The Eighth part of the invention consists in ventilating the between-decks and cabins in a manner more suited to ensure health by carrying off impure air.—*Not proceeded with.*

2349. T. M. GLADSTONE, *Parliament-street, Westminster*, "*Anchors.*"—*Dated 20th September*, 1861.

According to this invention the inventor makes an anchor with a joint or pivot in the well-known manner as Porter's, so far as the arms are concerned like them, but having palms that shall have a convex surface on the inner side, and the back of which shall be parallel to the back of the blade or thereabouts, declining from down the centre to the sides, the centre being in line with the curve of inside front of arm, or thereabouts. The front of the palm that rests upon the shank on the upper side when in use either rests in a groove fitted to it on the shank, or is protected from leaving its impact on the shank by raised parts on either side of the shank, whereby a great support is given to the joint at the crown and other parts of the anchor on any strain upon it in the veering of the ship. He also makes what he terms a compound stock, to consist of top and bottom plates of proportionate length, breadth, and strength, to be bolted together, so as to clasp the square of the anchor, and having between them, and secured at right angles, cross plates or clamps that shall grasp the nut or nuts of the anchor, and between the plates in each arm of the stock is fixed wood or other suitable material to keep the plates asunder.—*Not proceeded with.*

2357. W. G. CREAMER, *New York, U.S.*, "*Railway breaks.*"—*Dated 20th September*, 1861.

This invention relates Firstly to the application of a reserve power to railway brakes produced by a spring composed of an alloy of metals consisting of about fifty parts of zinc, thirty parts of copper five parts of tin, and fifteen parts of antimony; this combination of metals is melted together and rolled into a suitable form for the spring required. This spring is coiled up in a box in connection with the shaft on which the chain or medium for applying the brakes is wound by means of a jointed pawl. This pawl and its accompanying ratchet is disposed at or near the roof of the carriage, and t the pawl a hand lever is applied whereby it can be readily thrown out of gear with the ratchet when it is desired to release the brakes. The joint in the pawl is disposed between its joint and its abutment pivot or fulcrum, and is somewhat like a rule joint, which will transmit a thrust and remain rigid in its extended position, but when deflected by movement on its joint, it folds up; this is effected by the hand lever applied to its fulcrum end, which effectually forces it from the ratchet, and therefore disconnects the spring box from the brake operating shaft. The spring is subsequently wound up and placed in tension while the attendant is at leisure. One of such spring reserve brake powers is applied to each carriage, the chain which it winds up and acts on being attached to a brake lever; and these reserve powers being disposed at the top of the carriage, an attendant can readily disconnect the whole number in a train in passing along the roofs of the carriages. The invention also relates to an arrangement of parts by which the patentee places the guard at the rear, and the engine driver in front of the train, in communication with the several reserve brake powers of the train. This he effects by means of a rope carried throughout the train, which rope also serves as a signal between the guard and driver.

2359. F. W. WYMER, *Newcastle-on-Tyne*, "*Apparatus used in sounding the holes of ships.*"—*Dated 20th September*, 1861.

Heretofore, for sounding the holes of ships or vessels, a sounding pipe or tube descending through the deck for the passage of a sounding rod has been employed, and in vessels fitted with water tight bulk heads, a rod which also passed through the deck has been used for opening and closing the bulk head cock or valve, to allow the bilge water to pass from one compartment to another. Now, according to this invention the tube or pipe for the passage of the sounding rod is combined with the bulk head cock or valve in such manner as to enable the cock or valve to be opened and closed therewith, while at the same time such tube or pipe admits of the sounding rod being, as heretofore, passed down through it, by which combination and arrangement only one opening through the deck, and one plate or cover, will be required, and at the same time the keeping of the apparatus, clear and in a condition for use, will be rendered more certain than when the sounding pipe or tube and the rod or handle of the cock or valve were separate and had two distinct openings and deck plates.

2360. G. T. BOUSFIELD, *Loughborough Park, Brixton*, "*Machinery for manufacturing shoes for horses and other animals.*"—*A communication.*—*Dated 20th September*, 1861.

This invention cannot be described without reference to the drawings.

2365. W. STABLEFORD, *Oldbury, Worcester*, "*Improvements in the manufacture of wheels, and in securing tyres on or to wheels.*"—*Dated 21st September*, 1861.

This invention is intended, chiefly, to apply to railway wheels, but may be applied for common road purposes. To the nave of the wheel the patentee fixes a metal disc, or series of segments or spokes, and bends down the outer edge to form a hook, either all round the discs or segments, or at intervals only. He forms the tyres with an inner web, and forms that all round or at intervals only into a hook. The hooks on the tyres and on the discs, segments, or spokes correspond, or are counter parts each of the other, and where put together interlock and form a tight connection on each side of the hooked disc, segments, or spokes, and by preference with the grain placed radially. He fixes wood which bears against shoulders on the tyre at one end, and against the nave at the other. Or, instead of bearing directly against the nave, the wood is received in sockets free to move on the nave. He then bolts, rivets, or otherwise fastens the metal core and the two wooden surfaces together. In order to effect the bolting, he prefers to apply on both sides of the wheel a skeleton frame carrying two rings, through which bolts are passed and fastened by nuts. Instead of applying wood on each side of the core, metal discs, segments, or spokes may be used. In constructing wheels according to this invention he prefers that the wood or metal on each side of the core should be placed at an angle between the tyre and the nave, in order to allow of tightening the tyre, if it should wear loose or otherwise require tightening, by causing the wooden or outer metal surfaces to approach more or less a straight line, that is, bringing them nearer together at the ends where they rest on the nave or in the sockets upon the nave.

2369. J. H. DULEY, *Northampton*, "*Axle-boxes and bushes.*"—*Dated 23rd September*, 1861.

This invention consists in casting the axle-boxes and bushes for the wheels of carts, wagons, agricultural implements, and other carriages, in jointed metal moulds, in lieu of sand, by which means the inner and outer surfaces of such castings are chilled and hardened, and the strength and durability of the article greatly increased.

2374. V. JANKOWSKI, *Princes-street, Fitzroy-square, London*, "*Carriages.*"—*Dated 23rd September*, 1861.

The object of these improvements is to obtain an agreeable rising and falling or undulatory or wave motion to carriages adapted particularly for the use of children or invalids. For this purpose the supporting axle or axles are fixed to the wheels, and are formed with cranks or eccentrics where they support the body of the vehicle, so that as the wheels rotate by the movement of the carriage, the body will be alternately raised and lowered, producing an undulatory or wave effect. And this motion will be rendered more agreeable by the application of springs. The wheels may be arranged only to be fixed to the axles when required, so that, when this undulatory effect is not needed, the wheels may run freely on the axles as with ordinary vehicles.—*Not proceeded with.*

2376. J. PRICK, *Dundalk, Ireland*, "*Permanent-way of railways.*"—*Dated 23rd September*, 1861.

According to this invention it is proposed, in forming the joints of bridge or flat-bottomed rails, to employ a wrought iron chair of a sufficient width to contain the flanges of the rail and receive the fastening bolts which secure the chair to the sleeper, such bolts passing through the chair, but not through the flanges of the rail, the edges of which they touch, or nearly touch, when in their places. The actual bearing portion of the chair beneath the rail-joint is in the form of a flat plate, and the portions which extend laterally beyond the flanges are thicker than the central portion by the thickness of the flange of the rail, or nearly so, which is thus held in a species of flat trough. A washer-plate is laid upon each side of the chair, and projects some distance over the rail flanges at the joint or abutting ends of the rails, so that the bolts which are passed through these

plates and through the chairs will, when screwed up tight, compress the washer-plates firmly down upon the rail flanges, and thereby hold the rail ends securely in their places. The same chair may be used on the sleepers next the joints of a road formed of fish-jointed flat-bottomed rails. By causing the bolts to pass through the chair only, and not through the rail flanges, they may be considerably thicker than those hitherto used, which passed through the flanges and tended to weaken the rail, by reason of the necessity of having bolt-holes drilled through the flanges. It is also proposed, as a further improvement in the joints of bridge-rails, to use, in combination with the arrangement above described, a dowel of compressed or uncompressed wood, which is driven tightly into the hollow of the rails at the joints, half the dowel being enclosed in each rail.

2378. J. D. Parkes, *Parliament-street, Westminster, "Improvements in the propeller of a ship."—A communication.—Dated 24th September*, 1861.

This invention consists in a system of propellers improved and disposed in such a manner that they act horizontally throughout their course, presenting their entire surface to the water in a rectilinear alternative movement, which is communicated to them by a simple transmission from any motive power.—*Not proceeded with.*

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2317. J. Eastwood *and* J. B. Joyce, *Bradford, "Apparatus for combing wool and other fibrous substances."—Dated 17th September*, 1861.

This invention has reference to a patent granted to Mr. J. H. Johnson 26th April, 1859, and according to which the fibrous substances are taken by nipping instruments from gill combs used to feed the wool, and the present improvement consists in forming and substituting a vertical nip in place of the radial one which is used in the machinery above referred to. This vertical nip, moving in vertical slides, and actuated in a similar manner to the already mentioned vertical nip by a cam or cams, is so far superior to the said vertical nip as to considerably increase the productive power of the machine.

2331. E. Suckow *and* E. Habel, *Manchester, "Opening and cleaning cotton, &c."—Dated 18th September*, 1861.

This invention consists of a shaft capable of rotating in suitable bearings, having a cone fixed up it, to which spiral or screw vanes are attached; this arrangement is surrounded by a fixed cylindrical casing having screw vanes secured to its inner periphery. The front edges of the screw vanes upon the cone describe a plane at a right angle to the shaft, and are made either with or without teeth, and act upon the cotton or other fibrous material fed to them by means of toothed or fluted rollers, or other suitable arrangements; thus, by the rotation of the shaft, the screw vanes not only act upon the cotton or other fibrous material so as to detach and open it and drive out the seeds and other matters, but at the same time produce a strong current or blast of air which propels the detached fibrous materials into and through a chamber formed by a fixed cone joining up to the rotating cone, both together forming a double cone with their bases together, and a conical continuation of the cylindrical casing. Portions of the exterior casing of this chamber are made of net work, which permits the dust and other foreign matters detached from the fibrous materials to be carried away by the blast or current of air, but retains the loose fibre (thus freed from dust and other matters), and delivers it to a suitable arrangement of rollers or other mechanism for making the same into laps if required.

1334 J. Clouth, *Lancaster, "Machinery for preparing cotton, &c."— Dated 19th September*, 1861.

This invention cannot be described without reference to the drawings.

2358. G. T. Bousfield, *Loughborough Park, Brixton, "Machinery for combing cotton, &c."—A communication.—Dated 20th September*, 1861.

This invention cannot be described without reference to the drawings.

2371. H. Plantron, jun., *Paris, "Washing and scouring wools"—Dated 23rd September*, 1861.

The principle of this method of washing wools rests entirely upon the introduction of air into the water, and the agitation which it produces therein. The wool placed in a vase or trough, and abandoned to itself, no longer receives the shocks and friction sticks, claws, or any other foreign body which may felt, twist, or entwine it, and is only shaken by the water uniformly agitated in all its parts by currents of air coming from the bottom of the vase, trough, or other receptacle. The fatty and soapy matters resulting from the scouring become frothy and form a head or scum which constantly raised escapes very rapidly over the borders of the vase by the overflow of water. The textile matter is thus integrally attacked in all its fibres; it is well divided without felting or rolling, and being always held in suspension near the top of the water it permits all its soapy parts to escape easily. By this process wool enclosed in a vase may be washed in any locality where there is a simple well, and without the aid of a river with a very small expenditure of water compared with what would be required under any other system. To arrive at these results an apparatus is required to give compressed air, and a vertical or horizontal bellows or blowing engine fulfils this object.

2372. J. Kenyon, *Blackburn, "Treatment of yarns or warps previous to their being sized."—Dated 23rd September*, 1861.

This invention consists in causing the yarns or warps to pass through a trough or chamber containing steam or a boiling soap water before they come in contact with the size, which treatment opens the pores and fibres of the material, and enables more size to be absorbed and distributed in the yarns or warps, and leaves them more pliable or elastic for the weaver.—*Not proceeded with.*

Class 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

2313. W. Tunford, *Boston, Lincolnshire, "Improvements in thrashing machines, and in raising and stacking straw, &c."—Dated 16th September*, 1861.

The patentee claims, First, the elevating of grain and pulse by a partial vacuum formed by an exhausting or sucking apparatus. Secondly, the use of a perforated cone, flat or dished plates, for parting the grain or pulse from the air entering into the exhausting apparatus. Thirdly, the curved passages formed by the projections in the conical case for preventing grain rebounding to the centre. Fourthly, the carrying and elevating straw or other fibrous substance between two series of endless ropes, bands, or chains, or upon a series of endless ropes, bands, or chains running under stretched ropes, bands, chains, or wires. Fifthly, the drawing straw &c., along a trough with inclined or curved sides by means of an endless band or chain to which are attached forks or tines.

2314. R. Samuelson, *Banbury, "Harvesting machines."—Dated 17th September*, 1861.

This invention relates to harvesting machines having an upright shaft revolving to one side of, and in a line or thereabouts with, the cutters, such shaft being furnished with rakes or sweepers which enter the uncut crop at the proper inclination, cause it to meet the knives, and when cut, sweep it to one side and release themselves from it at the proper time. Now the patentee has found that it is desirable that the rakes or sweepers should remove the crop at frequent intervals, and although this may be regulated by the velocity communicated to the upright shaft, yet he finds that it is preferable to diminish the distance between the rakes or sweepers which traverse the platform, and he effects this by causing three rakes or sweepers at the least, at each revolution of the upright shaft, to travel by means of guides in such a path, and to extend so low that they shall remove the crop to one side after it is cut; and he interposes between such rakes or sweepers other sweepers which are so arranged as to bring the uncut crop towards the cutters, not interfere with it after it is cut. He also finds that it is desirable, in certain cases, to substitute toothless sweepers for rakes, or to cause the rake teeth to penetrate to a greater or less depth without otherwise disturbing the adjustment of the machine; and he effects this by holding or otherwise affixing boards or masks behind or in front of the rakes at a greater or less height, so as to mask the teeth of the rakes partially or entirely.

2318. F. J. E. A. G. D'Olincourt, *Paris, "Cultivating land."- Dated 17th September*, 1861.

This invention consists in a new system of cultivating land or elevated ground, and in valleys, by irrigating it with rain water. The ground is tilled by a new method, which produces what the inventor calls horizontal tilling, by which system of tilling the whole of the ground in cultivation is horizontally disposed, rising gradually as in an amphitheatre, which leaves between each field more or less elevated borders, which are planted with herbage, vegetables, or plantations, and reserved for the running off of waters after they have been used for the irrigation of cultivated land. The new tilling is effected by commencing the first furrow at the lower part of the earth, and forming the other furrows necessarily in a parallel direction, and juxtaposed, so as to effect, by successive tillings the excavating of the upper part of the field to bring it back to fill up the lower part, until all the superficies of the soil become perfectly horizontal. He raises around the land intended to be cultivated earth banks or borders which retain the rain waters as they fall in each field to the height that the cultivator may consider necessary. The banks or borders of the field above indicated have inclined reaches, more or less deep, made and arranged like reversed pyramids, and intended for the plantation of trees.—*Not proceeded with.*

2320. J. Stratham, *Salford, and* W. Statham, *Openshaw, "Apparatus for mowing and reaping."—Dated 17th September*, 1861.

This invention consists, First, in a novel form and description of framing of the machine which is made of "angle iron," for the purpose of durability and lightness, instead of wood as hitherto used in machinery employed for these purposes. The Second part of the invention relates to the cutters which are secured beneath a horizontal bar, which have a traversing or reciprocating action given to them by suitable gearing, from the driving wheels, and which may be thrown in and out of gear by "catch boxes" or levers. A Third part of the invention consists in two bent metallic bars or sledge like shoes, to which the bar of the cutters is attached, and which is supported at a certain point above the axle, instead of upon the axle, as usual, by which means it is kept in more perfect contact with the ground, and is capable of rising and falling with the irregularities of its surface more readily. Fourthly, the improvement consists in the novel use of a blast of air produced by a fan, and conducted by an air tube, the fan being worked from the driving gearing, the tube to be in advance of the cutters to bring any grass or corn not standing upright into a position to be cut.—*Not proceeded with.*

2327. H. Wickens, *Tokenhouse-yard, London, "Reaping and mowing machines."—A communication.—Dated 18th September*, 1861.

The machines constructed according to this invention may be used either as combined reapers and mowers, or merely as reaping machines, the difference in the machines being the provisions made in the mower, apart from the reaper, for a longer stroke and quicker motion of the knives than is required for reaping grain. There is a separate set of knives and guards, and a separate finger bar or sill, worked with a shoe instead of a wheel at the outer end of the finger bar or sill, in order to get the knives nearer the ground or surface for mowing, and doing away with the use of the reel as in reaping grain. There is a driving or bearing wheel, and the friction of the periphery arising from its contact with the ground causes it to rotate when the machine is moved. On the inner surface of the periphery is formed a cam groove, and when the wheel is in motion the cam groove or channel gives action to a roller, and the motion thus given is communicated to the knives by the connecting bar. In the machine with the motion attached for reaping grain, the stroke given to the knives is the same as the pitch of the cam groove or channel. A roller suspender acts as a pendulum or beal; it is hung from journals. There is a lever connection for raising the pendulum or beal with the roller attached sufficiently high to raise it clear of the groove, thus allowing the wheel to rotate without giving motion to the knives. The knives are of the ordinary construction, such as are used on other machines for similar purposes.—*Not proceeded with.*

2353. J. C. Davidson, *Falding, "Threshing machines."—Dated 20th September*, 1861.

The patentee claims the construction of threshing machines, in which the external surface of the beaters of the drum are formed with a curvature in the direction of the axis of the same, and in which the "concave" is made to follow the curved surface of the drum in the direction of its axis.

2354. Perman, *Salisbury, "Apparatus for cutting and turning up the soil." —Dated 20th September*, 1861.

This invention comprises what may be termed a rotary forking cultivator, consisting principally of a cylinder (or any number of cylinders put together on the same axle to make the width or length required) capable of revolving in suitable bearings, attached to an iron or other frame, and rolling on the surface of the ground. The cylinder or cylinders may be of any convenient diameter and width, and is or are provided with holes or slots in which are fixed curved "tines" or points projecting a sufficient distance from the surface of the cylinder to turn up or fork the land to the required depth. These curved "tines" or points are placed in rows round the cylinder or cylinders, and are capable of being placed nearer to or farther from each other, as may be required, according to the nature of the land, and the number of rows of the curved tines may also be increased or diminished for the same purpose. Between each two of the curved tines, in a continuous row round the circumference of the cylinder, may be placed a blade or cutter (extending from one tine to the other) which cuts into the surface of the ground, thereby greatly facilitating the action of the forks or tines, especially in cultivating grass land. As the cylinder revolves the forks or tines and the cylinder are cleaned and scraped by a series of scrapers or cleaners placed behind, fixed to the iron or other frame, and projecting downwards between each row of forks or tines. These scrapers or cleaners prevent the tines and cylinder from becoming filled up or choked, and at the same time serve to break up the clods and pulverise the soil or mould. When required a drilling or sowing machine may be affixed behind to the frame of the cultivator to sow or drill the ground as the cultivator proceeds, such drilling or sowing machine being actuated by the cylinder; and a chain or other harrow may also be added to, or substituted for, the drilling machine, to harrow or tine the ground after its being forked or sown, thus accomplishing at one operation cultivating, sowing, and harrowing or tining the ground. For the convenience of transport from place to place, the cultivator may be provided with a pair of running wheels, furnished with any suitable arrangement of mechanism, whereby the cylinder with its tines may be raised entirely from the ground.

2373. H. Brinsmead, *Ipswich, "Apparatus for raising and stacking straw, &c."—Dated 23rd September*, 1861.

In all the sets of apparatus hitherto used for this purpose, in connection with that kind of machine well known as combined portable threshing machines, the same has been constructed upon an independent framing, and carried about upon a separate carriage from that constituting the framing and carriage of the combined portable threshing machine. Now the object of this invention is to use the framing and carriage of the combined portable threshing machine as the chief support and portable carriage for the apparatus composing the straw elevator, and in the general arrangement of this consists the improvements of the apparatus. It may be well to avoid any misconception of what is intended in these improvements, to guard against the idea that this apparatus is intended to supersede, or is merely an addition to, the straw shakers which in some cases do, in their very action, elevate the straw to some slight extent, but this is not their object, neither have they hitherto been so constructed in these machines as to make the slight elevation which they give to straw of any practicable use as straw elevators. The improved apparatus is for the purpose of elevating the straw, and which receives the same after it has been submitted to the action of the shakers.

Class 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

2312. F. M. *and* E. L. Ransome, *Ipswich, "Improvements in treating stone, bricks, and other surfaces, and in the manufacture of filters."—Dated 16th September*, 1861.

For the purpose of treating stone, bricks, and other surfaces, the patentees employ powdered glass, or other vitrified or hard substance, or powdered flint or powdered stone or sand mixed with soluble silicate, with or without colouring matter, the object being so to apply soluble silicate that it may, for the most part, be retained in combination with the pulverised substance on the surface of the stone, bricks, or other substances to which it may be applied, and this is effected by the admixture of the pulverised substances with it. The compound of soluble silicate and pulverised matter or matters having been applied to the surface of the stone, bricks, or other material, the soluble silicate is then rendered insoluble in like manner to that practised when impregnating stone or other substances with soluble silicate, but by this mode of treatment the pulverised matters will be combined with the silicate (which is rendered insoluble) on the surface of the stone, bricks, or other substances, by which the surfaces of those substances will be found to be better preserved from the effects of atmospheric influences than when soluble silicate alone is used to impregnate the stone, bricks, or other substances, and is then rendered insoluble therein, as has been before practised. When making parts of filters of pulverised stone, sand, or other materials cemented by soluble silicate, and also, when using other porous stone or material, the patentees form such porous matters into hollow triangular forms or tubes, by which they are enabled to obtain more extended filtering substances within a given space than can be obtained by other constructions of filters, and such triangular tubes may be combined at pleasure, according to various arrangements.

2324. J. G. Briggs, *Earl-street, Blackfriars, London, "Fire-proof buildings, ships, &c."—Dated 18th September*, 1861.

This invention consists in making fire-proof buildings, ships, and other constructions, and preventing the spread of fire, by opposing to its progress water placed either between walls, floors, and ceilings, doors, or partitions of any kind, or within walls, floors, ceilings, doors, or partitions of any kind built or constructed hollow, or held in or by any convenient casing, or by any other means against or upon the surfaces of walls, floors, ceilings, doors, or partitions of any kind, or any surface it may be desirable to protect from the action of fire, providing for the free egress of steam or for its discharge upon the fire by means of a pipe-vent or opening.—*Not proceeded with.*

2332. J. Gurman, *Southampton, "Fittings and method of hanging window sashes."—Dated 18th September*, 1861.

This invention relates, First, to the fitting and hanging of window sashes in such manner that they can be readily removed from the frames for cleaning and other purposes without the necessity of disturbing the beads. To effect this the patentee forms what he terms a pocket in one side of the window frame, similar to that which is sometimes made to get at the counter balance weights. He makes such pocket somewhat longer than one of the sashes, and fits it with pieces jointed together in the length, the upper end having a spring catch, and the lower one fitting into a step or socket, or *vice versa*, by which means such pieces may be released and slid out and into position, the sash at the time being in a suitable position. In this pocket piece he also comprises part of the bead that separates the sashes, so that, when the pocket piece is removed, a part of the bead of some length also comes out. The pocket piece having been removed, the inside sash is slid into the position embraced by the pocket, and may there be moved laterally to an extent of, say, three-quarters of an inch, which is sufficient to clear the bead on the opposite side, and the sash so removed from the frame. In order to attach the cords readily he secures a metal piece to the end of the cord, which piece has a globular enlargement at the end; this is received in a socket fixed to the sash, from which it may be readily detached in the manner of a door chain. In the piece attached to the cord he forms a hole or socket to receive the end of the cord, which he secures thereto by one or more bending screws. The outside sash may also be slid to position opposite the pocket, into which it may be moved laterally, being first moved inwards a little on the pocket side, for which it is free, the mid or parting bead being removed at that point, as before mentioned. The attachments of the cords are as before described, and in this way both sashes are readily capable of removal. The next part of these improvements relate to the fittings of sashes which balance each other. For this purpose he uses cords with suitable metal attachments, such as before described, and at the one end he applies a regulating screw, which can be turned at pleasure to regulate the length of the cord to allow for expansion and contraction thereof, and ensure the simultaneous closing of the upper and lower sashes. The pulleys over which the cords pass to connect the two sashes are situated in the mid bead, or bead disposed between the two sashes. He forms the bracket or piece in which such pulley is mounted with a frame or part to form the continuation of such bead, and so give the whole a perfect appearance, and ensure the necessary strength.

2424. S. W. Rix, *Beccles, Suffolk, "Fixing woodwork, ironwork, fittings, or furniture to walls or buildings."—A communication.—Dated 28th September*, 1861.

The nature of this invention consists in the introduction of pieces of wood into cavities of appropriate forms constructed in certain of the bricks, stones, artificial stone, or composition material of any kind that may be suitable for the purpose used in the formation of a wall, in such a manner that the said pieces of wood are firmly and securely fixed therein, appearing upon the surface of the brickwork or masonry. To these pieces of wood is given the name of "keys," and it is deemed desirable to prepare the said keys by one of the known processes which will render them proof against dry-rot or any species of decay, and prevent them from either shrinking or swelling. To these keys either woodwork, ironwork, or other work can be firmly affixed by means of nails, screws, or otherwise, in a perfectly firm and durable manner, and at the same time rather adding to than diminishing the strength and solidity of the wall destined to support the work aforesaid.—*Not proceeded with.*

2335. J. C. Combe *and* J. Wright, *Bridge-street, Blackfriars, London "Improvements in the manufacture of stones, bricks, tiles, slabs, statuary, and such like materials, and in the method of and means for cleansing and indurating the same."—Dated 19th September*, 1861.

The patentees propose to make use of a solution of silicate of potash, weak or strong, as required by circumstances, and then to add to this solution a sufficient quantity of hydro-fluo-silicic acid, weak or strong as required, but preponderating in its equivalent, so as to leave the mixture decidedly acid.

Class 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

2315. F. Wrigley, *Manchester, "Construction, manufacture, and mode of securing armour for the protection of ships and fortifications."—Dated 17th September*, 1861.

This invention consists in making the armour of metal distributed in the cellular form, and in filling the cells with wood or other suitable material, or compound material possessing similar properties of elasticity. The patentee prefers to distribute the metal so as to form upon a plate a connected series of hexagonal spaces or cells, the metal forming the divisions between the spaces or cells. He manufactures the improved cellular armour plates from metal having the qualities of soft homogeneous wrought iron, which is obtained by means of "Bessemer's" process, forming the said armour plates by pouring the molten metal into suitable moulds, and afterwards annealing them if required. He secures the cellular armour to the sides of the ship or fortification by fixing thereto ribs of iron of the T, or other shaped section, between which the armour plates are introduced, the flanges of the ribs thus holding the said cellular armour plates in their places without bolts or other fastenings.

2337. C. W. Eddy, *Chester-terrace, Regent's Park, "Arming the bow of a ship of war."—Dated 19th September*, 1861.

This invention consists, First, in a method of applying at the bow of a ship of war a beak for the purpose of cutting down or smashing in the side of an enemy's ship. Secondly, in a method of applying a shell at the bow of a ship of war for purposes of destruction. The shell and beak can be fitted and unfitted at pleasure, and may be used conjointly or separately.—*Not proceeded with.*

2375. A. A. Hely, *Forest-hill, "Portable fire-arms."—Dated 23rd September*, 1861.

In carrying out this invention the inventor, First, constructs a weapon consisting of a gun or rifle barrel mounted upon a staff of tough and tight wood, instead of a stock of the ordinary description; the said barrel will be surmounted by a sword bayonet, with a two-edged blade, one edge being by preference curved like a scimitar. The said barrel may be permanently fixed on the said staff, or may be capable of being detached therefrom and carried separately. Secondly, he applies a cross guard to the said weapon, consisting of a steel bar, which, when not in use, lies in a socket at the back of the barrel, but draws out when required for use through two eyes, the one fixed and the other revolving, and locks itself in a catch at right angles to the said barrel, so as to form a means of defence against the cuts or thrusts from a sword or bayonet. Thirdly, he mounts the barrel on an ordinary lance staff (either with or without the said cross guard), whether the blade of the lance be fixed as at present on the said staff, or is capable of being detached and carried separately. He applies the said cross guard to ordinary guns and rifles, which may be done without altering their stocks or barrels, by using two additional straps, one a breach strap carrying the socket, and the other a muzzle strap carrying the eyes and catch for the said cross guard.—*Not proceeded with.*

2406. G. T. Bousfield, *Loughborough Park, Brixton, "Knapsacks."—A communication.—Dated 26th September*, 1861.

The object of the present invention is to prevent the contact of the knapsack with the man's back, and the invention consists in so suspending the knapsack from the shoulders that there shall be a space for the circulation of air between the back and the knapsack. And the invention further consists in replacing the ordinary shoulder strap with shoulder pads of a form and size suited to the form of the top of the man's shoulder, by which the weight of the knapsack can be more comfortably carried.—*Not proceeded with.*

Class 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

2311. R. A. Brooman, *Fleet-street, London, "Shirts."—A communication.—Dated 16th September*, 1861.

This invention consists in making shirts with plain fronts, which are not to be starched, and in furnishing the sides and bottom of the plain front with tabs or with other parts of fastenings, and in making false fronts with buckles or other parts of fastenings to correspond with those on the shirt Then the shirt and false front will each be provided with parts of fastenings which, on being brought together, will make the attachment of one to the other complete. The fronts are made with gussets to fit over the shoulder, and are made to open in front like an ordinary shirt front; or the band may be made to open at the back or side of the neck.—*Not proceeded with.*

2356. G. Roberts, *Bessborough-place, Pimlico, and* F. Lambe, *Cushion-court, Old Broad-street, "Lamps and lamp wicks."—Dated 20th September*, 1861.

This invention consists in adapting certain wheelwork to an ordinary moderator lamp for the purpose of causing the wick to be regularly raised as the oil or other burning fluid is consumed. Secondly, in making the surface of button deflectors perforated instead of solid, as heretofore, for the purpose of preventing the flame from lapping over. Thirdly, in constructing lamps intended to burn heavy oils the inventors propose to form a slit or opening through the outside of the burner, and affix thereto a duct or channel for carrying off the superfluous oil or burning fluid, and returning same into the receiver, thereby preventing overflow and ignition at the top of the burner. Fourthly, in adapting to a vase lamp a tube fitted with a plunger operating upon wheelwork for raising the wick as the oil or other burning fluid is consumed as before stated; or, instead of raising the wick, as above stated, the wick may remain stationary, and a double or single sliding tube be lowered by wheelwork, so as to uncover the wick, thereby producing the same result as by the former arrangement of raising the wick. Fifthly, in perforating the burner above and below the glass holder for the purpose of admitting a current of air to the wick, and letting it pass off outside the burner, thereby throttling the upper part of the burner and preventing explosion or backing of the flame. Sixthly, in a method of manufacturing wicks for lamps.—*Not proceeded with.*

Class 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Potter, Cements, Paint, Paper, Manures, &c.

2202. L. R. Bodmer, *Thavies-inn, Holborn, London, "Distilling apparatus." —A communication.—Dated 4th September*, 1861.

This invention consists in improvements in the apparatus for the continuous distillation of all descriptions of liquids and other substances yielding alcohol. The advantages derived from the said improvements are the production of apparatus comparatively much lighter than those hitherto used, and of diminished height, and consequently, rendered more portable.

Placed on wheels these apparatus can, according to their dimensions, be drawn or moved about either by hand or by horses, thus offering every facility for the distillation of all substances and liquids suitable for this purpose found on farms and in other places. These improvements consists First, in the peculiar construction of the distilling column, differing essentially from the system of construction hitherto known by the small number of platforms required, by the greatly reduced height, by exposing but a small surface to the external air as compared with the columns at present in use, in which the surrounding air is heated at the expense of the fuel employed; and, finally, by the rapidity of its operation and the saving in fuel resulting therefrom. The invention cannot be described without reference to the drawings.

2229. C. F. Kirkman, *Palace New-road, Lambeth, "Improvements in obtaining manure from sewerage, and in apparatus employed therein."—Dated 6th September*, 1861.

This invention cannot be described without reference to the drawings.

2238. N. D. P. Maillard, *Dublin, "Making potash, pearlash, and caustic potash of commerce."—Dated 7th September*, 1861.

The invention consists in the mode of treating peat or bog earth for the manufacture of what are known in commerce as potash, pearlash, and caustic potash, and the patentee performs the manufacture of such articles as follows:—He constructs a furnace of suitable shape and dimensions over an ash-pit, which is covered with a movable wire screen or sieve, when the fuel in the furnace has been got up to a red heat, he throws in the peat or bog earth on the arch of the furnace and the fuel so as to crown the heated fuel. He allows the fuel to remain until it is sufficiently burnt, and the ashes thereof then fall through the bottom of the furnace, or are driven through a hole or holes in the sides of the furnace by means of a blast or draught from the fan fixed on the outside of the furnace.

2288. R. Waller, *Baker-street, Portman-square, "Manufacturing and refining cane-juice and other saccharine substances." — Dated 14th September*, 1861.

In the process of evaporation it is well known that it is important for the saccharine solution to be exposed to a degree of heat which shall never be so high as the boiling point, and, in order that evaporation shall take place with sufficient rapidity, it becomes necessary to subject the solution, as extensively as possible, to the influence and action of the atmosphere, and to effect which is the object of the present invention. One modification or method of carrying out the invention is to employ pans or troughs for the reception of the saccharine solution, of any convenient form and size consistent with the apparatus and operations hereinafter described and referred to (the shape and size thereof not being in themselves essential to the efficacy of the process), which are arranged either singly or in sets of any desired number, such pans or troughs being divided, if thought advisable, into compartments or cells. In order to increase the extent of the heating surfaces, the material of which the pans or troughs are constructed may be cupped or corrugated. The pans or troughs may be arranged one above another, or otherwise combined, and, if required, may be placed at an inclination, so as to deliver their contents into a trough or receptacle of sufficient size to contain the same, from whence the solution can be returned by means of pumps, or any other suitable and known contrivances, to the pan or trough into which it was first introduced, and then again condensed through the series of pans or troughs. During these processes the saccharine solution can be subjected to the action of certain contrivances for the purpose of promoting evaporation.

2295. H. C. Jennings, *Great Tower-street, London, "Treating hides and skins."—Dated 14th September*, 1861.

For preparing bulls' or ox hides of great thickness and weight the hair should be removed by a solution of caustic lime in the usual manner, but after the hair and offal parts are separated the skin or felt should be again returned into the lime-pit for twenty-four hours, then removed and washed in water containing about 2 lb. per cent. of hydrochloric acid, for the purpose of dissolving or discharging the lime that may be contained in the skin, and to open the same. The skins are now to be laid horizontally and evenly upon the bottom of a perforated case or frame, which frame is to be fitted with a strong iron brace or handle sufficient to bear the weight of ten or a dozen ox hides, or about 1,500 lb., with a loop or ring in the centre by which to lift it in and out of the pits or tanks every six or more hours, as required. Between each skin or hide should be placed a wicker hurdle, so as to separate each skin from the other, by which the liquor or solutions employed will be enabled to penetrate freely and equally into each skin; there should be two of such cases or frames. Two pits or tanks are to be provided somewhat larger and deeper than the frames; these pits the patentee numbers 1 and 2. No. 1 is charged with a solution of sulphate of alumine or alum of commerce, situated at the atmospheric temperature; to this solution is added 2 lb. per cent. of sulphuric acid, and 2 lb. per cent. of hydrochloric acid. Pit or tank No. 2 is charged with a solution of carbonate of soda, or soda ashes, saturated at the atmospheric temperature, and to this it is preferred to add 5 lb. per cent. of dry tungstate of soda. The frames, charged with skins, are lowered into the pits by any convenient tackle, and left therein during six hours, taking care that the solutions in each pit contain enough liquor or solution to cover the uppermost skin in each frame. After the skins have remained six hours in the pits they should be raised out of the liquor, and allowed to drain each over the pit in which it has been immersed; when all the free liquid or solution has drained off the frames are to be moved and transferred into the opposite pit or solution, so that the skins shall alternately be exposed to the decomposing action of solutions, one acid, the other alkaline. Each frame is to remain six hours in the solutions. When perfect saturation has been obtained, and the whole of the gelatine has become fibrous and insoluble, the skins are drained, and then put into a solution of tungstate of soda, made by saturating soft water with that salt at the atmospheric temperature; the skins are, when saturated with the tungstate solution, to be placed in a solution of soap containing from 15 lb. to 20 lb. of soap to 100 lb. of soft water, and thoroughly dissolved and mixed; the skins should be turned over and agitated in the solution of soap until the whole of the soap is absorbed into them, and the water becomes clear and limpid. The skins are now left twenty-four hours in fresh water, to remove all extraneous salts and give brightness to the goods. It will now be of some advantage to steep the skins as above prepared in a solution of twig or coppice oak bark during twenty-four hours, to impart the colour and odour of common tanned leather; this object is best effected by hydraulic pressure, to ensure the complete penetration of the tannic acid solution.

2326. E. A. Cowper, *Great George-street, Westminster, "Improvements in apparatus for freeing gases from dust and other particles of matter floating therein, and for causing vapours or gases to be absorbed by liquids." —Dated 18th September*, 1861.

This invention consists in causing a large extent of surface, wetted with a liquid, to be exposed to the gas in a finely divided state, in such a manner that every minute portion of gas shall be brought into contact with such wetted surface, whilst at the same time any vapour or gas that is capable of being absorbed by the liquid shall be largely absorbed thereby.—*Not proceeded with.*

2339. E. Breffit, *King William-street, London, "An improved fuel."—Dated 19th September*, 1861.

This improved fuel is formed by combining coal with wood, by forming boxes or cases, by preference of or about the size of building bricks, and filling the same with the coal. The patentee then fixes a cover on the box, so as to completely enclose the coal. The said boxes or cases being perfectly clean may be placed on the fire by hand, and when placed on the fire they ignite more readily than coal by itself.

2348. T. Redwood, *Montague-street, Russell-square, London, "Paper."—Dated 19th September*, 1861.

This invention consists in the use of sulphite of zinc, which is added to the pulp of which paper is made, for the purpose of preventing the injurious effects of chlorine or compounds of chlorine which may result from the process of bleaching the rags, and also for improving in other ways the quality of the paper. The inventor has found the addition of about five parts of the sulphite to as much of the pulp as contains 100 parts of the dry ingredients to answer the purpose.—*Not proceeded with.*

2351. J. Oliver, *Colchester*, J. Grantham, *Nicholas-lane, London*, W. Sixnock, *Woodford*, and M. R. Leverson, *St. Helen's-place, London, "Improvements in the mode of obtaining certain chemical substances, and in the treatment of vegetable fibre, and in obtaining manurial and other products therefrom."—Dated 20th September*, 1861.

This invention consists, First, in improvements in the mode of obtaining alkaline salts and earthy chlorides; Secondly, in the application of the same to the treatment of vegetable fibrous material for the manufacture of pulp suitable for making the various descriptions of paper articles of furniture and other works of art; Thirdly, in the application of the organic matter, mineral and saline substances extracted from the vegetable fibrous material operated upon, combined with phosphatic and nitrogenous compounds, imparting a high commercial value to them as manurial compounds.

CLASS 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

2310. R. A. Broomax, *Fleet-street, London, "Apparatuses for stretching, supporting, and uniting telegraph wires." — A communication.—Dated 10th September*, 1861.

The apparatuses now in use for stretching telegraph wires carry at each end a roller, upon which the ends of the two wires are wound; this roller being solid, a third wire is requisite to unite the two wires. By the means about to be described, a third wire may be dispensed with, and this part of the invention consists in forming the rollers with a slot extending to the axis, and in forming the axle of the rollers hollow from the point where the slot terminates. The ends of the wires are carried through the slots, and, passing through the hollow axle, are brought towards each other, and are united in and by a clamp in which a wedge or wedges are inserted to jam the wires with a pressure screw for tightening up the wedges. The solid end of the rollers is provided with a ratchet wheel and ratchet, and with a square or angular spindle, which, on being turned with a key, stretches and tightens up the wires as required. This invention also consists in stretching telegraph wires by means of pincers made with grooved jaws for gripping the wires; behind the jaws is a bar for uniting the jaws while the legs of the pincers extend outwards from each other; the ends of the legs are united by two connecting rods themselves connected by a pin to one end of a bar, the other end of which terminates in an eye; a cord is fixed to the eye, and is carried round a windlass or barrel. By turning the barrel the legs of the pincers are pressed outwards, and the jaws are thereby tightened on the wire, and the strain being continued, the wire becomes stretched to the extent required. The apparatuses for supporting telegraph wires consist of a fixed upright and of a jaw hinged to it; the upright and jaw are formed with grooves in which the wires are placed and supported, and the two parts of the support are kept together by means of a screw.

CLASS 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

2151. V. A. Janvier, *Wilton-square, New North-road, London, "Fastenings for gloves, belts, &c."—Dated 29th August*, 1861.

The inventor forms a fastening so contrived that the parts of the glove which it immediately connects may be brought nearer to or further from each other at pleasure. For this purpose he employs a rack, and causes a piece to travel thereon, or work therein; to open or close the fastening to the required extent, preferring to connect the portions of the fastening to the glove by forming them with bent parts which hook into holes in the opposite sides of the opening of the glove, whereby the fastening may be easily connected and detached.—*Not proceeded with.*

2154. R. Penrose, *Coley Mill, near Halifax, Yorkshire, "Screw stocks and dies."—A communication.—Dated 30th August*, 1861.

This invention relates to stock sand dies for screwing or forming the threads on gas pipes or similar articles, and the improvements consist in having the stock or frame part of the apparatus so formed or constructed as to become a guide to the die, and having the die, which is made taper at the cutting part, placed at a small distance from the side of the ground, but parallel to and concentric therewith. By means of this apparatus screws can be cut at one operation with more accuracy and greater facility than heretofore.—*Not proceeded with.*

2156. R. Shaw, *Portlaw, Waterford, Ireland, "Windlasses, capstans, &c." —Dated 30th August*, 1861.

This invention consists in so constructing and arranging the several parts forming the brake that it is in operation while the weight is being hoisted and when it is raised, consequently, if the man at the handle should let it go the weight remains suspended until the brake is released; and, by this means, the injury and accidents resorting from the man at the handle being overpowered by the weight, or the handle breaking or coming off, are avoided. One mode of performing the invention is by applying one or more palls to the wheel on the drum or other shaft; these palls take into an internal ratchet wheel formed in the brake pulley which is surrounded by a friction clip. The details of construction may, however, be considerably varied and modified.

2157. A. J. Daumont, *Paris, "An improved umbrella."—Dated 30th August*, 1861.

The object of this invention is to prevent an opened umbrella from being upset or losing its shape by the action of the wind. For this purpose, towards the outer end, each rib of the frame of the umbrella is connected by means of a string, tape, small chain, or other similar tie, either to the runner or slide of the stick, or to a special movable ring or runner. It is desirable the above mentioned ties should offer sufficient elasticity for allowing the ribs to yield sufficiently to the impetus of the wind, and they must be arranged in such manner that, when the umbrella is shut, they may be hidden from sight in the interior thereof.—*Not proceeded with.*

2161. H. W. Spencer, *Stepney Causeway, Commercial-road, London, "Improvements in the manufacture of animal oils, the said improvements relating more particularly to the process of refining them to be used for lubricating purposes."—Dated 30th August*, 1861.

The patentee claims the process of purifying or refining animal oils by removing from them the gelatinous, albuminous, or such like substances, which they contain, in order to render them more useful for lubricating purposes, by means of the introduction of nut galls, or other such like substance containing tannin or tannic acid, in the manner and in the proportions described.

2162. J. S. Matthews, *Moore Cottage, Bowling Green-street, Kennington Park "Starch."—Dated 30th August*, 1861.

The first division of this invention relates to the manufacture and preparation of starch and starchy matters by a new and economical process from roots, cereals, and grain commonly employed for such purposes, as potatoes, arum corms, wheat, rice, oats, Indian corn, sago, and such like substances, either in the whole or in the ground state. Also from other roots, cereals, and grain, lichens and algæ not employed for such purposes, as Jerusalem artichokes, mangold-wurtzell, parsnips, hyacinth and other bulbs, broad beans, haricots, peas, lentils, carragheen moss, chonrous crispus, cetruria, islandica, and such like. The second division relates to the mixing and combining of the different starches and starchy matters produced from the foregoing substances in such proportions as shall best suit the purposes for which the starch is intended to be used. The third division relates to the preparation and employment of a variable alkaline or incombustible composition in the manufacture and preparation of the starch, and in the mixing and preparation of starch or starches already manufactured which shall render it incombustible, or non-inflammable in its use with all kinds of fabrics, even those of the finest texture, such composition being varied to suit the use of the starch for which it is intended.

2164. H. Lecaudey, *Wellington-street, Strand, London, "Apparatus for succouring persons before life is extinct."—A communication.—Dated 30th August*, 1861.

According to this invention the inventor screws on the inside or through the lid of the coffin a tube which is so arranged as to cover or be near the mouth of the recumbent. The outer end of the tube is to be so placed as to allow the outer air to penetrate into the coffin, and at this end of the tube is placed any means of conveying sound, such as a pistol, or gong, or a dark lantern. These may be so arranged that, when a spring (which will be so placed as at the slightest movement of the hand it will act on the means of sound, light, or any contrivance that he may elect to use, for the purpose of giving effect as signal) is released, the desired signal will be given.

2167. H. Brand, *Guildford-place, Clerkenwell, London, "Mattresses."—Dated 30th August*, 1861.

In carrying out this invention the inventor constructs spring mattresses in two, three, or more pieces, and prepares for each part a suitable frame and laths stretched across to receive the springs, as also bands or strips of canvas to pass over the springs, as usual; the whole is then enclosed in canvas, with the exception of the faces that abut against each other when placed together, which are left open; the edges of the canvas at the parts of the mattress joined together to form a whole are united by lacing straps, or in other suitable manner, to render the mattress complete.—*Not proceeded with.*

2170. H. Keach, *Bedford-terrace, Andover-road, Holloway, "Ornamentation of woven and other fabrics for garments."—Dated 31st August*, 1861.

In carrying out this invention the inventor cuts with tools or punches pieces of paper in various forms or figures, and which he afterwards embosses with dies; or he first embosses and then perforates with dies, punches, or tools, pieces of paper representing ornamental forms and figures, which he attaches by an adhesive substance to various parts of the woven or other fabric, so as, when combined, to form a pattern.—*Not proceeded with.*

2173. W. Southwood, *Barkham-terrace, Lambeth, "Boots and shoes."—Dated 30th August*, 1861.

This invention consists in rivetting or leaving the inside points or ends of the nails, pegs, or screws, when the boots and shoes are finished, between the leather or material of, or forming the inner soles of boots and shoes, when an inner sole, or more than one is used. But when one only is used, the inventor claims the rivetting or leaving the inside points or ends of nails, pegs, or screws, when the boots or shoes are finished, between the leather or material, substantially as described.—*Not proceeded with.*

2175. J. and E. Coppie, *Eccleston, near Prescot, "Apparatus to prevent overwinding at coal and other mines."—Dated 30th August*, 1861.

This invention relates, First, to a self-acting disengaging apparatus, which, when in use for lifting a cage, tub, or other weight from a pit or mine, serves as part of the winding rope or connection to the said cage, tub, or other weight, but which, when disengaged by overwinding, consists of two pieces of mechanism, the one of which is attached to the rope, and has arms kept expanded by springs; the other is attached to the cage or tub, and has the necessary spaces and studs to receive and secure the arms just mentioned. The disengaging is secured by having placed in the framing, at a sufficient height above the mouth of the pit or mine, two rigid horizontal bars or shafts, on which move friction rollers at a distance apart just sufficient to compress the disengaging apparatus, and allow that part to be drawn through whilst the other is retained. Secondly, the invention relates to the catching apparatus, which consists of strong rods and bars suspended from or affixed to the framing, and kept at equal distances apart by springs or otherwise, the distance being less than the width of the lower part of the disengaging apparatus. As soon as the uncoupling takes place, the lower part of the apparatus rests on the carrying or supporting bars above referred to, and the cage, tub, or other weight is thus suspended and free from danger. Thirdly, the invention relates to a trap door, placed about half way up the framing as a further security from accidents, this door is opened by the cage or tub when wound too high, but as soon as the said cage or tub has passed, and before it can become disengaged, the said door will have closed, and as it is sufficiently strong to carry the heaviest load of minerals drawn up pits or mines, this further security makes this system complete for the purpose first stated.—*Not proceeded with.*

2176. E. T. Hughes, *Chancery-lane, London, "Apparatus for collecting the gases which escape from furnaces."—A communication.—Dated 31st August*, 1861.

This invention is carried out as follows:—Upon the plate of the furnace, and surrounding its opening, is a conical cast iron ring fitted round the chimney, and provided with a suitable number of openings to feed the furnace. At the upper part of the furnace is placed a helmet-shaped pipe for receiving and delivering the gases as collected. Around the bottom end of the said receiving pipe is rivetted an anguiar iron hoop, which serves as a base for another conical ring which surrounds the gas pipe, which ring, by means of vertical bars and screws, can be brought into a horizontal position. The apparatus is provided with a cover which can be raised by balance levers to admit of the materials to be melted. A hemispherical valve is provided which closes by its own weight, and opens if the gases freely flow, thus serving as a safety valve. To prevent the bursting of the cover and the conical rings a narrow piece of sheet metal is rivetted in them. —*Not proceeded with.*

2177. J. Jones, *North John-street, Liverpool, "Clasps or fastenings for garments, belts, harness, &c."—Dated 30th August*, 1861.

This invention consists, principally, of two wedge shaped parts, the one of which is smaller than the other, and is made of such a form as to be easily passed into the other to fasten or join together two ends, edges, or sides of articles of wearing apparel, belts, harness, and other ends, edges, or sides of articles or apparatus of whatever nature, always provided that the said wedge shaped parts or clasps are fastened by sewing or otherwise to the two said ends, edges, or sides of the articles or materials to be joined together.

2178. W. A. Gilbee, *South-street, Finsbury, London, "Manufacture of steel." —A communication.—Dated 31st August*, 1861.

This invention consists in an improved process and apparatus for converting moulded and liquid cast iron into steel and cast steel. For converting moulded cast iron into steel the inventor places the moulded pieces of cast iron in a recipient or cementing case having two pipes adjusted to it, one at each extremity. The case is rapidly heated, and, when the iron pieces are red, steam is admitted on them through a cast iron pipe in communication with a steam boiler, and which passes through the fire place. This pipe winds round the thick part of the furnace, whereby the steam it conducts becomes heated to a high temperature on its arrival at the cementing case. A current of steam is caused to pass over the iron to be decarbonised during several hours, when it becomes converted into steel. For converting fluid cast iron steel he takes the metal on its leaving the crucible of the coke or charcoal furnace and frees it as much as possible from slag. The apparatus for forming steel is constructed as follows:—At the lower part of the furnace is a fire-place for keeping the metal in the most liquid state, the top of the fire-place being covered with a vault supporting the apparatus, and provided with passages communicating with other holes or passages round the apparatus for circulating the heat of the fire. In the converting apparatus or furnace are two chambers made of fire lumps with as few joints as possible, and separated by a plate of similar material perforated with holes of an oblique direction, which plate can be changed at will, and in some cases dispensed with altogether. The upper chamber is of an oval form, and about three feet in height, its base being formed by the said perforated plate, and its upper part being rounded off and perforated with a hole for the escape of gas. Near the top of this chamber is a pipe of refractory clay, with a wide bottom, so as to cause the fluid metal introduced through it to form into thin sheets. This pipe is provided with a funnel and opening for the introduction of powdered lime which spreads over the fluid metal in a regular manner. The lower chamber is of an ovoidal form, about six feet when formed. Three cast iron tuyeres are set in an inclined position near the bottom, two being in communication with a steam boiler, the third with an air receiver, which pipes pass in a serpentine form through a fire-place so as to acquire a high temperature.—*Not proceeded with.*

2180. W. Fox, *Amiens, France, "Parasols and umbrellas." — A communication.—Dated 31st August*, 1861.

For the purposes of this invention, in constructing the runners of parasols and umbrellas, springs are applied to the runners in such positions that the stretchers, when a parasol or runner is closed, may each rest against a spring having a tendency to force the end of the stretcher, near where it is attached to the runner, away from the stick of the parasol or umbrella, so that, in opening a parasol or umbrella, the upper ends of the stretchers, when free, are caused to incline away from the stick by the springs before mentioned. In place of using the springs above mentioned, a similar object may be accomplished by applying a projecting ring below the top notch. In this projecting ring there are as many notches as there are ribs to the parasol or umbrella, but the parts of the ribs which enter such notches do not come so near to the stick as the other parts of the stick which are above and below the notched ring. By these means, when a parasol or umbrella is closed, the ribs are slightly bent over the projecting ring, and they will, when their outer ends are released by their own elasticity, open outwards away from the stick, and thus facilitate the stretchers in their action on the ribs when the runner is forced up the stick.

2182. F. Curtis, *Bilston, "Shaping the tops or upper parts of boots from woollen or mixed fabrics."—Dated 31st August*, 1861.

The said tops or uppers consist, mainly, of two pieces (back and front), which said two pieces are cut to a pattern. Each one of the pieces is then folded down, the middle damped, and placed upon a flat block; a hot smoothing iron is then drawn and pressed from the edges of the fabric to the fold whilst the material is pulled into form. The damping, pulling, and ironing is repeated, the iron being worked from the plain parts gradually towards and over the creases until they are removed. During the process the piece should be turned over several times, and each side operated upon alternately. The front and back being formed, they are fastened at the waist by two short seams about three quarters of an inch each, and form (with the lining and elastic) a boot top seamless both back and front, and of a superior fit and appearance —*Not proceeded with.*

2184. T. S. *and* J. S. Stock, *and* H. Taylor, *Birmingham, "Improved tap or cock."—A communication.—Dated 31st August*, 1861.

This invention consists of a tap or stop cock in which the water way of the said tap or stop cock is opened and closed by a valve, which is pressed upon and lifted from its seat by means of a rod, to which the handle of the tap gives motion by a crank or eccentric. The invention cannot be described without reference to the drawings.

2187. J. Hall, *Oldham, "Portable pumps or engines for extinguishing fires." —Dated 2nd September*, 1861.

This invention relates to an improved construction and arrangement of portable pumps and engines, and consists in forming the bed and carriage (which is mounted on wheels) in one piece, in which are cast passages for water from the suction or inlet to the pumps, and from the pumps to the air vessel are secured to facings on the bed, and the inlet and outlet orifices are arranged above the level of the passages in the bed The two pumps are actuated by a beam lever fixed on a shaft carved by two brackets or standards, one secured on each side of the bed, and this shaft is worked by a beam lever with folding handles. The lift of the pumps, or extent of the oscillation of the beam lever, is determined by stops formed by projections from the side brackets carrying the shaft.

2188. J. Watson, *Glasgow, "Furnaces."—Dated 2nd September*, 1861.

Under one modification or arrangement of the improved furnace the furnace bars are formed of a serrated figure, that is to say, they are cast or otherwise formed with laterally projecting teeth of a rectangular figure. These bars are arranged across the furnace in a direction at right angles to the length of the furnace, and they rest at each end upon a longitudinal pipe or air passage, which extends from the front to the back part of the furnace. These air passages are made with lateral projections on their external surface, which alternately come in contact with the bars, and a rotatory or partial rotatory motion is communicated to the tubular air passages. When these air tubes are put in motion, each alternate bar is raised, which has the effect of breaking up the clinkers, as well as of exposing the fuel in a very superior manner to the action of the draught from the teeth of one bar projecting into the recesses of the contiguous bar. At the end of the range of fire-bars is a perforated fire bridge, and beyond this, in a backward direction, is a second fire bridge built up solid and parallel to the first. The opening at the upper part between the duplex fire bridges is closed by means of slabs of fire clay or other suitable material. The air passages extending beneath the fire bars open into the chamber formed between the fire bridges, and in its passage thereto gets considerably heated. The air thus passed into the chamber issues out through the horizontal openings in the front fire bridge, where it comes into contact with the unignited gaseous matters evolved from the burning fuel, which are thus instantly flashed into flame, and the emission of visible smoke is thus prevented. In this way the bars may be made much lighter, the fuel is more effectually and economically consumed, the stoppage of the draught from the accumulation of clinker is entirely prevented, and, at the same time, the visible smoke is consumed by the peculiar arrangement of the air passages and the chamber formed between the duplex fire bridges.

2191. G. Knight, *Foster-lane, London, "Giving lustre to written and printed letters, figures, and devices."—Dated 2nd September*, 1861.

For the purposes of this invention such letters, figures, and devices, or such parts of them as are intended to be rendered lustrous according to this invention, are to be written or printed with adhesive compounds, paints, or inks, or have such substances applied to them after being written or printed in order that pulverised lead ore (native sulphuret of lead or galena) may be dusted thereon, or be otherwise applied thereto, so that, when dry, the compounds, paints, or inks used may securely hold the pulverised lead ore.—*Not proceeded with.*

195. E. Suckow and E. Abel, *Oldham*, "*Apparatus for producing a strong blast or current of air.*"—*Dated 3rd September*, 1861.

In carrying out this invention the patentees enclose an archimedean screw in a cylinder, and give it a rapid rotary motion. The screw is composed of any number of blades, which are fixed to a conical disc, and have their outer edges revolving nearly at a right angle to projections or catch rings fixed to or forming part of the cylinder. When motion is given to the screw, a strong blast or current of air is produced, similar to that from an ordinary fan, but with a much more powerful effect. They also apply anti-friction rollers, when desired, to work against the prepared surface or collar of the shafts in order to lessen the friction.

2200. R. A. Brooman, *Fleet-street, London*, "*A new or improved parachute toy.*"—*A communication.—Dated 4th September*, 1861.

This invention consists in constructing a parachute toy by combining with a parachute a box which is used for throwing the toy in the air, as hereafter explained, and which is fixed to the parachute by threads. The box folds or doubles up at the centre, and forms a case in which the parachute and connecting threads are enclosed. Doubled up, and with a string with a weight at the end wound two or three times round two points in which the ends of the case terminate, the toy is thrown into the air, the string unwinds from the points, when a spring causes the case to open and assume somewhat the shape of a boat. The parachute expands, maintains its position over the boat-like case, and after the manner of a parachute of an aerostat the toy descends slowly.—*Not proceeded with.*

2201. W. E. Newton, *Chancery-lane, London*, "*Self-acting brakes.*"—*A communication.—Dated 4th September*, 1861.

This invention consists of a novel contrivance or arrangement of mechanism whereby the progress of the engine or carriage to which it may be applied may be arrested on inclined planes by means of a nipping apparatus which is made to seize and embrace the rails. The nipping apparatus (or pincers) is fixed at the lower end of a vertical shaft, which communicates by means of a connecting rod or lever with the traction rod of the carriage. When the carriage is hooked on to the traction rod or chains the nipping apparatus or pincers will not press upon or bite the rails, but immediately that the traction rod or chains become broken, the traction springs will act upon the connecting rod or lever of the brake. The wheels will at the same time be acted on by skids which will be made to press on their peripheries by means of a weight suspended from a lever conveniently arranged for the purpose. As a modification of the above, the traction spring, instead of acting on the nipping apparatus direct, causes the forked end of the actuating lever to be brought in contact with a screw on the axle-tree. This screw will act on the lever, and, by drawing it forward, will bring the nipping apparatus against the rails.

2205. H. Young, *Birmingham*, "*Counter or pillar beer engines.*"—*Dated 5th September*, 1861.

In constructing counter or pillar beer engines according to this invention the inventor fixes the engine or pump below the plate which is fixed to the counter, and above the said plate is a cylinder or column in which the parallel motion of the piston rod works. Near the top of the said column, and on one side thereof, the lever is situated by which the engine is worked, and the pipe which delivers the liquid passes up the said column. Or the parallel motion as well as the engine or pump may be placed beneath the counter-plate. In this case the lever is jointed to one side of a dome on the said plate, in which dome the short arm of the lever works.—*Not proceeded with.*

2206. R. McConnel, *Glasgow*. "*Locks.*"—*Dated 5th September*, 1861.

This invention cannot be described without reference to the drawings.

2208. C. Edkins, *Birmingham*, "*Ladies' dress suspenders.*"—*Dated 5th September*, 1861.

These improvements, whether realised in wire or sheet metal or partly sheet metal and partly of wire or other material, have for their objects the better securing or holding without injury the material of the dress desired to be held up, as also to simplify the action and movement of the parts for effecting this object, as for instance, if made of wire, and the parts for holding the dress are secured in position by a link in the form of a figure 8, the patentee forms the top or spring end so as to prevent the said loop or link from readily getting out of position, the parts for gripping or holding the dress being formed of a centre bar terminating with a broad flat eye, the bar pressing between a fork formed at the other corresponding part of the suspender. And this general description may be diversified by forming the spring of an additional twist or turn of the wire at the spring end; nor does the patentee propose confining himself to the link being of the shape of a figure 8, as a link parallel on its side, and round at its ends, may be used; and in some instances he purposes terminating the one end of wire suspenders for holding the dress with a round hook or eye, and the other in the same way, but smaller, so that it shall press and hold the dress in the larger eye by being partially pressed in or through it by the elastic force derived from the force of the top or spring end.

2213. F. Bennett, *Bagilt, Flint*, "*Coating the interior surface of lead and lead composition pipes with tin or its alloys.*"—*Dated 5th September*, 1861.

This invention relates to those lead or lead composition pipes which are manufactured by hydraulic pressure, and consists in forming the core or mandril, over or round which the pipes are formed, hollow or tubular, and in causing the tube or hollow in the mandril to communicate with a reservoir or supply of tin or alloy of tin the level of which is maintained at such a point that the tin will just overflow the lip or upper end of the tubular mandril. As the leaden tube is formed over the hollow core or mandril, so it receives a uniform coating on the interior of the tin alloy, which is kept flowing over the lip of the mandril.

214. W. Patey, jun., *Lombard-street, and* J. Richardson, *Brewer-street, Clerkenwell, London*, "*Brushes.*"—*Dated 5th September*, 1861.

The inventors form different classes of shaving brushes, having the handles or rigid parts of glass, either blown, moulded, or otherwise fashioned by ordinary or suitable methods of working that material.—*Not proceeded with.*

2218. J. Napier, *Glasgow, N.B.*, "*Machinery for rolling iron or other metals.*"—*Dated 5th September*, 1861.

This invention has for its object improvements in the arrangement of the machinery employed for rolling plates, bars, or other forms of iron or other metal, so as to produce a plate, bar, or other form in a finished state from the slab, bloom, or pile in less time, and whilst the metal is nearer a welding heat, than by the means at present employed for this purpose, by which arrangement plates, bars, angle, and other forms of iron or other metal, can be made in longer lengths with greater facility than heretofore. For the purpose of carrying out the invention the inventor arranges two or more pairs of rolls, at suitable distances apart from one another, in such manner that the piece or pile of iron, or other metal to be operated upon, shall pass straight onward through any requisite number of pairs of rolls placed in succession, and all in or about the same line or direction, the first pair being like the ordinary roughing rolls, and the last pair suitable for bringing the plate, bar, or other form of metal, down to the finished or required size. Each of these different pairs of rolls are driven separately by means of separate steam engines or other motive power, each being separately governed and regulated to suit the speed of each pair of rolls thus driven, so that in the process of rolling the plate or bar, whilst being rolled, may be passing through one, two, or more pairs of rolls at the same time, the speed of each pair of rolls being such as is necessary to compensate for the extension or elongation of the plate or bar as it passes from one pair of rolls to another. To allow, as much as possible, scoriæ or gases that may be lodged in the heart of the mass or pile of metal under operation to escape, it is also part of this invention, in the manufacture of broad slabs, bars, or plate, to make either the upper or under roll, or both of the first pair in the foregoing arrangement, of larger diameter about the middle of their length than at their ends, so that, when a bloom, slab, or pile is put through, it is compressed most near the centre of its breadth. The second pair will not require to have such a difference between the diameter of the middle and ends, the third pair—if not the finishing rolls—having less still, and so on to the last pair of rolls, which are formed to bring the slab plate, or bar to the required size and shape. Another part of this invention consists in employing, in combination with the foregoing arrangement of rolls, the use of other rolls working with their axles perpendicular, or placed at such an angle as may be found most suitable for the rolling of iron or other metal of peculiar shape or form.—*Not proceeded with.*

2220. T. Greenwood, *Leeds*, "*Machinery for sawing wood.*"—*Dated 5th September*, 1861.

This invention cannot be described without reference to the drawings. The patentee claims mounting the tension pulleys of band-saws on an adjustable rocking-frame, whereby the angle of the saw-blade to its work may be varied, as described.

2221. J. Reid, *Leith, N.B.*, "*Improvements in the treatment of gas, and the apparatus employed therein, with a view to its more accurate measurement in wet gas-meters.*"—*Dated 5th September*, 1861.

Under one modification or arrangement, suitable for effecting the object in view, the gas is caused to pass through a vessel which is divided by partitions, so as to cause the gas to take a circuitous route in its passage to the meter. And by this invention the gas is saturated with moisture before it enters the meter, and is thereby prevented from affecting the water-line level. The saturating chamber may be of various forms, and may either be detached from the meter or from a part of it. The essential feature of the invention is the treating of the gas so as to cause it to take up moisture, and prevent, as far as possible, its diminishing the volume of water in the measuring chambers of the meter, so as to secure accuracy of registration by preventing or diminishing the weight of water otherwise carried off by the gas in its passage through the meter.—*Not proceeded with.*

2225. W. Spence, *Chancery-lane, London*, "*Apparatus for dividing and softening vegetable fibres.*"—*A communication.—Dated 6th September*, 1861.

For the purposes of this invention there is used a machine or apparatus consisting of a revolving cylinder with longitudinal grooves on its circumference, surrounded by a stationary circular case having longitudinal grooves on its internal surface, the material to be operated upon being introduced into the space between the said cylinder and its surrounding case. There is an opening at one side of the case, through which the material is introduced into the machine over an endless feeding-cloth or apron, so as, by the revolution of the cylinder, to draw in the material to be operated upon at one side of the case, and to throw it out thereof, after being operated upon at the upper part of the same, on to an inclined plane. The case is kept in its required position by means of springs having suitable bearings external to the case, or by means of weights. The longitudinal grooves on the circumference of the cylinder, and on the internal surface of the case respectively, are by preference semicircular, and the space between the cylinder and the case may be varied to suit the nature of the material to be operated upon. In some cases the surfaces of the cylinder and the case may be smooth instead of grooved or roughened, and the material may be soaked in water before being passed through the machine, in order to facilitate the process of dividing and softening the fibres.

2227. W. Allott and J. Thelwall, *Hull*, "*Manufacture of crank shafts and crank axles, &c.*"—*Dated 6th September*, 1861.

In carrying out this invention the inventors first take a straight or nearly straight shaft, which may be made from faggots either of a square or other section, and after heating it to a welding heat, they place it under a steam hammer, and forge by the aid of blows a slight bend or indentation in it where the crank is to be produced, such bend or indentation being gradually increased by successive heatings and blows from the hammer, until the desired length of crank has been forged, the use of pressure and bending dies and the application of end pressure on the shaft being dispensed with. The shaft to be operated upon is placed over a suitable hollow matrix or aperture when under the hammer, so as to allow of the formation of the crank and its gradual elongation, a suitable hammer force or striking tool being fitted to the hammer block to produce the proper width of crank. It will thus be seen that the crank is formed in the first place by forging only, in lieu of cutting the same, whereby the grain of the iron is kept intact, and the strength of the crank consequently greatly increased.—*Not proceeded with.*

2230. J. J. Russell, *Wednesbury*, "*Preparing the ends of welded tubes previous to their being fixed in plates.*"—*Dated 6th September*, 1861.

For the purposes of this invention, in order that the ends of welded iron tubes which are used in the construction of flues of tubular boilers and for other purposes may be more uniformly and advantageously annealed, in order that such ends may be expanded and caused to fit the holes in the plates in which they may be applied, the patentee in place of heating them as heretofore employs a bath of fluid lead, or other suitable metal or alloy, into which the ends of the welded tubes are immersed, and by this means they are readily and very uniformly heated to the extent desired, which cannot be the case when a fire is used. The ends of the tubes having been immersed in the fluid metal bath to the extent desired, and heated thereby, are then forced into powdered coke or charcoal, or sand, or other suitable matter, to exclude the atmosphere while the ends are becoming cool.

2239. J. Carpendale and T. Middleton, *Sheffield*, "*Producing raised chasing on copper, silver, and Britannia metal.*"—*Dated 7th September*, 1861.

At present raised chasing is produced by manual pressure, which is necessarily limited in its application. This invention admits of the pressure being determined and applied on an improved scale by the adjustment of the machine.

2240. G. Norris, *Kilburn, Middlesex*, "*Soap.*"—*Dated 7th September*, 1861.

This invention consists in combining with the component parts of soap, during or after its manufacture, mucilage resulting from the pips or seeds of the quince.

2245. G. Malcolm, *Dundee*, "*Apparatus for softening or treating jute, hemp, &c.*"—*Dated 9th September*, 1861.

Under one modification the machine for carrying out this invention consists of two end standards united by longitudinal rails; on the upper part of these standards are fitted the bearings of the main or driving shaft, on one extremity of which is fitted a fast and loose pulley, and on the other a fly-wheel. A pinion on the driving shaft gives motion to a train of gearing, one part of which drives the rollers of an endless apron on which the material to be softened is placed. From the endless apron the jute or other material passes between a pair of rollers, which are driven from the end gearing; these rollers are arranged one above another, and they serve to carry the jute through a horizontal slot or opening formed in each of a series of vertical rubbers. There are a number of these rubbing surfaces arranged end to end in the longitudinal direction of the machine, and there is a second series arranged parallel to these a short distance asunder. These rubbers are arranged upon adjustable frames, which are connected by means of springs to admit of the adjustment of the rubbers, and the regulation of the frictional force exercised upon the rubbing plates which move up and down between the two series of rubbers. The main overhead shaft has formed in it a series of cranks, and these are fitted with rods, the lower ends of which are connected to the movable rubbing plates. The rotatory motion of these shafts causes these plates to move up and down between the stationary rubbers. The rubbing plates are made with slots in them corresponding to those in the stationary rubbers. The jute or other material to be softened is fed into the machine in separate parcels or continuous stricks, corresponding to the number of apertures in the rubbers. As the material passes through the openings in the rubbers it is subjected to a rapid frictional movement arising from the reciprocating motion of the central rubbers. The material passes out through the second series of the stationary rubbers, and is carried forward by a pair of fluted rollers on to an endless delivery apron. To avoid the inconvenience and waste attending the present system of oiling jute, or other generally similar material, it is preferred to effect this operation whilst the material under operation is passing through the machine. The oil, or a mixture of oil and water, caused to blend by the addition of an alkali, is placed in a trough, or other receptacle, arranged at the end, or in convenient proximity to the machine. From this receptacle the oily fluid is pumped or otherwise elevated to the upper part of the machine, where it is allowed to flow into troughs fitted with ducts which convey the fluid down and distribute it over each portion of jute as it passes between the rubbing surfaces. In this manner waste of oil is avoided, the fluid is uniformly distributed, and the operation is effected in a manner far superior to the ordinary method.

2248. S. R. O'Neill, *Hart-street, Bloomsbury, London*, "*Screw wrenches.*"—*Dated 9th September*, 1861.

In constructing screw wrenches or spanners according to one part of this invention the patentee attaches to the fixed jaw parallel bars; the movable jaw is made to slide along these bars, it being formed with two holes through it, through which the bars pass; the parallel bars have screw threads cut on them, on which nuts work, and by means of these nuts the movable jaw may be set in any required position. The opposite ends of the parallel bars to those which are connected to the fixed jaw are united together, and at the point where they are joined together they have a point or projection formed on them, by which they can be connected to a handle. In place of employing a single movable jaw, as above described, the jaw may be divided into two parts, each part being capable of sliding up or down on one of the bars on the fixed jaw, and of being set at any distance from the fixed jaw by the nut on the bar on which it slides; the spanner or wrench may thus be set to take two nuts of different sizes. When the movable jaw is divided into two parts, the parts are retained from turning round upon the bars on which they slide by forming the bars square in section, the screw thread being then merely cut on the edges of the bar, or they may be retained from turning by a third bar fixed between the two bars on the fixed jaw, this bar fitting into a groove in each of the parts of the movable jaw.

2250. J. H. Johnson, *Lincoln's-inn-fields, London*, "*Fire-grates and fur naces.*"—*A communication.—Dated 9th September*, 1861.

According to one arrangement of this invention applicable to domestic fire-grates, the grate itself is pivotted or made to rock upon centres, the centres being situate rather nearer to the front than the back of the grate, which will, consequently, incline downwards towards the back. When the fuel requires stirring, it is simply requisite to depress two or three times the front of the grate, and allow it to fall back again, the shaking thus produced being amply sufficient to clear out all the dead ashes and other obstructions to the free access of air into and amongst the fuel.—*Not proceeded with.*

2251. J. H. Johnson, *Lincoln's-inn-fields, London*, "*Apparatus for making cigars.*"—*A communication.—Dated 9th September*, 1861.

This invention consists of apparatus for cutting and delivering the proper charges of tobacco to be subsequently made up into cigars, and to a machine for rolling such charges in-side the outer leaf. In the first mentioned machinery the tobacco is fed forward by means of two endless bands, the lower one forming an endless table, while the upper one, which is slightly inclined towards the delivery end of the table, serves to compress slightly the tobacco, as it proceeds towards the point of its delivery, between suitable feed rollers, actuated by a rack and pall motion. At this point a knife descends and cuts off a certain regulated quantity sufficient to make one cigar. The tobacco thus severed falls into one of four revolving boxes, provided with hinges, covers, and carried by four revolving arms. As fast as the box is filled, the arms are rotated, so as to bring an empty box into a position suitable for the reception of the next charge, and as each box arrives at its lowest vertical position, its cover is opened and its contents dropped into one of a series of small troughs below. This series of troughs is made to slide forward for the extent of a single trough after each discharge of a box, until the whole are filled, when their contents are removed to the rolling machine to be rolled inside the leaf. This rolling machine consists, essentially, of a segmental or convex curved table, over which a sheet of india-rubber cloth is loosely extended; over this table a pair of rollers, carried in vibrating arms, is made to run to and fro from end to end of the table, at the same time doubling or folding the cloth in such a manner that the tobacco and its wrapping leaf, which are placed between the folds, are rolled together and delivered at the opposite end. By inserting a piece of paper behind the leaf the roll may be simultaneously enveloped in paper, in which it is retained during the drying process.

2252. C. Cheyne, *Great George-street, Westminster*, "*Extinguishing fires in buildings.*"—*Dated 9th September*, 1861.

This invention consists in extinguishing fire in warehouses, store-rooms, and other buildings and apartments, by filling the apartments where the fire exists with carbonic acid, or other gas which is known to extinguish or prevent flame, by admitting such gas through a pipe or pipes, provided with slide or other valves, which pipe is in communication with a bell or other reservoir containing a supply, or in which a supply can be readily generated and emitted under pressure or otherwise. The invention also consists in preventing the influx of air into any apartment in which fire may exist by simultaneously closing, by means of slides or shutters, all windows, chimneys, and other apertures communicating with the atmosphere.—*Not proceeded with.*

2254. W. E. Newton, *Chancery-lane, London*, "*Boots and shoes.*"—*A communication.—Dated 9th September*, 1861.

This invention consists in dispensing with a great portion of the "out sole," that is to say, the external portion of the sole hitherto used, and which extends from the front of the sole just behind the ball of the foot to the heel. The invention also dispenses with all the "shank leather," and gives greater ease to the foot in walking, and relieves the "upper leather" of much of the strain to which it is ordinarily subjected, and facilitates the manufacture of boots and shoes, as well as the repairing of the same when necessary. The invention consists in the employment or use of a shank, constructed of metal or any other suitable material of sufficient rigidity, and attached directly to the "insole" without the intervention of an "outsole," as hitherto.

2256. T. S. Tyson, *Leeds*, "*The application of a self-acting lubricator to corves and wagons.*"—*Dated 10th September*, 1861.

This invention consists of an enclosed vessel or receptacle, of rectangular or other suitable form, and of convenient size to contain oil or other fluid lubricant, with chambers in connection therewith of suitable capacity to hold one supply or discharge of the lubricant, according to requirement, and having tubes for conducting the same where required. When this vessel or lubricator is applied to corves or wagons having a tipping or tilting action or motion, the supply of oil or other lubricant to the axis of the wheels is rendered self-acting. The lubricators are fixed to the body of the corf, which, when tipped or tilted, the chambers become filled with oil, which gradually passes out through the tubes to the axis of the wheels while the corf is running, the quantity supplied at each tilt being regulated by the capacity of the chamber and the distribution of it by the bore or size of hole in the tube. This lubricator may be so arranged and applied to other axes or bearings as to be tilted by hand when required.—*Not proceeded with.*

2262. G. H. Birkbeck, *Southampton-buildings, Chancery-lane, London*, "*Needles.*"—*A communication.—Dated 12th September*, 1861.

This invention consists in forming the eye of the needle of a wedge shape, or by nearly closing the sides of the eye towards the upper ends thereof, so that, when the sewing thread is drawn into this narrow part of the eye, it is securely retained thereby from slipping during the working up of the length of thread contained in the needle; at the same time, by drawing it back into the wider part of the eye, the position of the thread can be readily changed if desired.

2265. C. Greaves, *Old Ford, Bow*, "*Apparatus for preventing waste of water from service pipes or cisterns.*"—*Dated 12th September*, 1861.

This invention consists in the employment, for that purpose, of a closed air vessel, which is supplied with water from any ordinary service pipe leading from the main, and is provided with a two-way cock, which is so constructed that, when turned in one direction, it will enable a supply of water to enter the air vessel, and partially fill the same, the air contained therein undergoing compression and when turned in another direction it will shut off the supply entering the air vessel, and open the outlet from such vessel, the water then issuing therefrom with a certain pressure due to gravity and the pressure of the air in the air vessel. By this arrangement it is obvious that the water to be drawn off for use must come from the air vessel, and not from the service pipe direct, hence the liability of the water being wasted by leaving the cock open is obviated, as the contents of the air vessel only can be run off.

2270. W. E. Gedge, *Wellington-street, Strand, London*, "*Improvements in the nautical compass.*"—*A communication.—Dated 12th September*, 1861.

The object of this invention is to render the mariner's compass independent of magnetic influence on board ship, more especially iron ships, and the invention consists in placing beneath the card a number of magnetised needles, say twenty-four, but this number may be increased or diminished, parallel to each other, and with their points directed due north and south.—*Not proceeded with.*

2277. G. C. Haselar, *Birmingham*, "*Lockets.*"—*Dated 13th September*, 1861.

This invention consists, First, in constructing ornaments with a secret ornament or inscription plate, or other ornamental design placed between the lids or sides of lockets, so as to be hidden from view when the locket is closed, and to stand up and be exposed to view when the locket is open. Secondly, for improvements in the construction of lockets known as "book lockets," by securing portraits or other ornamental designs in frames without glasses when inserted through a slit or aperture, and in stopping up such slit or aperture by means of plates, slides, or bolts.

2280. T. L. Murray, *Paris*, "*Letters and signs, decorating churches, rooms, shops, frames, &c.*"—*A communication.—Dated 13th April*, 1861.

The patentee claims the application of translucent sheets of mica upon all gilt, silvered, metallised, or coloured surfaces, so as to preserve the brilliancy and colour of the said surfaces; this smooth, inalterable, diaphanous coating is further capable of being washed and cleaned.

2281. J. B. Howell, *Sheffield*, "*Chains and chain cables.*"—*Dated 13th September*, 1861.

This invention comprehends certain improvements in the manufacture of chains, which combine economy with increased strength. The inventor employs steel or iron, or a combination of steel and iron, rolled of any required thickness and breadth, with one face concave, and the other convex. The metal so rolled he forms into links of such shape as may be necessary by coiling the strips of metal around in the centre, which corresponds with the interior of the link, and towards which the convex surface of the metal is turned, the convex bedding continuously into the corresponding concave surface. These coils, or helical laminated links, are built up to the proper substance when hot; when sufficient contraction has taken place, the ends are soldered or formed. One link can be turned within another by arranging an opening accessible by a hinged jaw within the die or centre on which the link is coiled. For chains made according to this invention the metal may be tinned, and when reduced to links brazed or soldered.—*Not proceeded with.*

2282. C. Sutton, *Salford*, "*Apparatus for indicating the position of sunken ships, &c.*"—*Dated 13th September*, 1861.

This invention consists in applying to ships or other such vessels a buoy or other body capable of floating, and in connecting the same to the ship or vessel by a rope capable of unwinding from a keel or similar apparatus, so that as the ship or vessel sinks, the said rope will be unwound and allow the floating body to rise.

2283. H. Dixon, *Pendleton, Lancashire, and* J. R. Renner, *Liverpool*, "*Carbonising saw-dust and other vegetable substances.*"—*Dated 13th September*, 1861.

This invention relates to the carbonisation of vegetable substances by steam, and consists in the employment of rotatory or other movable pipes or agitators perforated so as to allow steam to flow into contact with the material to be carbonised. These pipes or agitators are provided with angular vanes or scrapers, and are enclosed within a perforated vessel through which the steam is allowed to escape into an outer chamber. The material having been carbonised, the steam is shut off, and steam of a lower temperature is admitted, by which means the material becomes cooled and certain gases are drawn out.

2285. G. Dixon, *Wood-street, Cheapside, London*, "*Upholsterers' trimmings.*"—*Dated 14th September*, 1861.

This invention consists in manufacturing what are known as upholsterers' trimmings, such, for instance, as bullion fringe, curtain cords, curtain bands, and curtain holders, bell ropes, tassels, and other articles of similar character, by the use for the purpose aforesaid of "ruche," that is, a fabric composed of silk, worsted, mohair, thread, cotton, or other material manufactured into a web in one or more bodies by hand or power loom, with a warp consisting of silk, worsted, mohair, thread, cotton, or other material, having introduced into the said warp one or more hass or other wires.

2286. J. A. Knight, *Symonds-inn, Chancery-lane, London*, "*Apparatus for rendering fatty or oleaginous matter and delivering the same.*"—*A communication.—Dated 14th September*, 1861.

This invention consists in the employment of a close boiler or vessel of any suitable construction, but by preference of a cylindrical form, capable of sustaining the pressure of high pressure steam, together with other apparatus as herein explained. This vessel is provided with a man hole for admitting the supply of fatty or other oleaginous matters to the vessel; it is also provided with a safety valve; also a steam pipe leading from a suitable steam boiler; also with a cock or outlet to draw off the residue and impurities, and, also, a cock or outlet for drawing off condensed water or fluid. This apparatus is so arranged that the fluid fat or oleaginous matter, as it becomes melted and suitable to be drawn off, may be removed from near the upper surface, and this is effected, by preference, by means of a pipe, the lower end of which is supported by a float, whilst the upper end of the pipe moves in a joint, to which is connected, exterior of the vessel, another pipe on which there is a cock or valve to shut off or regulate the passage of the fluid. By this pipe the fluid fat may be raised or conducted to any part of the factory.

2287. W. H. Crispin, *Marsh-gate-lane, Stratford*, "*Curved and angular paper tubes and pipes.*"—*Dated 14th September*, 1861.

In order to form curved tubes or pipes or bends, as they are technically

termed. the paper of which the article is to be made is, in the first instance, covered with a coating of pitch or other bituminous material. This is conveniently and efficaciously done by reducing the pitch or other bituminous substance to a state of powder, which is sifted or distributed over the surface of the paper, the latter being exposed by means of hot metallic plates or otherwise to the action of a sufficient degree of heat to melt the pitch or bituminous substance employed. The paper thus receives a perfect and even coating of the pitch or bituminous substance.—*Not proceeded with.*

2293. M. A. F. MENNONS, *Paris*, "*Surgical instruments.*" — *A communication.*—*Dated 14th September*, 1861.

This instrument is composed of a tube or rod varying in form, material, and dimensions, according to its intended application, and provided externally with one or several longitudinal or spiral grooves, serving as receptacles or conductors to the medicinal substances which it may be necessary to convey into the diseased passage or cavity. For the treatment of the affections of the urethra, for instance, the apparatus takes the form of an ordinary bougie, fluted from end to end, the number, spacing, and depth of the grooves being dependent on the nature of the disease, and of the medicinal substances to which they serve as vehicle. For vaginal complaints, this instrument again changes in form to correspond with the affected parts. For fistula, and diseases of the lachrymal, auditory or nasal canals, it takes the form of a small fluted probe, and so on, *ad infinitum*. The tubular instruments employed for the conveyance of liquids are provided near the lower extremity with lateral orifices, forming the communication between the grooves and the inner capacity, the contents of which may be diffused over the diseased surfaces by piston or any other suitable pressure.—*Not proceeded with.*

2294. A. GREEN, *and* W. H. GLOVER, *Stourbridge*, "*Vice boxes.*"—*Dated 14th September*, 1861.

This invention annot be described without reference to the drawings.

2299. T. WEBB, *Victoria-street, Westminster*, "*Tills.*"—*Dated 14th September*, 1861.

The object of this invention is to prevent persons unlawfully taking money from the tills of shop-counters. The inventor proposes arranging the till in such a manner that it shall represent a double drawer, one sliding within the other. The inner till is provided at its extreme end with a catch lock, so that, when the till is closed, the inner receptacle becomes fastened. It is thus evident that any person now attempting to open the till will merely withdraw the outer casing, leaving the money in the inner one. A treadle is employed for unlocking the inner till, to which is attached a rod, actuating a spring, which releases the catch of the lock, and thus allows the inner till to be withdrawn simultaneously with the outer one.—*Not proceeded with.*

2300. S. HORSLEY *and* E. H. JONES, *Liverpool*, "*Apparatus for cleaning and polishing boots, shoes, &c.*"—*Dated 16th September*, 1861.

This invention relates to that class of cleaning and polishing machines where circular brushes are made to revolve by treadle or any other means, and consists, First, in constructing or making the brushes so that, when they are placed in positions on the spindles or shafts, they will form one continuous brush, the periphery of which will be alternately concave and convex. Secondly, in supplying the blacking or other polishing substance to the brushes by discs, arms, or vanes fastened to a spindle resting on a framing placed in the receptacle or trough for containing the said blacking or other polishing material, and which discs, arms, or vanes can be brought into contact with the brushes at pleasure to communicate the required quantity and no more.

2306. W. CLARK, *Chancery-lane, London*, "*Application of mica to ornamental and other purposes.*"—*A communication.*—*Dated 16th September*, 1861.

This invention relates to the covering of all kinds of gilding, silvering, and other leaf metal surface colouring and all kinds of decorations generally, with sheets of mica, pasted or otherwise cemented thereon, which are thereby protected from the destructive action of exterior agents, at the same time presenting various metallic or coloured effects through the mica.—*Not proceeded with.*

2308. W. STEWART, *Peckham, Surrey*, "*Apparatus for supporting persons in, and for enabling them to progress through, the water.*"—*Dated 16th September*, 1861.

This invention consists in constructing and fitting to the body, both in front and at back, an inflated waterproof bag or other buoyant support, connected between the legs and over the shoulders; that part of the bag extending down the back possesses greater buoyancy than that extending down the fore part of the body. The buoyant support may consist either of air and waterproof vessels, or it may be composed of cork. In addition to the buoyant support, the invention consists in attaching to each heel a paddle free to move within certain limits upon a hinge, and in some cases the patentee attaches similar paddles to the hands or wrists. When all these improved apparatuses are on a person, he will be supported at a slight angle in the water, and by performing with the feet a motion as if ascending a ladder, aided by a paddling motion with the hands, he will be able to progress through the water.

2316. F. BARNETT, *St Mary-axe, London*, "*An improvement in the light given by street and other lamps.*"—*Dated 17th September*, 1861.

This invention consists in improving the light given by street and other lamps by means of a reflector, which is to be made either of china, white earthenware, or any other enamelled material answering the desired purpose, that is to say, possessing the power of well reflecting the rays of light, resisting the heat of the flame, and remaining unimpaired by the smoke and pernicious exhalations arising from gas or other lighting materials. These reflectors are to be made in all shapes, forms and sizes suitable to the requirements.

2319. G. DAVIES, *Sardle-street, Lincoln's-inn, London*, "*Apparatus for the manufacture of horse-shoe and other nails.*"—*A communication.*—*Dated 17th September*, 1861.

The nature of this invention consists in forming or constructing an apparatus whereby horse-shoe or other nails are rolled and forged simultaneously. To obtain this result sectors are used, serving the purpose of rolls, which form the stem or body of the nail, drawing it out to the required dimensions, whilst the head of the same is forged by a punch of a suitable form actuated with great rapidity.

2322. A. H. BAILEY, *Boston, U.S.*, "*An improved system of combination types, and an improved case for containing the same.*"—*Dated 17th September*, 1861.

This invention consists in so combining in pairs those letters of the alphabet that are capable of being used together, that the compositor shall have within his reach, not only the letters which he requires, but also that letter joined with the one which immediately follows it, by which means he is enabled with the single motion which heretofore was required to set a single type or letter to set two letters, and thus greatly to facilitate the progress of compo-ing.—*Not proceded with.*

2323. G. WHITE, *Pancras-lane, London*, "*Apparatus for filtering or purifying water or other liquids.*"—*A communication.*—*Dated 18th September*, 1861.

This invention consists in making use, for the filtering or purifying of water, or of solution of acids, alkaline, or other substances, of thin porous filtering partitions, formed of any suitable mineral, vegetable, or animal substance, or a combination of them, according to the nature of the liquid to be filtered. These partitions may, for instance, be thin slabs of natural or artificial filtering stone, with or without carbon in its composition, a thin layer of a felted, woven, or any other suitable fabric or product, which slabs or layers by their thinness would not offer sufficient resistance to the pressure exerted on them by the liquid if they were not, as according to this invention, carved or supported and cemented on proper frames, grates, or railings, forming a casing for the apparatus. The said slabs are fitted together edgewise, in such manner that each filtering partition acts independently of the adjoining one, and may be thus caused to cease its filtration, or be altogether removed and replaced by another one, without interfering with the working of the remainder of the apparatus. The said frames or grates are held together so as to constitute a strong casing for each apparatus, and make this latter form a polyhedral vessel, presenting a large amount of filtering surface comparatively to its bulk, the outside or casing of each apparatus offering either an open or a closed surface with suitable exit openings for the filtered liquid according as required.

2325. W. CORY, jun., *Coal Exchange, London*, "*Vessels and machinery for unloading colliers, &c.*"—*Dated 18th September*, 1861.

This invention consists in combining a suitable construction of floating vessel or platform with proper cranes and weighing machinery, together with rail or tramways, in order that colliers or other vessels containing coals may come alongside whilst barges are on either side of both ends of the vessel or floating platform, and, when desired, the coals in descending from this vessel or platform into the barges may be screened by descending on screens suitably placed at each end of the vessel or floating platform, by which the cranes and machinery are carried.

2328. E. PARTINGTON, *Heap Bridge, Lancashire*, "*Paper.*"—*Dated 18th September*, 1861.

This invention relates to that portion of the manufacture of paper when the material is in the state called "half stuff," and is designed for the purpose of separating the superfluous liquid from the material to prepare it for the machine called "the willow and washing machine." The improvement consists in the employment of one or more pairs of bowls or rollers, suitably supported in a framing, between which rollers the material in the state of half stuff passes, and is pressed until sufficiently solidified for the next operation. The material is fed to the rollers by means of an endless travelling cloth, and is received, after having been pressed by the rollers, by another endless cloth. The upper roller is formed or composed of large discs placed side by side, and loose upon the central shaft, in order to allow any portion of the roller to rise in the event of any solid matter passing between the rollers.

2338. L. G. A. CONDROY, *Dowai, France*, "*Centrifugal apparatus.*"—*Dated 19th September*, 1861.

The substances to be submitted to the action of the centrifugal force are, according to this invention, operated upon in baskets or perforated boxes, lined inside, if necessary, with a woollen or common coarse cloth, or else with a wire cloth; the substances to be treated can be placed previously in the baskets or boxes, so that they can be partly drained before putting them in the apparatus, and after the operation or drying process is over, they are taken off and carried to the storehouses or gathering halls, whilst fresh baskets or boxes, previously prepared, are submitted to the same process, and so on, as fast as the first baskets are emptied and filled up anew.

2336. J. DURRANT, *Lewisham, Kent*, "*Coal box.*"—*Dated 19th September*, 1861.

This invention consists in forming a coal box or coal scuttle, the upper portion of a truncated conical form, with a lid on the top by which the coal is introduced or withdrawn. In a compartment underneath that in which the coal is deposited is placed a gridiron bottom, capable of being moved backwards and forwards by means of a handle which projects; the outer front of this gridiron slide is formed so as to cover the front of the compartment, and render it dust-tight; the cinders and ashes being placed on the slide (which acts as a shovel), it is inserted into the compartment and moved backwards and forwards, the ashes falling down into a lower compartment, the cinders remaining in the gridiron shovel. Instead of the backward and forward motion a rocking or oscillating motion may be given to the cinder sifter. The ashes passing from the sifting chamber fall into a compartment beneath, which is also dust tight, and into a dust pan, when they may be removed at leisure. A portion of this upper part of the coal compartment is separated by a partition, and in this is placed wood for fire lighting, brushes for stove polishing, matches, and such like articles.—*Not proceeded with.*

2340. W. CLARK, *Chancery-lane, London*, "*Machinery for the manufacture of fishing and other nets.*"—*A communication.*—*Dated 19th September*, 1861.

This invention cannot be described without reference to the drawings.

2341. W. T. TONGUE *and* J. GREER, *Liverpool*, "*Portable self-acting water engine.*"—*Dated 19th September*, 1861.

An apparatus constructed according to this invention may consist of a cylindrical or other suitably shaped air-tight vessel, which is by preference formed with a dome-shaped top, having a pipe passing through the centre thereof, and extending down nearly to the bottom of the interior of the vessel. The head of this vertical pipe above the top of the vessel is fitted with a stop-cock and a suitable screwed collar, for attaching thereto the nozzle pipe, or the end of an air-pipe, of an air-pump, by means of a union nut. The side of the vessel at, say, a point about two-thirds or three-fourths from the bottom, is fitted with a small tap or screwed vent for allowing the escape of air during the time of charging the vessel with water. The vessel is charged with water through the vertical pipe, the air in the vessel being allowed to escape as the water rises through the tap or screwed vent in the side of the vessel. When the water has risen to about two-thirds or three-fourths of the height of the vessel, the tap or screwed vent is closed, and to the head of the vertical pipe is attached, by a union joint, the end of an air-pipe connected with an air-pump, which pump may be temporarily attached or fixed to the side of the vessel. By means of the air-pump the patentees force into the cylinder the required quantity of compressed air, after which they close the tap on the head of the vertical pipe, and then remove the pipe of the air-pump and replace it by a flexible pipe fitted with a suitable nozzle piece, when the apparatus is ready for use, all that is required being to turn on the stop-cock and direct the nozzle in the direction the stream of water is desired to take. Any number of vessels that may be required can be kept ready charged with water and compressed air, only one air-pump being required to charge any number of the vessels with compressed air. The air-pump can, if preferred, be worked with a lever or crank-handle, and fitted with a fly-wheel.

2342. J. H. WILSON, *Liverpool*, "*Pumps.*"—*Dated 19th September*, 1861.

This invention is chiefly applicable to ships' lift pumps, and consists in placing the lower valve in a chamber on the head of the suction pipe, and enclosing the top of the chamber with an air-tight cover, and constructing the working barrel on the side and parallel with the chamber on the head of the suction pipe, a side opening or port being formed to connect the chamber on the head of the suction pipe at a point above the lower valve with the bottom of the working barrel, which is provided with an upper valve or bucket of a peculiar construction, and consists of an annular ring of cast metal forming the valve seat, and having an arch springing therefrom for connecting it with the pump rod. A cupped leather is placed on the horizontal annular ring, which is kept in its place by a flat annular ring or washer screwed on to the under side of the cupped leather by headed screws which pass through the bottom of the cupped leather, and are screwed into the underside of the valve seat. The clack or cover of the valve is formed in the ordinary way, and the centre of the cupped leather is removed to the extent of the outer port. By this arrangement the patentee is enabled to obtain a cheap and serviceable pump bucket, which requires little labour to fit, the side of the cupped leather accommodating itself to any irregularity on the side of the casting forming the valve seat. The lower valve is provided with a hollow screwed plug, which has a lateral opening in the side about the middle of its length, the object being to admit air under the lower valve when it is desired to remove it for examination or repair or renewal, or for sounding the pump well, which can be readily done by removing the cover on the head of the chamber in which it is enclosed.

2344. J. GRAHAM, *Commercial-road East, London*, "*Double-acting force or lift pump for ships, fire engines, &c.*"—*Dated 19th September*, 1861.

This invention consists of a double-acting force or lift pump which the patentee constructs with two chambers, and with two buckets or plungers working in each chamber; the rod of the bottom bucket or plunger in each chamber works through an orifice in the upper bucket or plunger, made water-tight by means of a movable brass packing, so as to allow the rod to work it without a parallel motion. Motion is given to the buckets in each chamber, so that when the one is ascending the other is descending, the upper bucket moving up and down in the upper end of the chamber, and the lower bucket up and down in the lower end of the chamber, meeting or nearly so in the middle of the chamber. At the side of each chamber, or connected with it, he makes an auxiliary chamber or suction pipe with a suction valve at the bottom of it for admitting water during the ascent of the upper bucket, the water being admitted through a suction valve at the bottom of the working chamber during the ascent of the lower bucket, and when one of the valves for admitting water is open, the other is closed. The water raised by the lower bucket of each pump is forced through an opening furnished with a valve into a reservoir placed between the working chambers, or in any convenient position, and the water raised by each of the upper buckets passes over the top of the working chamber into the same reservoir. The machine must be constructed or so placed that the suction valves shall be in contact with the water to be lifted. He prefers to give motion to the buckets and their rods in each chamber by means of an arrangement of two levers or beams, the motion being transmitted from the first to the second lever or beam by means of a tumbling lever working on a joint or fulcrum pin fixed on the framing or in any convenient manner.

2350. B. SMITH, *Birmingham*, "*Taps and cocks.*"—*Dated 20th September*, 1861.

This invention has reference to such naps or cocks as act by the raising and lowering of a valve by means of a screw, and consists in certain arrangements whereby the stuffing-box through which the spindle of the screw is ordinarily made to pass is dispensed with, and leakage around the said spindle prevented.—*Not proceeded with.*

2352. H. WALKER *and* D. JOHNSTONE, *Manchester*, "*Castors.*"—*Dated 20th September*, 1861.

This invention consists in employing a ball, sphere, or globe of glass, or other suitable material, and causing it to work against three rollers placed in triangular positions, and turning upon pins or axes fixed to a metal frame having a pivot working in a stop or socket, which arrangement enables the ball to turn free of side friction.—*Not proceeded with.*

2345. S. HAWKSWORTH, *Doncaster*, "*Floor cloth.*"—*Dated 19th September*, 1861.

For the purposes of this invention linseed oil is boiled slowly or simmered in a close vessel or boiler for some days, with a small proportion of litharge and Burgundy pitch until they become of a consistency somewhat similar in fluidity to tar; this compound is then placed in a masticator or mixing machine, and combined with suitable colouring matters, earths, or pigments, so as to produce any desired colour, and such colouring matters may be so employed and mixed as to imitate marbles or stones when rolled out into sheets.

2347. R. P. P. DAGRON, *Paris*, "*Microscope.*"—*Dated 19th September*, 1861.

This invention is based upon certain parts of a former invention for which letters patent, bearing date the 28th March, 1860 (No. 801), were granted to Aené Prudeir Patrick Dagron. The present invention consists, First, of a double tubular image microscope, composed of two cylinders, at the bottom of which are placed or fixed on each side two photographic microscopic images. Secondly, of a tube joined to the two cylinders aforesaid which serves to connect them together, and also to keep them asunder. This tube can be furnished with a partition to absorb the optic oblique rays. Thirdly, in placing photographic microscopic proofs on glass, each joined by an achromatic lens, the distance between the two should be such that the focus of the first lens acts on the second image which is opposite thereto, and the focus of the second lens acts on the first image, so that in looking either way the front image appears enlarged by the ocular lens. A remarkable feature in this arrangement is, that the image which is glued on to the optic lens does not obstruct the view of the opposite or front image. Or instead of making the microscope as above stated, the patentee proposes to make a double image microscope entirely of glass. The microscope is formed of three pieces of glass. The intermediate piece is formed either plain, cylindrical, or otherwise, and receives the two images to be viewed one at each end; the outer surface of each of the other two pieces of glass is formed convex, and these pieces are glued or otherwise affixed to the plain surfaces which contain the images to be viewed, and these two glasses or lenses serve as ocular or object lenses, according to which is looked through. Or, instead of the foregoing arrangement, the microscope may be composed of five pieces of glass, the three intermediate glasses being cylindrical with square or flat ends, the middle glass being considerably longer than the outer ones. These glasses are each coupled with a lens or end glass which can be rendered achromatic with said glasses.

2362. C. BOARD, *Bristol*, "*Veneering presses.*"—*Dated 21st September*, 1861.

This invention consists in constructing veneering presses in the following manner:—Upon a strong wood or metal frame the patentee lays and secures a sheet or plate of zinc or other metal, on the upper surface of which he fixes metal bars, in such manner that series of chambers or passages, extending from end to end of the plate, are formed. He places strips of wood, or other suitable material, at the ends and sides, and he covers the whole with another sheet of metal, similar to the first, in order to obtain a smooth and hollow bed on which to perform the veneering. Having formed the hollow bed, he places pipes below it in communication with the ends of each of the passages, at one end of which he admits steam, hot air, or hot water, which, travelling along the passage, passes off at the other end. Clamps are fitted to the press, which, for convenience, he hinges at one end to the frame.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

QUARTERLY MEETINGS IN BIRMINGHAM AND WOLVERHAMPTON — ARMOUR PLATES AND STAFFORDSHIRE HOUSES — PRICES OF PIG AND FINISHED IRON — LARGE SALES ON ACCOUNT OF FRANCE — BOARD OF TRADE RETURNS: *Iron and Steel* — NORTH STAFFORDSHIRE QUARTERLY MEETINGS — HARDWARE TRADES: *Growing Improvement.*

THE current series of Quarterly Meetings opened on Wednesday in Wolverhampton, and after the success of Mr. Bernal Osborne and Mr. Bentinck in the House of Commons on Friday night masters were not suprised to find that the meeting opened favourably. The tone was decidedly hopeful, if not, indeed, cheerful; and masters here are beginning to inquire how far they can benefit by the demand which must inevitably spring up for armour plates. At present there is no house in Staffordshire which possesses the machinery necessary to the production of four inch plates, and all those who are able are reluctant to embark in the expense which the preparation to roll them would entail. The cost of the requisite machinery is estimated at from £10,000 to £12,000, £15,000, and even £20,000. And if such an outlay should be incurred it is next to impossible that massive plates could be produced in South Staffordshire on the terms at which they are produced elsewhere. The competition is strong enough among the producers of that iron already. About three months ago Messrs. Brown, of Sheffield, obtained a Government order for 3,000 tons at, it is understood here, £35 a ton—a price which was below that at which Messrs. Beale and Co. had executed a former contract by £10 a ton! With the facilities over South Staffordshire which the makers who now supply Government have for producing iron at a low price, and the competition, too, which exists amongst those makers, the prospects of this district in the struggle are not such as would bode success. It is true that the Iron Plate Committee have reported in favour of iron made from argillaceous stone—the description for the best qualities of which South Staffordshire is celebrated—but Government have at all times manifested such a decided preference for low-priced offers, that although confidence is felt here that we could produce armour plates that would bear without injury an impact blow that the iron of the districts whence Government is now obtaining a supply of plates could not withstand, yet because of the greater price which we should have to demand we should not obtain enough of the orders to justify the outlay just sketched. Hopes are, therefore, entertained that the very different description of the shields by which the Merrimac and the Monitor were both successfully armed may lead to the adoption of a description of armour, by our own and other nations, which shall not be so costly as the four-inch armour plates now being supplied for the construction of the war vessels of the British Government. In that event South Staffordshire has yet left in it ironmasters who, inheriting some of the genius and the spirit of their fathers, will be prepared to enter the lists with all comers, and produce an article which, although not so low in price, shall still be a cheaper article.

The attendance in Birmingham yesterday of buyers from London, Liverpool, Manchester, and elsewhere, was tolerably numerous, and a quiet trade was done with them in finished iron, mostly at rates under those of the Preliminary Meeting. Where, however, iron of the first-class was desired those rates were firmly demanded by makers. The sales of pig iron, although quite equal to expectation, were not of the value of the sales which usually take place at the Birmingham Quarter Day. The prices obtained were generally those of three months ago; but in some instances an advance from 1s. 6d. to 2s. 6d. a ton was secured. The hematite houses remained tolerably firm in the prices which they were demanding where sales were really probable last week. The Workington Company are immovable from their recent advance. The agent of that company in this district reports to us the sale made since our last on account of the French market of 2,500 tons at £2 17s. a ton free on board at Workington. That price is equal to £3 12s. in this district. The iron was the No. 1 brand of the Workington Company, and, even at the price which ruled the transaction, a larger quantity might have been sold, if it had been possessed by the makers. Such a transaction is highly satisfactory, and is more than corroborative of the results deduced from the Board of Trade returns, and given in the next paragraph, as to the increasing value of France as a customer for British iron. Her value is exceeding all expectation. So great is it that in the past three months that country has taken from us more iron than was ever exported to the United States in any quarter.

The Board of Trade returns for February, which have been issued since our last letter was written, show a gradual return towards a state of prosperity. At present, however, the trade of the country is not equal to what it was in the second, and in the first and second months of 1857, inasmuch as whilst the total value of the exports in February, 1857, were £9,313,040, the worth of those in the same month this year was only £8,320,059; and whilst for January and February this year the value was not more than £16,759,114, in the corresponding months of 1857 it was £18,371,145. Compared with February, last year, the total reduction in trade is three-quarters per cent., but as compared with February, 1860, the falling off is twenty-two per cent. Iron and steel have not been exported in so large a relative proportion as some other articles of British manufacture. There appears a slight increase as compared with February last year. The increase is due in great part to the increased exportation of pig iron to France and Holland. So good a customer is France for the pig iron of Great Britain that she is now taking half the total quantity exported from our shores. Railroad iron has been taken in larger quantities, chiefly by France and Spain. Bar, bolt, angle, and rod iron have also gone out in increased quantities, France, Southern Italy, and India, being our principal customers. The large extent to which these returns show that France is increasing her consumption fully corroborate our remarks in this place, from time to time, relative to the demand on account of that market. In February this year France took three times as much British iron as in the corresponding month in 1861. Even India took but little more. Thus far in the year there has been a large increase in the quantity of iron sent to Spain and Holland; but the United States, India, British North America, and Prussia, all show a decline. While, however, we have sent to the United States in February this year not half so much as in February, 1861, and not a third so much as in February, 1860, the quantity taken by that country has been steadily increasing all the past six months. In September last the value of the iron taken by the United States was £32,918, but in February it has been £71,530. The total value of all the iron and steel exported in the second month of the year in 1860 was £765,058; last year it was £606,664; and in February, this year, it has been

£638,027. The aggregate sums here given have been obtained from the following items :—

	Month of February.		
	1860.	1861.	1862.
Iron—Pig and puddled..	£36,198	£46,165	£71,998
,, Bar, angle, bolt, and rod	169,699	110,211	132,082
,, Railroad, all sorts	194,554	168,545	176,042
,, Wire, except telegraphic wire ..	24,471	14,207	13,178
,, Cast	36,022	36,286	36,707
,, Hoops, sheet, and boiler plates ..	68,231	51,619	47,307
,, Wrought, all sorts	159,466	111,050	101,390
Steel, unwrought	76,497	63,581	59,423

The coal trade of South Staffordshire has not experienced any material change since our last. Some tolerably large contracts were entered into yesterday at the rates that have prevailed for some time.

The Quarterly Meeting of the North Staffordshire Coal and Ironmasters' Association has been held. Mr. Heathcote, one of the representatives of North Staffordshire at the meeting of the Mining Association of Great Britain in London in March, reported at length upon the proceedings of that meeting, and gave a detailed account of interviews which had taken place with the Secretary of State upon several subjects in which the interests of the iron and coal trades were involved to an important degree. In the discussion which followed it was generally expressed that the Mining Association was an important and valuable organisation, and worthy of hearty support throughout Staffordshire. In the discussion on the condition and prospects of the trade, reference was made to the improved price of Scotch pig iron and of Welsh railwaybars. In North Staffordshire, however, it was conceded that no marked alteration had taken place since the last Quarterly Meeting in the condition of the trade of coal, ironstone, pig iron, or finished iron, the amount of work done remaining about the same, and prices being unaltered.

The general hardware trades of Birmingham and Wolverhampton continue in the slightly improved condition reported last week. The alteration has been upon the whole slightly for the better; and in some instances the improvement is quite marked.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

State of Trade: *Sheffield: Leeds: Manchester*—Clyde Shipbuilding — Exhibition of the Ozone Light — Patent Case at the Liverpool Assizes — Mersey Docks and Harbour Board: *New Works*—Northern Topics: *Reduction in the Price of Gas at Durham: River Wear Commission: The Elswick Works and the Exhibition: The Tynemouth steamship.*

It is stated that the slight revival of trade noticed recently at Sheffield has scarcely been sustained. The large iron and steel houses continue, however, to have heavy orders on hand both for railway companies and general customers. The edge tool trade also continues moderately satisfactory. At Leeds some demand for steam ploughs on Fowler's principle, now being carried out at Messrs. Kitson and Hewitson's, is noted. The state of employment at Manchester is, speaking generally, becoming worse, more persons being wholly out of employment and more on short time, while fewer, of course, are working full time. Capt. Palin's statistics return the position of the machinists and foundries of Manchester as follows :—Of 47 machinists, 14 were working full time with all hands, 21 were on full time with a portion of their hands, 11 were on short time, and 1 had stopped altogether. Of 24 foundries, 6 were working full time with all hands, 15 were working full time with a portion of their hands, and 3 were on short time.

In connection with Clyde shipbuilding we may note the launch of the Nelson, a fine iron vessel, from the yard of Messrs. Laurence Hill and Co., Port-Glasgow. The Nelson has been built for Messrs. Potter, Wilson, and Co., and is intended for the New Zealand trade. The following are her dimensions :—Length of keel and forerake, 200ft.; breadth of beam, 36ft.; depth of hold, 23ft.; and her burthen is 1,250 tons. In addition to the iron in the hull, which is constructed with plates of the same quality as those used in the manufacture of steam boilers, iron has been brought into requisition in many parts where it was found to conduce to the strength and security of the ship. Thus the lower masts are of iron, and are so constructed that they will act as effective ventilators. Her bowsprit and lower and topsail yards are also constructed of iron; and the yards are a third part lighter than if they had been made of wood. The Nelson is ship-rigged with wire rope, and will be fitted with Cunningham's self-reefing gear for courses, top-sails, and topgallant-sails. She is also fitted with Emerson and Walker's patent windlass, and other modern improvements, including iron water-ways on deck. The Nelson, which has four water-tight compartments, is classed 12 years A1 at Lloyd's. The Lee Min, a screw steamer intended for the China trade, has been launched by Mr. Thomas B. Seath, of Rutherglen. She is to hail from Ayr, and is the third steamer built for the same company and trade within the last 12 months. The Lee Min is 150ft. long, 21ft. beam, and 12ft. deep, and is to be propelled by a pair of direct engines of 60 horse-power, which are expected to give a speed of not less than 10 knots. Mr. Seath's establishment has several other contracts on hand for China.

Messrs. Randolph, Elder, and Co., of Govan, launched yesterday week a large paddle steamer, the Colleen Bawn. This vessel, which has been contracted for by the Drogheda Steam Packet Company, is intended to ply between that port and Liverpool. The following are the dimensions of the Colleen Bawn :—Length between perpendiculars, 226ft.; depth in midships, top of keel, 16ft. 7in.; tonnage, 900. The engines, which are constructed after the patent of Messrs. Randolph, Elder, and Co., are double cylinder, of 400 nominal horse power, with feathering paddle-wheels. The cylinders are two of 88ft. and two of 44ft. in diameter, with 5ft. stroke, and completely jacketted on top, bottom, and insides. The steam is cut off at half-stroke in the one cylinder, and expanded four times more in the second, making an expansion of eight volumes. This arrangement enables the one-half amount of the steam usually required for the power to perform the necessary duty, thereby making a saving of 50 per cent. in the fuel. The boilers are of the ordinary tubular construction, and carry the usual pressure. The vessel was built under the inspection of Mr. Latham, the superintendent of the company; and she is to be placed under the command of Captain Brannaghan, who was actively engaged in the transport service during the Crimean war in charge of one of the steamers of this company which was chartered to the French Government.—The paddle steamer, lately launched by Messrs. Henderson, Coulborn, and Co., of Renfrew, had a satisfactory trial trip last week in the Clyde. The Rattler is about 500 tons burthen, and is fitted with a pair of the builders' diagonal oscillating engines, of the nominal power of 250 horses. She is chiefly intended for towing purposes on the Hoogly. Messrs. Henderson, Coulborn, and Co., launched yesterday week a screw steamer of about 700 tons, which received the name of the Lotus. She will be fitted with a pair of engines of 100-horse power, on the same diagonal oscillating principle, and was immediately placed in the crane berth on the builders' premises to receive her boiler and machinery. The portion of the building ground occupied by the Lotus while constructing was immediately cleared after the launch, and the keel of another screw steamer of about the same size was laid down by the builders.

The "ozone light," a new means of illumination, was exhibited at Manchester on Friday by Messrs. Trachsel and Clayton of that city. The light is clear and white, and it is said that all colours are seen by it in their true shade. It is produced by passing a current of air through a small box containing a chemical compound. The gas which escapes from the box and gives the light is said to be non-explosive; its cost is about the same as ordinary gas. With a carriage in motion a sufficient current is produced to cause a constant manufacture and supply of the gas. If it is desired to provide at stationary light, a pressure is procured by clockwork and weights. The cost of the apparatus for buildings would be from £12 to £14; and there would be also required an occasional renewal from the inventors of the liquid wherein their secret lies. The illuminating power, as compared with gas, has not yet been ascertained.

At the Liverpool Assizes, which have been in progress during the last few days, "Norton and Others *v.* Brooks" was a patent case of some interest. The plaintiffs were Thomas Noton, William Martin, and John Bond, who sued under a patent granted in 1852 to Messrs. Elsie and Bond. Elsie, who is deceased, was proprietor of the Phœnix Ironworks, at Manchester, and the two first-named plaintiffs, Messrs. Noton and Martin, are his representatives in the ownership of the foundry and the patent which was taken out by Elsie and John Bond, the third plaintiff, who was otherwise disconnected with him in trade. Up to 1859 the defendant, Samuel Brooks, was a servant in the Phœnix Works, and, on leaving to commence business on his own account, he applied for a license to manufacture under the plaintiff's patent the "double roller temple," an appliance attached to looms for preventing the web from shrinking. In September of that year a license was granted to the defendant, allowing him to use the patent for fourteen years, and securing to the patentees certain payments in respect of the number of machines he should make. The quarterly payments were duly made for some time, but subsequently he refused to continue the payments, and the plaintiffs now sought to enforce the payments under the license. Mr. James, Q.C., who opened the case, intimated that the defendant had set up a plea that Elsie and Bond were not the first inventors of the article, and that the patent was not novel when the rights were granted; but when the question was argued before the Court of Exchequer, it was held that this was no valid defence in the mouth of a licensee. The defendant now, however, set up a further plea of fraud, and he alleged that the plaintiff, Bond, at the time of entering into the agreement, concealed from Brooks the fact, of which he was well aware, that the invention was not new but was well and publicly known when the patent rights were granted in 1852. The plaintiffs positively denied any such concealment, as they were convinced of the novelty of their invention, and were anxious that the allegation should be investigated. Mr. Manisty, Q.C. for the defendant, explained that it was not the interest of Mr. Brooks to invalidate the patent, as he, as well as the plaintiffs, was anxious for its maintenance; that he was willing to pay the royalty, provided all other persons were compelled to respect the patent; but that it was ruinous for the defendant to pay a heavy royalty while many other persons were manufacturing the very same articles without being taxed by that charge. A consultation between the parties resulted in an agreement to enter a verdict for the plaintiff, damages £250, the defendant to be granted a new license upon different terms.

At the last weekly meeting of the Mersey Docks and Harbour Board the question of the sheds proposed to be erected on the south side of the Coburg Dock, at a cost of £3,100, for the use of the steamers of Messrs. G. H. Fletcher and Co., trading between Liverpool and Spain, was referred back for further consideration, as it was stated, by Mr. Brocklebank, that sheds, which would answer all the purposes contemplated, could be erected at a smaller cost. It was agreed to proceed with the erection of corn warehouses at Waterloo Dock, at a cost of £131,000, including the alteration in the south lock, in accordance with a resolution adopted on the 3rd of October, and subject to the plans and terms of letting being finally adjusted with the corn trade. It was agreed to commence at once graving docks at the south end in accordance with an estimate by the engineer that they would involve an outlay of £130,000. It was stated that the engineer had prepared a plan for approaches to the landing stages differing somewhat somewhat from that proposed by Mr. Hartley, and that it was to be submitted for consideration by the Town Council also.

We close with a few items of intelligence from the extreme north. It appears that the Durham Gas Company has announced a reduction in the price of gas to private consumers of 3d. per 1,000 cubic feet. In future the rate charged will be as follows:—Under 150,000ft. 3s. 9d., above 150,000ft. and under 300,000ft., 3s. 6d., above 300,000ft. and under 600,000ft., 3s. 3d., and 600,000ft. and upwards, 3s. 2d.

At the last meeting of the River Wear Commission a report of considerable length was presented on the state of the river. The most important recommendation made referred to the formation of a new dock, with a passage into the south outlet; on account of the magnitude of the work, however, its consideration was postponed, and the necessary plans and specifications were ordered to be prepared before the next meeting of the commission. The Elswick Engine Works have despatched to the International Exhibition a hydraulic crane, a hydraulic engine, a set of force pumps, an "accumulator," and a locomotive, all finished in a high style of workmanship. The Ordnance Department has also despatched some of its "especialities," or is about to do so. The screw steamer Tynemouth, the property of Mr. W. S. Lindsay, M.P., has just been engined by Messrs. Richardson and Sons, the Middleton Ironworks. The engines are exactly similar to a large model Messrs. Richardson intend sending to the Exhibition, of a pair of marine engines for screw propulsion, fitted up with steam jackets on the cylinders, and feed-heating apparatus on the multitubular principle. The Tynemouth is 1,500 tons burthen, and is intended for the British Columbia and China trade.

The Westminster Bridge Road Tramway.—Mr. Train was convicted at the Surrey Assizes, at Kingston, on Saturday last, of having caused a nuisance in the public highway, by the construction of a tramway in the Westminster bridge road. Some points of law were reserved, and, in the meantime, the tramway remains.

Association of Foremen Engineers.—A full meeting of this Association took place on Saturday evening, Mr. Joseph Newton, who had but partially recovered from an illness of two months, occupying the chair. A valuable paper on cast iron and iron founding was read by Mr. Oubridge, of Messrs. Simpson's, Pimlico.

A Railway Wagon Company in London.—A prospectus has been issued of the Metropolitan Railway Carriage and Wagon Company, with a capital of £100,000, in shares of £10 each. The undertaking is formed for the letting of carriages and wagons to railway companies, mineral owners, merchants, and others. Similar companies have for some time past been established in the provinces.

Our Iron Plated Fleet.—In addition to the Warrior, Black Prince, Defence, and Resistance, completed, and in addition to the iron frigate Achilles, 50, 6,079 tons, 1,250-horse power, building at Chatham dockyard, the following squadron of iron vessels are now under construction by private firms for the Admiralty, several of which are in a very advanced state, viz., the Agincourt, 50, 6,621 tons, 1,350-horse power, building at Birkenhead; the Northumberland, 50, 6,621 tons, 1,350-horse power, and the Valiant, 32, 4,063 tons, 800-horse power, building at Millwall; the Minotaur, 50, 6,621 tons, 1,350-horse power, and the Orontes, 3, 2,812 tons, 500-horse power, building at Blackwall; and the Hector, 32, 4,063 tons, 800-horse power, building at Glasgow. The following iron-plated frigates are now building at the several Royal dockyards, the whole of which are intended to be afloat during the present year, viz., the Caledonia, 50, 4,045 tons, 800-horse power, at Woolwich; the Ocean, 50, 4,045 tons, 1,000-horse power, at Devonport; the Prince Consort, 50, 4,045 tons, 1,000-horse power, at Pembroke; the Royal Oak, 50, 3,716 tons, 1,000-horse power, at Chatham; and the Royal Alfred, 50, 3,716 tons, 800-horse power, at Portsmouth. In addition to the above there are no fewer than thirty-one line-of-battle ships and other screw steamers now on the stocks, most of which are admirably adapted for conversion into shield ships, on Captain Coles' principle. The Victoria and Duke of Wellington, screw three deckers, at Portsmouth, are named as the next ships for conversion to shield ships on Captain Coles' principle and the work of razeeing them to their middle decks will be immediately taken in hand. The Duke was originally laid down as a sailing three decker, and was afterwards altered and adapted to the screw. Her engines are of 700 horse-power, and her burden in tons is 3,771. The Victoria is of 4,127 tons burden, and is fitted with engines of 1,000 horse-power nominal, and attained a speed on her light draught trial in Stokes-bay of nearly 13½ knots.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

	£ s. d.	Dis. p. cs.
IRON, English Bar and Bolt:—		
in London ..... per tn	5 15 0	3
in Wales ..... ,,	5 0 0	,,
in Liverpool ..... ,,	5 10 0	,,
Staffordshire Bars .. ,,	7 0 0	1
Sheet, Single ,,	8 10 0	,,
Dbl. ,,	10 0 0	,,
Hoop ..... ,,	8 0 0	,,
Rod, round ,,	7 0 0	,,
Nail Rod, sq ,,	7 5 0	,,
SHIPPING IRON, Staffordsh. Bars ,,	7 0 0	2
Sheet, Single .... ,,	8 15 0	,,
Double .... ,,	10 5 0	,,
Hoop ..... ,,	8 5 0	,,
Rod, Round..... ,,	7 0 0	,,
Nail Rod, square.. ,,	7 5 0	,,
IRON, Rails, in Wales, cash ,,	5 5 0	nett
,, ,, 6 months ,,	5 7 6	,,
Old, to cut up ,,	0 0 0	,,
Railway Chairs, in Wales ,,	4 0 0	,,
in Clyde ,,	4 15 0	,,
Pig No. 1, in Clyde .... ,,	2 13 6	,,
3-5ths No. 1 & 2-5ths No. 3. ..... ,,	2 14 0	,,
No. 1, in Wales..... ,,	3 10 0	,,
No. 1, in Tyne and Tees ,,	2 12 0	,,
Ditto, Forge ..... ,,	2 9 0	,,
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom. ,,	3 10 0	,,
Welsh Forge Pig (all Mine), at the Port .. ,,	3 5 0	,,
Acadian Pig, Charcoal.. ,,	7 10 0	,,
Scotch Pig, No. 1, in London ..... ,,	0 0 0	,,

	£ s. d.	Dis. p. ct
IRON, Swedish, Indian assortments..... per tn	11 5 0	2
Russian C C N D to arrive ,,	16 0 0	,,
STEEL, Swedish Keg, bem. ,,	15 10 0	2½
Ditto, rolled..... ,,	15 0 0	,,
Faggot..... ,,	17 0 0	,,
SPELTER, on the spot .. ,,	18 10 0	nett
To arrive ..... ,,	18 12 6	,,
Hard, remelted ..... ,,	17 0 0	,,
ZINC, in sheets ..... ,,	23 0 0	,,
COPPER, Tile, 14 to 28 lb. ,,	98 0 0	2½
Tough Cake..... ,,	98 0 0	,,
Sheathing and Bolts ..per lb.	0 0 11	,,
Sheet..... ,,	0 0 11	,,
Bottoms..... ,,	0 0 11	,,
Old ..... ,,	0 0 0	,,
Yellow Metal ..... ,,	0 0 9	,,
Burra..... ,,	100 0 0	,,
Russian..... do. ,,	0 0 0	,,
LEAD, British Pig ..... ,,	20 0 0	,,
Spanish..... ,,	19 0 0	,,
W. Bs. ..... ,,	21 5 0	,,
Sheet..... ,,	20 10 0	,,
TIN, English Block, nom.. ,,	117 0 0	,,
Bar ,, ,,	118 0 0	,,
Refined ,, ,,	122 0 0	,,
Foreign Banca ..... ,,	125 0 0	,,
Straits ..... ,,	115 0 0	,,
TIN PLATES, Char coal, IC..... per bx	1 2 0	,,
Ditto IX ..... ,,	1 15 0	,,
Coke, IC ..... ,,	1 2 6	,,
Ditto IX ..... ,,	1 8 6	,,
Do. at Newport, 1s. per bx less	—	,,
Do. at L'pool, 6d. ,,	—	,,
CANADA, Plates ..... per tn	12 0 0	2
QUICKSILVER ..... per bt	0	

Rails.—There has not been much inquiry this week.

Scotch Pig Iron.—A very large speculative business has been done during the past week, and the price of warrants advanced from 51s. 7½d. to 54s. cash; a fall of 1s. to 1s. 6d. then took place; but very soon afterwards the market recovered, and sales were effected at 53s. 10½d. per ton, which was the closing quotation yesterday in Glasgow.

Spelter.—Some sales are reported at £18 10s. per ton on the spot for choice brands. Market quiet.

Copper.—But little inquiry.

Lead easier, best English pig may be had 5s. lower than last week.

Tin.—English in fair request at the reduction. In foreign Bancs is still quoted £125, but Straits has fallen £2 (to £115), at which it may easily be had.

Tin Plates continue in good demand.

April 10th, 1862. Moate and Co., 65, Broad-street, London.

PRICES CURRENT OF TIMBER.

	1861.	1862.
Per load—	£ s. £ s.	£ s. £ s.
Teak.....	15 10 17 0	15 0 16 0
Quebec, red pine ..	3 10 4 10	3 5 4 0
yellow pine..	3 0 4 0	3 0 3 15
St. John, N.B., yel.	3 0 5 10	3 0 5 10
Quebec, oak, white	3 0 5 10	3 0 5 10
birch	3 10 4 0	4 10 0 0
Memel..	0 0 0 0	0 0 0 0
elm.....	3 10 4 15	3 10 4 15
Dantzic, oak	3 10 6 0	3 10 6 0
fir.....	2 15 3 10	3 0 4 0
Memel, fir	3 10 4 0	3 10 4 0
Riga.....	3 5 3 10	3 10 3 15
Swedish	2 15 3 0	2 15 3 0
Mass, Queb. red pine	5 0 6 0	5 0 6 0
yl. pine	5 0 6 0	5 0 6 0
rd pine	0 0 0 0	0 0 0 0
Lathwood, Dantz, im	6 0 8 10	6 0 7 0
St. Petersb.	8 0 8 10	9 0 9 10
Deals, per C., 12 ft. by 3 by 9 in.		
Quebec, wht spruce	13 18 0	15 0 19 0
St. John, wht spruce	13 16 0	15 0 17 10

	1861.	1862
Per load—	£ s. £ s.	£ s. £ s.
Yel. pine, per reduced C.		
Canada, 1st quality	17 0 18 10	17 10 19 0
2nd do ..	12 0 13 10	13 0 13 0
Archangel, yellow	13 0 13 10	14 0 15 0
St. Petersbg, yel...	13 0 13 10	13 10 13 10
Finland.....	9 0 10 0	9 10 10 10
Memel	10 0 15 0	10 0 15 0
Gothenburg, yel...	10 0 11 10	10 0 13 10
white	9 10 10 0	9 10 11 0
Gefle, yellow	10 0 11 0	11 0 13 10
Soderhamn	10 0 10 10	11 0 13 10
Christiania, per C		
12 ft by 3 by 9 in..... yellow	22 0 25 0	22 0 25 0
Deck plank, Dntz per 40 ft. 3 in.	0 14 1 4	0 14 1 4
Staves, per standard M		
Quebec, pipe	70 0 75 0	50 0 55 0
puncheon	45 0 45 0	16 0 17 0
Baltic, crown pipe	160 0 170 0	170 0 180 0

SCOTCH PIG IRON REPORT.

		s.	d.	
No. 1	Gartsherrie	53	3	f.o.b Glasgow.
,, 1	G.M.B.	52	3	,, do.
,, 3	Do.	51	0	,, do.
M. Nos.	Do.	51	9	,, do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths ,, 3 .. G.M.B.	Cash prompt	53	3	per ton.
	1 mo. open	53	4½	do.
	2 mos. ,, ...	53	6	do.
	3 ,, ,, ...	53	7½	do.

MANUFACTURED IRON.

	£	s.	d.
Bars, Govan	7	0	0
,, Common	6	10	0
Drumpellier, Common	6	10	0
Do. Best	7	10	0
Plates and Sheets	10	0	0
Rails	7	0	0
Pipes	4	17	6
Chairs	4	0	0

Glasgow, April 9th, 1862.

We have had a most exciting market since ours of this day week, and a very considerable business has been done from 51s. 6d. to 54s. cash.

The high prices induced some heavy realisations, and the result was a decline to 52s. 6d. cash. This, however, the market has partly recovered, and we close buyers at 53s., sellers 53s. 3d. cash.

Exports last week were 13,505 tons, against 14,992 tons in the corresponding week last year. Shaw, Thomson, and Moore, Metal Brokers.

The 68-pounder Gun.—In a letter to the *Times* Sir William Armstrong gives the initial velocity of the 68 lb. shot, projected with 16 lb. of powder, as 1,580ft. per second. Experienced artillerists well know it to be over 2,000ft. per second.

Railway Accidents and the Law.—It is not long since the London and North Western Railway Company were cast in damages in a case growing out of the explosion of a locomotive boiler, near Rugby, July 4th, 1861. Another case, growing out of the same accident, came on at the Surrey Assizes, at Kingston, on Wednesday, when, with nearly the same evidence, a verdict was given in the company's favour.

Captain Coles' Cupola Ship.—It is understood that the Admiralty contracted, on Tuesday, with Messrs. Samuda for the construction of one of the cupola iron ships of war, under the invention of Captain Cowper Coles, R.N. The price is to be £44 15s. per ton, including everything, and the vessel is to be ready for launching on the 3rd of February next, and to be delivered fit for sea on the 1st of June following.

Steel Boilers.—The Great Western Railway Company of Canada have two of their largest sized freight engines provided with boilers and fireboxes made of "steel," or "homogeneous" metal, manufactured by Messrs. Cammell and Co., of Sheffield. The engines have been constantly at work during the past 14 months, and, as far as present experience goes, the boilers are likely to fulfil all that was expected from them. A considerable number of steel fireboxes are in use upon the same line, and have hitherto given every satisfaction.

Gas in Sweden.—A prospectus has been issued of the Gefle Gas Company, with a capital of £15,000, in shares of £10. The object is to carry out a concession for lighting the town of Gefle, in Sweden.

Traffic Returns.—The traffic receipts of railways in the kingdom amounted for the week ending the 20th of March, on 10,145 miles, to £468,600, and for the corresponding week of last year, on 9,911 miles, to £519,195, showing an increase of 234 miles and a decrease of £50,595. The falling off in the traffic of the past week as compared with the corresponding period of 1861 is considerable in the passenger traffic of the great lines, caused by the comparison being made with Easter week in 1861, and also in the goods traffic, in consequence of the depression of trade in the manufacturing districts. The traffic receipts of the past week show a decrease of £1,587, as compared with those of the preceding week ending the 22nd inst. The total receipts for the thirteen weeks ending as above amounted to £6,044,697, and for the corresponding period of last year to £6,237,004, showing a decrease of £192,307, being at the rate of £14,800 a week, instead of an average increase of about £25,000 a week, as in preceding years, making a difference of about £40,000 a week in the receipts, chiefly in consequence of the depression of trade.

THE BREWERIES OF LONDON.

Of the fifty or more breweries in London upwards of a dozen are upon a scale of such magnitude as to rank among the great manufacturing establishments of the kingdom. Their fame, too, extends far over the world. It would, perhaps, be difficult to name a country on the surface of the globe into which Barclay, Perkins, and Co.'s "London stout" has not been introduced. Messrs. Meux and Co. ship their goods, under Government contracts, to nearly all the British possessions, Messrs. Hoare and Co.'s casks may be identified at the distant and lonely trading posts of the Hudson's Bay Company, while, nearer home, Messrs. Combe, Delafield, and Co.'s SSS stout is the royal drink of the King of Saxony. Among the Americans, even, with all their theories of total abstinence and practice in "gin cocktails," "whiskey slings," "mint juleps," "brandy smashes," "eye openers," "gum ticklers," &c. &c., London stout is appreciated, it being prescribed by the American medical men for consumption, debility, and, indeed, generally in cases of impaired vital power.

Into the history of brewing we shall hardly enter, further than to remark that there are but few of the great London breweries which have not been established for upwards of a hundred years. In 1760, Calvert and Seward were the foremost London brewers, they having sent out, in that year, rather more than 75,000 barrels of beer, equal to about one-sixth of the present yearly production of Truman's brewery, now the largest in the metropolis. A hundred years ago, Thrale's brewery, now grown into the vast establishment of Messrs. Barclay, Perkins, and Co., ranked as the fifth in London. At the death of Mrs. Thrale (Madame Piazzi), whose first husband was the friend of Dr. Johnson, the brewery was sold for £135,600. Its present value, with all the extensions and improvements which have been made in a century, can hardly be less than ten times that amount.

In 1853, when the brewers were required to make returns of the quantity of malt mashed, Messrs. Truman, Hanbury, Buxton, and Co. mashed 140,090 quarters; Messrs. Barclay, Perkins, and Co. 129,362 quarters, Messrs. Meux and Co. 66,509 quarters, and Messrs. Reid and Co. 63,550 quarters. In the preceding year of 1852, Messrs. Whitbread and Co. mashed 53,276 quarters of malt, and Messrs. Combe, Delafield, and Co. 47,304 quarters. The last named firm already mash upwards of 70,000 quarters yearly, and the trade of some of the other large houses has increased, within the last few years, in nearly the same proportion. None of the London brewers, we believe, make their own malt.

"Truman's brewery," although no one of the name of Truman has had a share in its ownership for nearly a hundred years, is still the recognised name of the great establishment in Brick-lane, Spitalfields, close to the Eastern Counties Railway station. It covers 3¾ acres, besides premises of 4 acres in another part of London. With the exception of Reid's brewery the buildings are the loftiest for the purpose in London. At Brick-lane there is storage for 16,500 quarters, or 132,000 bushels of malt, and 650 quarters are mashed daily in the winter months, and as rather more than three barrels of beer are made from a quarter of malt the maximum daily out-put may be taken as 2,300 barrels, worth, say, £4,500, the annual trade of the establishment being nearly £1,000,000. The malt is shot from the sacks into a bin on arrival, and taken thence, by a "Jacob's ladder," to the upper storey of the brewery. When required for use it goes through the crushing rollers and "grist cases" to the mash tuns, of which there are five, all of cast iron. Three of these tuns are sufficiently large to mash 160 quarters each, the other two having a collective capacity of 170 quarters. The under backs are proportionately large. The worts are then boiled in the coppers, of which there are six, four having a capacity of 500 barrels each, exclusive of the pan on top, while the other two, which have no pans, hold about 200 barrels each. The porter hop-back holds 800 barrels, and that for ale 300 barrels. The worts then pass into the coolers and the refrigerators, and thence into the fermenting tuns. Of these there are six for porter, four of which hold 1,500 barrels each. There are others also, but of smaller size, for ale. The cleansing rounds, into which the beer then passes, are upwards of 1,000 in number, a single range of cleansing rooms being 364ft. long and 43ft. wide. The beer is finally taken into the store vats and casks. Of the former there are 134, the largest holding 2,050 barrels each, while the aggregate capacity of the whole is 96,222 barrels. Upwards of 100,000 casks are also kept for storage. The delivery department includes 140 of the most powerful horses, the stables for which, as is generally the case in all well-managed London breweries, are fit for the reception of the royal stud.

There are seven steam engines on the premises, of, respectively, 50, 40, 12, 6, 6, 6, and 5 nominal horse power. About 7,000 barrels of water are used daily when the establishment is in full work, and of this great quantity about one-half is obtained from an artesian well, upwards of 300ft. deep.

Messrs. Barclay, Perkins, and Co.'s Anchor Brewery, the second in London in extent of its operations, is situated in Park-street, Borough, near the southern end of Southwark bridge. The buildings, although especially commodious, are not remarkable for loftiness, the works being spread over a large area, including, we have been told, 14 acres of ground. The same firm have a smaller establishment in Tooley-street. There are five coppers at the Park-street brewery, and all the other appliances for making 350,000 or 400,000 barrels of ale and beer yearly.

Messrs. Meux and Co.'s "Horse Shoe Brewery" is in the Tottenham-court-road, near Oxford-street. This establishment is said to mash 80,000 quarters of malt yearly, which is brewed into stout and porter only. There are three large coppers, one containing 700, and the other two 500 barrels each.

Messrs. Reid and Co.'s brewery is in Liquorpond-street, Holborn, and is believed to be the largest, under a single roof, in London. This establishment turns out from 7,000 to 8,000 barrels of stout and porter weekly during a brewing season of 30 weeks. There are three coppers, one of great size, and the others of a capacity respectively of 600 and 400 barrels. The store vats are 146 in number, the largest containing 2,400 barrels.

Messrs. Whitbread and Co.'s brewery is in Chiswell-street, near Finsbury-square, and covers nearly 8 acres of ground. Instead of coppers with fires kept up beneath them, eight large Cornish boilers are employed here to raise steam for heating the "liquor" (as water is called by the brewers), and for boiling the worts. All the heating and boiling is done in vessels called "boiling backs," by means of steam pipes led through the liquid to be heated. In other respects the brewing is conducted in the usual manner. It is understood that this brewery is now mashing between 70,000 and 80,000 quarters of malt yearly. There are very extensive vaults upon the premises, and in one of the underground beer cisterns called the "King" George III. once partook of a repast. There are 46 store vats, one of which is believed to be the largest in London, containing 3,150 barrels, or 113,400 gallons. In Messrs. Whitbread's brewery is one of the first steam engines set up by James Watt in London. That erected by Watt at the Albion Mills, at the southern end of Blackfriars bridge, is believed to have been the first, but we are unable just now to give the precise date of its erection. The engine at Messrs. Whitbread's was put in in 1785, and is still at work. It has a 24½in. cylinder, 6ft. stroke, and sun-and-planet wheel, the fly wheel making two revolutions for each double stroke of the piston. It is hardly fair to say that the present engine is that erected by Watt, for nearly every part of it with the exception of the fly-wheel has been renewed. The boiler is of the old hay-stack kind, and is worked at a pressure of from 2 lb. to 3 lb. per square inch, although it sometimes works at less than atmospheric pressure, the engine being driven by virtue of the vacuum created on the back of the piston.

On a post in the engine room is a framed silvered plate, on which is engraved the following inscription:—

"The Steam Engine was first invented by the Most Noble, Edward Somerset, Marquis and Earl of Worcester, 1655. Improved by Captain Thomas Savery, 1699. Further improved by Thomas Newcomen and John Cawley, ingenious mechanicians of Dartmouth, in the County of Devon, 1712. The expense of fuel reduced one-half by Mr. John Smeaton, F.R.S., of Austhorpe, in the County of York, Civil Engineer, 1768. Greatly enlarged in its Power and Uses and brought to its present state of perfection by Mr. James Watt, F.R.S., of the City of Glasgow, who received His Majesty's Patent, 1769, and in conjunction with Mr. Matthew Boulton, of Birmingham, F.R.S., obtained an Act for an exclusive privilege of 25 years, commencing 1775. They erected this engine, which performed the work of 35 horses, in 1785, but in the course of ten years' use, more power being found necessary, this engine was altered to make it equal to the work of 70 horses, 1795."

Messrs. Combe, Delafield, and Co.'s brewery is in Castle-street, Long Acre. It has two large coppers, besides boiling backs, and, when in full work, can turn out from 1,200 to 1,500 barrels of beer and ale daily, the yearly mash, as already stated, being upwards of 70,000 quarters.

Messrs. Elliot, Watney, and Co.'s Stag Brewery is situated in Brewer-street, Westminster, near Victoria-street, and but a short distance from the Queen's stables. The premises are very commodious, and a great deal of new machinery has been added within the last few years. About 270 quarters of malt are mashed daily in the brewing season, equal to the production of 950 barrels daily of beer and ale. There are four coppers, one of 490 barrels, two of 350 barrels each, and one of smaller capacity. There are 77 store vats, containing from 101 to 1,065 barrels each.

Messrs. Charrington, Head, and Co.'s brewery is in the Mile End-road. It has four coppers, the largest containing 360 barrels, exclusive of pan, and is understood to mash about 35,000 quarters yearly.

Messrs. Hoare and Co.'s Red Lion Brewery is in Lower East Smithfield, between St. Katherine's Dock and the Thames. This establishment has one 400-barrel and one 140-barrel copper, and mashes nearly 40,000 quarters of malt yearly, making about 120,000 barrels of beer. In this brewery the liquor (water) is heated in wooden boiling backs, through which steam-pipes are conducted, the coppers being employed only for boiling the worts. There are in the stores 75 vats, containing from 75 to 1,600 barrels each.

The City of London Brewery Company (Limited) carry on business at 89, Upper Thames-street, the brewery standing on the river side. Although not a very large establishment, this is one of the most notable in London in respect of neatness and general completeness of arrangement. Some of the apartments are noble in appearance, and the whole place, one might suppose, had been originally dedicated to some purpose much more ambitious than brewing. As a public company the proprietors report their profits yearly, the amount for 1861 having been about £42,000. Brewing can hardly be otherwise than profitable when carried on with sufficient capital, and with such attention to the quality of the beer that it shall meet the approval of the consumer. The price of best malt is from 62s. to 66s. a quarter, duty included, brown malt ranging from 50s. to 56s. A quarter of malt makes, say, 3½ barrels of London porter, the cost of the malt, therefore, being under 17s. a barrel. In winter brewing about 2¼ lb. of hops are used per barrel of porter, the summer allowance being about 3 lb. The best hops in the market—viz., Mid Kents and East Kents, sell for from £7 10s. to £10 per cwt., Weald of Kent and Sussex hops selling at from £6 10s. to £8. At 1s. 5d. per lb., therefore, the hops in a barrel of porter cost, say, 4s. Reckoning labour at 1s. 6d. even a barrel, and repairs, taxes, horse keep, &c., at as much more, the cost is brought only to 24s. a barrel. This rough mode of calculation will give some idea of how the profits of the City of London Brewery Company amount to more than 10s. per barrel. As for the proportion of malt used per barrel of the best (Burton) ale, and on the great scale, Mr. Bass, M.P., stated in the House of Commons, on the 10th instant, during the discussion of the licence tax about to be imposed on the brewers, that he had mashed 100,000 quarters of malt since the first of October last, and made 300,000 barrels of ale, the proportion being 2⅔ bushels of malt per barrel.

Before entering upon a description of the processes of brewing, and a notice of the engineering and mechanical appliances of the London breweries, we may state here, as an index of the extent of brewing operations in the kingdom, that in the year from September, 1858, to September, 1859, 6,122,892 quarters of malt were made, of which 4,866,402 quarters were used by brewers and victuallers. In the next year 5,970,829 quarters were made, the brewers and victuallers taking 5,075,805. In the year ending with September last, the quantities were 5,994,536 quarters, and 4,990,713 quarters, the difference being used by distillers and private consumers, or exported. The hop duty charged in 1859 was £599,346. In 1860 the hop crop was a failure, and the duty was £69,767, and in 1861 £149,700.

Dr. Ure, with his usual precision, defined beer as "the fermented infusion of malted barley, flavoured with hops." Barley, in its natural state, and exclusive of moisture, contains about 88 per cent. of starch, 5 of gum, 4 of grape sugar, and 3 per cent. of gluten. In the natural state, however, but one of the constituents of barley, that being the 4 per cent. of sugar, can be assimilated in a fermented solution having the properties of beer. Not only is beer, strictly speaking, a fermented solution of sugar, but it may be made from the sugar of commerce, and without any grain whatever. Malt, as is well known, is barley which has been steeped in water for from forty to forty-eight hours, then spread, in thick layers, for several days upon a floor, and until germination has commenced, after which, by means of a gradual application of heat, the grain is dried, and its germinating power thereby destroyed. Malt is, in nearly all respects but one, substantially the same as the barley from which it is made, the proportions of starch and sugar being altered to say 69 per cent. of the former and 16 of the latter, with 14 per cent. of gum and 1 of gluten. But were this, and the characteristic taste and appearance of malt, the whole difference between it and barley it would be hardly more fitted than barley itself for the purposes of the brewer. The important respect, then, in which malt differs from barley is this:—during the germinating stage a singular nitrogenous substance, known as diastase, is formed in the grain. This substance, which may be precipitated, by means of alcohol, from an infusion of crushed malt in water, has the remarkable property of converting a solution of starch into gum and grape sugar—at least when the solution is at a temperature between 32 deg. and 212 deg., although the most energetic action has been ascertained to take place when the range of temperature is limited to that from 158 deg. to 167 deg. But for the diastase, then, contained in malt, the latter would be commercially valueless to the brewer. Sugar is what he requires, and malt answers his purpose only in so far as he can, by mashing, obtain from it a saccharine or sugary extract, a result for which he is solely indebted to the diastase formed in the grain during the malting process, and by that process only. We may note here that dilute sulphuric acid also has the power of converting a solution of starch into sugar, and chemically, if not commercially, good beer might be made with no other constituents than starch, oil of vitriol, water, hops, and yeast.

The peculiar action of diastase is so energetic that it will saccharify, not merely the starch with which it is already associated in the malt, but a considerable (indeed, a large) quantity besides. Thus it is that, while nothing which would be recognised as beer could be made from raw or unmalted barley alone, the very best beer can be brewed from raw barley mixed with one-third or one-fourth its bulk of malt, the small proportion of diastase in the malt converting not only its associated starch into sugar, but the starch also of a three or four-fold additional quantity of barley. A large proportion of unmalted barley was indeed formerly used by brewers, especially in Scotland, in the production of the best ales, and but for the interposition of the Excise, raw grain would still be used for the same purpose, just as it is now used by the distillers, whose processes, up to the end of the fermenting stage, are practically identical with those of the brewer.

Let us now follow the whole process of brewing, at the same time noting the apparatus employed in the great London houses. As we have already mentioned, in connection with Truman's brewery, the malt is sometimes unsacked at the doors, being emptied into a bin, whence it is raised by a Jacob's ladder to the top of the building, and thence distributed by means of a long Archimedian screw into the separate malt bins. More generally, however, the sacks of malt are hoisted at once by tackle on the outside of the brew house. The malt is measured aloft, and sent on to the crushing mills. For ale the malt is all of the colour known as "pale." For porter, which is the chief product of the large London breweries, a mixture of pale and highly torrefied or black malt, generally called "patent malt," is employed, the patent malt forming somewhere about 10 per cent. of the whole. The only object in the use of black or burnt malt is to impart the peculiar flavour so much relished by porter drinkers. A like flavour is imparted by the addition of burnt sugar, known sometimes by the French name of *caramel*. Some brewers employ for porter about 85 per cent. by measure of pale, 9 or 10 per cent. of brown, and 5 or 6 per cent. of black or "patent" malt. The mixture is made aloft, and passes together through the crushing mill, which consists of a pair of nearly smooth cast iron rollers, revolving nearly in contact with each other, so as to break the husk and partially crush the fecula of the malt. At Barclay's brewery 18in. rolls are used, their speed being 160 turns a minute. From the rolls the crushed malt goes into the grist cases, whence it is either lifted or allowed to descend (according to the relative situation of the different vessels in the brew house) to the mash tuns. These are large circular vessels, made either of wood or iron, wood being more commonly preferred for ale, and iron for porter. Some of the large mash tuns are upwards of 25ft. in diameter, and there are two at Booth's distillery at Brentford which are 28ft. 4in. each in diameter. The depth of the vessel is such that, with the

larger tuns, from 150 to 160 quarters of malt are mashed at once. The mash tun has a false bottom of iron plates or deals perforated with holes of such a size as will allow the mash to drain without the escape of the grains. Upon the ordinary plan, the heated water, which, as well as all the water, cold or hot, used in a brewery, is called "liquor" by the brewers, is made to enter the mash tun from below, and to rise through the perforated false bottom, upon which the crushed malt has been previously shot down. But by a recent improvement, known as Steel's mashing machine, and made by Messrs. Pontifex and Wood, the well known brewers' engineers, of Shoe-lane, the malt and "liquor" are thoroughly mixed and introduced together at one side and near the top of the mash tun. As success in mashing, or, in other words, the conversion of the starch of the malt into sugar, greatly depends upon the maintenance of an uniform temperature throughout the "mash," the use of Steel's mashing machine appears to be important, and upon this view a large number of brewers throughout the kingdom have applied it to their mash tuns.

(*To be concluded next week.*)

THE INTERNATIONAL EXHIBITION.

Good progress has been made, during the past week, in entering and arranging the machinery and other objects in the annexes, and, incomplete as these departments of the Exhibition still are, we are not sure but that they are really more forward than any others. Messrs. Maudslay, Sons, and Field's pair of 800-horse screw engines are in place in the south-western corner of the western annexe. Messrs. Humphrys and Tennant's pair of 400-horse engines for the North Star are set up near by, and between these is a pair of 60-horse inverted cylinder engines by Messrs. Tod and McGregor. Not far off is a small pair of screw engines by Mr. John Kay, of Kirkcaldy, while near to these is a working model of a pair of inverted cylinder engines by Messrs. Richardson, of Stockton. Preparations are being made for the reception of Messrs. Penn and Son's engine, a single cylinder and gear of a pair of the largest class (1,350-horse power) for one of the new iron-plated frigates. The only competition to which the English marine engines are as yet exposed is that of the 400-horse screw engines of the Compagnie des Forges et Chantiers de la Méditerranée, and a working model of a pair of screw engines by Nillus, of Havre.

Besides Mr. McConnell's, Sir W. G. Armstrong and Co.'s, and Messrs. Manning, Wardle, and Co.'s locomotives, noticed in our last, two others have arrived, one from the Wien-Raaber Railway of Austria, and the other from Herr Borsig's great works in Berlin. The first of these engines, constructed by Mr. Haswell at the railway workshops in Vienna, is a somewhat remarkable production. It is an express locomotive, with a pair of 6½ft. driving wheels in front of the fire-box, and two pairs of leading wheels (not combined in a bogie) near the smoke-box. The peculiar feature, however, is that there are four cylinders, placed outside, and having their pistons connected to the same pair of wheels. Two cylinders, each 10½in. or 11in. in diameter, are cast together, in pairs, one over the other, for each side of the engine, each pair occupying the position of an ordinary outside cylinder. Neither cylinder is exactly horizontal, the centre lines of both converging towards the centre of the driving wheels. The piston of one cylinder is connected to a pin in a crank keyed to the driving axle, the framing being wholly outside of the wheels. Upon this pin a stout bar is so attached as to carry a second crank pin diametrically opposite to the first, and to this second crank pin the piston of the second cylinder is connected, the two pistons on each side of the engine working in exactly opposite directions. The object of all this appears to be to obtain an application of the power at four points in the circle of revolution instead of two. The Prussian locomotive, from Borsig's, is an outside cylinder engine, having four coupled wheels, about 5ft. in diameter, all in front of the fire-box, and a single pair of leading wheels. The boiler and cylinders are large, while the crank pins in the driving wheels are exceedingly small.

Mr. Clark has preferred to keep the locomotives a little back, to facilitate the entrance of other machinery, Among the engines yet to arrive will be one with 8ft. driving wheels, built by Messrs. Neilson and Co., of Glasgow, from the plans of Mr. Connor, for the Caledonian Railway. Mr. Connor is working express engines of this class up the long stretches of gradients of 1 in 70 and 1 in 75, which occur in crossing the Lowther Hills and in ascending the valley of the Clyde. Messrs. Sharp, Stewart, and Co. will send a six wheel coupled engine for the London, Chatham, and Dover Railway, the great ten-wheel tank engines, to weigh 48 tons, for the Bhore Ghaut incline of the Great Indian Peninsula Railway, having been hardly yet commenced. Messrs. Beyer, Peacock, and Co. exhibit an engine also for one of the Portuguese railways; and from what can now be seen this will be the neatest and most workmanlike locomotive in the Exhibition. La Société de Couillet have a large locomotive boiler up, and will, probably, fit up a complete engine in working order.

Of engineer's tools a large assortment is in place. Near the entrance to the annexe the visitor is confronted by a large planing machine, by Messrs. P. Fairbairn and Co., of Leeds, and intended for planing armour-plates. A large planing machine, by Mr. Whitworth, will also be placed near it. Messrs. Sharp, Stewart, and Co.'s contribution is very extensive, embracing a double-head lathe to turn objects 6½ft. in diameter, and having four tools—a large shaping machine, a single-head and a double-head slotting-drill, an improved bolt cutting machine upon the plan of William Sellers, of Philadelphia, U.S., and a variety of other objects. Messrs. William Muir and Co.'s, J. Hetherington and Sons', Shepherd, Hill, and Co.'s, and Maclea and March's tools, stand near by, and altogether make a most extensive and attractive display.

The tools from Messrs. Joseph Whitworth and Co. are not yet in, but they will form a most important feature in the Exhibition. They will comprise some of the best examples of Messrs. Whitworth's splendid workmanship, including a large planing machine, and other important tubes.

Messrs. Platt and Co., of Oldham, will be the great exhibitors of cotton machinery, and they have already made good progress in the erection of various examples in that line.

The exhibition of sugar mills, vacuum pans, and other sugar machinery, promises to be very extensive. Mr. Tait, of Glasgow, has got his monster mill completely in place. It is not, large as it is, quite the largest that his firm has made, for, not long since, they sent a mill to Cuba with 33-in. rolls, 7ft. 6in. long, the wrought-iron shafts being 15in. in diameter. The great mill, now in place, weighs, including the engine, 143 tons 9 cwt., and will be run during the Exhibition. The great rolls would easily flatten a large bar of iron if presented to them. Messrs. W. and A. Mc Onie's engine and mill, although not nearly as large as its giant rival, makes a fine appearance, and does its builders great credit. The same firm also exhibit a small mill. Messrs. Fawcett, Preston, and Co., of Liverpool, are putting up a sugar mill of considerable size, but the proportions of the gearing and the journals of the shafts are likely to provoke some unfavourable criticisms. Messrs. Forrester and Co.'s exhibition of vacuum pans, on Rilleux's plan, will attract much attention. The elevated platform, being raised around these pans, will be a favourite resort for visitors, commanding, as it does, a view of the long vistas of the annexe. Overhead will be hung a fine peal of Russian bells, wherewith the visitors will be "rung out" at the close of each day's exhibition. Messrs. Manlove, Alliott, and Co., near Nottingham, exhibit several centrifugal sugar-purifying machines, embracing the patent of Mr. Finzel, the eminent sugar refiner of Bristol. It is to be hoped that the expeditious mode of draining the molasses and syrup from sugar, effected by these machines, will at last be introduced into the general practice of the London sugar refiners, as it already is in that of the great Bristol and Greenock houses.

In hydraulic machinery the centrifugal pumps of Appold, and Gwynne and Co., the former made by Messrs. Easton, Amos, and Son, will attract a good share of attention. Messrs. Williamson Brothers, of Kendel, also send a turbine on Thomson's inward flow or vortex plan.

The display of wood working machinery is already very complete. Besides a number of machines from Messrs. S. Worssam and Co., Messrs. Powis, James, and Co., Greenwood and Batley, J. and T. Young (of Ayr), and John McDowall and Son (of Johnstone), have their machinery apparently in readiness to begin work.

Messrs. Powis, James, and Co.'s list is exceedingly full, including most of the tools for which this firm have acquired so extensive a reputation. It is a pity that this machinery, and all the rest of like purpose, will not be worked before the visitors to the Exhibition.

The paper-making machinery — two large Fourdriniers — from Messrs. Bryan, Donkin, and Co., of Bermondsey, and Mr. Bertram, of Edinburgh, shows conspicuously near the centre of the annexe. Near by is a quantity of printing machinery from Messrs. David Napier and Sons, and other makers.

We should not forget to notice here a high and low pressure engine by Messrs. Walter May and Co., of Birmingham, upon a plan which, if it be not altogether new, we have not seen before. In most, if not all compound engines, the high and low pressure pistons make their strokes simultaneously, either in the same or in opposite directions, and hence, in order to apply the power through cranks at right angles to each other, four cylinders must be employed. In a few compound engines, perhaps, the cranks are placed at right angles, the high pressure cylinder exhausting its steam, when its piston is at half stroke, into the low pressure cylinder, but here the use of compound cylinders is attended with little or no advantage. In Messrs. May and Co.'s engine, however, the cranks are not only placed at right angles, but the high pressure cylinder exhausts into a receiver below, and which is well clothed to prevent loss by the radiation of heat, and from this receiver steam is admitted at the right moment to the low pressure cylinder. Thus all the advantages of a compound engine with two cylinders, and with the advantage of having the cranks at right angles to each other.

The foreign department of the annexe does not appear to be as advanced as the British portion. Besides the machinery already noted, M. Quillacq of Anzin, has a large horizontal double cylinder winding engine set up. The work is in keeping with the purpose, and the stroke of piston is long. There is not a particle of elegance, however, in the design. MM. Farcot et Fils also exhibit a large horizontal steam engine with their arrangement for regulating the expansion by means of the governor.

The safety of the western annexe, which was at one time extremely doubtful, has been partially secured by propping up the building on the western side. The rickety supports of the roof, which has no tie rods to resist the outward thrust, are 28ft. high, and many of them were at one time 13in. out of plumb: some indeed were 16in. out. The props since put up have brought back the uprights by about 1½in. and it is hoped that the building may stand until the Exhibition is over. At the same time it need not excite any surprise to hear any day that the whole affair has tumbled to the ground, with the loss perhaps of several lives. The Commissioners really owe it to the public to consult some one besides Captain Fowke in this matter, unless that officer is willing to sink his pride of authority by coming forward with some plan of strengthening the roofs, of at least the western annexe. The wooden floors are generally of the most trumpery description, and, in the eastern annexe at least, they have been crushed in, in innumerable places, in getting in the heavy loads of machinery.

The supply of steam power in the western annexe will be less, we believe, than Mr. Clark and the exhibitors will desire. There are six Cornish boilers, made by Messrs. Hick and Sons, of Bolton, each boiler being 6½ft. in diameter, 30ft. long, and containing two flues, each 2½ft. in diameter. The chimney is low, and the draught must therefore be moderate, but, by working the whole, it may be that steam, equal to 500 indicated horse-power, may be obtained. Whether this will suffice for all who require steam, and at the same time allow for the inevitable loss by condensation, in over half a mile of mains, ranging from 15in. down to 8in. in diameter, with no end of service pipes, remains to be seen. Mr. Clark has already provided an ingenious apparatus for taking off the condensed steam under pressure, and also in the exhaust mains, so as to keep them clear.

In the eastern annexe the makers of agricultural machinery are represented on a most extensive scale. Messrs. Barrett, Exall, and Andrewes, Clayton, Shuttleworth, and Co., Richard Garrett and Sons, Ransomes and Sims, Aveling and Porter, Mr. John Fowler, jun., Mr. Charles Burrell, and others have a very large amount of machinery, and a great many implements already in place. In most cases the larger exhibitors have erected handsome verandah-like structures, with staircases leading to the top, on which a portion of the objects exhibited are arranged, the others, and generally the heavier articles, being placed below. Messrs. Clayton, Shuttleworth, and Co. exhibit a double cylinder portable engine, with self propelling gear and separate two wheel tender, but the whole plan is marked by grave faults of arrangement and proportion, and illustrates how those who have attained the greatest success in one particular line may fail in any considerable departure from their accustomed practice. Unless the exhibitors should conclude, as we would recommend them to do, to remove this engine from the Exhibition, we shall have an early occasion to criticise it in detail. The display by the same firm, of engines of the well-known Stamp End pattern, is very creditable.

Messrs. Ransomes and Sims exhibit portable engines both with and without Biddell and Balk's patent boiler, an arrangement which allows of the removal, *en masse*, of the firebox and tubes from the cylindrical barrel. These makers have recognised the merits of single cylinder engines, as all other builders must ultimately do, but they (Messrs. R. and S.) have placed their bell-crank half way between two bearings which are at a very great distance apart. Their contributions are generally excellent however.

Mr. Burrell sends a Boydell traction engine, which is the most elaborate, and, apparently, lavishly constructed example of that invention yet seen. The wrought iron driving wheels are wonders in the way of the smith's art, and the whole finish is much beyond the average for this class of engines.

Mr. Aveling, or, rather, Messrs. Aveling and Porter's, self-propelling engine, which run into the Exhibition, with its own steam, on Monday, is one of the most workmanlike examples of this class of construction in the building. The pitch chain driving gear may be to some extent objectionable, but there are means for taking up the wear, and altogether we should prefer it to spur gearing. When, as is likely to be the case, all traction and self-propelling engines are provided with springs, the pitch chain will probably be found the best driving gear.

Messrs. Williamson, Wright, and Co., of Boston, send a portable engine, the fire-box stay-bolts of which average upwards of 9in. from centre to centre.

Class 10 occupies a considerable amount of space in the main building, and already a number of large models, including one of the Boyne viaduct, the Clifton suspension-bridge, &c., are in place. Mr. Vignoles exhibits a large topographical model of one of the Spanish railways, of which he is engineer; and Messrs. Rennie will exhibit a model of the great floating dry dock which they are constructing for the Spanish Government.

The contributions of ordnance from the Royal Gun Factory, Woolwich Arsenal, from the Elswick Ordnance Company, the Mersey Iron and Steel Company, Messrs. Fawcett, Preston, and Co., and others, are very numerous, and must be noticed separately next week. So, too, we must defer till then a notice of the exhibition of steel and heavy ironwork, which promises to be unusually large and important. We may only mention here that Messrs. Naylor, Vickers, and Co., Messrs. Cammell and Co., Messrs. Shortridge, Howell, and Co., Messrs. Bessemer and Co., and others are sending wonders in the way of steel making, and we believe that their productions will divide attention with the choicest works of art in the building.

PULL ARMSTRONG, PULL ADMIRALTY.

A PROBABLE CHRONOLOGY, BY "MR. PUNCH."

1860. Mr. Armstrong, of Newcastle-upon-Tyne, invents Rifled Ordnance that will knock any ship to pieces. He is knighted and the Admiralty is benighted.

1861. The Admiralty recovers, and invents iron ships that resist any known cannon-balls.

1862. Sir William Armstrong invents a gun that smashes the Iron Ships into blacksmithereens. The Admiralty collapses.

1863. The Admiralty re-expands and invents Platina Ships fastened with diamond cement, and Sir William Armstrong's balls fly to pieces like bon-bons.

Mr. Gladstone doubles the Income Tax.

1864. Sir William Armstrong invents Brazen Thunderbolts (supposed to be the original Jupiters), and in a pleasing experiment sends the greater part of the British fleet to the bottom of the sea.

1865. The Admiralty invents Torpedo vessels which sail under water and below any range of guns. Sir William Armstrong tears his hair and swears in the Newcastle dialect.

1866. Sir William Armstrong invents a Vertical gun that discharges Greek fire straight down, and a second time he destroys the greater part of the British fleet. The Lords of the Admiralty are about to hang themselves, when a thought strikes them, and they don't.

Mr. Gladstone again doubles the Income-Ta

1867. Dr. Cumming, who has for some weeks en having in his coals by the sack only, suddenly proclaims the Millennium. As there is now to be peace everywhere, the Admiralty does not invent anything, but waits to see.

In order to test Dr. Cumming's veracity, and to find out whether lions will lie down with kids, the Zoological Society (against the advice of their excellent Secretary, Mr. Sclater) lets loose their biggest lion while a charity school is in the Gardens. As the lion, instead of lying down with a kid, only lies down to digest him, the Admiralty thinks there is some mistake somewhere, and determines to invent a new fleet.

Mr. Gladstone once more doubles the Income-Tax.

1868. The Admiralty invents a Stone Fleet, with cork keels, and defies Sir William Armstrong.

1869. Sir William Armstrong invents the Hannibal, or Alp-Shell, which contains the strongest vinegar, and melts the Stone ships. Having for the third time destroyed the British Fleet, he is raised to the peerage as Lord Bomb.

1870. The Admiralty invents an Aerial Fleet, which sails in the clouds, out of shot range, and the First Lord takes a double sight at Sir William Armstrong.

Mr. Gladstone a fourth time doubles the Income-Tax.

1871. Lord Bomb invents a Balloon battering-train, and in an experimental discharge brings down all the British fleet into the German ocean.

1872. The Admiralty, in desperation, invents a Subterranean Fleet, which is to be conveyed by tunnels to all the Colonies, but Mr. Gladstone blandly suggests that as everybody now pays twice his income in taxes the people may object to further imposts unless some proof of economy is given.

Government therefore stop the pensions of a hundred superannuated clerks, discharge some extra night-porters at the Treasury, and bring in Estimates for the Subterranean Fleet.

1873. Lord Bomb invents his Typhœons, or Earthquake Shells, and suffocates the British Fleet in the Tasmania Tunnel.

Mr. Gladstone a fifth time doubles the Income-Tax.

1874. The Emperor of the French proclaims the Millenium, which of course immediately occurs, no more war ships are wanted, and the collectors remit the quarter's Income-Tax not yet due. Lord Bomb invents his Volcano Fireworks in honour of the occasion, and by some accident burns up the Public.

LAW INTELLIGENCE.

COURT OF CHANCERY.—Lincoln's Inn, April 16th.

(*Before the* Lord Chancellor).

HILLS *v.* THE LIVERPOOL UNITED GASLIGHT COMPANY.

This was an appeal from an order of Vice-Chancellor Wood, granting an injunction to restrain the defendants from making use of the plaintiff's invention comprised in his letters patent, dated November, 1849, for purifying gas. It will be recollected that the question of infringement of Mr. Hills' patent by different persons has been for years before the various courts of law and equity, and resulted generally in establishing its validity. The effect of the injunction in the present case is to inhibit the defendants from making use of a certain natural oxide of iron, and from renovating or re-oxidising such purifying material used by them for purifying gas, whether the same be or not a precipitated or hydrated oxide of iron, by the action of the air, whenever such materials from time to time cease to absorb sulphuretted hydrogen, so that they may be used over and over again to purify gas.

Sir H. Cairns and Mr. Druce, for the defendants appealing, contended that it was an attempt on behalf of the plaintiff to extend his patent so as to include within it the use of native or natural oxides, whereas all the previous legal decisions establishing his patent were based upon the hypothesis that it embraced artificial oxides alone.

Mr. Rolt, Mr. Grove (of the common law bar), and Mr. Marten appeared for the plaintiff in support of the order of the court below, and urged that "native oxides" were within the spirit of the specification, and consequently the use of them by the defendants was an infringement of the letters patent.

The case was not concluded.

The Westminster Bridge-road Tramway Case.—We have frequently had occasion to call attention to the tramways recently put down in some of the streets of London by Mr. Train. We have regarded them as public benefits, and such we believe is the opinion of a vast majority of the inhabitants of the metropolis. But Mr. Train has been singularly unfortunate; in fact he has not had fair play. He has not been permitted to carry out his plans and extend the benefits his trams would confer on society. At Bayswater he was defeated by an aristocratic clique. In Victoria-street he was the victim of local prejudice, and in Kennington-road he had been checkmated by an obstinate and impatient jury. Being present at the trial at Kingston we can speak from practical knowledge. Mr. Train and several of the Lambeth vestrymen were indicted for causing a nuisance by the Lambeth tramway. Several witnesses were examined for the prosecution, and before a single witness was called, or a single word was said on behalf of the defendents, the jury interrupted the trial, and said they were perfectly satisfied the defendants were guilty. Possibly they might have come to the same conclusion had they heard what could have been said on the other side; but the very least they could have done was to have let the trial take its ordinary course, and decide according to the evidence. But they exhibited an indecent haste. "Strike but hear," is a motto as old as the hills. The Kingston jury were determined to strike without hearing; and, if one of their number is to be believed, they made up their minds before they came into court. If so, they were untrue to their oaths, wherein they undertook to decide not in obedience to preconceived notions, but according to the evidence. We are surprised at the unusual and unfair course taken by the jury, and we are equally surprised at the judge permitting such a farce to be enacted in a British court of law. The counsel for the defendants stated that they were prepared to submit overwhelming evidence to prove that the Lambeth tramway was almost universally appreciated, and that thousands every week participated in the benefits it conferred; and that, instead of being a nuisance, it was a public convenience. But the jury were deaf to everything but their own prejudices and one-sided opinion. Hence justice miscarried in their hands. We hope for the sake of fair play and the character of Englishmen that the defendants will have the right of appeal to a higher court.—*Mechanics' Magazine.*

INSTITUTION OF CIVIL ENGINEERS.

April 1, 1862.

John Hawkshaw, Esq., President, in the chair.

The first paper read was "On Railway Accidents—their Causes and Means of Prevention, Showing the Bearing which Existing Legislation has upon them." By Mr. James Brunlees, M. Inst. C.E.

The author proposed to treat the subject by dealing with the facts as they were, the causes of accidents being, in nearly all cases, sufficiently apparent; he would not, therefore, attempt by theory to establish rules for their prevention. From the reports of the officers of the Board of Trade it appeared that, during the seven years from 1854 to 1860, the number of accidents amounted to 540, as the result of 1,274 distinct causes. Of these accidents 11 per cent. were attributed to the permanent way, 7 per cent. to the rolling stock, and 76 per cent. to the management, including insufficient means for securing safety, leaving only 6 per cent. as not ascertained.

The accidents due to the permanent way were then referred to in detail, and it appeared that the general defects were most evident in the system of ballasting, of joint-fishing, of turning the rails, and of fastening the chairs to the sleepers. With regard to the ballast, it was argued that it would be found economical to have at least 6in. or 9in. of rough gravel or broken stone as a free draining bed to the sleepers and to the "top-dressing;" and that during the months of September and October an extra number of men should be employed to drain the ballast and beat up the road, in order that it might become consolidated before the winter's rains and frost set in, and thus avoid the evil effects of frost on wet ballast. It was urged that the plan now in general use of placing the fish-joint between two sleepers was objectionable, as the ends of the rails were unsupported except by the fish-plates, which together were frequently only equal to two-thirds of the section of the rail. It was submitted that all the joints should be fished directly over a sleeper, or that a bracket chair should be used. The practice of turning the rails was condemned, because when a rail was so much worn as to require turning its strength was generally so reduced as to render it unfit for main line traffic. With regard to the fastening of the chairs to the sleepers, it was urged that it was desirable that iron spikes only should be employed on the outer side of curves, or else that the chair should be partially sunk into the sleeper, to lessen the strain on the treenail. The superior economy of steeled, or partially steeled, rails, points, and crossings was also incidentally noticed.

In reference to the accidents which had arisen from defective or neglected rolling stock it was found that many of the fractures had occurred during the winter months, owing, possibly, in some degree to the rigid state of the "way" in frosty weather; whilst others were due to the use of bad iron, and some to defects either in the welding of, or in the mode of attaching the tyres of the wheels. Steel, or partially steeled, tyres, were now, to a certain extent, in use, and tyres formed of a continuous ring, or unwelded piece of metal, were also successfully employed. Several new methods of fastening the tyres had proved as fruitful of mischief as the ordinary plan of simply sinking them on, though others had been found to be efficient; and it was said that on some lines the tyres had not failed to any great extent. The author hoped that the importance both of the tyres and of the axles of wheels would lead to a useful discussion on this branch of the subject. The usual want of uniformity in the main features of the carriage portion of the rolling stock was then commented upon: and it was considered that this variety not only increased the cost of manufacture and of maintenance, but was often the cause of accidents, and frequently contributed to render them disastrous. The author thought that the carriages should be nearly uniform in size, and that the buffers should, in all cases, be the same height above the rails. The longitudinal beams should be in the same line throughout, be strong in themselves, and the framing securely braced. The present coupling in the centre should be increased in strength, and the whole attachment between the carriages should be such as to render a train in effect, as far as practicable, as one carriage, with a certain amount of flexibility; so that, in the event of a collision, the carriages should retain their position, instead of rising one upon another; and if an axle or wheel broke the crippled carriage should be partially borne up by the neighbouring carriages until the train could be stopped.

On the question of management, after some remarks upon the speed of trains, it was shown that by punctuality, both in the time of starting and in the rate of running, safety, so far as human foresight was concerned, was ensured. The system of working the traffic of a railway by allowing an interval of time between the trains was deemed unsatisfactory, and far inferior to the system of an interval of space. The accidents arising from the irregularity of excursion trains were then alluded to, and it was remarked that if, during the summer and autumn, the ordinary trains were run at lower rates of fares, the traffic would be increased, as the public would feel greater security in travelling. The difficulty in running coal or mineral trains to a fixed time-table might be met by a more general use of the electric telegraph, and by a better system of signalling arrangements. During the seven years, from 1854 to 1860 inclusive, eighty-eight accidents happened from inefficient signals, of which fourteen occurred in 1860. In some cases, especially at sidings, there were no signals; in others they were defective in form, or were improperly placed. It was desirable that junction signals and points should be worked simultaneously by one man, and at junctions separate main and distance signals should be provided for each line. If the system of working the traffic by the electric telegraph was generally adopted, and the line was divided into sections, so that a train should be prevented from entering any section until the preceding one had passed to the section in advance, collisions would be impossible, except those liable to arise from disregard of the signals, and a proper interval would be secured between the trains, in spite of unpunctuality. As the want of a means of communication between the engine driver and the guard or conductor had frequently been experienced, and as plans were in daily use on several lines, there was no reason why it should not be adopted on all. To render it fully effective the guard or conductor ought to start the train from each station by means of that machinery, so as to prove that it was in working order. Owing to the general high speeds and heavy trains it was of the utmost importance that ample brake power, capable of being applied in the least time, should be provided with each train. It was a question how far a regularly distributed retarding force, acting at the same moment on all the wheels, might not be preferable to a concentrated force applied at particular points. By the system of "continuous brakes" the employment of several men with each train was unnecessary. It had also another advantage, that a train was more under control, and could be stopped in a shorter distance. The negligence of servants, arising from their ignorance or inefficiency, was next adverted to, and it was thought to be due to the pay being too low to command the services of men of intelligence, steadiness, and self-reliance. Frequently they were insufficient in number, leading to overwork, and instances were on record in which engine drivers had been employed for seventeen hours daily, and in some cases for twenty-six and thirty hours continuously.

The author proposed leaving the bearing of existing legislation upon railways to be dealt with by Captain Douglas Galton. He would, however, observe that Government interference was not likely to render railways safer, or more available to the traveller; and that it would be better to rely on the consideration and calm reflection of those immediately interested in these enterprises, especially as from the heavy expenses attendant on accidents directors and shareholders would naturally desire to render this mode of travelling as safe as possible.

The second paper read was on "Railway Accidents," by Captain Douglas Galton, R.E., F.R.S., Assoc. Inst. C.E.

It was stated that the length of railway communication opened in the British Isles at the end of 1860 was 10,433 miles, upon which 163,435,678 passengers were conveyed in that year. From official returns it appeared that, during the seven years ending the 31st December, 1860, there were 116 passengers killed, and 2,832 injured from causes beyond their own control. From the sums paid by railway companies for compensation, it was calculated that an insurance of one twenty-fourth part of a farthing per passenger per mile would, on the average of all lines, cover the cost of railway accidents. It had been found impossible to obtain reliable information as to the number of coach accidents in this country. But the returns of the "Messageries Impériales" showed that, in a series of years, the number of passengers killed and injured, from causes beyond their own control, was 1 in 28,000. From the latest comparative returns the number of passengers killed and injured was on British railways 1 in 334,000, on Belgian railways 1 in 1,600,000, on Prussian railways 1 in 3,000,000, and on French railways 1 in 4,000,000. The greater comparative safety of foreign railways was traced to differences in the conditions of the traffic and of the management, as well as in the habits of the people.

In endeavouring to elucidate the question, whether any of the accidents which had occurred could have been prevented by reasonable precautions, the first point which arose was, the extent to which the amount of traffic on the several lines influenced the number of accidents. The general averages thus obtained showed that lines of small traffic were comparatively safe. But, as traffic alone did not determine the number of accidents, it was necessary to analyse the causes in detail; taking, first, those which could not be guarded against, and secondly, those which were within the control of the managing, or working staff. During the seven years before referred to 534 accidents to trains had been reported upon by the inspecting officers of the Board of Trade, in which 2,912 passengers were killed or injured. In many of these cases there had been more than one contributing cause, but the majority might be thus tabulated:—

	Number of accidents reported upon.	Number of sufferers.	Cases in which the accidents could not be guarded against.	Cases in which the accidents were due to causes within the control of the management.		
				Attributable to the works or rolling stock.	Attributable to the system of working.	Negligence of inferior servants.
Accidents from engines and carriages leaving the rails, or fractures of machinery	135	313	59	98	15	17
Collisions of every description	319	2,532	16	222	219	183

These figures showed that a large proportion of the so-called accidents were due to preventible causes. Those arising from the fracture of axles and tyres, and from engines and carriages leaving the rails, were less than one-half of the number which could not have been guarded against. But out of 319 collisions, only 16 were attributable to purely accidental causes, while 183 were assigned to the negligence of inferior servants, and 120 to the manner in which the traffic was conducted, and which ought not therefore, to have occurred.

With regard to the first class of cases, accidents which could not have been guarded against, the author remarked, that the best form of tyre for a railway wheel had not yet been definitely settled. The wheels and axles could scarcely be said to be mechanically satisfactory; the form of brake in use was also imperfect. Although simple negligence could not be entirely prevented, yet in several cases the negligence had been attributable to the defective arrangement of the company, in permitting pointsmen and engine-drivers to be habitually over-worked. Those accidents which arose from trains passing on to a wrong line through facing-points might not have occurred if an indicator had been attached to the points, to show in which direction they were set. The comparatively small number of accidents from negligence alone afforded strong evidence of the efficacy of the direct responsibility of the inferior servants. A few instances were then cursorily alluded to in illustration of those accidents which were wholly or partially attributed to defects in the condition of the railway, or the vehicles, or to the absence of the requisite auxiliaries to safety, such as signals, brakes, &c. It was observed that it was not for want of good rules that accidents occurred, but for want of a continued enforcement of those rules, and a close examination into the details of the manner in which the traffic was worked.

The discussions which had taken place on this subject in Parliament, both in 1853, and again in 1857, were then considered, and the conclusion was arrived at that freedom from railway accidents was not to be obtained by Government interference, but by an effective and responsible internal management, which would enforce the greatest punctuality and care in working the traffic, and maintain the strictest discipline amongst the servants employed.

The existing law affecting railway companies as carriers was then alluded to; and attention was next called to the principle of compensation for injuries sustained, Lord Campbell's Act being specially cited as the Parliamentary recognition of that principle. It was said that this Act removed a technical difficulty in the way of recovering compensation, rather than gave a new right to compensation. The money payment thus provided operated as a punishment, and tended to prevent the commission of careless acts. Compensation might, therefore, be looked upon partly as a penalty upon the company for its corporate carelessness, and partly as a remedy to the sufferer for the injury received. If viewed as a remedy it should be such as to tend to prevent a recurrence of the act for which punishment was awarded. It should, therefore, depend on the degree of blame which attached to the management for the accident, and it should be equally certain and just in its operation. In its aspect as a remedy it should be easily recoverable by the sufferer. As at present levied it did not properly fulfil either of these conditions, for reasons which were stated. Assuming that such a maximum amount was fixed upon as would fairly compensate the generality of passengers, according to the class in which they were travelling; and assuming that it were made payable in the case of every accident which occurred, beyond the control of the passengers, without there being any obligation to prove negligence, the author was inclined to think that the fine would be rendered more certain in its operation, but that as a preventive the effect of the alteration would not be appreciable. The true remedy against railway accidents lay, in the author's opinion, with the railway companies themselves. Improved management would be greatly assisted by placing at the head of each railway a director of adequate capacity, responsible to the board for the management of the concern, who should be required to devote the whole of his time to its interests, and be paid in proportion; by giving the chief officers of the railway control of, and making them responsible for, the several departments, so that they might be held answerable for the results; and by providing a gradation of responsibility throughout all the employés. Improvements in the machinery and system of working might be promoted by the formation of an association amongst railway companies embracing the objects of the association between the German railway companies, and of the association between manufacturers, near Manchester, for the prevention of boiler explosions. It was doubtful, however, whether such an association could become of any practical utility in this country, unless it assumed the form of an association for the purpose of mutual insurance against accidents, managed by a board of railway officials chosen from the associated companies.

Russian Machinery in the Exhibition.—There will, we understand, be a display of Russian machinery in the approaching Exhibition. It is a curious fact, however, that nearly the whole of it is the production of English workmen living in Russia. The great Russian gun factory is carried on under the mechanical management of an Englishman, and our countrymen are to be found scattered throughout all parts, indeed, of the vast Russian empire.

SOUTH WALES INSTITUTE OF ENGINEERS.

A quarterly general meeting of the members of this valuable scientific institution was held in the Town Hall, Cardiff, on Wednesday last. The president of the association, Wm. Adams, Esq., of Ebbw Vale, presided, and amongst those present we observed Lionel Brough, Esq., Government Inspector of Coal Mines for the West of England district; Thos. Evans, Esq., the Government Inspector for South Wales; Messrs Christopher James, Merthyr; Richard Beddlington, Rhymney; H. Moxham, Swansea; — Hewett, Coal Pit Heath, Bristol; P. P. P. James, Ebbw Vale; John Cox, Ebbw Vale; E. Brigden, Dowlais; — Martin, Dowlais; M. Lee, J. Williams, D. E. Steel, Newport; — Allen, J. E. Bevan, W. Child, G. W. Adams, Ebbw Vale; Alex. Bassett, Cardiff; — Nixon, Wireworks, Cardiff; — Peter, Ely; — Nasmyth, Aberdare; J. Fisher, Ystalyfera; — Trick, Yniscedwyn; — Tomlinson, Taff Vale Railway; — Thomas, Forest of Dean; — Trotter, &c. &c.

Mr. Bassett exhibited thirty-six specimens of wrought iron from Staffordshire, manufactured at the works of Lord Dudley. The room was also hung with diagrams, sections, &c., in explanation of the various papers.

The secretary, Mr. E. Williams, having read the minutes of the last meeting, which were duly confirmed.

The president said that the officers who went out of office during the ensuing year were himself, as president, Mr. Menelaus and Mr. Thomas Evans, as vice-presidents, and the members of the council, most or all of whom were eligible for re-election. The members of the council were unanimous in recommending that Mr. Thomas Evans, the Government Inspector of Coal Mines for this district, should be appointed the president for the ensuing year, and he would now propose that such an appointment be made.

Mr. Cox seconded the resolution, and Mr. Evans was then unanimously nominated the president, observing that the appointment would be made at the next meeting.

Mr. Beddlington proposed that Mr. Menelaus and Mr. Adams (the retiring president) be elected vice-presidents.

Mr. C. James seconded, and the resolution was passed.

Various members then proposed the following as the council for the ensuing year:—Alexander Bassett, George Martin, Greenwell, Levic, R. H. Rhys, David Roberts, R. Cox, and R. Beddlington Kirkhouse. Carried unanimously.

Upon the motion of the president Mr. E. Williams and Mr. E. Brigden were unanimously re-elected secretary and treasurer, and a cordial vote of thanks awarded them for their active exertions in promoting the interests of the institute during the past year.

The following gentlemen were then declared duly elected by vote as new members of the association:—Messrs. Frederick Davies, Aberdare; W. Child, Dowlais; J. E. Williams, Newport; W. H. Thomas, Swansea; and W. T. Lewis, Aberdare.

A paper by Mr. Cope Pearce on the Motion of Valves in Steam Engines (being in connection with that by Mr. R. Schmidt on Professor Zeuner's diagram for showing the motion of the slide valve) was next read. It was a well written paper, but of a purely technical character, and would not be understood unless accompanied by the diagrams. At its conclusion Mr. D. E. Steel said the paper was of too intricate a nature to be at once discussed, and it was, therefore, ordered to be printed, and both papers will be discussed at the next meeting.

THE SANITARY CONDITION OF MINES.

The valuable paper written by Mr. Mark Fryar, F.G.S., of Glasgow, upon this subject was next discussed. Mr. Fryar observes:—"The greatest of all blessings that man can enjoy in this world is that of perfect health; and whoever may devise means by which the health of a community shall be in any way improved must be looked upon as a benefactor of his race, and an instrument in the hands of the Almighty for the benefit and comfort of his creatures. The animal system of man is a most wonderful and strangely complex piece of mechanism, the order and healthy action of which depends upon the observance of certain laws, which laws are exceedingly simple, and suggested, in most cases, by instinct, the operation of natural desire, or absolute requirement. The violation of any one of these natural laws is sure to be productive of evil. No man has an absolute right to deal with his health according to his own will and pleasure. Our social bonds unite us so closely together that we cannot injure ourselves without injuring others; and the civil law of the kingdom very justly interferes with all projects and processes in the arts and industrial pursuits which necessarily endanger life, or are productive of ill health and premature death. The extent, however, to which such interference should be carried is a very grave question, affecting, as it does, not only political freedom and the just liberty of individuals, but also the full scope of productive and manufacturing skill and enterprise Not only is it the duty of every man to be careful of his own health and life, but he must be equally solicitous respecting the health and safety of his fellow man. There are some thousands of workmen employed in mining and other occupations in this country and the world who are daily exposed to dangers — to unhealthy fumes and vapours, deleterious gases, and atmospheres which, from various causes, are charged with insidious diseases, making life but a lingering death, and yet the workmen themselves are comparatively unaware of their own condition in this respect. There are special branches of industry and art in the pursuit of which the individuals occupied therein are exposed to what promotes discase and very materially shortens life, and from which the rest of mankind are exempt; but many of the evils are irremediable, and there must always be a class of men who are willing to sacrifice part of the years allotted to man that they may pursue a trade or calling of their liking, or society must dispense with some of its present conveniences and luxuries. It is, nevertheless, true that by care and skill the sanitary arrangements, even in places where deleterious operations cannot be avoided, may be considerably improved; and everything that can be done, by way of mitigating such an evil, surely ought to be done. . . . . The composition of the atmosphere, when in its normal condition of purity, and therefore best adapted for the requirements of life, has been ascertained to be, per 1,000 parts, 788 nitrogen, 197 oxygen, 16 moisture, and 1 carbonic acid gas. A consideration of the process of respiration will enable us more clearly to understand the ill effects of breathing in a vitiated atmosphere. The number of respirations, or alternate breathings, is about twenty per minute under ordinary muscular activity, and the average quantity of air inhaled about 30 cubic inches per minute. It has been discovered that the taller a man is the greater is the vital capacity of his lungs for air. . . . . In coal-mines there is, generally speaking, a much larger amount of deleterious gas produced than in metalliferous mines. Every crevice, opening, or pore met with in rocks during the process of mining is likely to be full of gases of some kind. In coal-mines these gases are chiefly carbonic acid, carburetted hydrogen, and nitrogen, the presence of the latter proving that the coal, while in its natural position of a bed or seam, is undergoing decomposition. Carbonic acid gas is also produced by the breathing of animals, the burning of lamps, and the decaying of timber; and Dr. Snow has shown that carbonic acid "acts more deleteriously upon the system in proportion as the normal quantity of oxygen has been reduced." The writer then traces the effects of breathing the impure atmosphere of mines, and concludes this part of his subject by saying, "A pretty expensive acquaintance with the most prevailing diseases among miners convinces me of the truth of the following, viz., that there are very few young men above the age of 25 who are quite free from pectoral disease in some shape or other, and above the age of 35 there are not 10 per cent. who do not suffer more or less from asthmatic disease. Above the age of 40 almost all miners are the subjects of chronic bronchitis and asthma; and at this age they generally bear the unmistakeable marks of premature old age, and for the most part are unfit for engaging in any severe manual occupation." As a remedy in connection with good ventilation, restriction should be placed upon the hours of labour in the pit, and the adoption of more stringent measures as to the age at which boys are allowed to work underground; for it was a notorious fact that in some districts boys

were at work in the mines at eight years of age! We cannot, however, dispense with any of the commercial activity and prosperity—the political power or domestic comforts—which arise from our mineral possessions, and we cannot therefore dispense with the miners; so that, if the sanitary condition of their subterranean workshops does not admit of improvement, the least said about it the better. "Where ignorance is bliss 'twere folly to be wise." But mines can be properly ventilated. In the report of evidence given before a Committee of the House of Commons, in 1842, it is said a mine, when properly ventilated and drained, and when both the main and side passages are tolerably high, is not only not unhealthy, but the temperature being moderate and uniform, is considered as a place of work more salubrious and even agreeable than those in which many kinds of labour are carried on above ground." The laws of ventilation are very simple, and of easy application. We have seen that a man actually requires about 300 cubic inches of air per minute to maintain vital energy; but seeing that the due supply of air to the working places in mines depends upon so many contingencies, and that so many causes are in operation by which the air is made impure, it is considered that from 50 to 100 cubic feet of air per minute is the least amount that should be supplied to each man in the underground places of a mine. Badly ventilated mines are most intolerably stupid means of making interest out of invested capital. Mr. Woodhouse, the eminent mining engineer of Overseal, Leicestershire, who has had large experience in the ventilation of coal mines, says, "A large saving is invariably realised in practice from the adoption of improved modes of ventilation, because the constant introduction of fresh currents of atmospheric air into the pits tends in a remarkable degree to protect the woodwork of the mine, and to keep the roadways dry and in good order. In pits with a rapid circulation the men respire more freely, the roadways are kept dry and repaired at less expense, and the timber lasts longer by years; and, therefore, it is a matter of strict economy to ensure a good ventilation." The best ventilated mine is the best paying mine, or, at any rate, its profits are much greater by a good ventilation than it would be by a bad one. It saves the timber and the cost of maintaining the ways; it enables the men to perform a much greater amount of work in a given time; preserves the health of the miner, and thereby adds to his comfort and to the number of his days in the world.

(To be concluded next week.)

THE *TIMES* (IN 1851) ON PATENTS.

"When it is said that a privilege of this nature is unjust we suppose that what is meant to be asserted is that the community generally is injured thereby; that invention is by this means retarded in place of being promoted; that, in short, an inventor would be more likely to undertake the labour of discovery, if he knew that he must rely wholly upon his own ingenuity for the protection of his secret, than if he was aware that the law would endeavour to aid him in the maintenance of his peculiar privilege. If this be so we admit at once that the opponents of a patent law are in the right. But what reason have we to believe in the truth of this assertion? What circumstances in support of it are adduced by those who make it? We are not speaking of those persons—rare, indeed, in every sense of the term—who seek for no other reward than the pleasure of discovery, and the contemplation of the benefit it will confer on their fellows. The law is not made for such men, neither does its existence interfere with them or their mode of proceeding. They give their inventions to the world, and have their reward in the admiration and gratitude of mankind. The law, however, regards those who wish to derive a pecuniary benefit from the result of their labour, inquiry, and ingenuity; and we ask what such men would do supposing no law existed by which they could secure a property in that which they had discovered? The answer is obvious; they would endeavour to keep their process a secret, and in those cases in which secrecy is impossible they would have no motive to go through the trouble and expense of discovery. Where secrecy might be possible we should find the new process fenced round by every mystery and mystification which the ingenuity of the discoverer could devise. Secrecy would be enforced on workmen, as far as possible, by keeping them in ignorance; and when this became no longer feasible the sanction of oaths would be employed to that end. A state of most painful suspicion and restraint would be the condition of everyone who was in possession of an invention, and of all whom he employed. A more mischievous, as well as a more disagreeable condition, can hardly be conceived. The necessary uncertainty of success, after every precaution taken, the suffering and expense attendant upon all such endeavours, would prove a heavy counterpoise to all expected benefit from the invention. Thus, under this system of no privilege, a large class of discoveries would be wholly without protection, and the remainder would be most imperfectly, and with great labour and expense, guarded against unfair appropriation. On the other hand, putting aside for the moment any consideration of the difficulty attending the means of attaining such an end, let us ask what would be the effect of a promise made by society to every *bond fide* inventor that he should enjoy an exclusive property in his discovery for a limited period? If such exclusive property could be insured, if the right itself could be accurately defined and easily acquired, society would, in so far as depended upon the law, have done its utmost to foster a spirit of discovery, because thereby it would render certain such reward as the invention itself really deserved; and to itself society would not by this means do injury, for although there would be some delay in the full and universal enjoyment of the benefit, whatever it might be, resulting from the invention, yet, upon the whole, ultimately there would be a greater harvest of discovery than would accrue from a system by which no reward was provided for him from whom the benefit came. With common men the common motives to exertion must be relied on, and society, by thus judiciously protecting private interests, would promote the general welfare."

Boring Rocks.—A rock-boring machine, invented by Capt. H. N. Penrice (late of the Royal Engineers), is now being worked by Messrs. Hawks, Crawshay, and Son, in the Claxton Quarry at Gateshead-upon-Tyne. It cuts a bore of 7½ft. in diameter at the rate of from 8in. to 13in. per hour. This is far in excess of what is being done by drilling, with compressed air and blasting, in the Mont Cenis Tunnel, and it is a much less costly operation. Immense power may be applied on the principle of this machine, and a much greater rate of progress than the above may be obtained. It is well worth the inspection of all contractors and mining engineers.

Steam Fire Engines.—On Wednesday afternoon a trial of the new steam fire engine, just completed by Messrs. Shand and Mason, of Blackfriars-road, was made at the distillery of Mr. Frederick Hodges, of Lambeth. A numerous assemblage, including the Duke of Sutherland, the Earl and Countess Caithness, &c., were present to witness the display. The steamer first tried was one made by Messrs. Shand and Mason, some time since, for the London Fire Brigade. With an 8¾in. cylinder and 9in. stroke a 1in. stream of water was thrown about 150ft. high. The new steamer of nearly the same dimensions was next tried with nearly the same results. In playing into a tank, the new steamer threw, through two 1in. jets, 470 gallons of water in 1m. 15 sec., equal to 376 gallons of water per minute. Mr. Hodges then manned his hand engine, weighing nearly 42 cwt., and threw a 1¼in. stream 190ft. horizontally. A large hand engine, made by the Messrs. Merryweather for the London and North-Western Railway, and having 9in. pumps, 9½in. stroke, was next manned by 50 men (among whom were his Grace the Duke of Sutherland and the Earl of Caithness), but the playing was rather short of Mr. Hodges' fine engine. A dinner at Mr. Hodges' private residence concluded the proceedings. The visitors were afterwards shown the handsome design for the decorations of the new fire engine making by Messrs. Merryweather and Son, of Long Acre, and about to be presented to Mr. Hodges by the residents of Lambeth. The beautiful designs of the engine were by Signor Casentini, of Hercules-buildings, Westminster-road, and were much admired.

GODWIN'S PUMPS.

FIG. 1

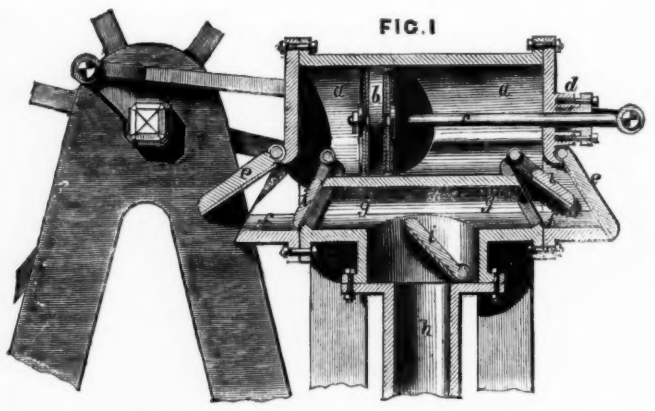
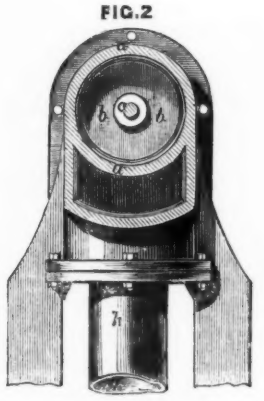


FIG. 2



This invention, by R. A. Godwin, of 151, Newport-street, Paradise-street, Lambeth, has for its object improvements in pumps. For this purpose a cylinder is employed mounted in a horizontal position, and having a piston fitted into it. Near each end of the cylinder a suction pipe enters it, passing through the side of the cylinder; each of these suction pipes is fitted with a valve opening into the cylinder. The ends of the cylinder are closed, and the piston rod is worked through a stuffing-box in one of the ends; and through the ends of the cylinders the exit passages are formed; these are fitted with valves opening outward; these valves are kept as low down as possible to allow the whole of the water the cylinder contains to run out.

Fig. 1 shows a vertical section of a pump constructed according to the invention; and Fig. 2 a transverse section of the pump barrel or cylinder and of one of the branch suction pipes.

a, *a*, is the barrel or cylinder of the pump, which is fixed in a horizontal position in a suitable framing; *b* is the piston, *c*, the piston rod, which works through a stuffing box *d* at one end of the barrel or cylinder of the pump. The openings through which the water passes into and from the pump barrel or cylinder are made at the lower side of and at the ends of the cylinder or barrel, as shown; *e*, *e*, are the outlet valves, which are hung, by preference, at their upper sides, and rest, when shut, on inclined seats formed at the outlets or openings *f*, *f*, of the barrel or cylinder of the pump, and such valves *e*, *e*, open outwards; *g*, *g*, are two branch suction pipes, which are connected to the descending suction pipe *h*, which has a retaining valve *j*, as shown; *i* *i*, are the two inlet valves in the branch suction pipes *g*; these valves are hung, by preference, at their upper parts, and they shut down on inclined seats parallel, or nearly so, with the seats of the outlet valves *e*, *e*.

SUCKOW AND HABEL'S MACHINERY FOR PRODUCING BLAST.

FIG. 1.

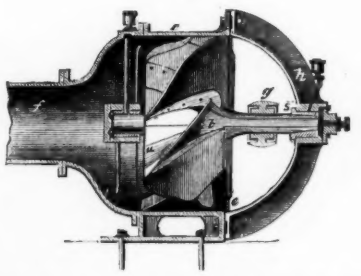


FIG. 2.

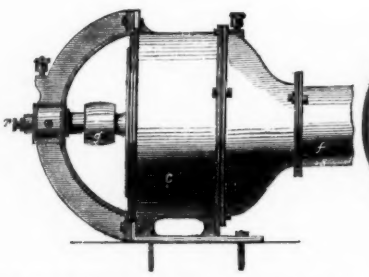
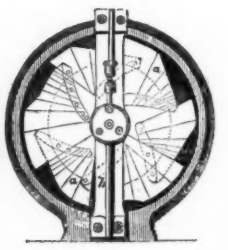


FIG. 3.



By this invention, by Edmund Suckow and Edward Habel, of Oldham, an archimedian screw is enclosed in a cylinder, and a rapid rotary motion given to it. The screw is composed of any number of blades, which are fixed to a conical disc, and have their outer edges revolving nearly at a right angle to projections or catch wings fixed to or forming part of the cylinder. When motion is given to the screw a strong blast or current of air is produced similar to that from an ordinary fan, but with a more powerful effect.

The invention is particularly applicable for obtaining a strong blast or current of air for compressing and exhausting air or gas, for lifting and forcing water and other fluids, and also for machinery or apparatus used for opening and cleaning fibrous materials, such as cotton openers, cotton gins, blowing machines, and similar apparatus.

Fig. 1 is a side section; Fig. 2, a side elevation; and Fig. 3 a front elevation of the arrangement for producing a strong blast or current of air.

The archimedian screw is made of any desired diameter and length, and caused to work in a vertical, horizontal, or angular position. The screw is represented at *a*, Figs. 1 and 3; its blades are fixed to a conical disc *b*, partly seen in Fig. 1. The said disc either forms part of the spindle, or is keyed upon it, as may be desired. The screw works in the interior of a cylinder marked *c*. On the inside of the cylinder, towards the exit end thereof, there are projecting ribs or catch wings *d*, which lessen the friction of the screw when revolving in air, gas, or fluid, prevent the return of the air or fluid, and cause a very powerful effect by the combination of the screw with the centrifugal force derived from the shape of the conical disc. At the front of the cylinder, or the end at which the air or fluids enter, there is a plate or ring, shown in section at *e*, Fig. 1, and externally in Fig. 2. This ring is for the purpose of lessening the opening, and preventing the back draught of air or return of fluid. The discharge pipe is shown at *f*, and the pulley for driving the screw at *g*. The spindle of the conical disc and screw of the blast apparatus works in the cross bars *h*, *i*, in the exhaust apparatus, in the cross bar and bearing *l*, and in the screw pumps in the bearings *m*.

TERRIBLE BOILER EXPLOSION.

At about a quarter-past 11 on Tuesday forenoon a boiler explosion happened at Priestfield, about two miles from Wolverhampton, which has occasioned the death of nineteen persons, and serious injuries to ten others, of whom two are not expected to recover.

Priestfield is the first station between Wolverhampton and Birmingham on the Great Western line. Among other ironworks at this place are those called the Millfield Works, now carried on by Mr. Thomas Rose, and belonging to the Birmingham Banking Company. They consist of two forges and three mills. One forge—the only one now at work—consists of twenty puddling furnaces, a shingling hammer for beating the dross from the balls of molten iron which are produced at the puddling furnaces, and a train of rolls for rolling the iron after it leaves the shingler's hammer into puddled bars, preparatory to its being cut up, reheated, and rolled into merchantable iron in the mills. The engine which worked the massive shingler's hammer and the puddled bar rolls was of 80-horse power, high-pressure, and was supplied with steam from two cylindrical boilers with hemispherical ends, 8ft. or 9ft. in diameter, by about 20ft. in length. The boilers were heated by the flame from a set of puddling furnaces, and were seated upright on one end. One was heated by the flues of four furnaces, and the other by the flues of two furnaces. The other four furnaces were unconnected with any boiler.

At the time mentioned the puddlers working at the four furnaces attached to the boiler No. 1 were taking out their charges, and dragging their red-hot balls of iron to the shingler's hammer, and thence to the puddled bar rolls. The furnaces had been for a quarter of an hour previously working at the utmost heat required in the operation. Indeed, the whole of the machinery of the forge was in full operation, and beneath the roof there were about forty men at work. When everything was supposed to be going on as usual, and without any previous warning, a noise was heard like a sudden outburst of a loud peal of thunder, and was immediately followed by the destruction of the roof and walls of the forge, which were tossed into the air and converted into a mass of ruins. The boiler No. 1 had exploded, three-fourths of it, weighing about eight tons, had been tossed into the air to a height of between 200ft. and 300ft., and the remainder, in three parts, had been driven through the forge in three different directions, tearing down the iron pillars which supported the roof, and rending the massive timber beams which rested upon them into splinters. At the same time the brickwork and masonry of the furnaces, with their contents of molten iron and the burning coals from their fires, completed the appalling catastrophe. Men fell bleeding and lifeless with the falling fragments—some into boats lying in the adjoining canal, and one at a place twenty yards distant from the boilers; others were buried beneath the molten iron, burning coals, and red-hot brickwork. Within an hour after the explosion fourteen bodies had been recovered, all of them most shockingly mutilated. The trunk of one body was taken up without the head, which has not yet been recovered. Another had been cut in two, and the extremities had been burnt away. All were more or less disfigured by being crushed under the iron and masonry, and scorched by fire, boiling water, and steam. Owing to their mutilated condition few of the fourteen referred to have been yet identified. This is partly attributable to the fact that workmen so employed are accustomed to wear little clothing at their work, and partly to the fact that what they did wear had been burnt. Another reason is that the large number of the men at work in the forge when the accident happened were strangers, and were taken on only this morning. Of fifteen persons injured nine were taken to the South Staffordshire Hospital, about a mile and a half from the Millfield Works, and six to their homes. Three died on their way to the hospital, and one while being taken to his own dwelling. In the hospital one has already died, two are supposed to be dying. Three of these corpses have not yet been claimed. The injuries which have been received by the deceased in the hospital are chiefly scalp wounds, fractures, and scalds. One of the injured has had a leg amputated at the hospital. The ruins are still being searched for two bodies said to be missing, and until to-morrow it is not expected to be known if even a larger number have not yet to be accounted for. Most of those who have been recognised are fathers of families.

The damage done to the works is estimated at between £2,000 and £3,000; they have been put up about 11 years, and until the beginning of last month had been unoccupied about four years.

The quantity of water scattered through the work seems to indicate that the explosion was not due to want of water in the boiler. There are traces of a seam rent below the water line and along a row of rivets, the heads of a few of which are burnt off. Here, perhaps, the boiler yielded. If the fire had been an ordinary one it would have been put out by the water which escaped, but the combined flame from the four furnace flues was so strong that steam was doubtless engendered beneath the boiler with a rapidity which produced the fearful explosion just described.

On the coroner's inquest, on Wednesday, Richard Rowley engineer, was called. He said: I am an engineer employed at the

works. I have known the boiler which exploded ever since it was erected, which is about ten years since. I was on duty on Monday night, and left the works at seven on Tuesday morning. Everything was then in good working order. Joseph and Thomas Starkley succeeded me when I went off duty. The boiler which exploded was a four furnace boiler; there were two floats and a whistle, the former causing the latter to sound when there was a scarcity of water. The boiler was egg-shaped, about 10ft. 6in. in diameter; the plates about $\frac{7}{8}$ths, the height of the boiler from 28ft. to 30ft. When the mill was full on it was worked up to 40 lb. to the square inch: at the time of the accident it was worked at 35 lb. The boiler was made by Mr. Elwell. Until three months ago the boiler had not been worked for four years. I and Starkey examined it before the work was recommenced, and found it in working order. Since operations were resumed the boiler had been cleaned every fortnight. The last examination took place on the Monday in last week. I think the boiler was too large; my impression is that it had more on it than it would bear. I had never had any caution or notice that the boiler was defective. There was a slight leakage a month ago at a rivet; a peck of bran was put in and no leakage had occurred since. I made an examination of the boiler-plates after the explosion, and found a good deal of scurf. Had the boiler been overheated the scurf would not have been on. The bell of the safety whistle had been removed from the boiler after the explosion, but the portion of the screw left was in a perfect state. I believe the boiler was too large for a high-pressure boiler. I am unable to account for the explosion. Do not believe there had been any deficiency of water.

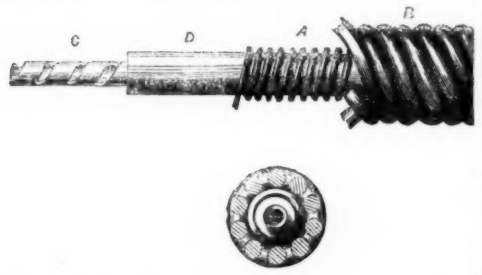
By a juryman: There was scurf on the top of the main or upright tube. The feed-pipe was within 2ft. 6in. of the bottom of the boiler. The "feeding" was by hand.

Joseph Johnson, engineer, of Bilston, sworn. — Put up the boiler which had exploded eight or nine years ago. It was a furnace four-flue boiler. Believed it was only 7ft. 6in. diameter. It was set to work at 35 lb. to the square inch. Considered it safe to work at 50 lb. They were half-inch plates before they were set and bent. Examined portions of the plates after the explosion; they seemed to be good, and of good iron. Was of opinion that the cause of the explosion was an excessive pressure of steam. Had the balance of the ball been at the extent of the lever it would not have caused a pressure of 50 lb. to the inch. It was most likely that the "clack" was not in good order, and that the steam generated faster than it passed away. A minute or two before the explosion there was a roar as of thunder, which shook the ground, and following instantly a rush of steam and the ascent of the boiler. Witness was in the adjoining work not more than 40 yards off, and described the motion of the boiler as resembling that of a balloon. It rose to a great height.

The inquiry was at this point adjourned until Thursday next.

MORGAN, JAY, EDWARDS, AND TILSTON'S ROPES OR CABLES.

This invention, by Messrs. Morgan, Tilston, and others, of 132, Upper Thames-street, and 2, Lower Kensington Gore, consists in the arrangement of a spiral coil of wire or ribbon A, composed of iron or other metal within a covering of rope B, composed of vegetable fibre, metallic wires, or metallic ribbons, in such a manner that the stretch of the rope longitudinally is prevented by the resistance of the internal coiled wire to a transverse strain. In electric telegraph cables for submarine and other purposes there is taken a conducting ribbon or wire C of copper or other metal, coiled spirally, or corrugated, or bent in such a manner as to allow it to stretch longitudinally to a considerable extent without fracture, and this ribbon or wire is insulated by surrounding it with one or more coatings D of pure india-rubber or other elastic insulating material, and the ribbon or wire thus insulated is placed within the spiral metallic wire covered by the rope of vegetable fibre, metallic wires, or metallic ribbons, above described.



The insulated conducting ribbon or wire is thus prevented from injury through any transverse strain by the spiral coil of wire A which surrounds it, while the greater part of any longitudinal strain is borne by the rope B of vegetable fibre, metallic wires, or metallic ribbons which surrounds the coil of spiral wire, and the combination of parts described allows great flexibility in the cable.

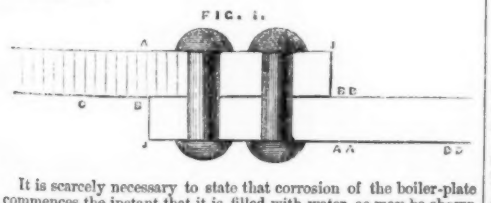
For the rigging of ships or other purposes where great longitudinal strength is required in the rope without stretching, the cable is used as above described, omitting the internal conducting ribbon or wire insulated with pure india-rubber or other insulating material.

THE WEAR AND STRENGTH OF BOILERS.

Some attention has, by a recent trial at Kingston, been called to two important points in connection with boiler joints, the first being the corrosion that takes place on the internal surface of the boiler in the vicinity of the joints; the other, the statical fact that there is a constant ratio between the strain for the joints running respectively vertically and horizontally.

It will be sufficient for the purpose if we consider the simplest form of boiler, namely, that which consists of a cylinder, whose axis is horizontal, with perfectly rigid ends, the axis being assumed to be horizontal solely for the purpose of enabling us to describe the joints as horizontal and vertical, and the respective strains as vertical and horizontal.

FIG. 1.



It is scarcely necessary to state that corrosion of the boiler-plate commences the instant that it is filled with water, as may be shown most easily by exposing a large surface of clean iron (iron filings) to the action of water, the formation of a certain amount of protoxide of iron being immediately proved by the escaping of the divorced hydrogen.

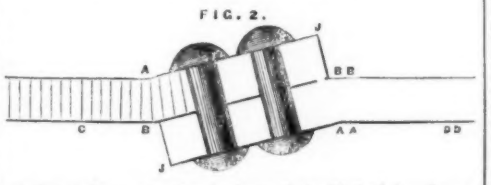
On the other hand, the internal coating of deposit which, fortunately, begins at once to appear, is, from the very nature of its origin, highly insoluble, and therefore most eminently fitted to form a scarf skin for the protection of the metal from corrosion.

Now, it has long been observed that the greatest amount of corrosion, and consequently the extreme diminution of thickness of the boiler-plate, occurs close to that part of the plate where it is internally overlapped by the plate adjoining. In the case of horizontal joints, when a ledge was thereby formed, a considerable amount of debris and powdered skin deposit accumulated on that ledge; and this was thenceforward overcome by inverting the method of jointing, and adopting that form internally which is adopted externally in weather-boarding of wooden houses.

But as experience has shown that the thinning process progresses in these and in vertical joints, and as this process is most unsatisfactorily accounted for by galvanic action and other theories, a new and demonstrable reason of this effect is necessary.

In Fig. 1 the section of a joint is shown in its normal condition, uninfluenced by statical effect of internal pressure.

FIG. 2.



In Fig. 2 the same section is shown, but with the internal pressure applied.

As the line of tension, the plates being of equal thickness and length, will pass through the centre of the joint, it is evident that the plates will have a tendency to assume a coincident direction; that the joint J, J, will have a tendency to revolve to a certain extent on its axis; and that, consequently, the internal surface of the plate B, C, will have a greater amount of expansion to undergo than the external has. But as this inequality of expansion does not occur throughout the whole of the plate, on account of the partial rigidity of the metal, this inequality must occur within a certain distance of the joint, and this distance will be found to be small.

In fact the pervading expansion, which is uniform throughout a great portion of the plate, will be found in the immediate vicinity of the joint to be almost nil on the external surface, while it is highly increased on the internal.

Hence we arrive at the fact that the expansion is very great between B and C, and very little at A and A, A.

Now as the deposit from the water, acting as a preventive from corrosion, is considerably inexpansive and incompressible, it follows that any perceptible expansion and compression that it may have to undergo will crack and break it.

If, then, this skin is repeatedly formed on the internal surface of the boiler, and by the greater extent of compression, which on each reduction of pressure (being, of course, greatest when the boiler is cooled), takes place between B and C as repeatedly blistered off at that part, it is clear that the metal in that part is exposed to much greater action and corrosion than all the other parts, and that consequently that part will thin far more rapidly than the rest of the internal surface.

The other point—namely, the ratio of the strains on the horizontal and vertical joints respectively—is as follows:—

The strain upon one whole joint in a vertical section of our boiler equals the enclosed circular area × pressure in pounds = the circumference × ½ radius × pressure in pounds, and the vertical strain upon the horizontal joint, whose length is equal to the circumference of the above-mentioned section, is equal to the area of the rectangle enclosed between this straight line and the axis of the cylinder × pressure in pounds = the circumference × radius × pressure in pounds. Hence the proportion is:—

Horizontal strain on vertical joints : V strain on H² joints.

Circumference × ½ radius × P : circumference × radius × P.

1 : 2

And hence we make this deduction that, when the compared joints are similar in all respects, such as the distances of the rivets, the diameters of the rivets, &c., the vertical strain, caused by any internal pressure, as exactly twice the tendency to shear the rivets in the horizontal joints that the horizontal strain has on those in the vertical joints.

GREENWOOD'S MACHINERY FOR SAWING WOOD.

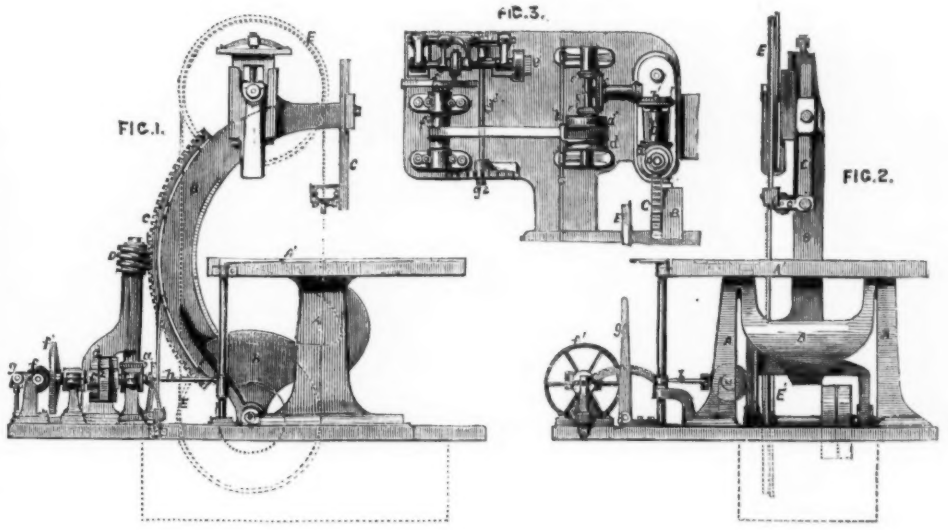
The object of this invention, by Thomas Greenwood, of Leeds, is to facilitate the cutting of straight, curvilinear, and other bevelled forms, by means of band saws. This it is proposed to effect by making the inclination of the saw band adjustable to the work while the action of sawing is proceeding.

Fig. 1 is a side elevation of a band saw machine constructed according to the invention; Fig. 2, an end view of the same; and the driving portions are shown in plan in Fig. 3. In these views it will be seen that the main element of novelty consists in mounting the tension pulleys which carry the band saw upon an adjustable or rocking frame, which by moving around a point cut by the operating edge of the saw will allow of the adjustment of the saw while the machine is in action.

Secured to the bed plate of the machine are two standards A, A, carrying the table A^1 of the machine; these standards are furnished with bearings for receiving the cranked trunnion supports of a rocking frame B. This frame is made of cast iron of a segmental form, and furnished with rack teeth C on its outer edge, into which gears a worm wheel D for imparting when desired an axial motion thereto. Upon this frame B is mounted a pair of tension pulleys E, E^1, which carry the saw band. The upper pulley E is mounted in adjustable

GREENWOOD'S MACHINERY FOR SAWING WOOD.

FIG.3.



bearings for the purpose of ensuring the maintenance of the saw F at a proper tension, and the shaft of the lower pulley E^1 is carried by pendent brackets of the frame B, shown best at Fig. 2. G is a guide supporting a pendent arm G^1 attached to the frame B for keeping the saw up to its work. The worm D is mounted on a vertical shaft supported in a hollow standard D^1 attached to the bed plate of the machine. Keyed to the lower end of the worm shaft is a bevel pinion *a*, into which a bevel pinion on a short horizontal shaft *b* gears. The opposite end of the shaft *b* is fitted with a bevel wheel b^1, which gears into and is driven by a pinion on a cross shaft, carrying at its opposite end a bevel wheel *c* in gear with a pair of pinions c^1, c^2; these pinions c^1, c^2, are supported by a horizontal driving shaft c^3, which has its bearings in short standards bolted to the bed plate. To this shaft the pinion c^1 is keyed, and also the pulley *d* of a set of band pulleys *d*, d^1, d^2. The pinion c^2 is keyed to a hollow shaft on the shaft c^3, and to it is also keyed the pulley d^2. The pulley d^2 is loose on the shaft c^3. This arrangement, it will be understood, is for the purpose of driving the worm wheel in either direction at pleasure. It is also important that the speed of the worm (which causes the rocking of the band saw frame) should be capable of easy adjustment relatively to the speed of the sawing operation; it is proposed, therefore, to transmit motion to the driving shaft c^3 through a friction gear arrangement, the speed given off by which may be determined by the adjustment of a hand lever; it consists of a feathered horizontal shaft *e*, to which band pulleys e^1 are keyed. Mounted loosely on this shaft *e* is a friction roller *f*, which is embraced by a forked guide *g*; this guide is free to slide on a fixed guide rod carried by standards, which also afford bearings for the feathered shaft *e*. Jointed to a lug on the under side of this forked guide is a rod which connects the guide *g* with a crank arm on the outer end of a rock shaft g^1; this shaft at its inner end carries a hand lever g^2, which works in front of a fixed quadrant, and a pin on the hand lever dropping into the notches formed on this quadrant retains it in any desired position. The friction roller *f* works upon the face of a vertical disc f^1 keyed to a horizontal shaft, to which a belt pulley f^2 is keyed, and a strap proceeding from this pulley f^2 to the pulleys *d* transmits the requisite motion for rocking the saw frame.

It will now be understood that when it is desired to decrease the speed of the worm D, it is only necessary to move the friction roller *f* nearer to the centre of the friction disc f^1, which movement is effected by simply rocking the shaft g^1 through the hand lever. As the shaft g^1 rocks the forked guide *g* is moved to or fro over the feathered shaft *e*, and with it the friction roller *f*, which drives the disc f^1 slower in proportion as it is advanced to the centre of the disc, the disc being kept up in close contact with the roller *f* by means of a spring f^3, which bears upon the rear end of the disc shaft. The saw band is driven by a belt from any first mover passing over the pulleys on the shaft of the lower tension pulley E^1. *h* is a belt shifter for throwing the band from the friction gear into either of the pulleys *d*, d^1 d^2, according to the work under operation. When a square cut is required the belt will be on the loose pulley, and no axial motion of the worm D will take place, the gearing in connection therewith being thrown out of action; but when a bevel either to the right or left is required in the work, the belt will be thrown on one or other of the pulleys *d*, d^2.

It will be understood that, according to the direction of the axial motion of the frame B, so will the direction of the cut of the saw band be determined; thus the saw being adjusted to make a vertical cut, may be re-adjusted while running to produce a diagonal cut with a gradually increasing inclination (if desired) at pleasure.

THE BLACK PRINCE OFF THE WIGHT.

The Black Prince iron frigate, fitting for commission at Portsmouth, made her experimental trial on Wednesday, outside the Isle of Wight, to test the capabilities of her enlarged rudder under steam. The original area of the rudder was 130ft., but with the temporary wooden casing the area has been increased to 153ft. The draught of water of the ship was, aft 23ft. 1in., and forward 22ft. The propeller is an improved Griffiths'—that is, with the tip of the blades inclining forward, with a pitch of 30ft., a diameter of 24ft. 6in., and an immersion of 2ft. 7in. It is hardly necessary to state that the engines are by Messrs. Penn and Son, of 1,250 nominal horse-power, made from the same pattern as the Warrior's. The ship cast off her fastenings at 9.50 a.m., and at "slow speed" left the harbour, increasing the revolutions of her engines to 40 as she passed the Spit Buoy, clear of the harbour channel, and to 52 revolutions as she passed the Nab, or Bembridge light vessel, where "full speed" was given to her. The weather was favourable, and the ship was put about the circle in 8m. 5sec. and 9m. 49sec. respectively on two trials.

The temperature of the ship below during the trial was much improved upon that of her trial of speed at light draught on the 19th of November last, on her arrival at Spithead from Greenock. On deck the average temperature was 49 deg. On the engine-room platform the average was 85·03. In the stoke-holes the seven thermometers gave an average, commencing from forward to aft, of 79·6, 96·6, 102·6, 102·0, 91·6, 101·3, and 80·6. At her present draught of water the ship's area of midship section is 1,150ft., with a displacement of 6,384 tons. The area of her screw blades is each 66ft. The coals used were specially placed on board for the trials, and were the same as were supplied to the Warrior on her trial trips, and which are also kept in store for the use of her Majesty's yachts. —Nixon's Navigation Steam Coal from the Aberdare pits. The mean revolutions of the engines during the trials were—at full speed 51½; at half-speed, 32.

ROYAL INSTITUTION OF GREAT BRITAIN.

Friday, March 28, 1862.

John Peter Gassiot, Esq., F.R.S., Vice-President, in the chair.

AN EXPLANATION OF THE METEOROLOGICAL TELEGRAPHY, AND ITS BASIS, NOW UNDER TRIAL AT THE BOARD OF TRADE.

By Rear-Admiral Fitz-Roy, F.R.S.

The telegraphic communication of meteorological changes from distant stations to a central position, whence occasional warnings of impending storms might be given, which has been organised and tried by Government, had its origin at a meeting of the British Association in 1859, at Aberdeen, under the presidency of that deeply lamented Prince, whose short life was wholly devoted to the most useful objects. It was then resolved by their council that application should be made to her Majesty's Government for an organisation and trial of a plan by which the approach of storms might be telegraphed to distant localities. At two meetings in Buckingham Palace, early the following year (1860), minutes were authorised on this subject, and correspondence ensued which resulted in establishing a telegraphic communication of meteorological facts between twenty home stations, besides foreign ones, and daily with Paris.

The Aberdeen meeting had only just terminated when public attention was startled by the loss of the Royal Charter. It so happened that the storm which caused the destruction of that iron ship (notwithstanding power of steam additional to that of sails, and while a sailing ship, managed differently, was bearing its brunt uninjured, within a few miles distant*)—that storm, completely cyclonic, passed over the middle of England, and could be more fully investigated than any storm hitherto, because in every direction observers happened to be ready, who recorded ample statical facts and many valuable dynamical results.

Advancing gradually, the first cautionary or storm-warning signals were made early in 1861, but on that occasion were unhappily disregarded in the Tyne, and on the following days awful losses of life were witnessed on the north-east coasts. From that time to the present similar warnings have been given there and elsewhere with increasingly advantageous effects it appears, if one may judge, in the first instance, by applications since sent officially from all the principal ports, and from the chief associations of underwriters, in addition to Admiralty approval, and the co-operation of the coast guard.

In August, 1861, the first published "forecasts" of weather were tried; and after another half-year had elapsed for gaining experience by varied tentative arrangements, the present system was established. Twenty reports are now received each morning (except Sundays), and ten each afternoon, besides five from the continent. Double forecasts (two days in advance) are published with the full tables (on which they chiefly depend), and are sent to six daily papers, to one weekly,—to Lloyds'—to the Admiralty,—and to the Horse Guards, besides the Board of Trade.

These forecasts add almost nothing to the pecuniary expense of the system—while their usefulness, practically, is said to be more and more recognised.† Warnings of storms arise out of them; and (scarcely enough considered) the satisfaction of knowing that no very bad weather is imminent may be very great to a person about to cross the sea. Thus their negative evidence may be actually little less valuable than the positive.

Prophecies or predictions they are not. The term forecast is strictly applicable to such an opinion as is the result of a scientific combination and calculation, liable to be occasionally, though rarely, marred by an unexpected "downrush"‡ of southernly wind, or by a rapid electrical action not yet sufficiently indicated to our extremely limited sight and feeling. We shall know more and more by degrees. At present it is satisfactory to know that the measures practised daily in these proceedings do not depend solely on one individual. They are the results of facts exactly recorded, and deductions from their consideration, for which rules have been given. An assistant has been practised, and is able to share their responsibility. Others are also advancing in the subject of dynamical meteorology.

Air currents sometimes flow side by side, though in opposite directions, as "parallel streams," for hundreds, or even thousands, of miles. Sometimes they are more or less superposed—occasionally, indeed frequently, crossing at various angles; sometimes combining, and by the composition of their forces and qualities causing those varieties of weather that are experienced as the wind veers more toward or from the equator or the nearest pole; and sometimes so antagonistic in their angular collision as to cause those large circling eddies or rotatory storms called cyclones (in modern parlance), which are really like the greater storms in all parts of the world, although they do not quite assimilate to those local whirlwinds, dust-storms, and other commotions of atmosphere which seem to be more electrical in their characteristics, if not in their origin.

Whenever a polar current prevails at any place, or is approaching, the air becomes heavy, and the barometer is high or rises. When the opposite (equatorial or tropical) prevails or approaches, the mercury is low or falls, because the air is, or is becoming, specifically lighter, and these changes take place slowly.

Whenever, from any causes—electrical, chemical, or simply mechanical—either current, or any combination of currents, ceases to press onward without being opposed, a gradual lightening of the atmosphere, through a greater or less area of hundreds, or perhaps thousands of miles occurs, not suddenly, but very gradually, and the barometer falls. There is less tension.

To restore equilibrium, the nearest disposable body of air (so to speak) or most movable, advances first; but an impulse, at the same time, may be given to other and greater masses that—though later in arriving—may be stronger, last longer, and cause greater pressure mechanically as well as by combination. Air, like water, mingles very slowly, either from above or laterally.

Taking, with Dové, north-east and south-west (true) as the "wind-poles," all intermediate directions are found to be more or less assimilated to the characteristics of those extremes; while all the variations of pressure, or tension, many of those caused by temperature, and all varieties of winds, may be clearly and directly traced to the operations of two constant principal currents—equatorial, or tropical and polar—our north-east and south-west.

Great distinction should be marked between those ever alternate and often conflicting main currents—tropical and polar, and the local effects of their union, or antagonism, namely, mixed winds—whether westerly or easterly, with occasional cyclones or circulating eddies, on a large or small scale.

Considering that the lower current does not ordinarily extend far upward (only a few thousand yards, or even feet), and that high land, mountains, especially ranges of mountains, alter and impede its progress, a variety of eddy winds, or as it were streams of wind, with local and apparently anomalous effects, must be frequently caused.

Electrical action, condensation of vapour into hail, snow, rain, or fog, causing heat; or its other changes, namely, evaporation, rarefaction, and expansion—absorbing heat, and therefore causing cold—immediately affect currents of air in a degree proportional to such influence; inducing horizontal motion.

The polar current always advances from the polar quarter, while laterally moving eastward (like a ship making lee-way), being pressed towards the east by the tropical flow which advances from the south-westward, usually above and at an angle with the polar stream or current of air, often mixing with it, but at times separately penetrating downward, then sweeping and warming the earth's surface, uncombined with the polar current, even while feeling its approaching influence: and thus, as it were, forcing passages between streams of chilling polar air that at the same time are moving in opposite and nearly parallel directions.

Sometimes their opposition is so equal, and equilibrium is so complete, that a calm is the result, no sensible movement horizontally along the earth's surface being perceptible.

Self-registering barometers show the alterations in tension, or, so to speak, the pulsations, on a large scale, of atmosphere, by hourly marks; and the diagram expresses to a practised observer what the "indicator card" of a steam cylinder shows to a skilful engineer, or a stethoscope to a physician.

Our own islands have very peculiar facilities for meteorological communication by telegraph, between outlying stations on the sea coast and a central place—all being at nearly the same level, and nearly all comparatively uninfluenced by mountain ranges.

And now, the results are that, having daily knowledge of weather (including ordinary facts of a meteorological nature), at the extreme limits and centre of our British Islands, we are warned of any great change taking place; the greater atmospherical changes being measured by days—rather than by hours. Only local changes, however violent they may be occasionally (and dangerous in proportion to their suddenness and violence)—only such changes are unfelt at a distance, and do not influence great breadths—say, hundreds of miles in area—of atmosphere.

Extensive changes, showing differences of pressure, above or below the normal or mean level, amounting to an inch or thereabouts, are certain to be followed by a marked commotion of the elements in the course of a few days. If the fall has been sudden, or the rise very rapid—swift, but brief, will be the resulting elementary movement; if slow, or gradual—time will elapse before the change, and the altered state of weather will take place more gradually, but last longer.

Notice may thus be obtained, and given, a few hours, or a day, or even some days before any important change in the weather actually occurs.

Having such knowledge it obviously follows that telegraphic warning may be sent in any direction reached by the wires, and that occasionally, on the occurrence of very ominous signs, barometric and other—including always those of the heavens—such cautions may be given before storms as will tend to diminish the risks and loss of life so frequent on our exposed and tempestuous shores.

It has been proved, also, lately, that storms, indeed all the greater circulations of atmosphere between the tropics and polar regions, have an eastward motion, bodily, while circulating around a centrical area. Within the tropics it is otherwise, or westward, till they recurve.

In answer to a question from the Royal Commissioners on Lights, Buoys, and Beacons, Sir John Herschel stated that—"the most important meterological communication which could be telegraphed, would be information just fresh received by telegraph, of a cyclone actually in progress at a great distance, and working its way towards the locality. There is no doubt that the progress of a cyclone may be telegraphed, and might secure many a ship from danger by forewarning.

Successive, or rather, consecutive gyrations, circuits, or cyclones often affect one another, acting as temporary mutual checks, until a combination and joint action occurs; their union causing even greater effects: as may be seen even in water currents,—as well as in the atmosphere.

Between the tropics and the polar regions, or in temperate zones, the main currents are incessantly active, while more or less antagonistic, from the causes above mentioned: besides which, wherever considerable changes of temperature, development of electricity, heavy rain, or these in combination, cause temporary disturbance of atmospheric equilibrium (or a much altered tension of air) these grand agents of nature, the two great currents, speedily move by the least resisting lines, to restore equilibrium, or fill the comparative void. One current arrives, probably, or acts sooner than the other—but invariably collision occurs, of some kind or degree, usually occasioning a circuit, a cyclonic or ellipsonic gyration; however little noticed when gentle, or moderate in force.

As there must be resistance to moving air (or conflicting currents) to cause gyration, and as there are no such causes, on a large scale, near the equator, there are no storms (except local squalls) in very low latitudes.

It is at some distance, from about 5 deg. to 20 deg., from the equator that hurricanes are occasionally felt in their violence.

They originate in or near those hot and densely-clouded spaces, sometimes spoken of as the "cloud-ring," where aggravated aqueous vapour is at times condensed into heavy rain (partly with vivid electrical action), and a comparative vacuum is suddenly caused, towards which air rushes from all sides. That which arrives from a higher latitude has a westwardly, that from a lower an eastwardly tendency, due to the earth's rotation, and to the change of latitude, whence a chief cause of the cyclone's invariable rotation in one direction, as above explained.

The hurricane or cyclone is impelled to the west, in low latitudes, because the tendency of both currents there is to the westward, along the surface: although one, the tropical, is much less so, and becomes actually easterly near the tropic, after which its equatorial centrifugal force is more and more evident, while the westwardly tendency of the polar current diminishes; and therefore, at that latitude, hurricane cyclones cease to move westward (re-curve), go then eastwardly, and toward the polar quarter.

Great and important changes of weather and wind are preceded, as well as accompanied, by notable alterations in the state of the atmosphere. Such changes, being indicated at some places sooner than at others around the British Islands, give frequent premonitions; and, therefore, great differences of pressure (or tension) shown by barometer of temperature, of dryness, or moisture, and direction of wind, should be considered as signs of changes, likely to occur soon.

It will be observed, on any continued comparison of weather reports, that during the stronger winds a far greater degree of uniformity and regularity is shown than during the prevalence of moderate or light breezes; and this should be remembered.

When neither of the greater and more extensive atmospheric currents is sweeping across the British Islands—currents of which the causes are remote, and on a large scale—the nature or character of our winds approaches, and is rather like, that of land and sea breezes in low latitudes; especially in summer.

Either the cooler sea wind is drawn in, over land heated by the summer sun; or cold air from frosty heights, snow-covered lands, or chilly valleys, moves towards the sea, which is so uniform in temperature for many weeks together, changing so slowly, and but little in comparison with land, during the year. These light variables may at such times be numerous, simultaneously, around the compass, on the various coasts of the British Islands.

Frequently it has been asked, "In this country, how much rise or fall of the glasses may foretell remarkable change, or a dangerous storm?"

To which can now be replied, Great changes or storms are usually shown by falls of barometers exceeding an inch; and by differences of temperature exceeding about 15 deg. A tenth of an inch an hour is a fall indicating a storm or very heavy rain. The more rapidly such changes occur the more risk there is of dangerous atmospheric commotion.

As all barometric instruments often, if not usually, show what may be expected a day or even days in advance, rather than the weather of the present or next few hours, and as wind, or its direction, affects them much more than rain or snow, due allowance should always be made for days as well as for hours to come.

The general effect of storms is felt unequally in our islands, and less inland than on the coasts. Lord Wrottesley has shown, by the anemometer at his observatory in Staffordshire that wind is diminished or checked by its passage over land. The mountain ranges of Wales and Scotland, rising 2,000ft. to 4,000ft. above the ocean level, must have great power to alter the direction, and probably the velocity of wind, independently of alterations caused by changes of temperature.

"It not unfrequently happens that a series of cyclones follow closely upon each other for several weeks, the preceding members of the series being often overtaken and interfered with by those succeeding. It is, however, important to remark that, amidst all the complexity necessarily occasioned by such combinations—the greater and more violent storms, and particularly that portion of them which is most dangerous and destructive, exhibit almost invariably the simple cyclonic character. It is thus with the 'Law of Storms' as with the 'Law of Gravitation;' the grand results of both are exceedingly simple, but the minor details become more and more complicated in proportion to their minuteness."•

Consecutive storms, at the meetings of main currents in zones of latitude, at certain periods have had appearances of continuity. The familiar instance of the Charles Heddle has so often been adduced as proof of continuing circuitous action, or gyration, that it may seem injudicious to doubt the evidence; but knowing how frequently circuits, or cyclones, succeed each other rapidly, and how unreliable are some of the earlier logs of events in a storm, written after its cessation, especially respecting directions of wind and courses steered, when waves and storm blasts were the guides, not the oscillating compass (if, indeed, that had not been washed away, as in the Charles Heddle's case); it does not appear accordant to experience, and enlarged acquaintance with the subject, to imagine that such atmospheric eddies are, *sui generis*, erratic, and so considerably independent, as to cross a wide ocean.

When opposing currents meet their masses must continue in motion a certain time, either rotating, or ascending, or going onward horizontally in combination.

Masses of air, either of polar or tropical origin, so to speak, returning, when driven back by stronger opposition, at first, and for a certain time, retain the characteristics of their peculiar and very different natures.

In our latitudes there is a continuous alternation of air currents—each specifically different, and denoting approach by marked characteristics: and we have proved by successive series of simultaneous statical observations, over a wide range—embracing Scotland, Ireland, all England, and adjacent islands—that while these alternating or circuitously moving currents are thus incessantly passing—the whole body of atmosphere filling our temperate zone is moving gradually towards the east—at an average rate of about five geographical miles an hour.

During strong westerly winds this eastward motion is greatly increased; and in easterly gales it is proportionally diminished, as measured by its passage along a horizontal surface of earth or ocean. Knowing these circumstances, and having accurate statical observations of these various currents, at selected outlying stations—showing pressure (or tension), temperature, and relative dryness, with the direction and estimated horizontal force of wind at each place simultaneously, the dynamical consequences are already measurable approximately, on geometrical principles; and, judging by the past, there appears to be reasonable ground for expectation that, soon, meteorological dynamics will be subjected to mathematical analysis and accurate formulas. The facts now weighed and measured mentally—in what may be correctly called "forecastle" weather—are—the direction and force of each air current, or wind—reported telegraphically to the central station in London, from many distant stations; their respective tension and temperature, moisture or dryness, and their changes since former recent observations.

These show whether any or either movement or change is on the increase or decrease; whether a polar current is moving laterally off, passing from our stations towards Europe, or approaching us from the Atlantic; whether moving direct towards the south-westward with great velocity, or with slow progress. If moving fast, in the direction of its length, it will approach England more from the east, its speed direct being twenty to fifty or eighty miles an hour, while its constant lateral or easterly tendency (like a ship's leeway in a current), being only five miles an hour, is then insensible to us (though clearly deducible from other facts ascertained), and is that much in alteration of actual direction, as well as of what would otherwise be the velocity of the polar current.

With the opposite principal current—the equatorial or south-westerly, more briefly and correctly tropical—similar but opposite results occur; the direct motion from a south-westerly quarter is accelerated, sensibly to our perception, by part of the eastward constant (about five miles hourly), and therefore a body of air approaches us sooner (other things being equal) from the westward than it does from the eastward.

To seamen accustomed to navigate in ships making leeway, while in currents setting variously over the ground, such movements, complicated as they may appear, are familiar. Another important consideration is the disposal or progress of bodies of air united, or mixed, or contiguous to each other, after their meeting—either directly opposed or at an angle—on the earth's (or ocean's) surface. They do not vanish:—They cannot go directly upwards—against gravitation;—Westward they cannot generally go when there is collision or meeting, because the momentum, elasticity, and extent of the tropical "antitrade"† usually overpowers any direct polar current, or rises over it, and more or less affects the subordinate below, by the friction of its eastward pressure. Downward there is no exit—eastwardly (towards the east) the accumulating air must go—and this tendency continued causes the varieties of wind from the westward—being more or less mixed—more or less purely polar or tropical as either one prevails, in combination.

After a body of air has passed, and gone to some distance southward or northward, it may be stopped by an advancing and more powerful mass of atmosphere which is moving in a direction contrary to, or diagonally across its line of force. If their appulse be gradual and gentle, only a check occurs—and the weaker body is pushed back until its special qualities, respecting temperature and moisture, are so masked by those of its opponent as to be almost obliterated. But, if these currents meet with energy—at very different temperatures and tension, rapid changes are noticed as the wind shifts—and circuitous eddies, storms or cyclones occur.

Otherwise—when their meeting is, as first mentioned, gradual—there is the return of a portion of either current (which previously pevailed) either direct or deflected—deflected even through more than one quadrant of a circle—by its advancing opponent—and retaining for some considerable time its own previous characteristics.

Thus we have, for short times, cold dry winds from the south-west, instead of the usual warm and moist ones;—or winds of this latter-kind from the north, instead of cold ones. The circuitous tendency of air in motion—and the numerous impediments to its horizontal progress, such as land, ranges of mountains, hills, or even cliffs—induce many a deviation from normal directions, extremely puzzling to the student of this subject; but so retentive is air of its tension and temperature, for a time, that like currents in the ocean, each may be traced by its characteristics as long as within our island web of stations. When the polar current is driven back by a tropical advancing from a southerly direction gradually—their action united becomes south-easterly (from the south-eastward), and as the one or other prevails, the wind blows more from one side of east or from the other.

So retentive of temperature are oceanic currents that when H.M.S Nile was going from Halifax to Bermuda, in May 1861, Admiral Milne found the temperature 70 deg. at the bow—while only 40 deg. at the stern, as he entered the Gulf Stream.

Time is required to produce motion in the air horizontally; time is indispensable for its gradual cessation from movement. Statical effects are noticed, at observatories, or by careful observers anywhere, hours or days before dynamical consequences occur.

The present daily forecasts, or premonitions of weather, are drawn up on the following arrangement. Districts are thus assumed:—

1. North Britain (including from the Moray Firth to the middle of Northumberland) along the coast.
2. Ireland, generally, around the coasts.
3. Central (Wales to the Solway) coast-wise.

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* The Cumming.

† At a recent meeting of the shareholders of the Great Western Docks, at Stonehouse, Plymouth, it was stated officially that "the deficiency (in revenue) is to be attributed chiefly to the absence of vessels requiring the use of the graving docks for the purpose of repairing the damages occasioned by storms and casualties at sea."—(Feb. 24, 1862.)

‡ Herschel.

• W. Stevenson, of Dunse, 1833. † Sir John Herschel's excellent term.

4. East Coast (from Northumberland to the Thames).
5. South England (from the Thames round to Wales) by the coast.

As our space is very limited, and as some words are used in different senses by different persons, extreme care is taken in selecting those for such brief, general, and yet sufficiently definite sentences, as will suit the purpose.

Such words as are on published scales of force, or nature of wind and weather, are generally understood, and therefore used in preference to others.

In saying, on any day, what the probable character of the weather will be to-morrow, or the day after, at the foot of a table showing its observed nature that very morning—a limited degree of information is offered for about two days in advance, which is as far as may be yet trusted generally, on an average, though at times a longer premonition might be given, with sufficient accuracy to be of occasional use.

Minute, or special details, such as showers at particular places, or merely local squalls, are avoided; but the general or average characteristics, those expected to be principally prevalent (with but few exceptions) the following day, and the next after it, including the nights—not those of the weather actually present—are cautiously expressed, after careful consideration.

It may now be seen, after many months' trial, whether tolerably correct forecasts of ordinary weather can be formed here sooner than at distant, isolated places, where the published general reports arrive a day or two later; and whether they are practically useful as conclusions available for the public.

Ordinary variations of cloudiness, or clear sky, or rain, of a local, or only temporary character, are not noticed usually.

A broad general average, or prevalence, is kept in view, referring to a day, or more, in advance, and to a district, rather than only to one time or place, should be remembered.

The great practical difficulty is in separating the effect, on the mind, of present states of air, weather, and clouds, from abstract considerations of what may be expected on the morrow, or next following day.

When in doubt, distrusting the indications, or inferences from them (duly considered on purely scientific principles, and checked by experience) the words "uncertain," or "doubtful" may be used without hesitation.

As meteorological instruments usually foretell important changes by at least a day, or much longer, we have to consider what wind and weather may be expected from the morning observations, compared with those of the days immediately previous, as indicative of the morrow's weather, and of the day after, at each place, to take an average of those expectations, for each district, collectively, in groups; and then to estimate dynamical effects.

Outline maps, with movable windmarkers, and cyclone glasses or horns, are useful in forecasting weather; and full consideration should be given to the probable position, direction, extent, and degree of progress of that centrical area, or node, round which the principal currents usually circulate, or turn, as they meet and alter, combine with, or succeed one another.

Here dynamical considerations, with comprehensive comparisons of statical facts, are most important; and to treat them even approximately well, with such quick despatch as is requisite, demands aptitude and experience.

Those who are most concerned about approaching changes, who are going to sea, or on a journey, or a mere excursion; those who have gardening, agricultural, or other out door pursuits, in view—may often derive useful cautionary notices from these published expectations of weather—although (from the nature of such subjects) they can be but scanty, and imperfect under present circumstances.

Objection has been taken to such forecasts, because they cannot be always exactly correct—for all places in one district. It is, however, considered by most persons that general comprehensive expressions, in aid of local observers, who can form independent judgments from the tables and their own instruments, respecting their immediate vicinity, though not so well for distant places, may be very useful, as well as interesting: while to an unprovided or otherwise uninformed person, an idea of the kind of weather thought probable cannot be otherwise than acceptable, provided that he is in no way bound to act in accordance with any such views, against his own judgment.

Like the storm signals, such notices should be merely cautionary—to denote anticipated disturbance somewhere over these islands—without being in the least degree compulsory, or interfering arbitrarily with the movements of vessels or individuals.

Certain it is that, although our conclusions may be incorrect—our judgment erroneous—the laws of nature, and the signs afforded to man, are invariably true. Accurate interpretation is the real deficiency.

Seamen know well the marked characteristics of the two great divisions of wind, in all parts of the world, and do not care to calculate the intermediate changes or combinations to two or three points. They want to know the quarter whence a gale may be expected—whether northerly or southerly.

Every seaman will admit that, however useful, and therefore desirable, it would be to know exactly the hour of a storm's commencement—as our acquaintance with meteorology does not enable such times to be fixed—the next best thing is to have limits assigned for extra vigilance and due precaution, which limits are clearly stated, in all the printed popular instructions, to be from the time of hoisting the signal until two or three days afterwards.

But, say some, and justly—are ships to remain waiting to avoid a gale that, after all, may not happen? Are fishermen and coasters to wait idle and miss their opportunities? By no means. All that the cautionary signals imply is—"Look out." "Be on your guard." "Notice your glasses and the signs of the weather." "The atmosphere is much disturbed."

Many remarkable cases have occurred, which show the value of such warnings, or cautionary notices. Some have been published in newspapers, and need not be repeated; others have been communicated only by private letters; and one or two of them may be mentioned now as instances.

Admiral Evans wrote that on one evening, after a warning had been given at Liverpool, such a sudden (though brief) storm swept over the Mersey as would have done much harm, had not the harbour-master made due preparations, because of the signal.

A gentleman intending to cross the Irish Channel with an invalid lady was warned to wait, though the weather then looked beautiful in London. That night it blew a "hurricane" on the west of Ireland, and a gale in the Irish Sea which lasted the following day.

Three ships-of-war were lying in Plymouth Sound, ready to sail for the West Indies. They waited two days, being cautioned, and then put to sea, in the intervening lull (as it happened), between two gales, the first of which was blowing while they were detained; and the second was a violent cyclone, that crossed France, the Netherlands, and Denmark, of which the northern semicircle swept our south and south-eastern coasts, but was just avoided by her Majesty's squadron, or, rather, utilised by them, as they steered to the westward, nearly before its easterly wind, for some hours, and so passed out clear into the Atlantic.

Full warning was given along our eastern coasts of that storm in which the Prussian corvette Amazon was totally lost; and so struck were the Prussian authorities by the facts of that period—taken in connection with other known cases—that an official application was soon afterwards made to the Board of Trade for information, with the view of enabling a similar system to be organised in the Baltic, communicating, if possible, with England.

On the 12th of November, 1861, a warning was sent to Yarmouth in the afternoon. Being nearly dusk—and having then no night signals—nothing was done till next day, after all the fishing boats had gone far out to sea—having started very early in the morning. That afternoon there was a storm; and to save their own lives the fishermen were obliged to cut from and abandon some £40,000 worth of nets and gear. Night signals might have saved that loss, and the imminent risk of many lives. Such means are ready now.

On Friday, the 7th of March, the warning drum was hoisted all day at Plymouth. Saturday was so fine, in appearance, that the caution was not appreciated, and mackerel boats went to a distance—as usual. That afternoon another signal was made—South Cone under drum—to show that a heavy southerly gale was coming soon. It was a beautiful afternoon. No one anticipated the sequel, except those who, spider like, could "feel along the lines." Before midnight there was a storm—which lasted much of the next day. One of the boats was lost with eight men. "A more dangerous gale had not been known," was written by an officer of experience and good judgment, in his letter to a friend.

Perhaps sufficient thought has not always been given to the consideration of mere pecuniary loss by wear and tear, risk, accident, delay, and demurrage—caused by a gale at sea—balanced against the results of waiting for a tide or two, perhaps once in two months, when cautioned by a storm signal.

But be this as it may, with coasters, short traders, or even screw colliers—the question is entirely different with ordinary over-sea or foreign-going ships—especially when starting from a southern or from a western port. To such vessels a gale in the Channel, or even during the first day or two after clearing the land, must always be very prejudicial. Officers and men are mutually strange. Things are not in their places; often not secured—and the ship perhaps is untried at sea. Of course, however, these remarks are inapplicable to fine first-class ships—and to powerful, well-managed steamers, independent of wind and weather, which start at fixed hours.

In conclusion it appears that if due attention be paid on the coasts to cautionary signals—and at the central office—to the telegraphed reports—no very dangerous storm need be anticipated, without more or less notice of its approach being generally communicated around the British Islands; or to those coasts which are likely to be most affected by its greatest strength. R. F.

LETTERS TO THE EDITOR.

We do not hold ourselves responsible for the opinions of our Correspondents.)

FIXED AND CONTINUOUS GIRDERS.

Sir,—As in a discussion which took place upon the subject of a paper which I read on the 10th inst., at the Civil and Mechanical Engineers' Society, and which was printed in the last impression of your valuable journal, the remarks of a "Visitor" seemed to show a general ignorance on the part of engineers of a fact worth knowing, I now beg a corner in your columns to demonstrate that fact, prefacing my observations with the remark that the same was not shown in the paper, as I presumed that it was well known. I showed on the black board certain diagrams of one curve each, giving the strain on any part of one span of a fixed or continuous girder, and the paper showed a simple method of approximating to such curve. The fact disputed by "Visitor" was that the whole strain was shown by the one curve, the details being as follow. Taking the example selected at the discussion above alluded to—

Let $g\ d$, Fig. A, represent the line of a girder fixed at the extremity g and supported at d, and let its span be 120ft., then the point of contraflexure b will be one-fourth of the span, or 30ft. from the point g. $a\ h\ b\ c\ d$ is the curve of strain which I exhibited, the strains being shown by the ordinates shown by the dotted lines between the curve and the line $g\ d$. I calculate it as follows:—For the part $b\ d$ (as a common girder) let S = strain on either flange; l = span $b\ d$; x = distance of any point from either b or d; d = depth of girder; w = load per foot run; then

$$S = \frac{w\ x}{2\ d}(l - x).$$

Let $w = 2$, $d = 10$, then for each value of x

$x = 9$	... ...	S = 72·1
18	... ...	= 129·6
27	... ...	= 170·1
36	... ...	= 194·4
45	... ...	= 202·5

the values being repeated for the other half of the part $b\ d$. These values are plotted on the figure. For the part $g\ b$ (as a cantilever bearing the distributed load upon it, and half the load on $b\ d$) let x' = the distance of any point in $b\ g$ from b; then for various points the strains will be—

$x' = 9$	... ...	S = 89·1
= 18	... ...	= 194·4
= 27	... ...	= 315·9
= 30	... ...	= 360·0

the formula which I use being

$$S = \frac{w\ x'}{2\ d}(l + x').$$

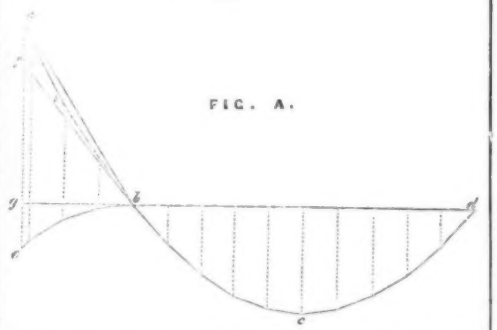


FIG. A.

The "Visitor" asserted that the diagram was incomplete, and added the curve $e\ b$ for the strain produced by the distributed load on $g\ b$, it being evident to me that he took the curve $a\ h\ b$ for a right line; and he said it should be one to show the strain produced by the dead load acting at the end of the cantilever $g\ b$. This line is accurately shown at $f\ b$, the lines $e\ b$ and $f\ b$ being found by the usual method, the strain by dead load being,

$$S = \frac{w\ l}{2\ d}\ x',$$

when $x' = 30$,

$$S = 270 = g\ f.$$

For the curve $e\ b$,

$$S = \frac{w\ x'^2}{2\ d}$$

For various values of x' we have,

$x' = 9$	... ...	S = 8·1
18	... ...	= 32·4
27	... ...	= 72·1
30	... ...	= 90·0

I then stated that the curve $a\ h\ b$ combined the results of the lines shown by the "Visitor," who said it was impossible (!) that the two were shown in Edwin Clark's work, and the other was wrong; and upon being asked for arguments to support his assertion said "it was a well-known fact," and therefore I have troubled you with this communication. To show the truth of the curve $a\ h\ b$ is easy, for it is only needful to compare its ordinates with those of $f\ b$ and $e\ b$, when it will be found that at any point the sum of the ordinates to $f\ b$ and $e\ b$ is equal to the ordinate to $a\ h\ b$, thus demonstrating that, notwithstanding the impossibility above mentioned being well known, it exists but as an assumption. The line $a\ b$ is straight, being the approximation I mentioned in my paper, and does not differ widely from $a\ h\ b$ in regard to the area $a\ g\ b$.

4, Great Queen-street, Westminster,
April 14th, 1862. Francis Campin.

Sir,—In your last number of The Engineer you publish a very interesting paper on Straight Girders, by Mr. Campin, which, however, in some parts is incomplete, and calls forth the following remarks, for which I have no doubt you will find room in one of your forthcoming numbers.

Mr. Campin's formula for determining the stress upon either flange, at any point of the girder situate at a distance x, from either of the piers, is—

$$S = \frac{w\ x}{2\ d}(x - l) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

and upon close investigation of this formula it will be perceived that when

$$x = o \text{ then } S = O,$$

which simply implies that the area of the flanges, immediately above the piers, may be reduced to nothing, or at least to an infinitesimal quantity.

This, however, we know is not the case in practice, and if practice and theory walk hand in hand together then ought theory not to sanction the above conclusion.

In order to investigate that question properly we must take into consideration all the strains that have to be equilibrated by the elasticity of the fibres, and remember that the general condition of equilibrium is expressed by the following formula—

$$\text{Rad} \pm \frac{\lesssim P\ d}{2} = \lesssim M \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Where R is the unit strain, $\lesssim$ P the sum of horizontal forces, either positive or negative, and $\lesssim$ M the sum moments.

It is true that, in the case of a bridge which is subject to external transverse strains only, the sum $\lesssim$ P seems to be nothing, but when we remember that the structure of the bridge is subject to a shearing strain, which at any distance x from the pier is—

$$S_1 = \frac{W}{2}(2\ x - l) \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

the case assumes a different aspect.

Experiments which Mr. Fairbairn has made many years ago, and which are recorded in many treatises on strength of materials, prove that the resistance of iron to shearing strains is practically the same as that to tensile strains, and therefore any shearing strain may have an equal tensile strain substituted in its place; and this being the case formula (1) must be corrected by the introduction into it of formula (3), and the real stress upon either of the flanges will be

$$S = \frac{W}{2}\left[\frac{x}{d}(x - l) \pm \frac{(2\ x - l)}{2}\right] \quad . \quad . \quad . \quad . \quad (4)$$

It is not difficult to determine the distance x from the piers, where the strain due to the moments is equal to the shearing strain; for, in order to do that, we have only to write—

$$x^2 - l\ x = d\ x - \frac{d\ l}{2} \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

which leads us to the solution of an equation of the second degree, and gives for x—

$$x = \tfrac{1}{2}(l + d) \pm \sqrt{\tfrac{1}{4}(l + d)^2 - \frac{d\ l}{2}} \quad . \quad . \quad (6)$$

and, if we put $d = n\ l$, equation (6) may be reduced to the simpler form—

$$x = \tfrac{1}{2}\ l\left[(1 + n) \pm \sqrt{1 + n^2}\right] \quad . \quad . \quad . \quad (7)$$

This formula, calculated for various values of n, gives the following values for x—

For $n = \frac{1}{10}$ we have $x = \frac{0{\cdot}96}{20}\ l.$

For $n = \frac{1}{12}$ we have $x = \frac{0{\cdot}96}{24}\ l.$

For $n = \frac{1}{15}$ we have $x = \frac{0{\cdot}97}{30}\ l.$

Or, without sensible error, we may put in each case—

$$x = \tfrac{1}{2}\ d.$$

At that point, therefore, the area of the bottom flange would require to be double that which Mr. Campin would teach us to make it; whereas the top flange might here be reduced to a practicable minimum.

To complete this I have only to point out what area is required immediately over the piers in either flange, and this must be able to resist a strain—

$$S\ o = \tfrac{1}{4}\ W\ l.$$

I am aware that to these remarks it may be objected that the shearing strain is taken up by the vertical webs of the girder; but this objection would certainly not be made in the case of a lattice girder, where the shearing strain between two consecutive supports must necessarily be resisted by the flanges.

I trust, Mr. Editor, you will not find these remarks unworthy your notice. J. J. Birkel.

Union Foundry, Liverpool, April 14th, 1862.

OCEAN TELEGRAPHY.

Sir,—As attempts are now making to again draw the public attention to the establishment of a telegraphic communication with America, allow me, through the medium of your widely-circulated journal, to make a few observations upon the failure of the first attempt. Unquestionably the result was very discouraging, but many people who were aware of the description of wire used, and the hurried and imperfect way in which it was manufactured, far from being surprised at the result, actually foretold what would occur.

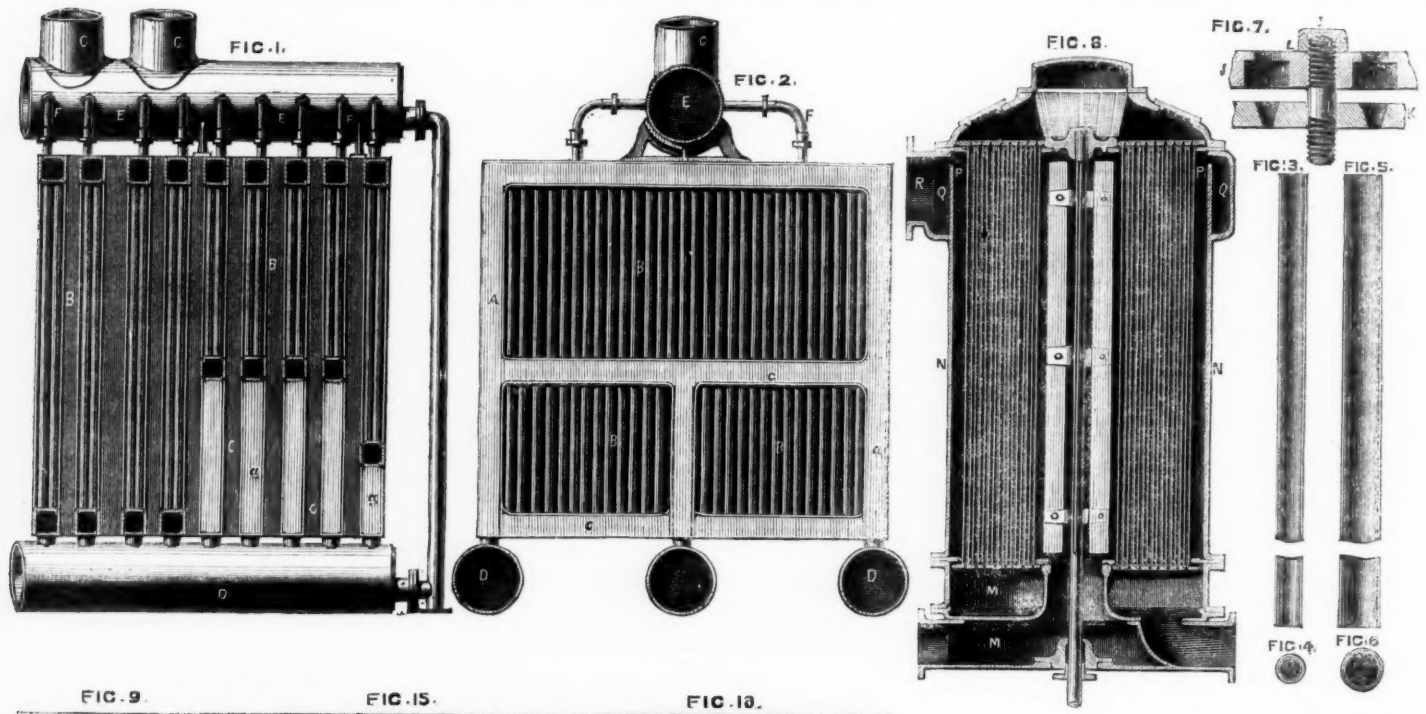
The great cause for astonishment would have been if the affair had succeeded, and to comprehend the why and the wherefore requires little acquaintance with telegraphic engineering.

Everybody has seen pieces of the Atlantic telegraph wire, which consisted of small copper wires surrounded by a gutta-percha coating, in which there was little strength, or comparatively none, to resist such a strain as was often put upon it, considerably over a ton—probably often two or more—for the external wire coating, being twisted in the form of a rope, would naturally stretch when paid out, partially untwist, and the strain coming upon the gutta percha core the latter would crack, and become honeycombed, and admit the water, destroying at once the insulation.

To better comprehend what I wish to explain, suppose a piece of the wire suspended from the top of the Monument, and a weight of one ton affixed to the end near the ground; suppose this weight occasionally to be raised a few inches and allowed to jerk back, what would naturally be the effect? Why, the wire being formed not of longitudinal but of spiral strands would give, and the internal core be strained. This, no doubt, was the case in laying the Atlantic telegraph, and to this cause alone may be attributed the failure of one of the greatest enterprises of modern times. Suspend a piece of wire, as I have suggested, for a few minutes, and let the gutta percha be afterwards carefully examined. The insulating coating would be found strained and crooked in many places, although not sufficiently perhaps to seriously affect the insulation in a short length until the wire had been sometime submerged, or until it was at such a depth that the pressure had become considerable.

Some persons may imagine that such a result could not have been unforeseen by the great engineering talent brought to bear upon this attempt, but even up to the present moment ocean telegraphy is little understood, and it is very questionable if wire covered cables are at

ROWAN AND HORTON'S STEAM BOILERS AND SURFACE CONDENSERS.



all adapted for lines sunk at great depths. Two facts are certain: one is, that the insulation is injured by the metal coating, and the second and more important is, that at the expiration of twelve months the wire covering is in a state of decomposition, and quite rusted away, as has been proved lately in the attempt to recover a portion of the Atlantic cable submerged on the coast of Newfoundland.

I believe there would be no great difficulty in establishing a submarine line of communication between Europe and America, but should never attempt it by a wire-covered cable: a hempen coating will be found much better, lighter, cheaper, stronger, more durable, and more easy to submerge.

Several patents have been taken out for these sort of coverings. One by a Mr. de Bergue appears to me most deserving of trial. The strands are longitudinal, and it may be made of any strength. One fact in reference to this sort of covering has been well-established, which is, that a tarred rope will last for a hundred years under water, many pieces of the standing and running rigging of the Royal George having been found in the most perfect state of preservation when brought to the surface after General Pasley's experiments at Spithead.

More than a twelvemonth ago Government appropriated a sum of £20,000 for experiments in submarine wires; but, as generally occurs in such grants, little good has resulted from the expenditure. Half that sum, properly applied, would have placed the question of what description of coating is most serviceable beyond doubt.

London, March 25th. T. W. B.

ON THE VIBRATIONS OF A STEAM ENGINE MOUNTED ON WHEELS.

Sir,—In a leading article which appeared in The Engineer of October 11th, 1861, the following statement is made concerning the machines of Messrs. Shand and Mason:—"Some of the moving parts are counterweighted and at high speed, the pitching is very considerable, showing a large loss of power in the injurious motion thus communicated and extinguished at every stroke to and in the mass of the engine." It was my intention to have answered this objection at the time, but was prevented by pressure of business. Similar opinions, however, having been expressed at a recent trial of one of those engines before certain high and influential personages, I beg leave to occupy your valuable space with the following remarks:—The pitching referred to does not proceed from want of counterweights, but from another cause which cannot be counteracted in any engine not bedded on an immovable sole plate. The crank axle is a permanent axis of rotation, or as nearly so as it can be made in practice. The cause of the pitching I shall endeavour to explain. In any steam engine where steam is admitted between the piston and cylinder cover these two surfaces are exposed to equal pressures. If the cylinder be so fixed that it can oppose a statical resistance equal to the pressure of the steam, the piston is propelled with the whole expansive force. When the cylinder and piston are alike free to move, or when the resistance to the motion of the former is not greater than the resistance to the motion of the latter, the expansive force of the steam imparts to each of them an equal momentum. Any of your readers can compute from the elementary formulæ of dynamics the values of the factors. To those who may not have studied mechanics the action may be made apparent by supposing the crosshead pin of an engine of this description to be made a dead fixture by means of brackets secured to solid masonry. Here the piston becomes a fixture, and the engine, with its boiler and appurtenances, the mass to be moved, the consequence will be that the latter will move on the piston and piston rod, and work will be done as in the ordinary way, the effective work, however, being less. The vibrations caused by the reaction of the steam on the cylinder covers are quite distinct from those caused by the unbalanced centrifugal actions of the masses rotating about the crank shaft; the former are inseparable from a portable engine; the latter arise from errors in construction. W. S. M.

[We must beg to differ from "W. S. M.," by saying that the pressure on the cylinder heads of a steam engine has nothing whatever to do with the oscillation when working. And all the power imparted in oscillating the mass of the engine is worse than lost, as the work is strained thereby.—Ed. E.]

ROWAN AND HORTON'S STEAM BOILERS AND SURFACE CONDENSERS.

This invention, by Messrs. J. M. Rowan and T. R. Horton, of Glasgow, relates to steam boilers and surface condensers, and to the more effective carrying out of the system of surface condensation, an important object of which system is the supplying of marine boilers with fresh water.

The improvements in boilers are comprised in a modification of the "compound-subdivided" class of boiler described in the specifications of letters patent granted to the present patentees, and dated the 19th April, 1858 (No. 856), and the 8th February, 1860 (No. 332). This improved modification is represented in Figs. 1 and 2, these Figures being vertical sections taken at right-angles to each other.

The boiler consists of a series of vertical leaves or sections, which, in this example, are hollow-sided frames A, crossed by vertical tubes B, and arranged transversely, being shaped at their lower parts to form two or more furnace spaces C, which run across the sections. The parts *a* of the section frames A, projecting down to form the sides to, or divisions between, the furnace spaces, communicate with large horizontal tubes D, placed beneath parallel to the furnaces C, and insuring an improved circulation of the water. A horizontal cylindrical steam chamber E runs along above the sections A, and communicates with each section by two or more curved pipes F, while one or more steam domes G rise from any convenient part or parts of the chamber E. To provide for a return current from the steam chamber E pipes H are carried from one or both ends of it down to one or more of the bottom tubes D, whilst the feed pipes communicate with one or other of these bottom tubes.

A first improvement in surface condensers consists in making the tubes of thin iron or steel coated externally or internally with copper, brass, or other metal or alloy not injuriously acted upon by sea water. If the sea water is outside the tubes the coating must be external, as shown in Figs. 3 and 4; and if the sea water is inside the tubes the coating must be internal, as shown in Figs. 5 and 6. With the view of preventing galvanic or corrosive action or oxidation, the coating metal is carefully closed over the ends of the iron or steel tube, or a coating of soft solder may be applied to the ends for that purpose. Similarly other internal parts of the condenser exposed to the sea water are, by preference, made of copper or brass, or with a coating of copper, brass, or similar metal or alloy. Thus the screw bolts as at I, Fig. 7, in the tube-plate J, for securing the stop plates K (in the case of condensers with the sea water outside the tubes), are held by brass nuts L, which are hollowed to receive soft solder *l*, to cover the end of the bolt I. According to another modification the condenser tubes, as also the tube-plates, may be made of copper or brass, galvanised or otherwise coated on the surface exposed to the steam or fresh water to prevent injurious action.

A second improvement in surface condensers applies to the kind described in the earlier specification hereinbefore referred to, and consists in providing an exit for the sea water all round, or at numerous points round the tube chamber. Fig. 8 is a vertical section of a surface condenser as made with this improvement. The sea water enters at the bottom by the passage M, communicating by a central aperture with the bottom of the tube chamber N, and has its exit by a narrow slit or opening P, formed round the uppermost part of this chamber N. An annular passage Q is formed round the shell of the chamber N, with which passage the slit P communicates, and by which the water finds its way to the exit pipe at R. The sea water is thus made to pass off in a uniform current on all sides, whereby the cooling action is rendered more uniform over the tubes.

A third portion of the improvements in surface condensers relates to the mode of holding the tubes in the tube plates. In one modification, as shown in section in Fig. 9, and in plan, in Fig. 10, the hole in the tube plate J is enlarged to receive a caoutchouc ring S, shown detached in section and in plan in Fig. 11, which ring is slit partly through cylindrically. A wedge-shaped metal ring T, also shown in Fig. 11, has its edge entered into the slit, as shown in Fig. 9, and tightens the joint by being pressed in more or less by the stop plate K. The stop plates K are made in sections of any convenient form, but by preference hexagonal when for a condenser of large size. In another modification of tube joint, a short tube U of caoutchouc, such as is shown in section and in plan in Figs. 12, 13, and 14 is applied to the tube V externally, as shown in Fig. 15, if the sea water is external, and internally, as shown in Fig. 16, if the sea water is inside the tube. The caoutchouc tube U is, by preference, made tapering in thickness, and is held between the tube plate J and the stop plate K, being formed with a flat flange *u*, having a hexagonal outline, as shown in Figs. 13, 14, and 17, so as to fit together with the adjacent flanges, or having a round thickened rim, as shown in Figs. 12 and 18, fitting in a recess, which may be either in the tube plate J, as shown at W, or in the stop plate K, as shown at X, Fig. 16.

Locomotives.—The Home Secretary has prohibited the working of locomotive engines in the streets of the metropolis between the hours of 7 a.m., and 10 p.m. Some uneducated horses were said to have been startled, a fortnight ago, by the appearance of their intelligent rival in the streets of London. The prohibition, we trust, will not long continue.

Saloon Steamer.—The handsome saloon steamer Prince Consort, built and engined by Messrs. Caird and Co. for the Loch Lomond traffic, had a very successful trial of her machinery this week. The engines worked as smoothly as if they had been six months in use, and, with a pressure of 25 lb. of steam, she accomplished the highly satisfactory speed of 16½ statute miles an hour. She was very steady, and, although there was a smart breeze, did not careen in the slightest degree. The builders are putting the finishing touch to her elegant and comfortable internal decorations and furnishings, and she will proceed to Loch Lomond as soon as the Leven attains sufficient depth to permit of her transit. There can be no doubt that steamers of this class, but of larger size, would be admirably adapted for river traffic as far as Rothesay, and for even greater distances during summer months, and we hope the day is not far distant for their general adoption.—*Greenock Herald.*

TO CORRESPONDENTS.

*** Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

Vacuum.—*We do not understand you.*

A. S. (Dundee).—*The same thing has been often proposed, but we are not aware of its practical use.*

Xerxes.—*The Protection of Designs Act has nothing to do with mechanical or patentable inventions. It could not meet the case you propose.*

A Foreign Constant Reader of the Engineer.—*We see no advantage in the deposit of a complete instead of a provisional specification. As to the other matters, it would be useless to differ from the authorities, especially when it is proposed to abolish patents altogether.*

STEAM CULTURE.

(To the Editor of the Engineer.)

Sir,—Your correspondent, Mr. R. Blackburn, puts several interrogatories in his letter on the above subject: but it is only on one that I have to remark. Mr. Blackburn asks, "Is it necessary, in order to cultivate by steam, to draw implements at four miles per hour? Would not half that speed do equally well? &c. &c." I will venture a decided negative to the latter question. My experience in the field has caused me to form a very strong opinion that a goodly speed to the cultivator is the next great requisite to depth in cultivation. Any of the forms of cultivators now in use turn out quite different qualities of tilth at speeds of two miles and four miles per hour. Indeed, so inferior is the quality when the speed is below, say one and a half mile per hour, that it may be doubted whether four operations at a speed of one mile per hour would benefit the soil so much as one at four miles.

William Collett Homersham.

1A, Adelphi-terrace, London, W.C.,
April, 8th, 1862.

JAMES HUMPHRYS' STEAM ENGINES.

(To the Editor of the Engineer.)

Sir,—Having observed in The Engineer, for the week ending April 11th, a letter from Mr. F. W. Turner, calling my attention to his patent, dated December 27th, 1858, No. 2962, I beg to inform that gentlemen that I have referred to his patent, as well as a large number of others, and I find that the oscillating engine he describes was, together with an inverted engine on the same principle, patented by Mr. David Rowan, December 15th, 1858, No. 2868, therefore invalidating Mr. Turner's patent. The method of placing one cylinder concentrically inside the other, as a modification of Woolf's well-known system, was carried into effect long before the date of either patent. I refer to one of the engines used to drain the Haarlem Lake, and constructed, if I recollect right, by Messrs. Harvey, of Hayle, Cornwall.

The form of slide-valve and disposition of passages, &c., with the arrangement of the parts as applicable to horizontal or vertical engines, as explained in my specification, to the best of my belief are entirely novel.

J. Humphrys.

8t. Katherine's, Tower-hill, April 16th, 1862.

MEETINGS NEXT WEEK.

Institution of Civil Engineers.—Tuesday, April 22, no meeting, it being Easter Tuesday.

Society of Arts.—Wednesday, at 8 p.m., "On the Effect of Prizes in Improving Manufactures," by Samuel Sidney.

Civil and Mechanical Engineers' Society. — Thursday, 7.30 p.m., resumed discussion "On Single and Continuous Straight Girders," by Francis Campin, C.E., President, followed by a paper "On Coal," by Mr. R. C. Paterson.

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THE ENGINEER.

FRIDAY, APRIL 18, 1862.

THE GUN OF THE FUTURE.

If there can be such a thing as an unburstable gun, it is already wanted. A gun which would not burst could, if made large enough, burn 1,000 lb., or any other quantity of powder at a round, and fire a shot of 5 tons, or any other weight, across the English Channel. How far the large Armstrong gun is likely to withstand maximum charges is not known, only some half dozen discharges with 40 lb. and 50 lb. of powder having yet been made. An American cast iron gun, firing a 425-lb. shot, was said, a year ago, to have been fired 350 times with charges of from 35 lb. to 50 lb. of powder, the initial velocity of the 425-lb. ball being 1,328ft. per second, with 40 lb. of powder, and the range something over 3 miles. The Mersey gun had been fired 139 times with from 40 lb. to 50 lb. of powder, but had begun to show signs of weakness, as the Armstrong will, very likely, also, after as many full charges have been fired. It has been said that there is no Armstrong gun in the service, rating over an 80-pounder, which has ever been fired 300 rounds in all, and until the larger guns have seen some such service it is useless to rely implicitly upon their endurance. Cast iron guns have been fired, with full charges, 2,000 times and more in succession, and even the ordinary 68-pounder gun has to bear a proof charge of 28 lb. of powder. Mr. Mallet's mortar fired a shell of 2,481 lb., or upwards of a ton in weight, with 80 lb. of powder, but the strain was too great, and the mortar gave out in almost the same manner as a number of the 110 lb. Armstrongs have done. Nearly twenty years ago Messrs. Walker, of Gospel Oak, near Bilston, cast a 20-in. mortar, ten guns each of $15\frac{3}{10}$-in. bore and throwing a 456 lb. shot, and a number of 10-in. guns, all for the Egyptian Government. Some of the 10-in. guns were fired at Deal, with 32lb. of powder. The Americans now propose to employ a few 20-in. guns to carry a 1,100 lb. or half-ton shot, and to burn, probably, 100 lb. charges of powder. If the large guns can only be made as strong in proportion to the increased charges as those of ordinary size, great progress will have been made towards an unburstable gun.

The Mersey gun was the first, about six years ago, to destroy a 4½-in armour plate, the wreck of which is now in the Exhibition building, although, as the officials have marked upon one of the fragments "No space allotted," it may be that the public will not be permitted to see what a pre-Armstrong gun has done.* The Mersey gun, firing its shot with 50 lb. of powder, or the American cast iron gun with the same charge, would, had they been turned upon a "Warrior target," have done just what the 10½-in. Armstrong gun did, there being the same driving power upon the shot in each case. The production of a gun, therefore, which should punch a 4½-in. iron plate, timber backed and supported behind by granite, was nothing new by Sir William Armstrong. The important point, in which the Armstrong gun is to succeed or fail, is to go on at the work, firing hundreds of full charges successively. This is the only kind of discipline which can properly test any gun. It was some time before the Mersey gun showed serious symptoms of weakness, and we have no doubt that, for two or three rounds, the gun might have withstood even 75-lb. or 80-lb. charges, with 180-lb. shot, or thereabouts, and in that case it would be strange if two Warrior targets, placed one behind the other, were not punched through and through at a single discharge. Then, again, what has the Armstrong gun cost, and what would it cost by the hundred? If it cost £35 a ton to make an armour plate, a mere flat slab, 4½-in. thick, what must the 12 tons of a gun cost when made upon the so-called Armstrong plan? Shall we say £2,000? Or will it be more? Not that even a cost of £5,000 (after Mr. Gladstone had doubled the income-tax) would preclude the use of the best gun; but a very little consideration of the requisites of a good piece of ordnance, and a little common sense, will teach us that nothing like such a cost is necessary in the construction of a single metal tube, closed at one end. The first requisite is strength, not only to resist tensile but compressive strains. Wrought iron has twice the tensile strength, and but about one-third the compressive strength of cast iron, thus being superior to it in one respect and greatly inferior in another. Hard steel has more than twice the tensile strength of the best wrought iron, and great compressive resistance also; but it is brittle, and inapplicable for guns. But there is a material known as homogeneous metal, or mild steel, most readily produced by the Bessemer process, which, with a tensile strength more than one half greater than that of the best wrought iron, has also great compressive strength, and is, moreover, as tough as copper. Furthermore, this material can be cast in ingots, large enough for guns or for any purpose, and, thus cast, is manifestly superior to any wrought iron forging which human ingenuity can devise. For, not only is all the homogeniety of a cast ingot first obtained, but the ingot is afterwards forged to any extent required, and, necessarily, without any risk of unsound welds, or flaws of any kind. The cost of the cast ingots, moreover, would not be more than £7 10s. per ton if taken upon the great scale by Government. While the War Office are going on with a lavish expenditure, let them look into this question of homogeneous iron or mild steel guns. Sir William Armstrong, whose literally roundabout processes would be swept away by the introduction of such a material for guns, affected the greatest ignorance of it when he presided over the meeting of Mechanical Engineers, last summer, at Sheffield. It is from a metal having the same qualities, but produced by a far more costly process, that Mr. Whitworth forms the internal tubes of his guns. And it is of such a material, we believe, at once strong, hard, tough and homogeneous, and withal cheap in itself and facilitating a ready and certain conversion into the required form, that an unburstable gun, if such a thing can be, is to be produced.

* The proprietors of this plate, or these fragments of a plate, may not be aware that they are being displayed as showing the havoc made by an "Armstrong" gun; such is the case, however.—Ed. E.

GAS AND GAS MAKING.

It is natural with most minds, after an artificial process has been established in practical and profitable use, to look upon it as substantially perfected. A few will expect that among a mass of details more or less improvement will be made, but nearly all will choose to believe that the region of important discovery must have been explored to its farthest limits. This is no more than the natural disinclination to believe in what is unseen, and were it not that experience has taught mankind that they can, voluntarily, remove themselves to distant parts of the world, most of us, probably, would doubt, if not deny, the existence of any material thing beyond the immediate range of our own vision. Gas making, nevertheless, which was first practised, on the great scale, a half century ago, has been practically revolutionised within the last few years. It is carried on very differently now from what it was in the year of the first Great Exhibition. We are referring more particularly to the London gasworks, where more gas is made than anywhere else in the world. Many consumers can remember when the price of gas was 6s. and even 8s. a thousand feet, and in many cases the gas had only three-fourths of the illuminating power of that now supplied in London at 4s. 6d. per thousand. The first great step to an improvement in gas making was the adoption of clay retorts, the Commercial Gasworks, at Stepney, then under the management of Mr. Christie, being the first in London to substitute clay retorts exclusively in place of those of iron. This was in 1851. It must be confessed that, even then, clay retorts were not at all new, inasmuch as they had been patented in 1820, and almost immediately afterwards adopted in Scotland. The question of absolute novelty is distinct however from that of general use, for, only ten years ago, there were gas engineers in plenty in London, and in many of the large provincial towns, who denied the possibility of successfully carbonising coal in clay retorts. It was said that they would crack, and so they do, but with exhausters there is no escape of gas after a few days' use, the carbon soon sealing up everything like a crevice admitting of the passage of gas. We do not remember all the rest that was said against clay retorts, but the result has proved their great superiority to iron retorts, costing less than half as much at the outset, making gas of equal quality, and lasting from three to four times as long. As for the coke used in firing, we are informed that the Phœnix Gas Company, who employ clay retorts exclusively, burn but 18 per cent. of all their coke, a result which may be safely set against the very best practice with iron retorts.

The retorts, too, have been more than doubled in length, and are now charged at both ends at the same time. By a careful organisation of labour, too, and with better appliances for handling the coal and coke, the cost for wages has been reduced to less than 6d. per thousand feet of gas made.

The purification of gas by the hydrated oxide of iron is, too, a great improvement, likely to be still more extensively adopted after the expiration, within less than two years, of Mr. Hills' patent. So thorough is this means of purification that the acetate of lead tests no longer show the least trace of sulphuretted hydrogen in the London gas, while with a little dry lime at the end of the purifying process, carbonic acid is as effectually removed. The oxide of iron, too, is practically costless, or will be so when the patent monopoly expires, inasmuch as its immense power of revivification, and the free sulphur finally collected in it, make up in great part for its cost at the outset. We think that, on the score of economy of labour alone, our gas companies will find their account in using still larger or more numerous purifiers, for the oxide only acts with its full energy when ample time is allowed for combination. Thus at the City Gasworks, when the gas from 1,500 tons of coal is sent weekly in winter, through the purifiers, the oxide has to be changed three times a week, but when, in summer, only 500 tons of coal are carbonised weekly, the oxide goes for three weeks, thereby showing that, when the proportion of passing gas is small in comparison with the oxide, three times as much sulphur is taken up by a given quantity of oxide before revivification.

Something further will be saved if the plan of revivifying the oxide in the purifiers themselves finally proves successful in extensive practice. We believe this plan was first carried out at the Western Gasworks under the directions of the late Mr. Alexander Wright, and it is still practised there by the present engineer, Mr. Pritchard. The gas made is cannel only, containing, we believe, a less proportion of sulphur than ordinary gas, and the oxide is placed in the purifiers in a single layer 18in. in depth. The bottom of the purifier being placed in communication with the chimney stalk, a fan, worked by manual power, is made to discharge under the lid at the top. It is found, however, that, if the fan be not used with care, the oxide is likely to take fire, and in any case it is found best to take out the oxide for the first and second revivification after it is first used. The tendency of the oxide to become clogged has, in other works, generally been found to be so great as to require its removal for the purpose of breaking it up into its original granular state. Mr. Hills, we believe, recommends that the oxide be kept constantly in course of revivification in the purifiers, by passing a small per centage of air through with the gas. This, it would seem, involves a loss, to a certain extent, of illuminating power, which is to be made up by a proportionate admixture of cannel or Boghead gas. We suspect that something like this mode of revivification is practised at many gasworks, the warmth, not to say heat, of the purifiers, and the occasional warping of the wooden sieves or gratings which support the oxide, being an indication of some strong chemical combination within. Mr. Hills, we believe, holds that, in this mode of revivification, the small quantity of air admitted does not really impoverish the gas. The oxygen of the air being taken up by the iron (with the precipitation of free sulphur), Mr. Hills believes that the liberated nitrogen seizes upon some of the hydro-carbons which would otherwise be deposited as naphthaline, and this "naphthalised nitrogen," as he terms it, is said to compare very favourably, in illuminating power, with ordinary gas.

Even as now carried out, and without any accessories or further improvements, the mode of purification by oxide of iron, with the entire absence of sulphuretted hydrogen, is a great step in gas making. As now carried on, indeed, our gasworks are hardly at all offensive to the olfactory sensibilities of neighbouring residents. The Templars, even, can hardly be aware, by any perception of smell, of the proximity of the City Gasworks; for, at that establishment, not a purifier lid is removed until the atmosphere of foul gas within it has been previously drawn out by an exhauster and passed through a second purifier, so that, when the lids do come off, nothing but light purified gas can arise from beneath them, and this gas soon ascends higher than any house-top, and far beyond the perceptions of ordinary noses.

Those who would fully appreciate the improvements which have been made of late years in gas making may gain an accurate idea from the following particulars of the Philadelphia (U.S.) Gasworks, as compiled from the report made to the authorities of that city for 1859, the works being the property of the city.

The whole investment in four gas-making establishments was £1,036,311, the district being upwards of fifty square miles in extent, and including a population of rather more than 600,000 persons. The gas rental, including sales of coke, &c., was, for 1859, £233,423.

The price of gas was 2 dollars 25 cents a thousand, or 9s. 3½d.

In 1859, 57,309 tons of coal were carbonised, producing 562,110,000ft. of gas, or the high average of 9,808 cubic feet per ton. The cost of coal at the works averaged 23s. per ton. Of the coke made 60½ per cent. was used under the retorts and in the offices and yards, leaving but 39½ per cent. for sale.

The retorts were 468 in number, generally 7ft. 6in. long, all of cast iron, set three in a bench, and charged every four hours.

The cost of labour within the walls of the gasworks was 9½d. per thousand feet of gas made. The cost of clerks and distribution outside the walls was 10¼d., or more than the whole cost of manufacture. The renewals of cast iron retorts amounted to 4d. per thousand feet of gas made, and the repairs of works to 2¼d. The whole cost of making gas was 97 cents, or exactly 4s. a thousand. The loss by leakage was slightly more than 12 per cent., which is not excessive. The whole manufacture in Philadelphia must, however, have been carried on upon an even more imperfect mode than prevailed here twenty years ago, and the results quoted afford a fair point of view from which we may judge how greatly the whole business of gas making has been improved.

INSTRUMENTS IN THE EXHIBITION.

(From the *Times*.)

In philosophical and scientific instruments of all kinds the English portion of the Exhibition will be unusually rich. These are included in Classes 13 and 25, which are placed under the superintendence of Mr. C. R. Weld. Class 13 (philosophical instruments and the processes depending upon their use) comprises almost every description of the newest and most improved kinds of philosophical, optical, and telegraphic apparatus, models of engines, &c. Among the exhibitors are all the great makers of instruments in England, with a large number shown by scientific gentlemen. The immense number of inventions devised within the last ten years upon electric telegraphy, each of which is successively an improvement upon the other, will be strikingly illustrated by the various collections exhibted by the Universal Telegraph, the British and Irish, the Submarine, and other companies.

The British and Irish Company exhibit an ingenious and novel system of controlling turret and other clocks, patented by Mr. L. Jones, of Chester, unlike any previously in use; the clocks being controlled only, and not moved either in whole or part, by electricity. The three clocks shown are in all respects, excepting the pendulum, of ordinary construction, and will go without the electric current, keeping their own time. The pendulum is a hollow electro-magnet, oscillating over or around permanent magnets. When a current is sent, second by second, from a controlling clock, the temporary attraction between the electro magnet and the permanent magnet compels the controlled pendulum to copy the vibrations of the controller, even though there may be a discrepancy of several minutes in their daily independent rates. The above company also send the acoustic telegraph, a clever and extensively used instrument, invented by Sir Charles and Mr. E. Bright. By its means a telegraph clerk, in taking off a message, writes it himself without being obliged to raise his eyes from the paper, the signals being produced by strokes on a pair of bells of different tones, one placed on either side of his writing-desk. The other telegraph instruments shown and in use by the company consist of Highton's needle telegraph and Henley's magnetic telegraph. There is also a transmitting relay, patented by the Messrs. Bright, for use in connection with a needle telegraph, by means of which the taking off of a message at an intermediate station is rendered unnecessary, extra battery power being used instead. We also notice a rarefied-air lightning protector, patented by these gentlemen, and specimens of insulators used by the company on their extensive lines of road telegraph throughout the kingdom. Professor Wheatstone's most ingenious, but most simple, telegraph for domestic use is to be shown in working order. Mr. Walker, the telegraph engineer of the South-Eastern Railway, will show the apparatus in use throughout the lines of the company for train signalling. The most important feature in this valuable apparatus is its extreme simplicity, being almost destitute of mechanism, in order to lessen the chance of its getting out of repair. Mr. Walker also exhibits a graphite battery in work, remarkable for its simplicity of action, and the constancy of the power evoked; an audible system of train signals; an index for counting, and an apparatus for recording them. None of these most valuable contrivances are patented. Messrs. Elliot exhibit a number of electrometers of the most delicate kind; large electrifying machines, with ebonite discs; improved air-pumps on a large scale; drawing instruments in aluminium, bronze, &c.; micrometer gauges for shot and shell; improved quadrants for levelling rifled cannon; and a large and very beautiful sectional model of a steam engine, with all the latest improvements. Messrs. Murray and Heath will show an improvement upon the electric lamp, by which the electrodes are kept at constant distances without the intervention of any clockwork motion. An improved instrument for observing the circular polarisation of liquids, and an entirely new reflecting stereoscopic microscope, as might be expected, form a most prominent feature in this class. All the principal makers of these important instruments, which have, since their great improvement, developed microscopic study into a distinct science, show their most valuable and simple apparatus, from the costly binocular instrument which defines the globules of the blood, or the circulation of vegetables, down to the cheap but serviceable instrument for the young student or schoolboy. The collection of improved binocular microscopes will be one of the finest of the kind ever seen. In this class also will be shown some exquisitely-adjusted balances and weights —balances which the 100th part of a grain would turn at once. Mr. Warren de la Rue exhibits a most interesting series of photographs, showing the progress of the late total eclipse of sun, as seen in Spain. Among the chief exhibitors in this class, also, are the great makers Messrs. Negretti and Zambra. Their show of scientific and philosophical instruments will be one of the most complete and extensive of all. Some of their instruments are entirely new, and most of the important ones, upon the instant action of which scientific observation depends, are self-registering. Among these will be shown a thermometer so exquisitely sensitive as to rise atonce upon the approach of the hand within two or three inches. This was made specially to test the temperature of the body and coils of the python during her attempted incubation at the Zoological Gardens. This class of philosophical instruments also contributes trophies to the nave, among them the large telescopes by Messrs. Grubb, Dalmere, and Cooke. Lighthouse lanterns, with all the recent improvements, are also shown, including, among others, the execrable red post and ball we have already referred to. The new observatory, under the management of a committee of the British Association for the Advancement of Science, send a beautiful series of instruments for the automatic registration of the variations of magnetometers. These present some very convenient, though not very important modifications of Mr. Brook's ingenious instruments as employed in the observatories of Greenwich and Paris.

Messrs. Caird and Co.'s Model Engines in the Exhibition.—The models of engines are three in number, two of them being made to a scale of a quarter of an inch to the foot, and all of steel. They are, perhaps, the most delicate and exquisitely finished pieces of mechanism ever exhibited in this town, and there is so much labour and work shown in so small a space that an attempt to describe them would be useless. We may mention that the time taken to make each of them was about ten month's constant work. One of them is a model of a pair of oscillating engines of 180-horse power collectively supplied to the paddle wheel steamer Dania, built by Caird and Co. in 1858 for H. P. Prior, Esq., Copenhagen. The other small model in steel represents the engines fitted on board the Spanish Steam Navigation Company's screw steam ship Colon, launched 31st December, 1861. They are 400-horse power, of the inverted cylinder direct acting class originally designed by J. T. Caird, Esq., and which have been fitted by the firm on board of upwards of twenty screw steamers, some of them of the largest size. The largest and most useful of the model engines which Messrs. Caird exhibit is that representing to a tenth of the full size a pair of engines of 1,000-horse power collectively. This engine was designed as suitable for vessels of war, where it is of the utmost importance to have all the machinery below the level of the water to protect it from shot and other sources of danger. The model is a working one, and makes a very compact and complete pair of small engines equal to 10-horse power collectively. It is fitted up in a most tasteful and elaborate manner, with all the latest improvements, having link motion for reversing, and a variable expansion-valve, with gear suitable for cutting off the supply of steam to the cylinder at any part of the stroke of the piston, as may be required for service and economy. This model is fitted up with the regular injection-cocks, bilge injection-cocks, throttle-valves, expansion-joints, flooring plates, brass hand-rail, and starting gear complete. The number of bolts and separate pieces internally and externally is such as would be required in the large engine, all having been carefully reduced to the scale in size, thus keeping everything in proportion—*Greenock Herald.*

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

3241. Peter Armand le Comte de Fontaine Moreau, South-street, Finsbury, London, "Improvements in treating fatty and resinous bodies either in a neutral or acid state."—A communication from Charles Monier, St. Ouen, Paris.—*Petition recorded 27th December*, 1861.

242. William Davies, Elizabeth-place, Old Bethnal Green-road, Middlesex, "Improvements in apparatus for cutting corks and bungs."—*Petition recorded 30th January*, 1862.

311. Adam Carlisle Bamlett, Middleton Tyas, near Richmond, Yorkshire, "Improvements in reaping and mowing machines."—*Petition recorded 4th February*, 1862.

415. Arthur Henry Harrison, Park-place, Highbury, Middlesex, "An improved under garment for gentlemen and ladies' wear."—*Petition recorded 15th February*, 1862.

478. James Peterkin Douglas Camp, Fleet-street, London, "Improvements in the arrangement of valves for steam and other engines, and in the means of operating the same."—A communication from Henry Steele, Jersey, New Jersey, U.S.—*Petition recorded 22nd February*, 1862.

507. Carlo Minasi, St. James's-terrace, Kentish Town-road, Middlesex, "Improvements in cartridges, and in apparatus for facilitating the proper aiming with fire-arms."—*Petition recorded 25th February*, 1862.

533. Thomas Adams, Deptford, Kent, "Improved arrangements for effecting an equilibrium of the steam pressure upon valves, the said arrangements being also applicable for effecting equilibrium of fluid or gaseous pre-sure upon other valves."—*Petition recorded 27th February*, 1862.

625. John Platt and William Richardson, Oldham, Lancashire, "Improvements in machinery or apparatus for cleaning cotton from seeds."—*Petition recorded 8th March*, 1862.

656. Oliver Kerautret and Jules Kerautret, Passage des Petites Ecuries, Paris, "Improvements in the construction and ornamentation of buildings, by the use of which hewn stone and faced bricks are dispensed with in some parts thereof."

659. Thomas Barnes Wilson, Queen's Ferry, Flintshire, and William Wilson, Preston, Lancashire, "Improvements in means or apparatus for the splitting of cane and other fibrous substance."—*Petitions recorded 11th March*, 1862.

665. Alexander James Russell, Edinburgh, Mid Lothian, N.B., "Improvements in the arrangement of the electric conductors for submarine telegraphs."—A communication from Francis Bensa and Windham Charles James Anstruther, Florence.

676. Frederick Tollhausen, Rue de Faubourg Montmartre, Paris, "An improved kind of spinning or humming top."—A communication from Jean Marie Charles Martin, Esq., Rue Neuve des Martyrs, Paris.—*Petitions recorded 12th March*, 1862.

718. James Hunter and Robert Scott, Coltness Ironworks, Cambusnethan, Lanarkshire, N.B., "Improvements in reaping machines."—*Petition recorded 15th March*, 1862.

735. Bereton Todd, Bissoe and Perran Smelting Works, near Falmouth, Cornwall, "Improvements in the manufacture of antimony and the oxide of antimony."—*Petition recorded 17th March*, 1862.

773. Albert Hill, Cheddar, Somersetshire, "An improved fastening for stays."

775. Edwin Smith, Sheffield, "Improvements in means or apparatus for cutting stone, wood, and other material, which improvements are also applicable to modelling in plastic materials."

779. William Baddeley, Angel-terrace, Islington, London, "An improved method of preparing tobacco for smoking, and in the apparatus to be used for that purpose."—A communication from Charles Hoppe, Cologne, Germany.

781. John George Thompson, Porchester-place, Middlesex, "Improvements in pianofortes, organs, harmoniums, and other instruments having key-boards."—*Petitions recorded 20th March*, 1862.

783. Robert Kay, Castleton Print Works, Blue Pits, Lancashire, "Certain improvements in the method of printing calico and other surfaces, and in apparatus connected therewith."

785. James Newall Emy, Lancashire, "Improvements in supplying gas to railway carriages, stations, steamboats, and other vessels, omnibuses, or other carriages, at any required pressure and in apparatus connected therewith."

786. John Matthias Hart, Cheapside, and Robert Lavender, Goswell-road, London, "Improvements in means for generating steam."

787. James Fawcett, Wakefield, Yorkshire, "Improvements in the manufacture of soap, particularly applicable to the scouring, cleansing, and fulling of woollen or other cloths."

789. Brownlow Hugh Mathew, St. James's, Middlesex, "Improvements in fire-arms and in cartriages."

791. James Warbrick, William Warbrick, and Alfred Travis, Furnace Hill Ironworks, Dukinfield, Cheshire, "Improvements in engines for carding cotton and other fibrous materials."—*Petitions recorded 21st March*, 1862.

793. David Abercrombie, Glasgow, Lanarkshire, N.B., "Improvements in power looms."

795. Toni Fontenay, Grenoble, France, "Improvements in smoke-consuming furnaces."

797. Edward Lord, Todmorden, Yorkshire, "Improvements in certain machines for preparing cotton and other fibrous substances."

799. Robertson Gladstone, Court-Hey, Broad Green, Lancashire, "Certain improvements in tilting or tipping wagons."

801. Joseph Henry Tuck, Cannon-street, London, "Improvements in the manufacture of flexible valves."

803. Thomas Mosdell Smith, High-street, Kensington, Middlesex, "Improvements in the manufacture of candles."

805. William Holiday, Union Foundry, Bradford, Yorkshire, "Improvements in the manufacture of press plates."—*Petitions recorded 22nd March*, 1862.

808. John Henry Brierley, Beech Hill Mills, Halifax, Yorkshire, "An improved clasp or fastener for reversible belts, bands, or straps."

809. John Clarke, Shiffnal, Salop, "An improvement or improvements in carriage axles."

811. Samuel Ellison Turner, Birkenhead, Cheshire, "An improved apparatus for burning a mixture of inflammable gas and air."

812. Charles Marien Roullier, Paris, "Improvements in flat cables or chains."

813. Benjamin Fleet, East-street, Walworth, Surrey, "Improvements in apparatus for manufacturing and bottling soda water."

815. Edmund Morewood, Stratford, Essex, and Andrew Whytock, Little St. Andrew-street, St. Martin's-lane, London, "Improvements in the process of coating metals and in the apparatus employed."

819. William Henson, Great Alfred-street, Nottingham, "Improvements in knitting machinery."—*Petitions recorded 24th March*, 1862.

819. Echlin Molyneux, Seaview, Enniskerry, Wicklow, Ireland, "Improvements in air, gas, and vapour engines."

820. Amherst Hawker Renton, Royal Avenue-terrace, Chelsea, and Edward Cottam, Pimlico, Middlesex, "Improvements in apparatus for steering ships."

821. Walter Beaumont and John William Edge, Manchester, "Improvements in sights for rifles."

823. Albert Marcius Silber, Wood-street, London, "An improved fastening for purses, pocket books, bags, and other articles."—A communication from Johann George Klem, Offenbach, Germany.

825. Edmund Morewood, Stratford, Essex, and Andrew Whytock, Little St. Andrew-street, St. Martin's-lane, London, "Improvements in the manufacture or shaping of iron or other material."

826. William Palmer, Sutton-street, Clerkenwell, London, "Improvements in lamps."

827. Charles Culling, Downham Market, Norfolk, "Improvements in fire-arms."

829. John Thomas Loft, Brooklyn, New York, U.S., "Improved machinery for covering strips of metal and wire."—*Petitions recorded 25th March*, 1862.

831. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements, in apparatus for cleaning tubes and flues of steam boilers and similar conduits."—A communication from Claude Dumas, Paris.

833. James Parker, Huddersfield, Yorkshire, "Improvements in steam engines, and in apparatus connected therewith."—Partly a communication from Bernhard August Schaffer, Magdeburg, Prussia.

835. Henry Nunn, Chelsea, Middlesex, "Improvements in the construction of mangles."

837. James Boothman, Gisburn, near Skipton, Yorkshire, "Improvements in bee-hives, and apparatus connected therewith."

839. Henry Carr, Victoria-street, Westminster, Middlesex, "Improvements in applying lubricating fluids to the journals of railway carriages and locomotive engines."—*Petitions recorded 26th March*, 1862.

842. Alfred Vincent Newton, Chancery-lane, London, "An improved process of and apparatus for separating the fibres of wool, flax, hemp, and other vegetable substances, and extracting the colouring matters therefrom."—A communication from Azel Storrs Lyman, New York, U.S.

852. Jeanne Louise Henriette Clemence Comtesse de Vernede de Corneillan, Paris, "Improvements in treating open cocoons of silk-worms, and in converting the waste resulting therefrom into paper."—*Petitions recorded 27th March*, 1862.

862. James Jones, Bierley Bank, Warrington, Lancashire, "Improvements in apparatus for raising and forcing liquids."

868. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in chaff cutters."—A communication from Auguste Bernard Albaret, Paris.

870. Robert Lublinski, City-road, London, "An improved method of jointing crutch hooks on umbrellas or walking canes."—*Petitions recorded 28th March* 1862.

872. John Boucher, Surrey-villas, Camberwell New-road, Surrey, "Improvements in rifled ordnance and fire-arms, and in the projectiles to be used therewith."

878. William Glass, Princes-street, Stamford-street, Lambeth, Surrey, "Improvements in the treatment of sulphuret of antimony, and in obtaining products therefrom."

880. William Patterson, Glasgow, Lanarkshire, N.B., "Improvements in the manufacture of iodine."

882. John Baker, Devonshire-grove, Old Kent-road, Surrey, "Improved alimentary preparations."

884. John Platt and William Richardson, Oldham, Lancashire, "Improvements in carding engines."—*Petitions recorded 29th March*, 1862.

886. John Clinton, Percy-street, Tottenham Court-road, London, "Improvements in flutes."

888. John Jordan, Liverpool, "Improvements in the construction of armour plated vessels or other like structures."

892. William Henry Hook, Walworth, Surrey, "Improvements in folding envelopes and paper, and in machinery or apparatus employed therein."

894. William Barry Lord, Plymouth, Devonshire, and Frederick Hughes Gilbert, Brixton, Surrey, "An improved hame slip for suddenly releasing horses and other cattle from their harness, also applicable for releasing heavy bodies or weights."

896. Richard Burley, Lower Thames-street, London, "An improved material for forming or lining the bearings of axles and shafts, and other rubbing parts of machinery."

898. Robert Nightingale, Maldon, Essex, "Improvements in markers, butts, or mantelets."

900. John Harding, Beeston Manor Iron and Coal Works, Leeds, Yorkshire, "Improvements in the application of the waste heat arising from coke ovens for heating air for blast furnaces, also for calcining ironstone and other minerals, and for heating and smelting iron."

902. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in rotatory engines."—A communication from Wilhelm Heinrich Christian Voss, Berlin, Prussia.

904. William McIntyre Crakston, King-William-street, London, "Improvements in machinery for cutting corn and other crops."—A communication from James Smith Thayer, New York, U.S.—*Petitions recorded 31st March*, 1862.

908. William Clark, Chancery-lane, London, "Improvements in the manufacture of manure."—A communication from Mr. Leopold Eugène Lavigne, Boulevart St. Martin, Paris.

912. Frederick Knudsen, Cockspur-street, Charing-cross, London, "Improvements in chronometers."

914. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in machinery or apparatus for spinning cotton and other fibrous substances."—A communication from James Eaton, Boston, Massachusetts, U.S.

916. Henry Walton Whitehead and George Bray, Leeds, Yorkshire, "Improvements in machinery for carding wool and other fibrous substances."

918. John Platt and William Richardson, Oldham, Lancashire, "Improvements in mules for spinning and doubling."

920. John Platt and William Richardson, Oldham, Lancashire, "Improvements in machinery or apparatus used for applying motive power derived from bullocks, horses, or other animals."—*Petitions recorded 1st April*, 1862.

922. William Currie Harrison, Sutherland place, Pimlico, and Henry John Standly, Cockspur-street, Westminster, Middlesex, "An improved instrument or tool for boring or drilling holes in slate or other rock."

924. Reverend George Scratton, Stickney, Lincolnshire, "Improvements in shades or blinds for windows."

926. Richard Archibald Brooman, Fleet-street, London, "Improvements in memorandum pocket and other books, and in pencils and penholders to be used therewith."—A communication from Eugene Recordon, Vaison, Vaucluse, France.

928. Alfred Vincent Newton, Chancery-lane, London, "Improvements in bits for taming or subduing vicious horses and breaking colts."—A communication from Aurelius Langdon, Weymouth, Boston, Massachusetts, U.S.

930. Bewicke Blackburn, York-buildings, Adelphi, London, "Improvements in apparatus for lubricating locomotive and other axles."

932. Thomas Moore, Regent-circus, Piccadilly, London, "Improvements in winding apparatus especially applicable to fishing lines, nets, and loglines, and in leaders or travellers to be used therewith, which leaders or travellers are also applicable to working ships' sails, and other useful purposes."

936. William Clark, Chancery-lane, London, "Improvements in the manufacture of carbonic acid."—A communication from Louis Joseph Frédéric Marguerite and Alfred Lalouël de Sourdeval, Boulevart St. Martin, Paris.—*Petitions recorded 2nd April*, 1862.

940. George Bower, Ashton under-Lyne, Lancashire, and John Qualter, Dukinfield, Cheshire, "Certain improvements in metallic pistons."

942. George Hunter, Coleford, Gloucestershire, "Improvements in machinery and tools for cutting, sawing, and planing stone, marble, and slate."

944. William Kemp, Spital-square, and Thomas Cowley, Harts-lane, Bethnal Green, Middlesex, "Improvements in the manufacture of silk pile velvet."

946. David Wilson, Wandsworth Common, Surrey, and Edward Alfred Cowper, Great George-street, Westminster, "Improvements in presses for pressing cotton, fibrous materials, and hay."

948. Alexander Mann, Tottenham, Middlesex, "Improvements in photographic apparatus."

950. Henry Thomas Hassall, Birmingham, and Michael Burke, Liverpool, "Improvements in reclining or invalids' chairs, and in swinging or ships' chairs."—*Petitions recorded 3rd April*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

932. John Lee Stevens, Fish-street-hill, London.—Dated 13th April, 1859.

899. Rudolph Wappenstein, Manchester.—Dated 11th April, 1859.

890. John Hawkins, Lisle-street, London.—Dated 9th April, 1859.

922. Samuel Tatton, Leek, Staffordshire.—Dated 12th April, 1859.

921. Richard Archibald Brooman, Fleet-street, London.—A communication.—Dated 12th April, 1859.

951. Hugh Adams Silver, Bishopsgate-street Within, London.—Dated 15th April, 1859.

997. Lucius Phelps Porter, New York, U.S.—A communication.—Dated 20th April, 1859.

1100. Daniel Moore, Brooklyn, New York, U.S.—Dated 2nd May, 1859.

938. Joseph Beattie, Lawn-place, South Lambeth, Surrey.—Dated 14th April, 1859.

960. Henry Harrison, Blackburn, Lancashire.—Dated 16th April, 1859.

961. John Sidebottom, Broadbottom, near Mortram, Cheshire.—Dated 16th April, 1859.

1050. John Henry Johnson, Lincoln's-inn-fields, London.—A communication.—Dated 26th April, 1859.

924. William Arena Martin and James Purdie, Woolwich, Kent.—Dated 13th April, 1859.

Patents on which the Stamp Duty of £100 has been paid.

663. John McKinnell, Glasgow, Lanarkshire, N.B.—Dated 26th March, 1855.

789. John Henry Johnson, Lincoln's-inn-fields, London.—A communication.—Dated 10th April, 1855.

865. James Lee Norton, Holland street, Blackfriars, Surrey.—Dated 11th April, 1855.

816. James Templeton, Glasgow, Lanarkshire, N.B.—Dated 13th April, 1855.

823. George Turner, Northfleet, Cheshire.—Dated 13th April, 1855.

Erratum.

898. For "markers, butts," read "markers' butts."

Notices to Proceed.

2022. James Wakenell, Hitchin, Hertfordshire, "Improvements in the construction of invalid bedsteads, convertible into other articles of furniture for the use of invalids."

3024. Gerard Ralston, Tokenhouse-yard, London, "Improvements in the mode of preparing and applying a certain material on the hulls of iron or wooden ships, or on the surfaces of materials for building the same, also for preventing oxidation and tubercles in iron water pipes."—A communication from Jacob Snider, jun., Paris.—*Petitions recorded 2nd December*, 1861.

3026. Robert Anderson Rust, Great Marlborough-street, Westminster, Middlesex, "Improvements in the construction of the cases of pianofortes."—*Petition recorded 3rd December*, 1861.

3048. John Knowellen, Southwark, Surrey, "Improvements in pumps."—*Petition recorded 5th December*, 1861.

3057. Adam Woodward, Robert Woodward, and William Woodward, Manchester, "Improved arrangements of compound steam engines."

3062. Frederick Vetterlin, Scarborough-street, Goodman's Fields, Middlesex, "Improvements in breech-loading ordnance, and the projectiles to be used therewith, which may also be applied to small arms."

3065. Heinrich Gottfried Schramm, Rothenburgsort, Hamburgh, "Improvements in rotatory engines and pumps."—Partly a communication from Edward Rösch, Lindenau, Saxony.—*Petitions recorded 6th December*, 1861.

3069. Richard Jolley, St. John-street, Smithfield, London, "An improved apparatus for heating, cooling or drying, infusing, extracting or absorbing vapours or gases for manufacturing medical or domestic purposes, and for preserving liquids and solids alimentary or otherwise."

3072. William Nelson Hutchinson, Devonport, Devonshire, "Improvements in projectiles and ordnance, and in apparatus to be used therewith."

3075. Thomas Mellodew, Oldham, Charles William Kesselmeyer, Manchester, and John Mayo Worrall, Salford, Lancashire, "Improvements in dyeing and printing certain descriptions of woven fabrics."

3076. Balthasar Wilhelm Gerland, Newton-le-Willows, Lancashire, "Improvements in the manufacture of sulphate of copper and other salts of the same metal."—*Petitions recorded 7th December*, 1861.

3090. Hector Alexander, Glasgow, Lanarkshire, N.B., "Improvements in turning apparatus for making gas burners."

3099. David Vogl, Sambrook-court, Basinghall-street, London, "Improvements in garments for gentlemen and ladies' wear."

3100. John Washington Agnew, Windsor-chambers, Great St. Helen's, London, "A new and improved electro-voltaic pocket battery."—Partly a communication from Henry Palmer, London, Canada West.—*Petitions recorded 10th December*, 1861.

3109. John Potter, Leeds, Yorkshire, "An improved mode of jointing or connecting telegraph wires, which is also applicable to jointing or connecting signal wires, fencing wires, and other wires or rods."—*Petition recorded 11th December*, 1861.

3115. William Edward Wiley, Great Hampton-street, Birmingham, "An improvement or improvements in pencil cases and holders for crayons and other solid writing or marking materials, which improvement or improvements may also be applied to crotchet needle holders."

3117. William Smith Longridge, Alderwasley Ironworks, Derby, "Improvements in railway engines and tyres."

3118. Augustus Tonnar, Eupen, Rhenish Prussia, "Improvements in the method of and apparatus for drying and cleansing malt, as well as any other species of grain and seed intended for brewing, distilling, and agricultural purposes."—*Petitions recorded 12th December*, 1861.

3129. John Walter Friend, Freemantle, Southampton, "Improvements in apparatus for registering the depth and flow of liquids, and the distances run by ships at sea."

3137. Henry Appleby, Tavistock-place, Plumstead Common, Kent, and Henry Harrison, Grand Junction Works, Northampton, "Improvements in machinery for boring wood and other materials used in the manufacture of brooms and brushes."—*Petitions recorded 13th December*, 1861.

3135. David Chalmers, Glasgow, Lanarkshire, N.B., "Improvements in looms for weaving, and in the manufacture of cloth therefrom."

3158. Charles Baumann, Altdorf Weingarten, Wurtemburg, "Improvements in buttons."—*Petitions recorded 14th December*, 1861.

3162. Robert Shaw, Marple, Cheshire, "Certain improvements in carding engines."—*Petition recorded 17th December*, 1861.

3181. Theodore Bourne, Charlotte-street, Bedford-square, London, "Improvements in cotton gins."—A communication from Hiram Wilson Brown, Millville, Cumberland, New Jersey, U.S.—*Petition recorded 19th December*, 1861.

3199. Eugene Etienne Pereau, Moorgate-street, London, "An improved composition for cleaning and revivifying woollen cloths and other fabrics and the colours thereof."—A communication from Alfred Thomas, Paris.—*Petition recorded 20th December*, 1861.

3212. William Kempe, Holbeck Mills, Leeds, "Improvements in scrays or tables applicable to gig mills, brushing mills, and other like machinery."—*Petition recorded 21st December*, 1861.

3215. Louis Rudolph Bodmer, Davies'-inn, London, "Improvements in looms for the manufacture of sacks, knapsacks, mattress cases, and other goods."—A communication from Charles Hippolyte Tessier, Paris.—*Petition recorded 24th December*, 1861.

3241. Peter Armand le Comte de Fontaine-Moreau, South-street, Finsbury, London, "Improvements in treating fatty and resinous bodies, either in a neutral or acid state."—A communication from Charles Monier, St. Ouen, Paris.—*Petition recorded 27th December*, 1861.

3249. Edward Lord, Todmorden, Yorkshire, "Certain improvements in machinery for preparing cotton and other fibrous substances."

3251. Michael Henry, Fleet-street, London, "Improvements in fire-arms, and in adapting bayonets, or cutting or piercing weapons thereto."—A communication from Mathieu Louis Michel Descoutures, Boulevart St. Martin, Paris.—*Petitions recorded 28th December*, 1861.

3257. William Edward Newton, Chancery-lane, London, "Improvements in the manufacture of cube sugar."—A communication from Gustavus Finken, Brooklyn, King's County, New York, U.S.—*Petition recorded 30th December*, 1861.

3269. William Henry Bailey, Salford, Lancashire, "Certain improvements in sewing machines."—*Petition recorded 31st December*, 1861.

37. Arthur Warner, Threadneedle-street, London, "Improvements in preparing materials for and in purifying coal gas."—*Petition recorded 4th January*, 1862.

44. Frederick Shaw, Sheffield, Yorkshire, "Improvements in apparatus for stopping railway trains."—*Petition recorded 7th January*, 1862.

67. Richard Archibald Brooman, Fleet-street, London, "Improvements in apparatus for carburetting and burning gas."—A communication from Leon Farrenc and Henri Glossener, Paris.—*Petition recorded 9th January*, 1862.

151. John Adams Knight, Symond's-inn, Chancery-lane, London, "Improvements in the permanent way of railways."—A communication from Hiram Carpenter, New York, U.S.—*Petition recorded 21st January*, 1862.

240. William Edward Newton, Chancery-lane, London, "Improvements in the boxes for the journals of railroad carriage and other axles."—A communication from Davis Henry Dotterer, Chicago, Cook, Illinois, U.S.—*Petition recorded 29th January*, 1862.

311. Adam Carlisle Bamlett, Middleton Tyas, near Richmond, Yorkshire, "Improvements in reaping and mowing machines."—*Petition recorded 6th February*, 1862.

64. Godfrey Joachim Aman, Liverpool, "Improvements in envelopes or bags to hold grain or similar substances for transmission by post or as parcels."—*Petition recorded 12th February*, 1862.

392. Edwin Green and James Newman, Birmingham, "Certain improvements in buttons for fastening and ornamenting articles of dress."—*Petition recorded 13th February*, 1862.

472. James Kirkwood, Paisley, Renfrewshire, N.B., "Improvements in looms for weaving."

478. James Peterkin Douglas Camp, Fleet-street, London, "Improvements in the arrangement of valves for steam and other engines, and in the means of operating the same."—A communication from Henry Steele, Jersey, New Jersey, U.S.—*Petitions recorded 22nd February*, 1862.

667. William Henry Latham and Frederick Cartwright Ward Latham, Bolton, Lancashire, "Certain improvements in machinery or apparatus for perforating and numbering paper or other substances to be employed as 'tickets,' or where other 'counter registration' is required."

668. William Henry Latham and Frederick Cartwright Ward Latham, Bolton, Lancashire, "Certain improvements in machinery or apparatus for cutting paper, pasteboard, and other similar substances."—*Petitions recorded 12th March*, 1862.

687. James Wadsworth, Salford, near Manchester, "Improvements in the construction and manufacture of movable or adjustable heels for boots and shoes."—*Petitions recorded 13th March*, 1862.

827. William Barber, Stockport, Cheshire, "Improvements in the manufacture of hats."—*Petition recorded 17th March*, 1862.

872. Alfred Fryer, Manchester, "Improvements in the manufacture of sugar, and in separating liquids from sugar and other substances."

829. John Thomas Loft, Berwick-street, Pimlico, Middlesex, "Improved machinery for covering strips of metal and wire."—*Petitions recorded 25th March*, 1862.

832. John Wilson, Glasgow, Lanarkshire, N.B., "Improvements in the apparatus used for, and in the method of hotpressing or finishing plaids, shawls, handkerchiefs, and other woven fabrics."—*Petition recorded 26th March*, 1862.

844. William Greenway, Birmingham, "Improvements in the manufacture of bolts for fastening doors and for other like purposes."—*Petition recorded 27th March*, 1862.

And notice is hereby further given that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days next after the date of the Gazette (and of the Journal, in which this notice is issued.

List of Specifications published during the Week ending April 12th, 1862.

2185, 10d. ; 2186, 6d. ; 2187, 6d. ; 2188, 7d. ; 2189, 1s. 3d. ; 2190, 5d. ; 2191, 3d. ; 2192, 1s. 4d. ; 2193, 7d. ; 2194, 3d. ; 2195, 10d. ; 2196, 3d. ; 2197, 4d. ; 2198, 5d. ; 2199, 3d. ; 2200, 3d ; 2201, 10d. ; 2202, 10d. ; 2203, 1s. 2d. ; 2205, 3d. ; 2206, 10d. ; 2207, 10d. ; 2208, 7d. ; 2209, 10d. ; 2210, 3d. ; 2211, 2s. 1d. ; 2212, 7d. ; 2213, 6d. ; 2214, 3d. ; 2215, 5d. ; 2216, 3d. ; 2217, 3d. ; 2218, 3d. ; 2219, 3d. ; 2220, 10d. ; 2221, 3d. ; 2222, 6d. ; 2223, 9d. ; 2224, 9d. ; 2225, 7d. ; 2226, 3d. ; 2227, 3d. ; 2228, 7d. ; 2229, 10d. ; 2230, 3d. ; 2231, 6d. ; 2232, 6d. ; 2233, 3d. ; 2234, 10d. ; 2235, 6d. ; 2236, 3d. ; 2238, 6d. ; 2239, 3d. ; 2240, 8d. ; 2241, 7d. ; 2242, 4d. ; 2243, 3d. ; 2244, 7d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for The Engineer, *at the office of her Majesty's Commissioners of Patents.*

Class 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2450. J. Hesford, *Bolton-le-Moors*, "*Steam engines.*"—*Dated 2nd October*, 1861.

This invention consists in dispensing with the usual eccentric for working the slide or other admission valve, and in working such valves by means of a double lever connected to the piston rod of the steam cylinder, and to the spindle of the valve. The improvements in valves consist in fixing a taper plug to a screwed spindle, which spindle works through a stuffing-box. When the spindle is turned round to open or close the valve, the plug is lifted partly out of or pressed into the socket, and as the plug is fixed to the spindle, the opening or closing of the valve turns the plug round or partly round, and thus removes the impurities adhering to it.—*Not proceeded with.*

2457. J. A. Coffey, *Providence-row, Finsbury, London*, "*Engines or apparatus for obtaining the motive power of steam, water, air, gas, or fluids.*"—*Dated 2nd October*, 1861.

In carrying this invention into effect the inventor has a central pipe or duct of any suitable kind, from which radiate other pipes or ducts, and at the other ends thereof he has angled stopped pipes, cylinders, or ducts, and at or near the junction of the radial pipes or ducts, and those last mentioned are openings (one to each radial and its angled pipe or cylinder aforesaid), and these openings are made to slide air tight against a fixed annulus, so that, upon steam, air, or other fluid being admitted into the central pipe or duct, and filling the radial pipe or duct, it will exert pressure against the said annulus, so as to cause rotation. The central pipe or duct and the attachments aforesaid are constructed free to turn in the centre.—*Not proceeded with.*

2463. J. C. Dickinson, *Blackburn*, "*Steam engines.*"—*Dated 3rd October*, 1861.

According to this invention the high pressure and low pressure cylinders are placed near to each other, and by preference they are cast together ; the piston rods of both the cylinders are connected to a beam, to which are also connected the plungers of the air pump, and the force pump ; the connecting rod by which motion is communicated to the crank shaft is also connected to the beam.

Class 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2380. A. J. Sedley, *Regent-street, London*, "*Constructing bridges and viaducts.*"—*Dated 24th September*, 1861.

This invention consists in combining the principles of construction employed in the formation of tubular and suspension bridges and viaducts in such manner that the suspension shall form part of the tubular construction ; and, in place of having recourse to the use of centerings, and the other means heretofore employed or resorted to in constructing and raising tubular bridges and viaducts, part of this invention consists in constructing tubular bridges and viaducts on an embankment or raised way, or on a suitable surface or way on the margin of the river or other water or valley across which a tubular bridge or viaduct is to be placed, preferring to construct such raised or other way with suitable rails or trams, in order that, when the tubular bridge or viaduct has been constructed inland, it may with greater facility be run out to the distance required, either to span the water or valley, or to partly span it, in those cases where a bridge or viaduct is to be in two parts, to meet and be connected intermediate of the width of the water or valley. Such bridge or viaduct, or the two sections thereof, having been built inland, are then moved outward to the extent desired, sufficient length of the structure in each case remaining inland to counterbalance the part projecting beyond the pier ; and it may here be stated that the part left inland need not in itself be of equal length or weight with the part projecting beyond the pier, as the part inland may be weighted or held down or anchored to the way or surface inland.

2381. G. J. Gladstone, *Blackwall*, "*Apparatus for disengaging boats.*"—*Dated 24th September*, 1861.

For the purposes of this invention an axis turns in suitable bearings, by preference near the bottom of a boat, and the axis is of such a length as to reach nearly from end to end of the boat. At each end of the axis is a crank, to which is attached a connecting-rod which, at its upper end, has a a hook or eye formed to receive the hook of the lowering tackle. The hook or eye at the end of each of the two connecting-rods is formed to open on a hinge. The point of a hook when closed is parallel with the upper end of the connecting-rod, and the hook or eye passes between guides or plates which are only wide enough to allow the hook or eye to be received when the same is closed, hence the connecting-rod and the point of the hook, when at the lowest position, will be retained shut ; but when the axis is turned partly round, by a handle or projecting arm thereon, the upper end of each of the connecting-rods will be raised to such a height as to release the point of the hook, when the boat's tackle at both ends of the boat will be simultaneously released.

2393. W. T. Crane and T. J. Ellis, *Liverpool-road, London*, "*Applying brakes to omnibuses and other four-wheeled carriages.*"—*Dated 25th September*, 1861.

This invention consists in fitting a cranked lever or levers to the fore carriage or other convenient part, one arm of which lever bears against the rear end of the pole or shafts ; and in connecting the other arm by means of a rod, rods, or chains, to a disc or crank, connected also to a bar carrying brake-blocks. The action upon the cheeking of the horses is to depress one arm of the lever and bring forward the other, which, acting through the connections, brings the brake-blocks on the hind wheels ; a spring releases the blocks, and restores or allows of the cranked lever resuming its position as soon as the pole or shafts resume their ordinary position.—*Not proceeded with.*

2432. E. Funnell, *Brighton*, "*A self-acting alarum which can be fixed on tenders, guards' compartments, and other parts of railway trains for preventing collisions.*"—*Dated 30th September*, 1861.

This invention consists, First, in the application of a self-acting alarum to tenders and guards' compartments, or other parts of the train ; Secondly, in the application of separate movement for the point of contact with the alarum for the use of station masters and other persons employed ; Thirdly, in communicating self-acting contact with the alarum at over half a mile distance ; Fourthly, in the application of levers, connected with bevel-wheels and cranks at fixed stages, for the locking and unlocking points of contact ; Fifthly, in the mode in which the sliding bar is made to move the lever horizontally to carry their movements to distant stages and act simultaneously ; Sixthly, in producing compensation for the expansion and contraction of the length of conductors arising from changes of temperature, thereby ensuring safe locking and unlocking of the cranks at combined stages. The invention cannot be described without reference to the drawings.—*Not proceeded with.*

2454. A. Fowler, *Scott's-yard, Cannon-street, London*, "*Buffers of railway carriages.*"—*Dated 2nd October*, 1861.

This invention has for its object improvements in buffers of railway carriages. In order to prevent the buffer heads of the buffer apparatus of railway carriages rising or falling in respect to each other, tubular shields or guards are applied to the buffer heads of one carriage, into which the buffer head of the next carriage may slide or pass freely, and so that, when a buffer head of one carriage has entered the tubular shield or guard carried by the buffer heads of the next two carriages, the carriages will be prevented rising or falling to different levels, whether by reason of one carriage being forced violently towards the other carriage, or by reason of injury to the wheels or axles of one of the carriages. It is preferred to construct these tubular shields or guards each in two halves, and to put them together by projecting longitudinal flanges at the top and bottom, in order thus to obtain strength.—*Not proceeded with.*

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2384. J. Fawcett, *Wakefield, Yorkshire*, "*An improved material particularly adapted for the scouring, cleansing, and fulling of woollen or other cloths.*"—*Dated 24th September*, 1861.

In carrying this invention into effect the patentee uses "lichen," commonly called and known as "Iceland moss," or "Irish" or other "moss" containing gelatinous matter, which he boils in a large quantity of water in any suitable vessel, by which operation a liquid will be produced capable of forming a firm and strong jelly ; or the lichen may, in some cases, be steamed when considered preferable for certain purposes. The liquor should be freed from the refuse or insoluble portions or residue of the lichen by straining it, or by any other method, in order to obtain a clear and firm jelly. He also adopts another process, which is to dry the lichen or other moss, and grind it into a powder, and when required for use he adds water, and either boils or steams the whole. By this operation or mode of manufacture a jelly is produced which becomes perfectly free from residuum by straining. Having thus produced a clear and firm jelly he then adds to it soda or soda ash, or other alkali, which is to be intimately and thoroughly incorporated and mixed with the jelly.

2390. T. Bright and R. Mills, *Rochdale*, "*Apparatus or means employed in the printing of yarns for carpets, &c.*"—*Dated 25th September*, 1861.

This invention cannot be described without reference to the drawings.

2402. J. Openshaw, W. Entwistle, and J. Lord, *Bury, Lancashire*, "*Mules.*"—*Dated 26th September*, 1861.

This invention is designed for the purpose of facilitating the "doffing," or removal of the finished "cops" from the spindles upon which they have been wound, and is more particularly applicable to those mules in which "cop tubes" are used as a foundation for the "cops." The improvements consist in the use of an inclined plane fitted to slide on a suitably shaped bar extending the length of the spindle carriage, the inclined plane being caused to travel along the spindle carriage from end to end in either direction. This inclined plane is drawn from the end of the carriage, passing close up to the spindles, its lower end or the point of the incline coming in contact with the underside of the flange of a short tubular ring fitting loosely into the lower end of the cop tubes upon each spindle, and in its passage raising or lifting the rings, together with the attached cops, until the cops are loose on the spindles ready for doffing, in which position they are held or sustained by the faller-rod and wire which is brought to bear against them ; the cops may then be easily doffed or removed in the usual manner.

2458. R. A. Brooman, *Fleet-street, London*, "*Improvements in the manufacture of coloured figured fabrics, and in machinery employed therein.*"—*A communication.*—*Dated 2nd October*, 1861.

The First part of this invention consists of improvements in the dipping boxes, whereby India shawls and similar articles can be made much more expeditiously and economically than heretofore. By this improved process the different threads, instead of passing above and below across the whole shawl, are used only when the figure appears : a great economy of material is thus effected ; it is the same also in the case of stripes. The dipping box has already been employed in the manufacture of embroidery to carry the weft over a certain distance of the fabric. But in this invention this box is applied to effect another purpose, namely, to work or unite together the warp threads and embroidering threads by crossing the threads or raised threads, according to the different intercrossings of the threads used on different tissues such as serges, satins, cloth, and the like. Thus a new result is obtained, namely, any kind of raised work may be produced upon the figures, and especially the twill upon woven shalls. The second part of this invention refers to the manufacture of Indian fabrics by two boxes. The invention cannot be further described without reference to the drawings.

Class 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

2403. G. Cardwell, *Kilmarnock, and* J. Y. Miller, *Renfrew*, "*Apparatus for dressing flour.*"—*Dated 26th September*, 1861.

This invention consists in combining with the well known silk dressing machine a fan or other blowing apparatus arranged so as to pass a blast or current of air against or through the silk sieve or dressing material, whereby the flour is cooled, and a greater quantity and of superior quality is obtained from the same wheat than by apparatus hitherto in use. The improvement is also applicable to dressing apparatus having the sieve or dressing material of wire or other material.—*Not proceeded with.*

2418. S. Rowsell, *Buckland, St. Mary, Somersetshire*, "*Horse rakes.*"—*Dated 27th September*, 1861.

This invention consists in forming the beam or head of the rake of tubular iron, through which the teeth are fastened, thus combining strength with lightness ; and in so arranging the bearing pieces that they take a bearing upon the ground behind their centres, by which means less weight is thrown upon the hands of the user.

2452. D. Rebolle, *Paris*, "*Steam digging-machine.*"—*Dated 2nd October*, 1861.

The locomotive parts of this machine consists, First, in the employment of motive wheels, like the wheels of ordinary carriages, which move on the soil as usual. Secondly, in the employment of a front train of wheels of large diameter, which, by means of two axles, one fixed, the other oscillating, permits of easily giving the required direction to the machine. The apparatus for digging consists of a wheel with teeth, which, turning from below upwards, raises the earth, and throws it off in such a way as to allow the passage of the machine. This wheel is put in motion by another wheel with rollers, which catches directly with its teeth ; it is usually furnished with scrapers. The apparatus for carrying the earth is sometimes not used ; it may consist merely of an inclined plane, or of an endless cloth or band having two motions, one in a direction perpendicular to the axis of the digger for carrying the earth to a certain height, the other for transporting it in a direction parallel to that of the digger, which is always accompanied by the endless band.—*Not proceeded with.*

Class 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

2436. C. H. Pennycook, *Glasgow*, "*Chimney hoods and ventilators.*"—*Dated 30th September*, 1861.

This apparatus, arranged as for a chimney hood, consists of a cylindrical shell, formed or divided internally, so as to present one or more helical or screw-shaped passages, and mounted upon an upright spindle, so as to revolve as freely as possible. The lower edge of the cylindrical shell dips down into an annular trough formed in the bottom or part by which the apparatus is fixed upon the chimney or vent, and to which the spindle is fixed. This trough being filled with water, which will be continually replenished by rain, forms a liquid joint, and prevents interference with the internal current at that part. A cap is attached to the drum or cylinder at a slight distance above it, the smoke having free egress laterally or radially between the two. The revolving cylinder and the cap are both formed with external pocket-like vanes, having the sides inclined, but with no openings through into the interior, as with vaned hoods hitherto constructed. The slightest external air current, by acting on the vanes, causes the hood to revolve ; and, the vanes being set in a suitable direction relatively to the internal screw, the latter in turning exerts an upward drawing or propelling action on the smoke.—*Not proceeded with.*

2449. W. S. Hogg, *Rotherhithe, London*, "*Rendering columns, girders, doors, shutters, and other parts of buildings fire-proof.*"—*Dated 1st October*, 1861.

This invention consists in casing and enclosing such parts in fire-proof bricks, or other forms of clay or analogous fire-proof material, moulded and formed to suit the particular object to be enclosed.

Class 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

2414. F. W. Shields, *Parliament-street, Westminster*, "*Applying wrought iron or steel plates to the covering and protection, from the effects of shot and shell, of forts, buildings, floating vessels, &c.*"—*Dated 27th September*, 1861.

This invention consists in the fastening or securing of two or more plies or tiers of wrought iron or steel plates together in such a manner that not only the requisite mass or thickness of iron or steel covering necessary for resisting the effect of shot or shell shall be obtained, but that the whole of such covering to such construction, as above mentioned, shall be connected together and united into one mass, instead of being fixed on in separate and detached plates as heretofore : and also so united that if the outside tier or ply of such plates be destroyed, the inner tier or tiers shall still be held together, or in their place, and be capable of presenting a continued resistance to the shot or shell fired against them. The inventor proposes for these purposes to employ as a covering to the construction, either in conjunction or not in conjunction with an internal or external backing or framing of any description, two, three, or more plates of wrought iron or steel of any thickness, or of such varying thickness as may be found convenient in each case overlapping or breaking joint with each other, and fastened together by tap screws screwed through some or all of the plies of plate of which the covering is composed, so as to form an independent connection of each plate with the other plates which lie under or over it.—*Not proceeded with.*

2433 J. S. Bickford and G. Smith, *Camborne, Cornwall*, "*Safety fuzes.*"—*Dated 30th September*, 1861.

According to this invention the small metal tube filled with gunpowder is enclosed in threads of yarn and countered, and, if necessary, varnished in the manner of the ordinary Bickford's fuse.—*Not proceeded with.*

2437. W. J. Christy, *St. Albans, Hertfordshire*, "*Mailing ships of war.*"—*Dated 30th September*, 1861.

This improved mail or armour is formed of a series of wrought iron belts or girdles placed one above another in horizontal planes, and separated from each other by beams of wood placed in the intervening spaces. The girdles are sufficiently narrow to escape fracturing, and sufficiently near to each other to prevent shot passing between them, and at the bows they are made to form either a wedge-shaped or conical beak.—*Not proceeded with.*

2445. R. Nightingale, *Malden, Essex*, "*Markers' butts or mantelets.*"—*Dated 1st October*, 1861.

In carrying out this invention the inventor constructs a marker's butt or mantelet enclosed on all sides, and he makes all parts sufficiently bullet proof to prevent accident to the markers, whether by the direct action of bullets or portions of bullets, or by their rebound, or by their being deflected into the butt or mantelet, or from any stone or substance struck by a bullet ; and in order to enable the markers to ascertain the positions where any balls may strike a target, he applies at the upper part of a marker's butt or mantelet a bullet proof camera, so arranged that it may throw an image of the target on to a table or surface below, on which is placed properly ruled or prepared paper, corresponding with the divided surface of the target, so that the mark made by each bullet on striking the target will be imaged in its precise position on the ruled or divided paper, and be

there marked or indicated by the marker with ink or other material, together with the number of the shot; and in order to obtain a full record of all the shots, the marker may also register or mark in the margin of the paper all shots which miss the target with the numbers or the orders in which such misses have occurred. In order that the markers in such enclosed butts or mantelets may hear any call or signal from without, and also to obtain good ventilation, inclined or bent passages or tubes are applied which prevent the passage of light, but admit air and sound freely. In order the better to employ signalling flags he mounts each flag on a staff or handle, the end of which is screwed in to the periphery of a disc, which is arranged to work on an axis in a slit or narrow passage, so that, by having a handle on each disc interior of a butt or mantelet, the disc on which a flag is mounted may be moved on its axis, so as to raise the flag to any desired height, and in such manner as to indicate whether a ball has struck the target high or low, and by employing flags thus mounted on both sides of a butt or mantelet for indicating "centres" and "outers," and one flag at either side for indicating a "bull's-eye," it may be indicated whether a bullet has struck towards the right or left of the target.—*Not proceeded with.*

2445. J. W. Scott, *Worcester*, "*Gun-wads.*"—*Dated 1st October*, 1861.

The object of this invention is to obtain a gun-wad which shall not be easily compressible and absorb a portion of the effect of the powder, and which shall, at the same time, tend to keep the barrel clean and the shot from spreading. The invention consists in manufacturing gun-wads from leather (by preference sole butt leather) compressed and fashioned into suitable forms for the purpose. The inventor forms the under wad, or that which is to be placed on the powder, dished or concave on one side, and intends the concave side to be placed uppermost in the gun, while the upper wad need only be in the form of a disc.—*Not proceeded with.*

2453. A. Wyley, *Allsopp's-place, Regent's Park*, "*Fire-arms.*"—*Dated 2nd October*, 1861.

This invention cannot be described without reference to the drawings.

Class 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

2439. J. D. D. Passager, *Paris*, "*Lamps.*"—*Dated 26th September*, 1861.

This invention relates to an improved construction of lamp for burning palm or other similar or other fat oil, and the same consists in having the oil vessel situated at a suitable distance above the burner or the glass chimney, so that, by the heat evolved from the burner, the oil becomes liquified, and is allowed to reach the wick of the burner by running down a pipe connecting this latter with the oil vessel, a conical obturator serving for regulating the quantity of oil running down through this connecting pipe, whilst any excess of oil reaching the burner flows over the sides of this latter into a receiver situated underneath the burner in the interior of the lower part of the lamp. For regulating the heat to be transmitted to the upper oil vessel a flat metal ring or washer provided with a central opening is held between the bottom of this vessel and the burner or glass chimney, and thus serves as a sort of screen for allowing only the required quantity of heat to reach the oil vessel, for which purpose this ring or washer is allowed to glide along the rod connecting the oil vessel to the lamp, and the said ring or washer may be fixed on this rod at any required height by a set screw or other suitable means.—*Not proceeded with.*

2430. C. Comer, jun., *Salford*, "*Metal tubs for bedsteads, &c.*"—*Dated 28th September*, 1861.

This invention relates, First, to the application of the improvements in combining metals and alloys of metal for which letters patent were applied for by the present inventor, in conjunction with Daniel Stone, on the 6th day of April, 1861 (No. 836), to the manufacture of metal tubes for bedsteads and other purposes, and consists in bending sheets of metal over a conical roller in which is a groove; one edge of the metal sheet is placed in this groove, and when the roller is turned round the remainder of the sheet of metal is bent into a tapered tube. The edges are then brazed or otherwise secured together. The end of the conical roller is raised to allow the tube to be taken off. In making ornamental tubes, either tapered or otherwise, with flutes or spiral ribs or other designs on their surface the sheet of metal is passed between two rollers, the surfaces of which are made with projections and depressions corresponding to the design to be produced.—*Not proceeded with.*

Class 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Potter, Cements, Paint, Paper, Manures, &c.

2370. C. Stevens, *Charing-cross, London*, "*Improvements in the manufacture of steel, and in the hardening of metals.*"—*A communication.*—*Dated 23rd September*, 1861.

According to this invention the iron to be converted into steel is immersed in a solution composed of thirty parts of borne acid in crystals, to 1,000 parts of water at a temperature of 10 deg. Centigrade; the iron is allowed to remain a sufficient time for the liquid to completely penetrate the oxide of iron; it is then removed wet from the bath, and at once placed in a crucible or furnace for melting; it is covered, as usual, with slack or with a plug; a slight layer of damped coal-dust can also be placed first on the iron; heat is applied as usual.—*Not proceeded with.*

2377. J. Jacob, *Brun, Austria*, "*Improvements in the mode of, and apparatus for, obtaining and treating hydrogen gas, and the application thereof to various purposes, parts of which improvements are applicable to the manufacture of iron and steel.*"—*A communication.*—*Dated 22nd September*, 1861.

The patentee claims, First, the use and application of the hydrogen gas, with or without the illuminating gas produced with the hydrogen, as a reducing medium for the manufacture of metals, and the production thereby of improved qualities of metals, as described. Secondly, the use and application of the hydrogen gas for the production of illuminating gas by mixing the same with volatile compounds of carburetted hydrogen, as described. Thirdly, the mode of employing hydrogen gas by transforming the same into illuminating gas immediately before its distribution to the gas pipes and burners, as described. Fourthly, the use of the simple condensing apparatus for the purification of the hydrogen gas, as described. Fifthly, the improved mode of manufacturing iron and steel by employing purified oxides, as described. Sixthly, the production of cast steel in furnaces, without the employment of crucibles, by the application of the gas melting process, as described. Seventhly, the use of hydrogen gas, in combination with atmospheric air or oxygen, for blasting, as described.

2383. C. Watt *and* J. Watt, *Walworth, and* T. S. Haviside, *Cornhill, London*, "*Bleaching palm oil.*"—*Dated 24th September*, 1861.

This invention consists in boiling palm oil in an aqueous solution of either sulphate of zinc or chloride of zinc, or sulphate of copper or sulphate of iron, or chloride of iron, or chloride of calcium.

2386. G. Davies, *Serle-street, Lincoln's-inn, London*, "*Preserving provisions.*"—*A communication.*—*Dated 24th September*, 1861.

This invention relates to the preservation of provisions in metal cases, and applies principally to the process of cooking the same, comprising an addition to the means or apparatus employed in such process, whereby an economy of time and also great improvement in the davour and nutritious qualities of the provisions are effected. According to this invention the provisions are placed in a metal case, the lid of which is properly soldered, and has a small hole at the top, as before, to which (if preferred) a small tin tube is soldered. Heat is then applied, and as soon as the contents commence to boil the vessel is put in connection with a second vessel having a corresponding hole at the bottom, to which is also soldered a small taper tin tube, which is inserted in the tube or hole of the lid of the first named vessel. If the vessel in which the provisions are placed to be preserved contains much liquid, the steam formed inside the same, pressing upon that liquid, forces it to rise into the upper vessel, and it then serves as a water valve, which allows the gases to pass by bubbling into the atmosphere, but retains the aroma and flavour of the provisions that otherwise might have been lost, and when this first process of cooking or boiling is considered complete, the temperature of the case is lowered by raising it out of the bath into the atmosphere, and a partial vacuum being thus formed inside the lower vessel or case, the pressure of the atmosphere forces the liquid to re-enter the vessel underneath. The temperature is then again raised, the connection between the two vessels is cut off, the hole in the lid is closed, and the case is again lowered into the bath and boiled, until the operation of cooking is concluded.

2384. T. Richardson, *Newcastle-on-Tyne, and* R. Irvine, *Harlet, Renfrew*, "*Treating gelatine.*"—*Dated 25th September*, 1861.

This invention consists in increasing the sizeing properties and hardness of gelatine by the addition of one or more of the phosphates of lime and magnesia, silicates of potash, soda, lime, and magnesia, and bichromate of potash. These improvements further consist in treating the gelatine obtained from bones by muriatic acid with the sulphites, sulphates, phosphates, or silicates of the alkalies or weak sulphuric acid or aqueous sulphurous acid.—*Not proceeded with.*

2396. T. Richardson, *Newcastle-on-Tyne*, "*Manufacture of muriate of iron for the purification of coal gas.*"—*Dated 27th September*, 1861.

This invention consists in dissolving the burnt sulphur ore left as a waste product in the manufacture of sulphuric acid in muriatic acid, and evaporating the solution to dryness, or in drying up the solution with saw dust, charcoal, small coke, gypsum, the waste burnt sulphur ore ground to powder, or any natural oxide of iron in powder, and in employing any of these mixtures with lime or magnesia in the usual way in the purification of coal gas.—*Not proceeded with.*

2407. J. Tessier, *Paris*, "*Treating barley, corn, and other cereals for brewing and other purposes.*"—*Dated 26th September*, 1861.

The inventor proposes to saccharify or give sweetness to barley, corn, and other cereals; also all fecula, and even inuline and cellulose. He mixes with the matter to be saccharified an animal matter, a little malted barley, or any other body capable of decomposing or attaching the gluten, and that at the commencement of the operation or decomposition. These substances remain in contact, and dry for a longer or shorter time, according to circumstances. He then steeps them several times in water at different degrees of temperature, so as to bring them nearly to, but not actually forming a starch, mixing and stirring them for from five to six hours, more or less, and when the fecula, the starch, and the other saccharifiable bodies are discernible in the water he raises the temperature to ebullition, retaining it thus until all the gluten is precipitated, and the liquid becomes limpid and sweet. He then filters on to the grains, and with hops makes beer; or he makes syrups, as may be desired.—*Not proceeded with.*

2412. W. Clark, *Chancery-lane, London*, "*Peat.*"—*A communication.*—*Dated 26th September*, 1861.

The patentee states that he has found that certain defined combinations, however varied in their proportions (which are determined either by the slow but progressive decomposition of peat in water, or by the much more energetic and rapid action of the atmosphere when the water is expelled, and the body reaches the last stage of decomposition) are the real causes of the inferiority of peat as a fuel. One result of these combinations, viz., that produced by water, constitutes, to a certain point, the essence of the body, and determines its nature. Hence these natural combinations can only be neutralised by decomposing them, or by forming new equivalent combinations. The distinctive feature of this invention thus consists in destroying, so to speak, the constituents of the primary combination to prevent its forming as far as possible, or of so changing its nature that it shall no longer produce the same effects. This result is obtained without the aid of any new chemical combinations, as in the present invention it is only the purely chemical treatment of the product which is considered apart from the general treatment necessary for ensuring its success.

Class 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

2355. A. V. Newton, *Chancery-lane, London*, "*Construction of and mode of working telegraphic apparatus.*"—*A communication.*—*Dated 25th September*, 1861.

This invention relates to a novel arrangement of mechanism for transmitting currents of electricity, and termed by the inventor the "pantelegraph," which mechanism depends for its accurate operation on there being a perfect accord or synchronism between the oscillations of the pendulums of two connected instruments, placed at distant stations, the metallic circuit between the stations being made and broken, as is well understood, by the oscillations of such pendulums. This desired accord in the action of the pendulums it is now proposed to obtain by the pressure of a spring, regulated by a micrometric screw. The invention also relates to the employment of a special arrangement of the electric battery by means of which, after every interruption of the principal telegraphic current, a weak current in the contrary direction is produced in the line wire. And the invention also relates to an arrangement of mechanism specially applicable to the copying of telegrams in Morse or similar characters. By the application of this invention the following results may be produced, viz.:—Firstly, coloured letters or characters are obtainable upon white paper direct by the line current, without any local battery or relay, and from original writing in ordinary ink. Secondly, dispatches may be reproduced either of the same size as the originals, or reduced, the character of the original writing at the same time being retained. Thirdly, different messages may be simultaneously transmitted through a single line wire. Fourthly, telegrams written in Morse or similar characters may be reproduced by electric chemical action. The invention cannot be described in detail without reference to the drawings.

2425. J. Reeves, *New York*, "*Electro-magnetic engines for obtaining and applying motive power.*"—*Dated 28th September*, 1861.

This invention consists in constructing helices with copper or other metal cylinders, and placing them one, two, or more in number, as may be required, in line with each other, leaving a space between the ends, and through these helices the patentee passes a metallic piston, encircled with iron tubes placed at proper distances apart from each other, which, when acted upon by the electric current, are put in motion, and the piston is thus caused to pass through the helices from one end to the other of the series and back again to a greater extent than it is possible to obtain by the piston passing through one helix alone. The piston is connected by a rod to a crank on a driving axis to give motion thereto. The advantage obtained by this arrangement is that the length of the leverage or crank on the driving shaft of the machine can be varied to any extent desired, and the combined and successive action of a series of helices may be brought to bear thereon.

2429. M. Theiler, *Einsedeln, Switzerland*, "*Telegraphs.*"—*Dated 28th September*, 1861.

The First part of this invention relates to dial instruments in which the letters, figures, and other marks are presented on a dial as in other telegraphic instruments of this description. Both the sending and receiving station being in circuit, the hands of the dials at both stations move in uniformity. The peculiarity of these improvements consists in a far less number of currents and motions being required for carrying the hands round the dial than in any other instrument hitherto used. The Second part of this invention consists in the combination of the dial telegraph with a mechanism for printing letters and other marks. The Third part of the invention consists in improvements in the Morse and other mark printing instruments, whereby the various marks representing the letters of the alphabet and other marks can be produced or printed with greater rapidity.

Class 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

2355. J. Burnand, *Sheffield*, "*Fastening or securing the handles of table knives and forks, daggers, &c.*"—*Dated 20th September*, 1861.

This invention consists, Firstly, in enlarging the bore of the haft towards the heel; Secondly, in twining or soldering the tang, and pouring in molten metal or alloy.

2361. L. R. Bodmer, *Thavies-inn, Holborn, London*, "*Gasaliers.*"—*Dated 21st September*, 1861.

These improvements are chiefly applicable to gaseliers with two or more burners, and fixed to or suspended from the ceiling or roofs of rooms or buildings. The burners may be placed vertically, as in ordinary gas lights, but the inventor prefers to use the star-shaped gaseliers with horizontal burners. The gas pipe, to the end of which the star is fixed, is placed within a second pipe or tube of larger diameter, and this second tube is the ventilating tube, which carries off the products of combustion, sufficient space being left between the two tubes for their rapid escape. The upper end of the ventilating tube may pass through the roof into the open air, where it is covered with a suitable cowl or hood to prevent back draught, or it may terminate between the ceiling and the floor above it, and enter into a flue leading to the open air, the chimney, or some suitable part of the building. The lower part of the tube terminates a short distance above the star, when it enters into or opens upon the aperture of a globe or other mantle of glass, spherical or half-shaped, or of the shape of an inverted funnel, the larger end of the mantle embracing or covering in the jets of lighted gas.—*Not proceeded with.*

2363. H. *and* F. C. Cockey, *Somerset*, "*Apparatus employed in the manufacture of gas.*"—*Dated 21st September*, 1861.

This invention relates to a peculiar arrangement connected with those parts of the apparatus employed in the manufacture of gas for lighting and other purposes, known as the dip pipe and hydraulic main, and its object is to allow for the contraction and expansion, or rise and fall, of the ascension pipe, and thereby to prevent the strain upon the joints of those pipes, and upon the mouthpieces of the retorts. According to this invention it is proposed to fix in the hydraulic main a short flanch pipe, sufficiently long to give the necessary seat for the dip pipe, and this pipe is to be bored out so as to allow the dip pipe to pass through it. The outside of the dip pipe is to be turned to fit the short pipe truly, but allowing it space to shift easily through it as the ascension pipe expands or contracts. In fixing the pipes the lower edge of the dip pipe should extend about a quarter of an inch below the outer pipe.

2379. W. E. Wiley, *Birmingham*, "*Pens and pen-holders.*"—*Dated 24th September*, 1861.

For the purposes of this invention, in making metal pens in order to retain ink therein, the patentee employs tongues or holders which it is preferred should be of metal, and have but little elasticity, but depend for their elasticity on vulcanised india-rubber, or other elastic material acting on them in such manner as to cause them to press towards the nibs of the pens, and to follow and remain in contact with them as they open in writing, and yet that the elasticity acting on the tongues may be overcome by the elasticity of the nibs of the pens.

2382. T. Davey, *Camborne, Cornwall*, "*Improvements in the manufacture of safety-fuses, parts of which are applicable to the manufacture of pipes and tubes of lead, and other soft metal, gutta-percha, caoutchouc, Chinese, and earthenware.*"—*Dated 24th September*, 1861.

These improvements in the manufacture of safety-fuses consists in coating the wires or fibrous materials, or both wires and fibrous materials of which the fuse is partly composed, with gutta-percha or its compounds, caoutchouc, waterproof varnish, soft metal, or other suitable adhesive material; also in the employment of wires as a substitute for, or combination with, fibrous materials placed intermediately, or covering such wires, or as a substitute for, or in combination with, lead or other soft metal. The parts of the invention which apply to the manufacture of pipes and tubes of lead, gutta-percha, &c., consists in embedding in or incorporating wire with these materials during their manufacture.

2385. J. Cottrill, *Studley, Warwick*, "*Needles.*"—*Dated 24th September*, 1861.

This invention relates to needles used for sail making, sack making, glove making, and other similar purposes, and consists in making such needles square or four sided in section, or with five or more sides and angles, except at the head, which will be of the usual form.

2388. C. G. Lene, *Maddox-street, Regent-street, London*, "*Pens.*"—*Dated 25th September*, 1861.

This invention consists in making pens to hold ink or any other fluid for the purpose of writing or designing. They are made of brass, or other metals, porcelain, glass, india-rubber, and gutta-percha. The construction of these pens is as follows:—The pen holder is a cylinder, and is made of brass, or any other above mentioned material. In the top of this cylinder above is a screw, in connection with a wire which goes down the cylinder in the pen to open or close the same at liberty by a pressure of the screw, through which operation the stroke can be made fine or thick. The pen is at the bottom of the cylinder, and made of steel like the common writing pens, but the chief thing in the whole invention consists in a little hole in the pen through which, by a certain pressure of the air, the pen is allowed to discharge only so much ink or fluid as is wanted for writing or designing.—*Not proceeded with.*

2391. H. Parnell, *Glasgow*, "*Constructing and arranging warming apparatus.*"—*Dated 25th September*, 1861.

This invention cannot be described without reference to the drawings.

2397. J. Vaughan, *Middlesborough*, "*Treating gas produced by blast furnaces in its passage from the blast furnaces to other furnaces, stoves, boilers, &c.*"—*Dated 25th September*, 1861.

This invention consists in the employment of a jet or jets of steam in connection with a regular supply of water.—*Not proceeded with.*

2392. G. Russell, *Shrewsbury*, "*Spring stretchers or beds'eads for camp, hospital, or general use.*"—*Dated 25th September*, 1861.

This invention cannot be described without reference to the drawings.

2399. D. J. Fleetwood, *Birmingham*, "*Nails.*"—*Dated 26th September*, 1861.

This invention consists in making nails having on their cylindrical or tapering bodies one or more ribs or longitudinal projections, the said ribs or projections being either straight or slightly twisted about the axis of the nail. The bodies of nails made according to this invention have in cross section the figure of a circle, with one, two, or more arms situated radially upon the said circle. When the inventor gives the ribs or projections a twisted or screw-like figure he makes the twist so light that it does not interfere with the driving of the nail. Each of the said ribs need not pass more than a quarter around the circumference of the cylindrical or taper body of the nail.—*Not proceeded with.*

2400. T. Bentley, *Margate*, "*Apparatus for beating eggs, &c.*"—*Dated 26th September*, 1861.

This invention relates to improvements in that description of apparatus for beating eggs or other matters known as the "archimedian egg beater," which consists of an axis on which a spiral or screw thread is formed, the lower end having an open wire frame or beater attached thereto, the whole being caused to rotate in opposite directions alternately by moving a sliding socket containing a pin which enters between the threads of the spiral, or screw up and down thereon, the upper end of the axis being held while the lower end rests on the bottom of the vessel containing the eggs or other matters to be beat or stirred, and this invention consists in forming the archimedean screw or spiral upon a tube to which the rotatory beaters are attached, the tube and beaters being caused to rotate upon and around a fixed central axis, to the lower end of which a fixed frame with stationary arms is attached, which may intersect or surround the arms of the rotating beaters. Rotary motion is communicated alternately in opposite directions to the beaters by a sliding socket (containing a pin which enters between the threads of the screw on the hollow axis) which is moved up and down, while the central axis is held stationary by hand, or in a suitable frame at the time the beaters are immersed in the eggs, batter, or other matters to be stirred or agitated.

2401. H. Nunn, *Chelsea, London*, "*Mangles.*"—*Dated 26th September*, 1861.

The first part of this invention has for its object improvements in the mechanism employed for giving motion to the ordinary box mangle, or those consisting of a heavy weight moving to and fro upon rollers supported in a suitable frame, and the invention consists in improved arrangements of the mechanism employed for converting and transferring the continuous rotatory motion of the main driving axis into an alternating rectilinear to and fro movement of the travelling weight.—*Not proceeded with.*

2404. J. H. Johnson, *Lincoln's-inn-fields, London*, "*Smoothing-irons.*"—*A communication.*—*Dated 26th September*, 1861.

This invention relates to smoothing irons having two faces, and made reversible, so that one face may be heated while the other is in use. According to this invention the iron is heated by gas jets issuing from a pipe inside the iron, such pipe being secured to an end plate which allows the iron to be reversed, and enables it to be locked in its proper position by a spring catch. The jets are surmounted by a small chamber covered with wire gauze, whereby the production of smoke is prevented. A gas cock in connection with a flexible tube is soldered to the outside of the loose end plate above referred to, or a small nozzle only may be soldered thereon, over which the end of the flexible tube is passed and secured, the gas cock in that case being at the other end, or in any other convenient part of the tube.—*Not proceeded with.*

2405. S. S. Rosson, *Sunderland*, "*Apparatus for raising or lowering heavy bodies.*"—*Dated 26th September*, 1861.

This invention relates to a peculiar construction and arrangement of direct acting or gravitating crane capable of being worked either by steam, air, gas, or water, and consists in the employment of a cylinder of a length equal to the greatest lift required by the crane, in combination with a piston and counter weight, the piston working accurately within the cylinder, and the counter weight being heavier than the heaviest weight to be raised.

2408. M. A. F. Courtoise, *Paris*, "*Kilns or ovens for burning or calcining limestone, chalk, cement &c.*"—*Dated 26th September*, 1861.

This invention relates to an improved construction of kiln or oven for burning or calcining limestone, chalk, cement, and other substances requiring such process, such, for instance, as gypsum, shells, or others. The outside of the kiln is either of a round, a square, truncated, pyramidal, or other suitable form, whilst the inside central calcining flue or oven is of an elliptical truncated conical shape; towards the bottom this calcining flue is provided round part of its periphery with an arched gallery or colonnade of fire bricks, or other suitable fire resisting material, which gallery serves as a fire place in which the fuel is thrown from the outside through one or more suitable doors, whilst flame arising from the fuel passes between the columns to reach the limestone or other materials to be calcined contained in the central flue. In the interior of the brick work round the gallery is a flue communicating with the outer air, which outer air in passing through the flue becomes suitably heated, and is projected on the fuel through a quantity of small openings with which the said flue is provided. The limestone or other materials to be burned or calcined are introduced at the top of the kiln, and, after having been sufficiently calcined, the same are raked out towards the bottom of the oven along a suitable incline. The kiln may be heated with wood, coals, or any other suitable fuel.—*Not proceeded with.*

2410. V. S. Lete, *Paris*, "*Aërated or sparkling white wines.*"—*Dated 26th September*, 1861.

The patentee claims mixing with champagne or other white wines of the description known as aerated or sparkling wines small pieces of leaf gold, or leaf silver, or of both, the pieces being sufficiently light for allowing the same to be kept in suspension in the wine.

2411. R. Davies, *Brickchurch-lane, London*, "*Churns.*"—*Dated 26th September*, 1861.

The inventor constructs these churns of a cylindrical form of staves somewhat in the manner of barrel staves, but having their ends rebated, and which are received in circular grooves formed in the wooden plates or surfaces forming the ends of the churning vessel, into which they are driven and held by the pressure or hold so produced, or with the addition of pins, brads, or other suitable fastenings. The ends of the staves being rebated, a shoulder or shoulders is or are formed which abut against the plane surfaces of the plates or ends, and thereby form a close joint. He disposes this vessel on feet formed by projections of the end plates before mentioned, or feet otherwise produced, and in position so that the axis is horizontal; this axis he passes through one end and screws or otherwise fixes it to the dasher or beater, which he prefers to be of a plain piece of board with holes cut through it. The dasher fills as near as may be the sectional area of the chamber taken in a longitudinal direction, and revolves therein by motion communicated to the axis by a winch handle fixed thereon. An oval or other opening and suitable cover is made in the circular body at the upper part.—*Not proceeded with.*

2413. R. Franklin *and* G. Bacchus, *Stratford*, "*A reversible back supporting nursing belt.*"—*Dated 27th September*, 1861.

This invention consists in a reversible back supporting belt, by aid of which a person nursing can move the child with ease and comfort, both to herself and it, and the belt at the same time furnishes an extra means of holding the child, and by being reversed, that is, by placing the back or padded part in front of the child, it serves admirably as a support in teaching it to walk, the nurse holding it by means of the handle part of the belt. The belt is made of fine webbing, attached to the back of which is a soft pad, made of any suitable materials, and having supporters of about three inches in length of whalebone, cane, or other like substance; the band is of sufficient length, so that, after passing round the waist to which it is adjusted by means of a buckle or other suitable fastening, it forms a handle for the nurse, the two ends being tied together by means of ribbon ends tacked to the webbing; or they can be attached in any other suitable manner.—*Not proceeded with.*

2415. G. SMITH, *Liverpool*, "*Gas meters.*"—*Dated 27th September*, 1861.
The patentee claims the construction and application to wet gas meters of syphon or water line regulating pipes, which are capable of being adjusted from the exterior of the meters, as described.

2416. J. KIMBERLEY, *Birmingham*, "*Machine for mortising, tenoning, sawing, boring, drilling, and grooving wood.*"—*Dated 27th September*, 1861.
This invention cannot be described without reference to the drawings.

2417. D. MCCULLUM, *Greenock*, "*Filling and closing bottles, &c.*"—*Dated 27th September*, 1861.
This invention cannot be described without reference to the drawings.

2421. G. J. GAMIER *and* E. E. COLLET, *Paris*, "*Envelopes.*"—*Dated 27th September*, 1861.
This invention consists in manufacturing these articles from blanks of peculiar form, and which, when laid out flat before being folded into envelopes, will present a plain surface of considerable extent, which may be used for the purpose of giving publicity, by means of printing, to any advertisements or announcements that may be desired, and when these blanks are folded up into the form of a letter envelope all access to the interior will be prevented, unless the envelope be forcibly torn, or so far damaged as to render detection inevitable. This object is effected by forming the blank with a back-piece of nearly the same dimensions as the face of the envelope, and with side flaps which will fold over the back, and, being provided with overlapping ends, may be secured in the middle to prevent the back-piece from being moved.

2423. W. N. WILSON, *High Holborn, London*, "*Sewing machines.*"—*Dated 28th September*, 1861.
This invention consists, First, in the combination of a peculiar looper with a stationary shuttle or spool-case. To one extremity of the axis of the looper is fixed a worm, which is driven by another worm fixed upon the axis of the driving-shaft of the machine. The worm on the driving-shaft is so constructed as to perform the double function of carrying the looper forward and reversing its action. When the needle has pierced the cloth the looper takes the loop and carries it over a stationary spool-case containing a reel, and formed so as to open the loop, which is then drawn tight by the needle-bar acting in combination with two fixed guides. A brake is applied to the surface of the driving or driven wheel or pulley, consisting of a hinged lever in the form of a segment of a portion of the periphery of such wheel, and acting on its circumference by means of a lining of india-rubber or other suitable material, so as to prevent any backward or reverse motion of the cam-shaft of the machine. The Second part of the improvements is applicable to sewing machines used in hosiery, and consists in substituting a small tube or trough, through which the needle operates, for the ordinary pointed wire at present in use, and on which the fabric is hung while being stitched, and by which means the patentee is enabled to lay the sewing closer to the edge of the fabric. The Third part of the improvements applies to machines for producing the lock-stitch, and may, in part, be also applied to other machines. The first improvement consists in the arrangement of feed and its operation, and is as follows:—One extremity of the cam-shaft forms a compound eccentric, one part of which propels and the other raises the feed lever, which is in form similar to a three pronged fork, the two outer prongs sliding in bearings as the butt end is operated on by the eccentric, whilst the centre prong, in a divergent line, passes through a spring which is compressed in the forward motion, and in its reaction gives the backward and downward motion to the feed-lever. The length of the stitch is regulated by a small eccentric lever against which the butt of the feed-lever presses at its backward movement. The shuttle in this machine is in the form of a segment of a circle, corresponding exactly with the curve of the shuttle-race; or it may be made straight. By the combination of a segmental curve in the bobbin-holder of this shuttle, with a similar segmental slot in the upper side of the shuttle, the strain on the thread is equalised along the entire length of the bobbin. The improvements in apparatus to be used in connection with sewing machines consist, first, in an improved binder, the principal feature of which is the fixing of the clips to the body of the binder, while the back is made in a separate piece, and capable of adjustment, so as to slide up to the work within the clips, thereby laying the binding tight upon the fabric, whatever the width of binding may be. The second improvement under this head consists in a peculiar mode of driving sewing machines, but is applicable also to other machinery. Instead of the ordinary crank-motion he applies rotatory motion, obtained as follows:—Attached to the end of the driving-shaft is a small smooth-faced wheel, and on each side of this wheel, movably connected with the shaft, is a bridle or lever, having its outer end extended above the wheel sufficiently to support between them a small cam, one side of which is attached to the connecting rod. By the downward pressure of the treadle this cam is made to impinge on the periphery of the small wheel, and produce a rotatory motion. A spring may be used to return the cam to its former position, but the shaft continues to revolve, and the renewed action of the treadle and cam give an accelerated speed to the wheel, and thence to the machine, to any extent that may be desired.

2426. D. LAND, "*Apparatus whereby to regulate the passage or flow of gas, water, &c.*"—*Dated 28th September*, 1861.
This invention cannot be described without reference to the drawings.

2428. T. POTTS, *Old Kent-road, London*, "*Clasps for books, portfolios, desks, &c.*"—*Dated 28th September*, 1861.
This invention consists in forming the clasps with a spring, and with a spring-catch, in such manner that, on the spring catch being liberated by pressure upon a knob or otherwise, the spring shall cause the clasp to fly up or out from the catch. The spring also has the effect of preventing the clasp from falling on the edges of the leaves when fitted to a book, or from falling below the level at which the clasp is fixed.—*Not proceeded with.*

2431. T. SMITH, *Sheffield*, "*Umbrellas adapted to purposes of self-defence.*"—*Dated 30th September*, 1861.
This invention consists of a hollow steel rod or tube, round, oval, or square, with two grooves cut into it to receive a spring to fasten the umbrella, either up or down, with a steel dagger at the end, and with a guard-cover which screws over it, and which can be removed at pleasure. There are also steel ribs, elastic steel joints, steel stretchers, with shoulder heads enclosed in a brass or metal box, in place of the ordinary umbrella slide. The box consists of two parts, which screw together and contain eight holes or chambers for the stretcher-heads to rest in, and corresponding grooves outside.

2434. B. G. GEORGE, *Hatton-garden, London*, "*Mounting of tablets, showbills, prints, photographs, &c.*"—*Dated 30th September*, 1861.
The invention consists in making a slab of plaster of Paris, papier mache, or composition of mineral and vegetable substances, of the shape and size required, upon which the patentee mounts the showbill or other article, securing it to the plaster or composition back by means of any suitable cement. When it is desired that the tablet should have an ornamental border or framing, or any ornament, or in relief, he uses moulds formed from a model of the pattern or design required, and from which casts may be taken in plaster of Paris or other composition; and these ornamental portions, which may represent the frame or any other part of the showbill, or other design, may be gilt or painted, or otherwise ornamented as desired, and the showbill or design may be mounted upon the smooth or other portion of the cast, and the whole or any part thereof may then be covered with varnish, gelatine, glass, or other suitable preserving material.

2440. F. WALTON, *and* R. BEARD, *jun., Chiswick*, "*Varnishes applicable to the waterproofing and coating of fabrics, &c.*"—*Dated 30th September*, 1861.
In the specification of a patent granted to one of the present patentees on the 27th January, 1860 (No. 209), there was described, amongst the matters of invention, the manufacturing varnishes by dissolving in volatile solvents drying oils oxydised or converted into resinous bodies, using therewith gums or gum resins. Since the filing of the said specification the patentees have discovered that the manufacture of varnishes, when employing in that manufacture drying oils thus oxydised or converted into resinous bodies, is greatly improved by combining or employing as a solvent) with the converted drying oil coal, naphtha, benzole, or other suitable distillate from coal, together with gum or gum resins, soluble in such solvents as Burgundy pitch, gum copal, gum kuri, and others; and it is preferred to treat the resinous bodies obtained from drying oils by first subjecting the same to pressing rollers, to convert those bodies into thin films or sheets, and then to place such films or sheets into a suitable still or vessel with naphtha or other solvent distilled from coal or from products of coal, and in some cases they combine therewith turpentine. In applying these varnishes to woven or other cloths they are enabled to use the ordinary spreading apparatus, such as is used by manufacturers in spreading india-rubber on fabrics.

2442. W. F. MATTHEWS, *St. Helen's, Isle of Wight*, "*Conveying a line or other medium of communication from a ship or vessel.*"—*Dated 1st October*, 1861.
The apparatus for carrying out this invention consists of a cradle or frame formed of wood or other floating material, which, in order to render the same portable, is secured by bolts shouldered inside, according to the width of the frame, and the outside with nuts and screws on the same bolts. A ball or balls, either constructed whole or in two hemispheres, composed of gutta-percha, india-rubber, or of other material of a light and buoyant nature, is or are secured to the frame by lashings with a handle or handles or loops through which to pass a rope or belt if required, such ball or balls when so attached being intended as an impelling power when acted on by the wind and waves combined, the insides of the frame being hollowed to fit the shape of the ball, where the ball rests, to cause it to take the water; behind the ball or balls is a block to secure a reel, and attached to this block is a spindle which is movable, and on which the reel revolves, and the line or rope wound on such reel passes through a loop or eye connected with a shifting line.

2443. J. A. KNIGHT, *Symond's-inn, Chancery-lane, London*, "*Boots and shoes.*" *A communication.*—*Dated 1st October*, 1861.
This invention consists in rivetting the external sole to the upper, and to the insole, by means of flat-pointed rivets that are alternately clenched in opposite directions, and are made in a staple shape, and extend across the sole at the shank and heel portion of it.—*Not proceeded with.*

2444. O. O. LESOURD, *Paris*, "*Joining pipes and tubes.*"—*A communication.*—*Dated 1st October*, 1861.
For the purposes of this invention a box is placed or fitted over the joint, junction, or nearest ends of the pipes or tubes to be joined or secured, into which box is introduced a cement or other substance, hereinafter called the "sealing agent," after which the box is sometimes removed, but sometimes left on. It is preferred to form the box of two pieces, connected by a hinge joint, binding ring, or otherwise, and it is preferred to keep it in place on the pipes or tubes by collars, and to furnish it with a screw or other instrument for closing or tightening; it is constructed with an opening for admitting the sealing agent. It is mostly desirable to form the box with ends or necks fitting closely round the tubes. The sealing agent may sometimes be applied to plaster or coat the outside of the box, or to close it where its necks or ends surround the pipes, either instead of, or in addition to, the introducing of the sealing agent within it. The mechanical joint, fitting, or pipe end that the patentee prefers to use when the box is applied is a form of the socket fitting, that is, the fitting in which the end of one pipe is formed with a collar, and enters a mouth or socket formed at the end of the other pipe, the socket being of larger diameter than the body of the pipe, and terminating in a flange. The sealing agent is a material proper for closing, securing, completing, or forming the joint with a view to render it as tight, sound, or secure as may be, and the agent to be adopted for this purpose is, in many cases, sulphur in a state of fusion, alone or mixed with peroxide of iron, or with red or yellow ochre, or other similar ingredient, and at a temperature of at least 170 deg. Fah.; but other substances may be used as the sealing agent, as lead, tin, alloys, and metals analogous, resins, gums, pitch, gelatine, alumina, soap, gum lac, copal, melted and marine glue, and other matters alone or combined with other ingredients. To facilitate the adhesion of the sealing agent to metal surfaces the metal may be sometimes oxydised and roughened, file fashion or otherwise.

2447. J. W. SCOTT, *Worcester*, "*Tools for the manufacture of leather and other rings, washers, and laces.*"—*Dated 1st October*, 1861.
This invention consists in the construction of tools or cutters for the manufacture of leather rings and washers. The tool or cutter is composed of a fixed punch with a series of concentric circular cutters, having annular pistons working between every two; all the pistons are connected to a cross bolt, and the bolt to a ring; the bolt is free to move in slots cut in and through the cutters; a helical spring is placed outside, and bears at top against a ring, and at bottom against the ring first mentioned, to force the pistons down upon and push the washers from between the cutters, when the tool is raised by the press or other apparatus to which it may be fitted. The tool for cutting laces consists of a cutting blade fixed or bedded spirally in any suitable holder; the spaces between the coils of the spirals determine the width of the lace. A movable piston may be used with this tool, or the lace may be withdrawn by hand. The length of the lace is determined by the number of coils in the cutting blade; space is left in the centre of the tool, so as to form an enlarged head at the end of the lace; or a head may be formed at each end, so that, by dividing the lace in the centre, two laces are formed, each having a head at one end.

2448. W. H. PAYN, *Dover*, "*Preventing the loss of, and facilitating the recovery of ships' moorings, &c.*"—*A communication.*—*Dated 1st October*, 1861.
In recovering ships' moorings and other property practical experience has shown the uncertainty of the present surface buoy, whether attached to a rope or a chain, therefore the inventor has adopted a buoy to float under the surface of the water, which shall be free from all the objections to which the surface buoy is subject. This buoy, which the patentee denominates a "submarine recovery buoy," is attached to a short piece of chain, by which it is shackled on to the ship's cable in the place of the ordinary buoy rope; the buoy has three hooks (more or less) on its circumference, and being of sufficient buoyancy to float itself and a portion of the ship's cable, it will, consequently, remain floating near the surface of the anchorage ground in a position suitable to be caught by a sweeping rope when required. For convenience and expedition in finding the exact spot he also attaches the ordinary surface rope and buoy, as usual, and if this should disappear the cable may be still easily recovered.

2451. A. D. BISHOP, *King-street, Cheapside, London*, "*Pumps.*"—*Dated 2nd October*, 1861.
This invention consists in diminishing the power requisite for pumping liquids, which the inventor proposes to do by means of a vacuum chamber; and also in filtering or purifying the liquid raised; and also in a method of separating the sediment from the liquid previous to its entering the pump, which improvements can be worked separately or together. The inventor places a vacuum chamber of any convenient shape or size, and at any convenient place, and into that vacuum chamber he passes a pipe which leads down into the well. He also either places a pump down into the vacuum chamber, or leads a pipe from the chamber to the pump, and with the pump he removes the liquid from the vacuum chamber, thereby producing a vacuum in the chamber which causes the liquid to rise from the well into the vacuum chamber; and in order to filter the liquid he forms a separate compartment in the vacuum chamber, and from that chamber he passes the liquid through the pump, having been filtered through the compartment in the vacuum chamber. And he passes the mud or sediment down into a receiver below the vacuum chamber, and by means of cocks or valves he discharges the mud or sediment from the mud vessel.—*Not proceeded with.*

2459. W. THOMPSON *and* T. STATHER, *Kingston-upon-Hull*, "*Hydraulic presses.*"—*Dated 2nd October*, 1861.
This invention relates to those presses in which one large and two small pumps are employed for working a pair of presses or double press, and the invention consists in fitting stop valves commanded by handles accessible to the attendant, whereby communication can be opened with both or either of the presses as required. The large pump has two stop valves, so that it may act with either of the small pumps, as may be required. All the stop valves have separate handles, and are entirely under the control of the pressman.

2460. E. BREFFIT, *King William-street, London*, "*Improvements in machinery employed in cutting hollow and solid corks.*"—*Dated 2nd October*, 1861.
In cutting hollow corks it is necessary to arrange the position of the strip of cork to be operated on, so that, on its being presented to the cutter, it may enter at such intervals that sufficient space is left to present for the second cut to form the hollow or cylindrical cork of equal thickness throughout, and the inner and outer circle truly concentric. This invention being directed to this end the patentee arranges the bed on which the strip of cork to be operated on rests, and makes it adjustable by means of a slot and screw in the upright which supports it, so that, without waiting to look, the workman presents the cork to the cutter at a fixed distance from the best or belly side of the cork. This part of the invention applies to solid corks, but in cutting hollow corks it is necessary to provide for the lateral position of the piercings of the cutter, so that enough, and no more, cork is left between than sufficient to form the hollow corks of the required substance. For this purpose he provides a guide adjusted by slot and screw parallel with the bed, and by means of the guide the workman determines the intervals at which it is necessary to push the strip of cork towards the cutter. In presenting the strip of cork a second time to the cutter the invention is directed to keeping the edge of the circular cutter truly concentric with the first cut, and for this purpose he arranges a mandril, which is pressed forward at proper intervals through a rest with the same centre as the first cut.

2461. E. BREFFIT, *King William-street, London*, "*Improvements in the manufacture of boxes or cases, and in machinery employed therein.*"—*Dated 1st October*, 1861.
This invention is intended chiefly to apply to the making of rough cases or boxes, and consists in taking the wood, after being sawn to the required sizes, and drilling holes for the reception of the nails. The machinery consists of movable adjustable metal frames and fences, upon which the wood and the cases in their various stages of manufacture are placed and held while being nailed together.

2462. C. G. HILL, *Nottingham*, "*Manufacture of bonnet and cap fronts, rouches, &c.*"—*Dated 2nd October*, 1861.
The machinery or apparatus which the patentee uses in this invention for the making up of bonnet and cap fronts and rouches is under one modification arranged as follows:—First, he employs a pair of movable guides, similar in character to those described in the specification of a previous patent granted to him, but having a reversing screw at each end, between which screws he places two strips of metal, having suitable portions cut away to correspond with the corrugations or plates of the goffered material, or in lieu of such strips of metal he places two or more rows of pins, and around those portions of the strips which are not cut away, but which stand up vertically to the guides, and form pillars; or around the pins he passes the ribbon or other ornamenting material, carrying the ribbon from side to side of the guides, and around a pillar on each strip alternately; or he passes by several pillars on each side, according to the number of bows or loops, and at such distance or distances apart as he requires the ribbon or other material. When he has passed the ornamenting material around the pillars or pins on the strips, he places the goffered quilling or other material on the top of the ribbon, and pushes or inserts a corrugation or plait between the lengths of ribbon as required, repeating the process until the guides are filled from end to end. He then stretches a damped silk or cotton band or thread on the top in the centre, or where required, and takes the guides and places them under the making up press as described in the specification of the patent before referred to. He then presses the ribbon, quilling, silk, or cotton band or threads together, and cuts off the waste, when only one front or rouch is made, but if he uses the quilling of such width that it will make up two bonnet or cap fronts or rouches, he cuts the same in two parts, thus forming two fronts or rouches.

2466. T. WARWICK, *Birmingham*, "*Umbrellas and parasols.*"—*Partly a communication.*—*Dated 3rd October*, 1861.
This invention cannot be described without reference to the drawings.

2468. J. A. TANNERHILL, *Truro*, "*Apparatus for counting money.*"—*Dated 3rd October*, 1861.
In carrying out this invention the inventor proposes, in the first instance, to sort the silver or gold, as the machinery to be used is to be made for counting either sovereigns, half sovereigns, crowns, half-crowns, florins, shillings, or sixpences. The money is to be placed in a wide-mouthed funnel, the pipe of which is sufficiently large to allow the coins to fall flat one upon the other, to ensure which a conical-shaped piece of metal is to be fixed in the centre of the mouth by means of a metal rod; a small space is left between the bottom of the funnel pipe and a semi-circular plate or ledge upon which the coin falls, from which it is withdrawn by a rotating disc, so formed around its edge that it shall have numbered spur-like projections or teeth, the space between each being of such a curvature as to suit the size of the coin, and carry it around the plate until it reaches an opening formed therein, through which it falls into a drawer or other receptacle. A small plate of metal is fixed above the opening in order to prevent the accidental passage of the coin beyond the opening, and a hole is perforated in this plate for the purpose of allowing the odd coins to be counted by the number on the disc, one revolution of which takes a sufficient number of coins to make one pound.—*Not proceeded with.*

2469. R. J. ELLERSHAW, *Leeds*, "*Machine for expressing oil.*"—*Dated 3rd October*, 1861.
Instead of using hydraulic pressure in the said clodding process, as heretofore, the inventor expresses the oil by means of rollers in the following manner:—The seed is conveyed to the machine through a spout, and is then taken up by a feed roller, which is fluted or corrugated longitudinally, so as to deliver the seed to the expressing rollers in proper quantities. Two large hollow cylinders revolving in contact form the expressing rollers; these are covered on their outsides with wire cloth, cocoa-nut matting, or other suitable material, and are drilled with small holes for the admission of the oil into their interiors, where it is collected on a longitudinal shelf with which each roller is furnished, and from whence it is conveyed through their ends. The crushed seed passes through the said rollers in the form of a thin cake, and falls on to a pair of toothed rollers through which it passes in a broken up state, and falls upon another pair of rollers; these are finely fluted and revolve against a fluted apron, by which means the seed is reduced to a fine pulverised state, and falls into a shaking screen. The said screen has a wire cloth bottom of suitable texture through which the pulverised seed is now sifted; that portion of the material which passes through it is in a fit state to be expressed and made into cakes by hydraulic pressure in the ordinary manner, but the remainder would fall over at the end of the screen, and would require to be ground between edge stones before being expressed and made into cakes. Revolving brushes are mounted at the sides of the said expressing rollers for the purpose of keeping them clear from seed.—*Not proceeded with.*

2470. T. EVANS, *Westmoreland-street, Westminster*, "*Boots, shoes, &c.*"—*Dated 3rd October*, 1862.
According to this invention the inner sole and the upper leather are placed on the last in the ordinary way; the last is then put in the machine hereafter described, and rests upon a slide and upon a cross bar hereafter referred to, by means of which the drafting or stitching is performed; the toe part of the last bears upon a cross bar capable of raising or lowering the last, so as to adjust it to the clip used in crimping or piping. The drafting or stretching is performed by temporarily fixing the toe part of the upper to the said cross bar, and by drawing back the said slide, carrying the last until the upper is sufficiently drawn, when the piping of the toe and heel may be performed by inserting a cord or wire round the edge of the upper at the toe and heel; these are then looked together and tightened, to retain the piping, and the waist is then drawn in by the action of the shoemaker's pincers ordinarily employed, and the upper is secured as usual to the inner sole by tacks, or by being braced in the usual manner; or the piping may be performed by clips centred on slides placed at each end of the last. In the arrangement hereafter described three clips are applied to the toe only; each slide is worked by a screw, and is fitted with a camb which causes the slips to act on the edge of the upper and perform the operation of piping. When the piping is fixed, the said clips and slides, which are connected together in a case or frame hung on centres, may be drawn back from the last. The outer sole is placed on the last ready pierced, and is blocked by means of straps, which are passed over the sole, and may be connected to hand or foot levers. The machine or apparatus may be attached to a counter or table, and any size of last can be used without altering the machine.

2472. J. WOOD, *Birmingham*, "*Improvements in the manufacture of metal pens and holders, in tools employed, and in cards for carrying the same.*"—*Dated 3rd October*, 1861.
The main object of this invention is to produce pens ready for hardening and tempering by machinery, and without waste of metal. The invention consists in cutting out from the back or tail end of one pen the point of another, as hereafter explained, and so on for as many pens as the strip of metal will make. The pens, when made by the tools hereafter described, are dished between the two side slits, somewhat in the form of an arrow's point, to form a reservoir for the ink, and the wings made by the metal which is cut out for the points afford a means for securing the pens in the holder, the latter being made in such manner that the wings of the pen when inserted in it become interlaced, a certain portion of the holder being for that purpose compressed below the level of the adjoining parts. The several operations on the strip of steel from which the pens are cut are performed in two divisions or parts, namely, the tools for cutting the diagonal lines of the pen, and the side slits, and the stamping of the name or other device are performed by being fixed in the usual cutting out and stamping press, while the cutting of the longitudinal and parallel lines, and the raising of the pen, are performed by means of a pair of rolls, having the necessary steel cutters and tools keyed on to the same, such rolls likewise performing the double duty of feeding rollers by drawing the strip of steel the required distance from under the punch after each stroke of the same. The tools or dies used by the inventor in effecting the operations performed by the stamping and cutting out press are by preference four, which, when laid together and secured in a planed iron frame, form the bottom die-plate or fixed bed of the press. There are notches and indentations at the sides as a provision for holding and securing them firmly together. The circular cutting and raising tools are of two kinds; that used for cutting is turned on the edge or face in a concave form, and that used for raising is turned on the edge or face in a convex form, so that, when they are keyed on to the spindles alternately, they fit and work together. The convex or raising tool is made of a less thickness than the concave and cutting tool, so as to admit of the introduction of small india-rubber washers at each side, to facilitate their proper working, and to enable them to be screwed up to the required gauge to meet the corresponding gauge of the tools used in the press. By the means before described the inventor is enabled at one stroke to perform all the operations of cutting and stamping, piercing and raising wholly by power, the pens being delivered from the raising rolls ready for hardening and tempering. The machine by which he proposes to work these tools is of the ordinary construction. In working he uses a strip of steel broader than the breadth of the working tools, so as to leave a margin on each side to hold them together while passing from the punch to the rolls, and having once fixed the steel in the rolls parallel to the lines of the tools in the punch, he fastens the ends of each succeeding strip together by means of a small dovetail previously cut to fit each other. By simply changing the ratchet-wheel he can cut each row of pens of any required length, which will likewise have the effect of increasing or diminishing the distance between the side slits and the points of the pens. He forms cards for carrying pens by stamping, embossing, or otherwise raising portions of the surface thereof, leaving spaces between the raised surfaces for the reception of the pens and penholders, so that, when the latter are laid and stitched on the card, they do not rise above the raised portions of the card. Or the pens may be stitched on the raised surfaces. He prefers to make the dies for producing the raised surfaces on the cards circular.—*Not proceeded with.*

2473. W. MALAM, *Skinner-street, London*, "*Manufacture of gas.*"—*Dated 3rd October*, 1861.
Instead of the usual mode heretofore adopted of feeding retorts by hand (by opening the end or mouth piece) the patentee employs a self-acting feeding apparatus. For this purpose he fits a hopper or charging box, so that its discharge end may be within the retort, and he places within the retort a scoop, shovel, tray, or box capable of travelling to and fro thereon, and having a portion of its top covered with a lid, or fitted with a plate, while another portion is open; when the open portion is below the hopper mouth, the scoop or tray fills with the coal or substance to be fed in, and the scoop is then caused to move till its open part comes away from the hopper mouth, and its other part comes under and closes it; and when it reaches the end of its travel in this direction it is driven back sharply, so that it may discharge its contents into the retort, and return for a fresh supply. This may be done in one arrangement by moving the scoop or tray away from the hopper by a rack, screw, or other contrivance worked by a wheel with teeth on a portion of its periphery, the scoop in its motion compressing a spring, so that, when the rack comes to the smooth part of the wheel, the spring is free to act, and forces the scoop back again. The shock of the tray, by shaking the hopper, facilitates feed. The speed of the scoop's travel may be varied by a train of wheels or multiplied gearing. The spring may, however, be otherwise acted on and set free by other arrangements. Thus this arrangement may be adapted for being worked by hand by furnishing the scoop or tray with a shank or handle extending out of the retort; it is in that case also combined with a spring, so that on releasing it to the action of the spring it will discharge.

2477. C. HUBSON, *Nantes*, "*Silvering looking-glass in piles of several sheets superposed without interruption.*"—*Dated 4th October*, 1861.
This invention consists in a great measure in the use of a chemical powder, without which the sheets of glass could not be separated, but its combination with the mechanical means completes the invention. This chemical powder is composed of three matters in the following proportions:—White soap in powder, about 9 oz.; silicate of magnesia,

about 12½ oz.; starch (the residue of wheat), about 14 oz.; the whole to be well pulverised, sifted, and quite dry. Plates silvered by this process may be lifted three, four, or five hours after the operation (according to the dryness or humidity of the atmosphere) to be placed to drain.

2478. A. David, jun., *Nantes, France*, "*Preparing and fixing steel and other inscriptions or lettering on metallic plates.*"—*Dated 4th October*, 1861.

The letters, ciphers, vignettes, or other inscriptions (always in projection) are cast with the plate itself or movable, and fixed with screws rivetted or driven upon the plates or sheets. The shape and size of the letters must, like that of the plates, depend upon the use to which they are destined. The plates bearing these letters, ciphers, or other inscriptions, are, after the fusion of the metal, scoured with an acid to remove from the surfaces all traces of oxide. Each plate is then washed, and when sufficiently dried is coated with wax and placed in a heated oven. The wax runs and spreads, penetrates into all the pores (especially of cast iron) and interstices, stops them, and prevents any lodgment of water, and consequent oxidation. This steeping in wax being effected, and all the superabundant wax removed, the painting, properly so called, in drying oils is laid in two coats over the entire surface, not excepting the letters or other projections. This painting may be allowed to dry, and when dry the patentee siezes with a tamkin or rubber any desired shade of somewhat thick colour, and laces the said colour by dabbing or pressing the tamkin upon the projections. Two thin layers of colour will suffice to make the projections tand clearly out. The first coats of paint may, if desired, be at once wiped off the projections, and the colour at once laid on them with the tamk'n. A coating of copal or caoutchouc varnish, spread finally over the plate, will give more brilliancy to the whole.

2479. J. Beesley, *Coventry*, "*Covering crinoline wire, &c.*"—*Dated 4th October*, 1861.

This invention relates to covering crinoline wire and other like substances in looms ordinarily used in weaving ribbons and other like fabrics, for which purpose the inventor constructs a reed or slay to be used in such looms, which permits the crinoline wire or other substance to pass horizontally through the slay, the dents of the slay being intercepted, and their ends, where intercepted, lodged in bars crossing from side to side of the slay, through which bars the crinoline wire or other substance is passed in the process of covering. He then imparts an upward movement to the slay while the shuttle passes through the under steel.—*Not proceeded with.*

2481. C. M. Elston, *Spalding*, "*Buckets and portable water cisterns.*"—*Dated 4th October*, 1861.

In carrying out this invention the patentee makes buckets and cisterns by weaving them round, in place of using fabrics made or woven in the ordinary manner, and converting them into buckets or cisterns by seams or joints at one side of each bucket or cistern.—*Not proceeded with.*

2482. T. G. Ghislin, *Hatton-garden, London*, "*Treatment or preparation of certain foreign plants or vegetable substances.*"—*Dated 4th October*, 1862.

The plants or substances the patentee uses for the purposes of this invention are those known to botanists as the ciklonia buccinalis, laminaræ buccinalis, duvillea utillea, sarcophycus potatorum, and their allies. He proposes to apply the above named substances to the following uses, viz., veneering, coating, mounting, and inlaying, applied to wood, metal, glass, papier mâche, or any other material, to the manufacture of handles for cutlery, surgical instruments, and tools, whips, umbrellas, and parasols; to the manufacture of walking sticks and acoustic and musical instrument boxes, picture and other frames, medallions, book covers, and a variety of other articles. In preparing the raw material for the purposes of this invention he cuts off or removes all extraneous matters, and then immerses the substance in a hot lye of caustic lime for about three hours, and on removing it from the lime it should be steeped in a bath of sulphuric acid, diluted with about fifty times its weight of water. The substance may then be removed from the acid and placed in a solution of common soda, after which any mucilage or dirt that may adhere externally to the plant should be brushed away, and after washing it for a time in pure water the prepared substance may be removed to the drying room, and when half dry it can be shaped into any form desired. By opening out the tubular plant, and laying it flat to dry under pressure, it will be converted into sheets. As a modification of the process just described, the plant, after being trimmed, may be steeped in a solution of American potash, then in dilute nitric acid, and afterwards in spirits of naphtha, and when well brushed out in naphtha it should be left to dry. After the substance has been prepared in the manner above described it may be softened or rendered in some degree plastic by means of steam, and when in the softened state it can be moulded into any desired shape; or the material may be steeped for about an hour-and-a-half in a hot solution of common soda, then applied (while hot) to the prepared frame or moulds, where it should be left to dry; or while on the moulds it may be steeped for about three hours in a solution of nitrate of lead, and then left to dry. The prepared substance then contracts and adheres to the mould; or, if the moulds are prepared to take to pieces, they can be removed, and the prepared material will remain the shape of the mould.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

The Week's Orders for Iron—Excellent Armour Plates—Coal Trade—Hardware Trades—Specimens for the Exhibition: *Chubb's Locks, Keys, and Safes*—Aluminium Casket for Miss Burdett Coutts.

Neither in Birmingham yesterday (Thursday) nor in Wolverhampton the day before was there much business done. The reports, however, furnished by the leading representatives were equally favourable with those of last week. Orders on both foreign and home account continue to be received from most parts of the kingdom, London furnishing the greater number of the current specifications for merchant iron for use in this country, and Liverpool is the centre of the demand for the foreign markets. For trustworthy iron paying prices are being received; but descriptions in which quality is a secondary consideration are selling at prices which are regarded as without precedent in modern times for their extreme lowness. "Small rounds" among the extra sizes are included in this category. Much attention is being directed to the future demand of the Admiralty and the War Office.

Plates have been produced, and "have proved of a very good quality for resisting shot, owing to their being soft and tough." The face of the plate received a 40-pound shot fired at 100 yards without showing signs of cracking. The iron masters, however, evince an even greater reluctance to embark in the necessary expenditure for producing iron plates than they did last week, owing to the uncertainty which prevails as to the description that will be hereafter mostly used. On the other hand, the conviction has grown stronger that a period of unmistakeable revival in trade is close at hand. The Scotch pig market is alleged to demonstrate that capitalists knowing this have begun to speculate in iron. The plates above referred to are supplied by Mr. S. Millington, of Tipton. Although the face of the plate was so excellent, yet the back seemed to be of rather harder metal, and was cracked across. "The usual fault (writes Captain Dyer, R.A. in reporting to Mr. Millington) which is apparently invariable in all plates, was present in yours, although not nearly so apparent as in many the committee have tried. I refer to the separation of the piles of the plate, when struck by a shot." A report so comparatively favourable in regard to plates produced under circumstances so adverse as the machinery of the South Staffordshire houses present is occasioning much encouragement to those of the trade who will be among the first to embark in any expenditure additional to that which their existing operations have entailed.

The best South Staffordshire thick coal is experiencing a slightly improved demand, as compared with a week since.

The general hardware trades maintain the improved condition which they began to assume a fortnight ago; and the fancy trades of Birmingham have begun to move in the right direction.

Certain international exhibitors have been showing some of their wares since our last. The most prominent of these have been Messrs. Chubb and Son, who, on Monday and Tuesday, had their works in Wolverhampton thronged with visitors, among which the workmen of the other factories in the town were comprised, to inspect their locks and keys intended for exhibition. About 300 specimens of locks were shown, and fifty different specimens of keys, the price of the latter of which averaged from £50 to 50s. The collection was really a magnificent one, and is sure to excite great notice in the Exhibition. Much regret is felt by Wolverhampton men that the specimens will be shown, not in the Wolverhampton, but in the London court.

In addition to the locks and keys, Messrs. Chubb will show a number of strong room doors and safes. Among the latter will be a jewel safe, with ornamental sides and door, on each side a panel of Italian design. The door is executed in similar style, but in a mixture of dead and burnished steel, inlaid gilt scrolls and ormolu mountings. The interior is fitted up in ornamental wool for the reception of jewellery. The door is secured by Chubb's patent wheel lock, throwing bolts all round. There is a second jewel safe, with folding doors of dead steel, with inlaid gilt scrolls and ormolu mouldings. Also a very large banker's safe, weighing four tons, the interior fitted with drawers, cupboards, and partitions for books. The outer folding doors are made of wrought iron plates and hardened steel combined, in the most effective manner, into a solid mass or plate 1½in. in thickness. The doors are secured by two gunpowder proof wheel locks, throwing thirty-one bolts all round. There is a second banker's safe, having the same system of combined iron and hard steel applied throughout the entire casing of body as well as the door.

One of the most interesting articles in the Wolverhampton court will be exhibited by Messrs. Mander, Weaver, and Co., wholesale chemists, of Wolverhampton. It consists of a small aluminium casket, about 12½in. long, 9in. wide, and 8in. deep. Aluminium, our readers may be aware, is quite a new metal, and is of such extreme hardness and difficult to work that the manufacture of it into anything so large and intricate as an ornamental casket is quite a success. In appearance it is of a blue zinc hue, is extremely sonorous, and its gravity is even less than that of glass. It is becoming cheaper every day, and will in time, no doubt, supplant much of the plated and silver ware, for which it is especially suited. The casket in question is worth £150, and it was made, we believe, for Miss Burdett Coutts. The style of the ornamentation is Italian. In manufacturing it the maker adopted the system of casting, in the carrying out of which the metal had to be fused to almost an electric heat. Aluminium, we may add, is procured from cryolite or mineral soda, a block of which will be exhibited by the side of the casket.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

Liverpool: *Mersey Docks and Harbour Board: Immense Iron Battery Plate*—State of Trade: *Sheffield: Leeds*—Scottish Shipbuilders' Association—Manchester: *Messrs. Muir and Co.: State of Employment*—Northern Matters: *Eden Valley Railway: North-Eastern Railway Branches: Furness: Explosion at the Works of the Derwent and Consett Company: Whittle Dean Water Company: Border Union Railway: South Tyne Pier: Whitley*—Cutlery for the Exhibition.

To commence with Liverpool. At the last meeting of the Mersey Dock Board it was agreed to order a monthly survey of the state of the river in front of the works on the Birkenhead side. It was also agreed to take the Woodside landing-stage off the hands of the contractors. On the recommendation of the Warehouse Committee it was determined that a shed should be set apart for the reception of petroleum and other inflammable liquids, and that rent should be charged for the same at the rate of 5d. per ton per week. It was also resolved that a foot-bridge should be constructed across the passage between the Clarence Graving Dock Basin and the Salisbury Dock at a cost of about £500. A mysterious vessel, named the Oreto, sailed from the Mersey last month for a foreign port. She was built by Messrs. Miller, and fitted with engines, &c., by Messrs. Fawcett, Preston, and Co. She is a fine vessel of 800 tons, and it is conjectured that she has been built for the service of the Confederate States. On Friday a gigantic hammered-iron battery plate was forwarded by the Mersey Steel and Iron Company to London, to be placed in the Exhibition. It was 21ft. 3in. in length, 6ft. 3in. wide, 5½in. thick, and weighed between 13 and 14 tons. This gigantic plate, which was more than double the size of those supplied for the construction of the steam-rams now in course of being built, is remarkable in several respects; in none more than its width. It is a fine specimen of iron-forging, and speaks favourable of the capabilities of the immense new steam hammers possessed by the company. Before it was completed the company applied for an extension of space and time for its production. Had that been granted the length of the plate would have been increased to between 30ft. and 40ft., and its weight to upwards of 20 tons. While it was being prepared several Government officers and members of the Defence Committee, including General Sir John Burgoyne, visited the works.

Trade matters continue generally dull at Sheffield. The file and steel trades, however, show an average activity, and the demand for crinoline steel is, on the whole, unabated both for home use and exportation. The orders for tools for agricultural purposes also continue moderately good. At Leeds a fair demand is still experienced for the best descriptions of iron, and many of the tool shops are pretty well off for orders. The locomotive business is also better than hitherto.

At the last monthly meeting of the Scottish Shipbuilders' Association Mr. O. Hamerton read a paper on "Steamship Economy," particularly with reference to the question of expansion of the steam in the cylinders with relation to the pressure, and showing by a number of diagrams taken from marine engines, and others obtained by calculation, the most probable advantageous grades of expansion for the different amounts of initial pressure. He advocated the use of higher pressures than at present, showing that, with higher pressures in condensing engines, an early grade of expansion was much more economical than lower pressures carried further over the stroke. He further showed that in conjunction with higher pressure the usual weights of machinery might be made to develope a greater amount of power, as some of the marine machinery of our most eminent engineers already show. He advocated greater speed of piston as one means of obtaining power from a given weight, and stated his conviction that 480ft. per minute was probably the most advantageous economical speed of piston for practical utility. He believed that a more extended application of surface condensers in connection with the other points indicated would be eminently conducive to the furtherance of steamship economy. Some discussion ensued, but it was finally agreed that, in consequence of the difficult nature of the subject and the mode of treating it, the discussion should be adjourned till next meeting, by which time members would have an opportunity of reading the paper and of being prepared to discuss it.

A new lathe has been perfected and patented by Messrs. W. Muir and Co., of the Britannia Works, Strangeways. It is stated that by an adaptation of the treadles with alternate action, as much power is obtained for turning metals as with a steam power lathe of the same capacity. The Great Eastern has been furnished with one of the lathes, and the Admiralty has purchased more than one. A specimen of the lathe will be shown in the Exhibition, to which Messrs. Muir will also contribute some powerful drilling and slotting machines, besides other engineers' tools. With regard to the state of employment at Manchester, Captain Palin reports as follows as to the machinists and founders:—Machinists—working full time with all hands, 14; ditto with a portion of their hands, 21; working short time, 11; stopped altogether, 1. Foundries—working full time with all hands, 6; working full time with a portion of their hands, 14; working short time, 4.

In the north the opening of the Eden Valley Railway, which has just been effected, will provide a new outlet for the minerals of the Cleveland and South Durham districts to Carlisle, Glasgow, and the south-west of Scotland. The erection of the pedestal for the monument of George Stephenson at Newcastle has been entrusted to a local builder, and will be proceeded with immediately. The branch from the North-Eastern Railway at Ripley to Pateley Bridge will be ready for traffic some time next month. The line will open up the comparatively dormant resources of the valley of the Nidd, and is expected to yield a good return upon the capital expended in it. The Harrogate deviation line of the same system is also expected to be completed next month. Three new companies have been formed at Furness for the purpose of procuring iron ore. The ore, with which the district abounds, is now manufactured into iron, instead of being sent into Staffordshire, Wales, and Scotland. An explosion took place on Friday night at the works of the Derwent and Consett Iron Company. There are ten boilers, ranged side by side at the blast furnaces, and the third of these exploded. The damage done was not so serious as might perhaps have been anticipated, and the company's operations will not be interrupted. The boiler had been examined a short time previously; it had then been found to be all right, and was working, with plenty of water, at the pressure of 26 lb. to the square inch. The cause of the explosion has, therefore, not been explained at present. Business has slightly improved during the last few days on Tyneside, and the trade returns for the past month show an increase in the shipments of coals and coke. The Whittle Dean Company has laid a considerable portion of a line of new pipe between Newcastle and Newburn. The operation has been much facilitated by the employment of a new description of crane, the joint invention of Mr. Main, the secretary, and Mr. Hendry, inspector, which travels on rails attached to semicircular bars slung across the pipe. The crane not only lifts the pipe, weighing about 1¼ ton, into its place to be jointed, but the line of rails being in two divisions it is made to form its own permanent way by lifting each length forward as it is required. The present 24in. pipe has been in use since 1848; if the town increases as hitherto the 30in. pipe now being laid should suffice for a long period of years. There is a strong probability that the Border Union Railway will be open for traffic by the 1st of June at latest. The South Tyne pier is making great progress at Shields. Messrs. Bagnall, extensive ironmasters in Staffordshire, have completed the purchase of two farms at Grosmont, near Whitby, comprising about 300 acres. The land contains ironstone of the best quality, and blast furnaces and other works on a large scale are to be at once commenced, the expenditure proposed being, it is said, not far short of £100,000.

Mr. A. Rotherham, of Old Rockingham Works, Sheffield, has contracted to supply 9,600 pieces of table knife cutlery for the refreshment rooms of the Exhibition. Mr. Rotherham has been also manufacturing for Messrs. Bessemer and Co., of Sheffield, a select order of fine spring cutlery, from steel manufactured by their patented process. Of Mr. Rotherham's contract for the refreshment rooms, nearly the whole of the articles to be provided have been delivered, so that no delay will be experienced in fulfilling the requirements of visitors to the *mangezvous*.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

	£ s. d.	Dis. p. cs.
IRON, English Bar and Bolt:—		
in London ..... pr tn	5 15 0	3
in Wales ..... "	5 0 0	"
in Liverpool ..... "	5 10 0	"
Staffordshire Bars "	7 0 0	1
Sheet, Single "	8 10 0	"
Dbl. "	10 0 0	"
Hoop ..... "	8 0 0	"
Rod, round "	7 0 0	"
Nail Rod, sq "	7 5 0	"
SHIPPING IRON, Staffordsh. Bars "	7 0 0	2
Sheet, Single .... "	8 15 0	"
Double..... "	10 5 0	"
Hoop ..... "	8 5 0	"
Rod, Round..... "	7 5 0	"
Nail Rod, Square.. "	7 5 0	"
IRON, Rails, in Wales, cash "	5 5 0	nett
" 6 months "	5 7 6	"
Old, to cut up "	0 0 0	"
Railway Chairs, in Wales "	4 0 0	"
" in Clyde "	3 15 0	"
Pig No. 1, in Clyde .... "	2 11 6	"
3-5ths No. 1 & 2-5ths No. 3. ..... "	2 12 0	"
No. 1, in Wales..... "	3 10 0	"
No. 1, in Tyne and Tees "	2 12 0	"
Ditto, Forge ..... "	2 0	"
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom. "	3 10 0	"
Welsh Forge Pig (all Mine), at the Port .. "	3 5 0	"
Acadian Pig, Charcoal.. "	7 10 0	"
Scotch Pig, No. 1, in London ..... "	0 0 0	"

	£ s. d.	Dis. p. cs.
IRON, Swedish, Indian assortments..... pr tn	11 5 0	2
Russian U C N D to arrive "	16 0 0	"
STEEL, Swedish Keg, bars. "	15 10 0	2½
Ditto, rolled..... "	15 0 0	"
Faggot..... "	17 0 0	"
SPELTER, on the spot .. "	18 0 0	nett
To arrive ..... "	18 5 0	"
Hard, remelted ..... "	17 0 0	"
ZINC, in sheets ..... "	23 0 0	"
COPPER, Tile, 14 to 28 lb. "	98 0 0	2
Tough Cake..... "	98 0 0	"
Sheathing and Bolts ..pr lb.	0 0 11	"
Sheet..... "	0 0 11	"
Bottoms..... "	0 0 11	"
Old ..... "	0 0 9	"
Yellow Metal ..... "	0 0 9	"
Burra..... "	100 0 0	"
Russian ..... do. "	0 0 0	"
LEAD, British Pig ..... "	20 0 0	"
Spanish ..... "	19 0 0	"
W. B. ..... "	21 0 0	"
Sheet ..... "	20 10 0	"
TIN, English Block, nom. "	117 0 0	"
Bar " .. "	118 0 0	"
Refined " .. "	122 0 0	"
Foreign Banca ..... "	124 0 0	"
Straits ..... "	114 0 0	"
TIN PLATES, Charcoal, IC..... pr ba	1 9 0	"
Ditto IX ..... "	1 15 0	"
Coke, IC ..... "	1 2 6	"
Ditto IX ..... "	1 8 6	"
Do. at Newport, 1s. per box less	—	"
Do. at Liverpool, 6d. "		
CANADA, Plates .... pr tn	12 0 0	2
QUICKSILVER ..... pr bt	0	

Rails have been quiet this week.

Scotch Pig Iron.—During the last few days a reaction has taken place in this market, and the price of Warrants has declined from 53s. 10½d. to 52s. 6d., and now closes 52s. cash, and 52s. 9d. three months open, Mixed Nos. f.o.b. in Glasgow.

Spelter has been flat, and may be bought from 5s. to 10s. lower than last week.

Copper continues dull.

Lead in fair demand.

Tin.—English is but little inquired for. Foreign is very quiet. Banca quoted £124, and Straits £114 10s. to £115 per ton.

Tin Plates in good demand.

April 17th, 1862. Moate and Co., 65, Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s. d. £ s. d.	1862. £ s. d. £ s. d.
Teak.....	15 10 17 0	15 0 16 0
Quebec, red pine ..	3 10 4 10	3 5 4 0
yellow pine..	3 0 4 0	3 0 3 15
St. John, N.B., yel.	3 0 3 10	3 0 3 10
Quebec, oak, white	5 0 5 10	5 0 5 10
birch	3 10 4 0	4 10 0 0
Memel..	0 0 0 0	0 0 0 0
elm	3 10 4 15	3 10 4 10
Dantzic, oak	3 10 6 0	3 10 6 0
fir.....	2 15 3 10	3 0 4 0
Memel, fir	3 10 4 0	3 10 4 0
Riga.....	3 5 3 10	3 10 3 15
Swedish	2 15 3 0	2 15 3 0
Masts, Quebec red pine	5 0 6 0	5 0 6 0
yl. pine	5 0 6 0	5 0 6 0
rd pine	0 0 0 0	0 0 0 0
Lathwood, Dantzic, fm	6 0 6 10	6 0 7 0
St. Peters.	8 0 8 10	9 0 9 10
Deals, per C., 12 ft. by 3 by 9 in.		
Quebec, wht spruce	13 0 18 0	15 0 19 0
St. John, wht. spruce	14 0 16 0	15 0 17 10

Per load—	1861. £ s. d. £ s. d.	1862 £ s. d. £ s. d.
Yel. pine, per reduced C.		
Canada, 1st quality	17 0 18 10	17 10 19 0
2nd do ..	12 0 12 10	12 0 13 0
Archangel, yellow.	13 0 13 10	14 0 15 0
St. Petersbg, yel...	12 0 12 10	13 10 13 10
Finland.....	9 0 10 0	9 10 10 10
Memel	10 0 15 0	10 0 13 0
Gothenburg, yel...	10 0 11 10	10 0 12 10
white	9 10 10 0	9 10 11 0
Gefle, yellow	10 0 11 0	11 0 13 10
Soderhamn	10 0 10 10	11 0 13 10
Christiania, per C. 12 ft by 3 by 9 in.....yellow	22 0 25 0	22 0 24 0
Deck plank, Dantz. per 40 ft. 3 in.	0 14 1 4	0 14 1 4
Staves, per standard M		
Quebec, pipe	70 0 75 0	50 0 55 0
puncheon	16 0 18 0	16 0 17 0
Baltic, crown pipe	160 0 170 0	170 0 180 0

SCOTCH PIG IRON REPORT.

		s.	d.	
No. 1	Gartsherrie	57	6	f.o.b Glasgow.
" 1	G.M.B.	51	6	" do.
" 3	Do.	50	3	" do.
M. Nos.	Do.	51	0	" do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths " 3 .. G.M.B.	Cash prompt	52	0	per ton.
	1 mo. open	52	3	do.
	2 mos. "	52	6	do.
	3 " "	52	7½	do.

MANUFACTURED IRON.

	£	s.	d.
Bars, Govan	7	0	0
" Common	6	10	0
Drumpeller, Common	6	10	0
Do. Best	7	10	0
Plates and Sheets	10	0	0
Rails	7	0	0
Pipes	4	17	6
Chairs	4	0	0

Glasgow, April 16th, 1862.

From the closing price last Wednesday considerable fluctuations have taken place. After a rapid rise to 54s. cash, the market steadily declined to 52s. cash, which is the closing price to-day sellers, buyers 51s. 10½d.

A large quantity of iron has been cleared out, and, aided by a number of "bear" sales, the upward movement has, for the present, been checked.

Exports continue large, being last week 15,608 tons, against 14,419 tons in the corresponding week last year.

Shaw, Thomson, and Moore, Metal Brokers.

Charing Cross Railway.—The contractors have commenced the demolition of Hungerford-market. The steamboat passengers have already been sent through Villiers-street, to reach the boats. It will be some time before this important line is open for public use. The bridges on the Surrey side are nearly completed, the work being very creditable to the contractors, Messrs. Cochrane and Co., of Woodside, near Dudley.

THE BREWERIES OF LONDON.

Concluded from page 234.

We have gone as far as the mash tuns, and have shown how the crushed malt and "liquor" are first mixed in them. Mechanically, the process of mashing the malt is as simple as that of making oat meal porridge, but chemically the mashing is one of the most delicate and critical operations in the range of the brewer's art. The object of mashing is to produce, from crushed malt and warm water, a weak solution of grape sugar, or otherwise, in the language of the brewers, a "wort," or saccharine extract. For this result the brewer is wholly dependent on the small proportion of diastase, generally about one per cent., contained in the malt, this proportion being sufficient not only to convert all the starch of the malt into gum and sugar, but to induce that change in a quantity of starch even 2,000 times greater than that of the diastase itself. We have said that the diastasê is found to act most energetically at a temperature of from 158 deg. to 167 deg. Fahrenheit in converting starch into sugar. These limits were assigned by two eminent continental chemists, Messrs. Payen and Parsoz, but the practical brewers allege that, but for one circumstance, the conversion into sugar would occur more readily at a higher temperature. This circumstance is that, at high heats, there is danger of forming the crushed malt into a paste, or, in the language of the brewer, of "setting the goods." In mashing for porter, therefore, "liquor" (water) at a temperature of 160 deg. is first let in at the bottom of the mash tun in the proportion of, say, 1¾ barrels for every quarter of crushed malt in the tun. At the same time the "liquor" and malt are thoroughly mixed, either, on entering the tun, by Steel's mashing machine, already noticed, or by agitators, or rakes, worked by machinery, in the tun itself. Within half an hour an additional quantity of "liquor" at a temperature ranging from 180 deg. to 190 deg. is let on, the mashing or stirring process being still continued, say, for an hour and a half in all. The mash tun has a sort of circular roof over it, and say 4ft. or 5ft. above it. Thick sacking curtains falling from the edges of this roof are now let down, so as completely to enclose the mash tun and prevent the escape of the heat. To this end, also, all iron mash tuns, generally used for porter, are felted and lagged with wood. The malt is now left itself to infuse for an hour and a half longer, the whole period of the mash and infusion being thus three hours from the time the hot "liquor" was first let on. This is called the first mash. The wort is then drained off, through the "goods" and the perforated false bottom of the mash tun, leaving the partially steeped malt in readiness for a second mash. Then "liquor" or "raw wort" (the meaning of the latter term will appear presently) is let on at the bottom of the mash tun, at a temperature of 175 deg., and in the proportion of one barrel per quarter of malt in the tun. After this has steeped for a while, "liquor" at 160 deg. is let on above and through a "sparger" in the proportion of half a barrel for every quarter of malt. The sparger consists of one or more radial tubes, perforated with numerous small holes along one side and made to revolve so as to sprinkle the "goods," in order to wash out and free them from the extract which they contain, the extract so washed out then mingling with the rest of the liquid contents of the mash tun. The sparger is said to have been first used by Mr. Masterman. Where there is a sufficient head or elevation of the source of supply of the hot "liquor," the radial copper tubes of the sparger will revolve of themselves, over the tun, by the reaction of the escaping water, on the principle of Barker's mill. The "goods" being sparged, the steep is continued for about an hour and a half from the commencement of the second mash, when the wort, much weaker than that obtained for the first mash, is drawn off. A third mash is generally taken with liquor at the same temperatures as for the second mash. Where, however, a third mash is not made, the amount of "liquor" which would, in that case, have been used, is to be added in the first and second mashes. After the crushed malt or "goods" have been well steeped, it is not unusual to let on hot liquor, in the proportion of a barrel for each quarter of malt sparging, it may be also at the same time. This weak extract is known as "raw wort," and in those breweries in which it is produced, is used as "liquor" for the second mashing as already explained. Altogether, in brewing London porter, 5 barrels of "liquor" are used for each quarter of malt, the final product being 3½ barrels of beer. Of the 1½ barrels of liquor lost per quarter of malt, one-half of it, or say ¾ barrel, is retained in the mashed and steeped grains, in which it is absorbed by capillary attraction, and from which it could only be expressed at a cost greater than the value of the extract thereby obtained. We shall show further on what becomes of the other ¾ barrel of "liquor" per quarter of malt.

Mr. Tizard, who wrote on brewing some years ago, recommended a single mash only extending over a period of six hours. A few other authorities agree with him in this choice, but we cannot name a brewery in which it is practically acted upon. It is pretty evident that, with a single mash, a good deal of strong wort must be left in the goods at the end of the process, and so much moisture can be held in crushed malt by capillary absorption only, that it would cost more than it was worth to remove the wort, further than that which would spend or drain off by itself.

A particular temperature, uniformly maintained throughout the mash tun, is, as may be supposed from what has already been said, of great importance. Observing brewers, nevertheless, have found, by applying the thermometer, that a difference of temperature amounting to 20 deg. occasionally exists in different parts of the tun, and sometimes at two points not more than a foot apart. Various attemperators have been devised to correct this inequality, which cannot be entirely prevented by any process of mashing. One kind of attemperator which has been extensively used by brewers, although no great number are at work in London, is that invented by Mr. Crockford, of the Castle-street Brewery, Long Acre. Mr. Crockford employs a tubular vessel, on the principle of a multitubular boiler, and places it at one side of and near the mash tun. Steam of a regulated temperature (say at 5 lb. pressure) is admitted within this vessel and around the tubes. The wort is then taken from near the surface of the contents of the mash tun and drawn through the tubes of the attemperator, from which it is returned to the bottom of the mash tun. By continuing this operation over the mash, an almost exactly uniform temperature is secured throughout the whole contents of the mash tun, and, what is of even greater consequence, the temperature can be exactly controlled, giving to the wort either a constant temperature, or raising it gradually from its heat at the beginning of the mashing process, just as may be found best in practice. With raw grain especially, as used in distilleries and vinegar factories, this command of temperature is of great importance, as, with a less quantity of diastase for carrying on the conversion of the starch into sugar, the change will be incomplete at a temperature a few degrees above 170 deg., whereby a good deal of undecomposed starch will pass into the underback, to the impediment of the subsequent fermenting process; while, on the other hand, with a temperature a little below 150 deg. the worts will turn sour.

The mash or infusion being over, the worts drain through the false bottom of the mash tun into a large vessel placed at a lower level, and called the underback. From here it is pumped into the coppers, to be boiled along with the hops, the spent grain being taken away by the cowkeepers as food for their cattle. The coppers, which are properly boilers, might have been described before coming to the mash tuns, as not only are the coppers employed for boiling the worts, but for heating the liquor also for the purpose of mashing. At Whitbread's brewery, indeed, the coppers are employed only for the latter purpose, the worts being boiled in separate vessels heated by coils of steam-pipes, and known as boiling backs. At Hoare's brewery, on the other hand, the liquor is heated in large circular wooden vessels, by means of copper pipes through which a constant flow of steam is maintained, the usual coppers being employed for boiling the worts.

The copper is an upright vessel of that material, its bottom being shaped much like that of a bottle, while the upper portion has the form of the large end of an egg. The whole is set in brickwork, and over a fire-grate, an escape flue being made in the brickwork to carry the products of combustion into the chimney. The largest coppers in London hold, we believe, 700 barrels, although one at Messrs. Reid and Co.'s has been said to hold 1,001 barrels, or over 160 tons of worts. Messrs. Guinness, of Dublin, have a 1,000-barrel copper. The sides of the copper are about ¼in. thick, the bottom of a large copper being, say, 1in. thick, with the exception of the crown, or central portion, which may be 1¼in. Some copper bottoms, however, are ¼in. thicker. A hole, which may be covered by a lid, is made near the top of the copper for charging the hops, &c., while at the top there is an opening through which the steam disengaged in boiling may escape directly into the air, or be sent through two or more short pipes to be condensed within a large copper pan surrounding the upper part of the copper, and filled with water, which is thus heated for subsequent use in the copper itself. An upright revolving shaft, having arms upon which are hung festoons of iron chains dragging upon the bottom of the copper, is employed in porter brewers. This contrivance is called a rouser, and prevents the hops from settling and charring on the bottom of the copper. For delicate ales, however, at least those made at Burton-upon-Trent, open coppers, of a capacity seldom greater than 200 barrels, are employed, and the rouser is dispensed with. Indeed, the Burton brewers are said to deny that fine ales can be made in close coppers provided with rousers.

The large coppers of the London breweries have been made, in most cases, by Messrs. James Shears and Sons, of Bankside, Southwark, and Messrs. Pontifex and Wood, of Shoe-lane. Many of the large coppers weigh 15 tons and upwards.

The fires are generally made on Jukes' grates, although the ordinary bars, and Coupland's and others are occasionally used. Jukes' grate is formed of a great number of short cast iron bars linked together in an endless web, which revolves slowly upon two drums. The fresh coal, generally screenings, being put on in front, is thus presented very gradually to the fire, being partly or wholly coked before commencing to burn.

The worts from each mash are boiled separately, the proper quantity of hops being put in with the first mash. For every quarter of malt brewed into porter, from 7 lb. to 9 lb. of hops are put in the copper in winter, and 11 lb. or thereabouts in summer. For stout of extra strength, 12lb. of hops per quarter of malt are sometimes used, and a like quantity would, we presume, be used for a strong ale, a still larger quantity being used for export ales. The bottom of the copper being first covered with "liquor" the hops are put in, and the vessel filled. The first mash is boiled about two hours, not under pressure as the steam escapes freely into the open air or into the pan. The rouser is kept agoing in the meantime, and it drags with such force upon the bottom of the copper that the stout iron links of the chain are worn completely through generally in two years, a gradual wear of the copper going on at the same time. After the worts have been sufficiently boiled, the whole contents of the copper are discharged through a large pipe into the underback, where the wort drains off, through a perforated false bottom, leaving the hops behind. These are again taken into the copper to be boiled a second time with the second mash, and again with the third mash where a third mash is made. If there be but two mashes, the second is generally boiled at once down to the required strength, which may occupy two or three hours, but if three mashes have been made the second may be boiled one hour only. Some of the water of the wort is lost by evaporation in boiling, and in a large brewing, a number of barrels of wort are finally left in the hops, which retains the liquid by capillary attraction in the same manner as does the crushed malt. The spent hops are variously disposed of, sometimes as manure, again to farmers who, by spreading them upon the ground (where, when fully dried, they move about with the least wind), thereby frightening away the birds, while in other cases, as at Truman's brewery, the spare hops are mixed with the coal and burnt under the coppers. Mr. King, the engineer at Truman's brewery, has made a machine consisting of two endless webs formed of short iron bars, and resembling two Jukes' grates placed one over the other, between which the hops are pressed together and delivered in a state in which the stokers can handle them. By thus treating the 750 tons of hops which are yearly used at that vast establishment Messrs. Truman, Hanbury, and Co., effect a large saving. In some of the Burton breweries the hops are being pressed out in a stout box within which works a large piston moved by a hydraulic press. One of these machines, as made, under Mr. Paul R. Hodge's patent, by Messrs. Handyside and Co., of Derby, for Messrs. Allsopp and Co., is to be seen in the western annexe of the Exhibition.

The object of boiling the worts is not merely to extract the flavour of the hops, for that might be done at much less cost, but to coagulate the albuminous matter always present in wort, and which, if not thus treated, would decompose in the beer, to the injury, most likely, of its qualities as a pleasant and healthful beverage. Tizard, who, as we have mentioned, proposed a single mash of six hours' duration, considered boiling the worts as unnecessary, and held that it would be quite enough to infuse the hops by themselves and to run the worts through the infusion. This, if it were really practicable, would save the great cost of coppers and that of the fuel burnt in boiling. None of the London brewers, we believe, have acted upon Tizard's recommendation, but at Messrs. Elliot, Watney, and Co's., in making ales, the hops are infused by themselves in Mr. Paul R. Hodge's "hop digester," and the infusion added to the worts, which are afterwards boiled, in the usual manner, in the coppers. This process is followed only for ales, the porter being made in the usual manner. Mr. Hodge's plan, we are informed, is also carried out at Messrs. Allsopp and Sons' great brewery at Burton-upon-Trent.

We might write a lengthy essay on the qualities and use of hops, but these are so much the subject of observation and practical skill on the part of the brewer, that all we could say under this head would be of little use.

From the hop backs, into which the contents of the coppers have been discharged, the worts are pumped up to the coolers. Each mash is not only boiled separately, but cooled separately also, the several mashes being finally mixed in the fermenting tuns. The pumps for sending up the worts are of brass, and are generally worked three together. A cast iron three-throw crank has been working a set of pumps in Combe's brewery for nearly a century, which is more, we fear, than could be expected of a like shaft made of such cast iron as we have now-a-days.

The coolers are in the upper part of the brewery, and are no more than broad iron floors upon which the hot worts are run to a depth of a few inches. A thorough circulation of air being kept up by openings in the sides of the cooling room, the worts are cooled, in a few hours, from 220 deg. or so down to the temperature of the atmosphere. By this evaporation one-eighth of the water ("liquor") in the worts is lost, and the density or strength of the worts correspondingly increased by concentration. Thus, 500 barrels of "liquor" being turned upon 100 quarters of malt, from which 350 barrels of beer are to be made, the loss of 150 barrels of "liquor" is as follows:—¾ barrel per quarter being carried off in the spent malt, is 75 barrels, then as, say, 2½lb. of hops are used per barrel of beer, or 875 lb. for 350 barrels, and as 1¾ barrels of "liquor" are carried off in each 100 lb. of spent hops, this accounts for a loss of 15¼ barrels. Then if 10 barrels more are lost by evaporation during the boiling process, we have about 400 barrels of wort left to go into the coolers. One-eighth of this being lost by evaporation leaves 350 barrels, and as this bulk is not affected by the subsequent fermentation and cleansing, it is the final quantity of beer made.

The cooling process is occasionally hastened by the use of large fans, revolving horizontally above the surface of the wort so as to promote a rapid circulation of air. These fans are employed in most porter breweries, although here and there, as at Truman's, they are not used, on the ground, as is alleged, that the motion thereby imparted to the worts is injurious.

As the quality of the beer is completely dependent upon the success of the fermenting process, and as the fermentation cannot be successfully carried on unless begun at a moderate temperature, it is almost indispensable to employ refrigerators in summer for cooling the worts. In most of the London breweries, therefore, refrigerators of some kind are employed, the worts having been first cooled in the ordinary manner. One of the commonest varieties is a series of copper pipes so arranged as to form a long circuit in a cast iron trough or pan. Cold water is forced through the pipes, the worts being placed in the pan or trough, in which are divisions or guides so placed as to direct the current of worts along the whole circuit of the pipes. In passing through these refrigerators the wort and the cold "liquor" are always to be made to move in opposite directions, so that the coolest wort meets the coolest "liquor" and the hottest wort the hottest "liquor." A simple, effective, and compact refrigerator, patented many years ago by Robert Wheeler, is also used, and is highly spoken of by the London brewers. It is formed of copper plates rolled spirally into a kind of coil, and so connected at the upper and lower edges as to give a deep narrow spiral channel for the flow of the worts, and a similar passage for the cold "liquor," which is admitted below, the two currents being everywhere separated only by the thin copper plate. By this apparatus a portion or the whole of the worts can be rapidly cooled to as low a point as is desirable.

We may here note that, at one time, it was a general belief among brewers that the presence and contact of dissimilar metals in a brew-house, as iron tuns and cooling pans, and brass pumps and copper pipes, were objectionable by reason of the galvanic action thereby set up, and which,

it was believed, interfered with the whole process of brewing. Mr. Black, a celebrated author on brewing, held strongly to this opinion, and so much was it shared by others that some brewers actually interdicted iron columns, shafting, and gearing in the brew-house, and went to the trouble of having their worts conveyed from the coppers to the coolers in wooden pails. It may be perfectly true that a thunderstorm will turn beer into vinegar, or something very much like it, but one of the most intelligent practical London brewers has connected the poles of a galvanic battery through a barrel of beer without affecting it one way or the other. Whether the same experiment, if made upon the contents of the fermenting tun, would have had the same result we cannot say, but this is certain, that the best beer now made goes through a number of processes the apparatus for which presents repeated combinations of iron and brass and iron and copper.

On leaving the coolers the worts are run into the fermenting tuns, and it is here that the separate mashes are first brought together. In the coolers a deposit of some of the body or solid substance of the worts takes place, but this is generally swept up and placed in the fermenting tuns with the worts to which it belongs. The fermenting tuns are almost always made of wood, never, we believe, of metal, but, at Truman's brewery, a slate fermenting tun has been made. The wood is generally Dantzic, of the quality used for deck planks, and the form of the tun may be either round or square, the former being preferable on most accounts, although the latter are the more economical of space. The porter worts go into the fermenting tun at a temperature, generally, of from 60 degrees to 65 degrees. The yeast being added in the proportion of 1 lb. or 2 lb. of good dry yeast per barrel of beer, fermentation commences. The worts being a mere solution of gum and malt sugar (the latter practically identical with grape sugar) flavoured with hops, the object of fermentation is to convert a portion of the sugar into alcohol. In this process the carbon of the sugar is oxidised and escapes as carbonic acid gas, which, one-half heavier than air, accumulates upon the surface of the fermenting worts, pouring slowly over when an opening is made in the side of the tun and just above the worts. By the removal of carbon, therefore, in carbonic acid gas, the density or "weight" of the wort is diminished. Brewers take the barrel of pure water, = 36 gallons, = 360 lb., as their standard of weight, and represent the strength of a wort by the excess of its weight above that of a barrel of water. Thus a wort weighing 390 lb. per barrel would be spoken of as a wort of 30 lb. The strongest ale wort weighs about 40 lb. on going into the fermenting tuns, the ale itself, when ready for the cask, weighing say 8 lb., or, in other words, a barrel of such ale would weigh 368 lb. Porter wort generally goes into the fermenting tuns at a strength of from 18 lb. to 23 lb. The reduction of its weight by fermentation is known as attenuation, and is generally carried on until a barrel of porter weighs but 7 lb. more than a barrel of water. The fermentation of porter is generally over in two days, when the beer goes into the cleansing rounds to have the surface yeast or barm separated. During the fermentation the beer gradually rises in temperature, each degree (Fahrenheit) of increase indicating a loss of weight of about 1 lb. per barrel. For very strong ales some of the London brewers ferment three days and then skim off the head of yeast, leaving the beer to work slowly for seven days longer, the ale remaining ten days in all in the fermenting tuns. The total attenuation will be from, say, 40 lb. at the beginning down to 8 lb.

The cleansing rounds or tunning casks are wooden butts, standing on their larger ends, and having each a broad spout, of wood or galvanised iron, at the top to conduct the yeast over into troughs, called stillions, and which are commonly made of slate. In these rounds, or tunning casks, the beer is left sometimes two and sometimes four days to cleanse, when, with the exception of passing into settling tanks, where it is left for a day or two, it is ready for the store vats or the trade casks. At Truman's brewery there are upwards of 1,000 cleansing rounds. At Allsopp's great brewery, at Burton-upon-Trent, the cleansing room is a vast apartment somewhere about 500ft. long and 100ft. wide, and there are said to be upwards of 2,000 tunning casks. The latter require to be cleaned with great care every time they are used. And as to every one there are three connections of pipes to be broken and re-made at every cleaning, the operation repeated upon 1,000 or 2,000 casks is a tedious one. By a very simple arrangement, lately brought out by Messrs. Pontifex and Wood, of Shoe-lane, and illustrated in another column, the old laborious mode of cleaning is entirely obviated.

All the pipes through which the worts and beer are conducted in a brewery are made of tinned copper, the cocks being in all cases of brass.

From the tunning casks, or rather from the settling tanks, the beer is taken either to the store vats or direct to the trade casks. Formerly the taste of consumers was such that only beer which had been kept for a long time was in favour. Then the brewers were compelled to construct and maintain enormous vats in which the beer slowly ripened. These vats were made of thoroughly seasoned heart of oak, strongly hooped with iron, and were provided with thick, tightly fitting heads, which were covered with sand for the more effectual exclusion of air. The larger vats were of 2,000 barrels capacity and upwards. Formerly there was a vat at Meux's of the great capacity of 3,500 barrels, but, in the year 1814, it burst when full, the contents, 570 tons in weight, overthrowing the walls of an adjoining house, and thereby killing some and wounding others of the inmates. At Whitbread's there is a vat of the capacity of 3,150 barrels, and we have, indeed, been informed that some of the vats at Barclay's hold 3,300 barrels. Very few vats are now made of a capacity greater than 1,000 barrels, and we believe a still smaller size is preferred. A great deal of the beer never goes into store vats at all, but direct into the casks, of which Messrs. Truman, Hanbury, and Co. alone have upwards of 100,000.

There is no great uniformity in the mechanical appliances in breweries, various but generally very simple expedients being adopted at different establishments for moving the goods and casks, the worts and beer being forced through pipes either by gravitation or by pumping. The millwrighting of breweries, although generally effective, does not often afford any valuable examples for the study of the mechanical engineer. In the construction of some of the larger buildings, iron girders and columns have been employed on an extensive scale, and at Truman's brewery some examples in this class of construction, executed under the directions of Mr. King, the engineer of that establishment, will be found well worthy of the attention of the engineer and architect. Nearly all of the large London breweries have deep wells, that at Truman's being over 530ft. deep.

Breweries and brewing, although beyond the province of the engineer, can hardly fail to command from him some considerable degree of interest. The very magnitude of the operations and plant, and the scientific principles involved in brewing, render the whole subject worthy a share of the attention of the profession which includes the majority of our readers.

NOTES FROM NEW SOUTH WALES.

Messrs. Peto and Co. appear to be now bringing their railway contracts in New South Wales to a successful consummation. The Engineer reported a month or two since the opening of a portion of the Western line as far as Rooty Hill, a length of four miles. Since then the rails have been laid down as far as South Creek, four miles further, and a special train has run upon it conveying his Excellency the Governor and a party of gentlemen on an excursion to the ascent of the Blue Mountains. The extension could be opened at once to South Creek, but no arrangements are likely to be made for commencing the traffic upon it until the line is finished to Penrith. The contract for this will expire at the end of April, and the line will be ready for use by that time. Upon the Northern line the permanent way is laid down as far as Black Creek, nine miles beyond Lochinvar. The station will be about half a mile on this side of the creek, and about a third of a mile from the Northern road. The platform is nearly finished, and the station buildings are in hand. It was intended to open the line to Black Creek on the 1st of March, but, as the road connecting the station with the main road would not be made by that time, a short delay in the opening would be necessary. Beyond Black Creek the works are in a very advanced condition. With the exception of three cuttings all the earthworks are completed, and little requires to be done upon the bridges and culverts. The only works of any importance remaining are the ballasting of the line, and the laying the permanent way; these operations will occupy considerable time, as all the ballast has to be brought from the banks of the Hunter, at Singleton. The contractors are bound to finish the line by the end of the year. The southern extension is also well advanced, most of the outworks being completed, as well as a great portion of the ballasting. The viaduct across the Nepean, at Menangle, will be a work of considerable magnitude, but operations are being actively proceeded with. In the middle of February the first of the four piers in the northern bank was completed up to the cornice, and most of the masonry for the second pier was done, and the foundations for the third and fourth piers were being prepared. It was expected that the masonry would be ready to receive the iron girders on their arrival. The Pitt-street tramway continued to work satisfactorily, and was admitted to be a great public convenience. The only complaint raised against it is on account of the rails presenting an obstruction to the wheels of vehicles crossing the street, the rail being elevated in some places nearly two inches above the roadway. It was understood that steps were about to be taken to remedy this inconvenience, by packing the roadway close inside the rails. Hitherto the tramway has been used solely for the conveyance of passengers; but the Government were disposing of the materials of the building recently occupied as colonial stores, with a view to the erection on its site of a store for the reception of produce and merchandise. On the completion of this structure the line would be opened for goods' traffic.—A contract has recently been taken for the completion of the Darling Harbour extension, which was commenced seven or eight years ago, when the Parramatta line was constructed, and has since remained in an unfinished state.

Telegraphs are being actively extended in the colony. Tenders were invited in February for the construction of all the lines for which appropriations passed last session. The most important of these will be the extension from Orange to Wagga Wagga, a length of 250 miles. This line will connect with Sydney the Burrangong and the Lachlan diggings. The estimate passed by Parliament was simply for a line to the Burrangong goldfields; and the reason for extending it to Wagga Wagga, where it will be connected with the South Australian system, is that there may be two independent lines between Sydney and Melbourne, there being a communication between the latter city and Wagga Wagga, by way of Deniliquin, Echuca, and Sandhurst. The advantage of this extension will be that, in the event of the current being interrupted on the Southern wires, the Western line will be available for the transmission of messages between Victoria and New South Wales. Two years since a second wire was stretched between Sydney and Allbury, upon the promise of the then Victorian Government that a second wire would also be carried from Allbury to Melbourne—a promise which has not yet been redeemed. The extension of the Northern line from Tenterfield to Grafton will place the Clarence district in communication with Sydney. The line will be 125 miles in length, and the only township that it will pass through will be Tabulam. In addition to the above, tenders have been invited for a line from Campbelltown to Wollongong and Kiama, a length of 60 miles; and also for an extension from Mudgee to Wellington, which will be about the same length.

We may add a few details with regard to miscellaneous public works which have been prosecuted in the colony. The lighthouse at Port Stephens being finished, the lighting apparatus has lately been fixed, and on being tried was found to answer very well. It is now waiting for the Pilot Board to direct its being brought into use. Several important works are being carried on near Newcastle for the improvement of that harbour. The public wharf is completed for a length of about 1,240ft., and two contracts for its further extension at either end are in progress. A wharf on the north shore is also finished, and ballast is being deposited upon it; it is intended to convey this across to the coast to form a breakwater, the effect of which will be to check the indraught of sand into the harbour; for the conveyance of the ballast rails are about to be laid down. The construction of a dyke in front of Bullock Island, for the purpose of increasing the scour in the coal channel and thereby deepening it, is in progress; perches have been fixed at every 200 feet to mark the outline of the dyke, and the ballast is being deposited. The sum of £7,000 having been voted last session for the improvement of the Shoalhaven River, a contract was about to be taken for the construction of an iron steam dredge, which will be employed to excavate the sand bars in the cross channel between the Shoalhaven and the Crookhaven rivers. The vessel is to be 60ft. long, 22ft. wide, and to be capable of dredging 500 tons a day. By the removal of these sand bars, so as to give a clear depth of 12ft., steamers from Sydney will be able to proceed as far as Nowra, and the services of tenders will thereby be dispensed with. The works for the improvement of the Moruya river are proceeding rapidly. The breakwater, which is carried from the southern bank at the entrance, is already about 200ft. in length. Prior to commencing the works at the Clarence River the contractor has advertised for tenders for putting up residences for the men to be employed. Tenders have also been called by the Government for supplying a weighbridge, as the contractor is to be paid for the stone delivered at the breakwater according to weight, that being the most convenient mode of payment for the work. In pursuance of a vote last session for further surveys, a party was about to be despatched to the Manning, to commence a survey of the river, with a view to the construction of works for the improvement of the navigation.

INSTITUTION OF ENGINEERS IN IRELAND.

At an ordinary general meeting of the Institution of Civil Engineers of Ireland, held on the 9th instant in Trinity College, Dublin, Professor T. Downing, C.E., LL.D., in the chair, Mr. G. H. Strype (member) read the following paper on the 50-ton crane recently erected at Belfast:—

The crane about to be described is of the kind known as a rolling crane, and is built from the designs of George Smith, Esq., engineer to the Belfast Harbour Commissioners, a somewhat similar one at Liverpool having served him as a rough model. It consists of a timber carriage mounted on sixteen wheels, running on four lines of rails, four wheels on each rail. At the outer end of the carriage is a pair of malleable iron jibs or shears, meeting together at the head, and supported by stays connected with the back end of the carriage. A pair of timber struts or spurs change the direction of the string in the stays, and forms a portion of a system of bracing, giving steadiness to the whole. The hoisting gear is placed at the back end of the carriage, and a winch in the middle of the length of the carriage serves for traversing the crane backwards and forwards on the rails.

The site selected for placing the crane was on ground reclaimed from the Lough, and the soil, being very soft, required peculiar care in making the foundations. This was a part that came but little under my observation, but on my writing to Mr. Smith he has kindly furnished me with the particulars. The length of the work at right angles with the quay front is 105ft., and the breadth is 8ft. 6in. for each pair of rails, the foundation for each railway being separate and distinct from the other, with a distance of 7ft. 4in. between the stonework of the two. The ground, in the first instance, was excavated to a depth of about 6ft. for each line of foundation, and larch piles, 35ft. long, driven in each excavation in three parallel lines. The heads of the piles were cut off level at a depth of 5ft. 8in. below the surface of the quay, and on the top of each three piles were placed transversely a balk of larch 9in. by 9in. On these balks were laid longitudinal planks of red pine, 4in. thick, on which was built a thickness of 3ft. 3in. of rubble masonry. Resting on this rubble work, and under each rail is a line of cut stone 1ft. 4in. thick and 3ft. wide, on which the rails are fastened with oak trenails, the spaces between the stonework being filled in with the ordinary paving of the quay. The gauge of each railway is 5ft., and the distance between the centres of two lines 15ft. 10in.

The carriage of the crane is of pitch pine, 60ft. long and 19ft. 6in. wide. There are four longitudinal pieces extending the whole length of the carriage, and a fifth, a central one, which does not extend the entire length, being divided near the centre to give space for the traversing winch. These timbers are 14in. square. The transverse timbers are eleven in number, all of them, with the exception of the end ones, being 14in. by 9in., placed under the longitudinal timbers, to which they are secured by two bolts, 1in. diameter, at each joint; these timbers are half lapped into each other at every crossing at depth of 1in. The end timbers are 14in. square, and are fastened to the longitudinals by tenons and mortises. A pair of diagonal bolts, 2in. diameter, with strong cast iron washer plates, secures the whole framework from cross twisting.

The railway wheels are sixteen in number, 4ft. in diameter, 7in. wide at the rim, and are cast with solid discs, 2in. thick; they run loose upon their axles, the naves being 10½in. deep. The four front axles, those under the shears, having the greatest load to sustain, are 7in. diameter in the body, and 5½in. diameter in the naves of the wheel; the remaining four axles are 5½in. in the body, and 4½in. in the wheels. All these axles are keyed fast in cast iron brackets, bolted to the longitudinal timbers of the carriage.

The two transverse timbers of the carriage at the front end, and the portions of the longitudinals between them, are strengthened with additional pieces on the top, 10in. deep, and on these are bolted a pair of strong castings, which carry the two shears or jibs and the two spurs. The length of the shears is 56ft. 9in. from centre to centre; the height of the centre of the head from the ground, 50ft. 9in., and the overhang clear of the carriage, 30ft. 9in. They are made of boiler plate, ⅜in. thick, in ten lengths of plate, the external diameter of the ends being 20in., and in the centre 30in. In constructing these the plates, after being bent to form, had the longitudinal edges planed, and were rivetted together with strips in the inside 8in. wide. The ends of each section were then turned in the lathe, and rivetted together with internal rings 8in. wide, covering the joints. The joints throughout are double rivetted, and the rivets countersunk on the outside, making a perfectly fair external surface. The ends of the shears enter into cast iron sockets 2in. thick and 2ft. 1in. deep, with a clear space of $\frac{5}{16}$in. around, which was filled up with rust cement, when the sockets were properly adjusted. The lower sockets have rule joints cast on them, which enter between corresponding joints cast on the plates carrying the shears, the joint pins being 4in. diameter; these pins, however, do not support the thrust of the shears, which is carried by the cylindrical portions of the rule joints, all the surfaces of which, where they come into contact, being accurately fitted together. As the shears are separated from each other a distance of 15ft. 10in., a strong tendency to spread at the foot is produced; this is not allowed to be communicated to the carriage, but is sustained by a tie rod 2½in. diameter, connecting the pins of the joints together, the union being effected by sockets and cotters. The sheave heads are cast with the upper sockets, and have strong side flanges, which were faced in the planing machine, and when bolted together form the connections between the shears at the top.

The spurs are made of greenheart; their length between the centres is 36ft. 3in., their diameter at the middle 15in., and at the ends 12in. They are fitted with cast iron sockets, similarly to the shears, and the lower sockets have also rule joints connected to the same plates as those of the shears. The upper sockets are not connected immediately together, like the shears, but are placed at a distance apart of 9ft. 3in. between their centres, and are joined by a tie-rod 2½in. diameter, with sockets and cotters, as described for the lower end of the shears.

A pair of tension-rods, 2½in. diameter, connect the heads of the shears and spurs together, and two other pairs of tie-rods connect the spurs with the hinder end of the carriage. These sustain the shears in position. Two other smaller pairs of tension-rods radiate from the heads of the spurs to different points in the shears, and from these points rise bars of T-iron, with their upper ends connected to articulated joints in the main tension-rods. The pairs of T-iron struts are stiffened laterally with diagonal bracing, and diagonal tension-rods, placed also between the spurs, prevents lateral movement in them. It may be observed here that when the crane was first commenced upon it was purposed to make the shears of timber, and the two pairs of tension-rods just described were essential in preventing the shears sinking in the middle by their own weight; but by substituting iron for timber in their construction, they were found to be so rigid that it is probable these tension-rods might have been omitted without detriment to the stability of the structure. This would have materially simplified the work, as it was found that getting the pins through so many eyes at the top of the spurs was a difficult operation.

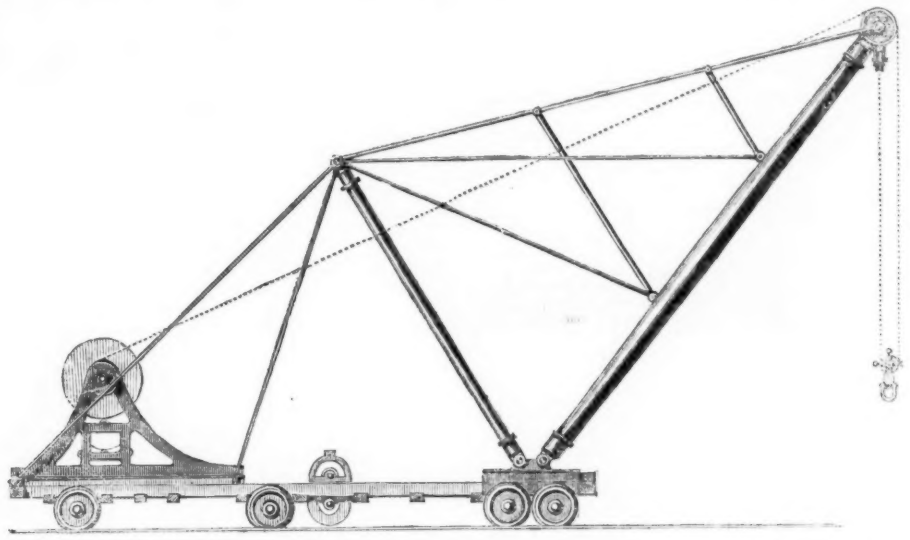
There are two sets of hoisting gear, the exact counterpart of each other. These are carried by three cheeks, bolted down to a cast iron platform or sole at the back end of the carriage, the middle cheek being common to both sets of gear. The platform is 24ft. long, 12ft. 8in. wide, and 1¼in. thick, and is cast in four pieces, with strengthening ribs on the under side. It has also three sets of transverse trusses underneath of malleable iron, which counteract the tendency to sink in the centre.

The hoisting barrels are 3ft. 6in. diameter and 4ft. 10in. long, and are cast with a spiral groove in each to receive the vertical links of the chain. The barrels are brushed with brass at the ends, and run

loose on the shaft, which passes through both barrels, and serves also as a stay to connect the heads of the three cheeks together. The main spur wheels are keyed on to the outer ends of the barrels. The particulars of the hoisting gear are as follow:—

1st wheel,	8ft. 4½in.	diam.,	105	teeth,	3in.	pitch,	7in.	face,	6in. shaft journals.
1st pinion,	1ft. 4½in.	,,	17	,,	3in.	,,	7½in.	,,	3in. ,,
2nd wheel,	5ft. 1in.	,,	90	,,	2½in.	,,	5in.	,,	3in. ,,
2nd pinion,	8½in.	,,	12	,,	2½in.	,,	5½in.	,,	2½in. ,,
3rd wheel,	4ft. 0½in.	,,	87	,,	1½in.	,,	4in.	,,	2½in. ,,
3rd pinion,	7½in.	,,	13	,,	1½in.	,,	4½in.	,,	2in. ,,

There are two of the pinions last in the table working into the third wheel, and they are provided with separate shafts and handles, the object being to enable a greater number of men to be employed



in working the crane. The radius of the handles being 16in., the ratio of velocity between them and the barrels is 230 to 1, and as the blocks increase the power fourfold, the ratio between the initial and final velocities is 920 to 1. In cases where a quicker velocity is desirable, such as in taking up the slack of the chains, the handle can be put on the shaft of the second pinion, in which case the ratio of velocity is 138 to 1. There is a ratchet wheel and pawl on each of the shafts of the second wheel, by means of which either set of the hoisting gear can be used singly, or the whole fixed when required, but no brake is employed. The chains between the barrels and the head of the shears is supported on three pair of friction pulleys, one pair of them carried by the spurs, and the others by the T-iron struts.

These pulleys are free to move on end on their respective shafts in obedience to the lateral movement of the chains as it becomes coiled on the barrels. In tracing the course of the chains it will be seen that, proceeding from one of the barrels, it passes over the friction pulleys and one of the sheaves of the jib, then under the travelling block—over the gin block, and again under the travelling block, from thence it passes over the second sheave of the jib, and finally over the second set of friction pulleys to the second hoisting barrel. Thus it is obvious that eight men employed at one of the sets of hoisting gear can raise as great a weight as sixteen men working both sets, but require twice the time to raise the weight through any given height. On each side of the sole of the hoisting gear and resting on the frame of the carriage is a flooring of cast plates, on which the men stand in working the crane. The sheaves of the jibs are 3ft. diameter, and those of the blocks 2ft. 2in. diameter, they are all finished in the lathe, and are formed with a groove in each in which the vertical links of the chain lie. This produces less strain in the chain in passing round the pulleys than if they were formed with the groove wide enough to receive the chain bodily, at the same time the chain is effectively prevented from twisting. The hoisting chain is 1¼in. diameter, short linked, and is 400ft. long, it was proved to 22 tons, being equivalent to a load of 88 tons lifted.

The traversing gear is carried by two cheeks bolted to two balks of timber secured to the transverse timbers of the carriage near the centre of its length, the middle longitudinal timber being cut away at this place to make room for the gear. The barrel is 16in. diameter, and 4ft. 6in. long, and its axle is carried by a pair of cast iron brackets bolted to the underside of the two balks just named, the same bolts holding down the cheeks of the winels and securing these also. The chain is ⅝in. diameter, and, after making three or four coils round the barrel, the ends are fastened to two cast iron beams bolted to the end stones of the foundation. The wheels of the traversing winels are as follow:—

1st wheel,	4ft. 3in.	dia.,	56	teeth,	1⅞in.	pitch,	5in.	face,	3½in. shaft journals.
1st pinion,	6⅜in.	,,	11	,,	1⅞in.	,,	5½in.	,,	2½in. ,,
2nd wheel,	4ft. 3½in.	,,	108	,,	1½in.	,,	3½in.	,,	2½in. ,,
2nd pinion,	5⅝in.	,,	11	,,	1½in.	,,	3⅜in.	,,	2in. ,,

The final ratio of velocities is, therefore, 136 to 1, and it was found that two men could readily traverse the crane to and fro with the load of 50 tons.

In calculating the strains to which the various parts of the crane is subjected in carrying its maximum load, we must first consider the weight of the shears themselves together with the parts immediately resting on them. This, when reduced to its equivalent effect, suspended by the chain is equal to 12 tons. Adding this amount to the 50 tons to be lifted, we have 62 tons as the greatest load to be sustained vertically, which resolves itself into a force of 107 tons acting in the direction of the axles of the shears. The smallest diameter of the shears is 20in. externally and 19in. internally, the sectional area consequently is 30½ square inches, and 50½ square inches by 30½ square inches, equal to 1¾ tons per inch is the maximum compressive strain in them.

The experiments of Mr. Hodgkinson show the ultimate crushing strength of malleable iron columns such as these to be about 12 tons per inch of section; hence these shears, with the maximum load suspended are strained to about ⅛th of their ultimate strength.

The disposition of the blocks causes half the lifting weight to be sustained by the tension rods and the other half by the chains: but, in addition to this, the tension rods have the dead weight of the shears to support, the total being 25 by 12 = 37 tons acting vertically. The resultant of this in the direction of the tension rods is equivalent to 38 tons, or 19 tons on each rod. These rods are 2½in. diameter, or 5in. sectional area, and $\frac{19}{20}$ths, equal to 3·8 tons per square inch, or about ⅛th of the breaking strain.

In the act of lowering by the crane, that portion of the chain extending from the barrels to the shear head is relieved from a portion of the load equal to the friction of the various pulleys, and consequently the strain of the tension rods is increased by an equal amount. However, the surplus of strength possessed by the rods is amply sufficient to cover this, as well as any accidental jerk of a moderate character that may occur in using the crane.

Although the section of iron in these rods was thus evidently sufficient for the purpose, still as there were many welds in them, it was highly important that the soundness of the whole should be ensured before leaving the works. In the absence of any regularly constructed apparatus for this object, the following method of proving the bars was adopted:—The tubular portions of the shears having been completed, one of them served as the basis of operations. A strong cast iron disc was placed against the end of the tube, and a powerful screw, which happened to be on the premises, was passed through a hole in the centre of the disc, the nut of the screw resting in contact with the outside face of the disc. The portions of the tension rod about to be tested were placed inside the tube, one end being secured to the extremity of the tube farthest from the disc, and the other end of the rod connected to the screw by a piece of iron of a quality known to be capable of withstanding a tensional strain of 24 tons to the inch. When all the connections were made, the nut was turned round with a long lever until the given pieces of test iron was torn asunder; and as its area at the point intended to be broken was 1¼in., the rods were each subjected to a strain of about 36 tons, thus proving them to nearly twice the amount they have to bear with the maximum load.

In testing the crane when finished, a pile of rails weighing, with the chains that bound them together, 42 tons was raised 15ft. high from the ground, and after traversing the crane several times backwards and forwards, the load was left suspended for six hours, the result was satisfactory in every respect.

The total weight of this crane is about 108 tons, of which 72 tons are cast iron, 22 tons malleable iron, 2¾ cwt. brass, and 14 tons timber. Messrs. John Rowan and Son were the contractors, by whom this crane was constructed, and the cost, including some trifling extras, was about £1,650. The cost of the foundation was about £800.

ROYAL INSTITUTION OF GREAT BRITAIN.

Friday, March 21, 1862.

The Rev. John Barlow, M.A., F.R.S., Vice-President, in the Chair.

ON SOME OF THE CAUSES, EFFECTS, AND MILITARY APPLICATIONS OF EXPLOSIONS.

By F. A. Abel, Esq. F.R.S., Director of the Chemical Establishment of the War Department.

A glance was taken at the general nature and causes of the phenomena termed explosions, and attention was then specially directed to those explosions which are due to chemical agency.

In all instances of chemical action accompanied by an explosion, the production and violence of the latter are either entirely or principally due to the sudden and very considerable development of heat, which results from the disappearance, for the time, of chemical activity. The violence of such explosions is therefore regulated by the energy of the chemical action, or the degree of rapidity with which the chemical change takes place. There are instances in which the change of state, (*e. g.* the conversion of solids into vapours and gases), resulting from chemical action, and the suddenness with which this transformation occurs, would suffice to produce explosive effects, quite independently of the effects of heat developed by the change; but in all such instances the sudden increase in volume of the matter, resulting simply from the chemical change, is insignificant as compared with the expansive effect exerted, at the same time, by the heat developed in consequence of the sudden and violent disturbance of chemical equilibrium. Thus, the actual volume of gas produced on the decomposition of gunpowder, though very considerable in comparison with that of the original solid, is but small when compared with the volume which it occupies at the moment of its production, when under the influence of the intense heat resulting from the chemical change.

Explosions are occasionally produced by energetic chemical combination between elementary substances. Thus, potassium combines with bromine with explosive violence, in consequence of the powerfully expansive effect of the heat resulting from the intense and sudden chemical action between the two elements. Again, the union of hydrogen with oxygen or chlorine is so energetic, that the resulting water or hydrochloric acid is suddenly and enormously expanded by the heat developed; a powerfully explosive effect being consequently produced.

Explosions are much more frequently the result of chemical decomposition. Several classes of compounds are known, the unstable character of which endows them with explosive properties. Thus, the compounds known as the chloride, iodide, and bromide of nitrogen are highly susceptible of instantaneous decomposition; the very slightest disturbing causes sufficing to destroy the chemical equilibrium which exists between their component particles. Compounds of silver and gold with nitrogen, hydrogen, and oxygen (fulminating silver and gold) and of silver and mercury with a peculiar organic group, generally known as fulminic acid (the fulminates of mercury and silver), are also highly susceptible of sudden and therefore violently explosive decomposition. By the action of nitric and nitrous acids upon several organic bodies, compounds of highly explosive characters are produced, their formation resulting from the abstraction, by oxidation, of a proportion of hydrogen atoms from the original body, and the introduction, in their place, of a high oxide of nitrogen. The products of the action of nitric acid upon starch and cotton, in different forms, are the best known of these; among others the substances known as nitromannite (obtained by the action of nitric acid upon mannite) and nitroglycerine, or glonoïne (the product of the action of nitric acid at low temperature upon glycerine), are remarkable for the violence with which they explode when submitted to friction or concussion. One of the most recently discovered and curious of these explosive organic bodies is the nitrite of diazobenzol, obtained by the action of nitrous acid at a low temperature upon aniline. This substance explodes at least as violently as iodide of nitrogen and fulminate of silver, if exposed to a heat approaching that of boiling water; it is, however, far less sensitive to friction than those two bodies. Similarly explosive substances have been quite recently obtained by Dr. Hofmann from derivatives of the interesting and important base, rosaniline, the salts of which furnish some of the most beautiful of the colours now obtained from aniline.

Explosions are most readily produced by establishing chemical action between certain substances, greatly opposed to each other in their properties, and brought together in an intimate state of mixture. The substances applicable to the production of such mixtures are, on the one hand, bodies remarkable for their great affinity for oxygen; and on the other, compounds containing that element in abundance, and partly, or entirely, in a loose state of combination. To the first class belong the elements carbon, sulphur, and phosphorus, and compounds of the last two, with readily oxidisable metals; the second class includes a few of the higher metallic oxides (such as the higher oxides of manganese and lead) and combinations of metals with nitric, chloric, and perchloric acids. Mixtures produced with these two classes of bodies readily ignite, or afford explosions, either upon the direct application of heat, or by submitting them to friction, percussion, or concussion; and, in a few instances, by establishing chemical action in a small portion of the mixture, with the aid of some other compound. These explosive mixtures vary greatly in the ease with which chemical action is established in them, and in the rapidity and violence of their transformation; their properties are naturally regulated by the chemical and physical characters of their constituents, and by the degree of intimacy of their mixture.

The variation in their explosive properties, and the great extent to which the characters of any particular mixture may be modified, are very important elements in their application to practical purposes; while the comparatively instantaneous nature of the decomposition of explosive compounds, and the facility with which it is brought about, present very great, and in many cases insuperable, obstacles to their employment as explosive agents. By the comparatively gradual decomposition of an explosive mixture, such as gunpowder (when employed as a charge in a gun), the force exerted, by the gases generated in the confined space, discovers, before it attains its maximum, that portion of the chamber enclosing the powder (*i. e.* the projectile) which is separated from the remainder. By the motion which it immediately imparts to this the *smaller* mass, the strain upon the *larger* mass, forming all but one side of the chamber (*i. e.* the breech of the gun), is at once relieved, while the force continues, to the close of its development, to act in the direction of the mass which has once yielded to its influence, and thus propels the projectile. The explosion of a charge of a fulminate, on the other hand, in the chamber of a gun, is so instantaneous that the maximum of force is at once developed, and the strain thus exerted within the chamber, at the same time that it overcomes the inertia of the projectile (or the movable side of the chamber) will also overwhelm the cohesive force which maintains the mass of the chamber entire, and the breech of the gun will therefore be shattered. Enclosed in a shell a charge of a fulminate will produce a much greater shattering effect than gunpowder upon the metal enveloped, reducing it to a much larger number of fragments; but the pieces of the shell, produced by employing gunpowder as the bursting agent, will be propelled with much greater violence, because there is still a development of force after the rupture of the shell, while, with the fulminate, the entire force is at once expended upon the bursting of the shell.

The very great extent to which the rapidity of explosion of gunpowder may be modified to suit different applications is one of the most important properties possessed by this material. A very rapidly burning powder is necessary in many instances; for example, in shrapnel shells, in which the charge of powder is required to break open the shell without interfering, by any great dispersive effect, with the flight of the enclosed bullets or fragments of metal. In mortars, and short guns also, a quickly burning powder is required, as they afford a comparatively limited space for the combustion of the charge. If a slowly burning powder be employed in such arms, a portion of the unexploded charge is expelled together with the projectile, the period between the first ignition of the powder and the expulsion of the shot or shell from the gun being insufficient for the combustion of the entire charge. In long guns and in rifled cannon it is very important, on the other hand, that the ignition of the charge of powder should take place gradually, so that the pressure exerted thereby upon the gun and the projectile should, after the first ignition, be as far as possible uniformly continuous during the passage of the shot or shell along the principal portion, if not the entire length, of the gun's bore. With the gunpowder which has been, until quite recently, in general use for large cannon, the actual explosion of a charge is almost entirely accomplished before the projectile has passed beyond the trunnions of the gun. Hence the rear portion of the weapon is subject to a strain which is enormous as compared to that sustained by the front part of the cannon. Numerous important advantages naturally result from a more uniform distribution of the pressure over the interior of the gun; for instance, the necessity of constructing the part reaching from the breech to the trunnions of very much greater strength than the remainder (a measure which, in the production of cast iron cannon, involves considerable difficulties) is greatly diminished, and the risk of fracture of guns, or of their serious injury from submission to excessive strain, is considerably lessened. The explosive action of gunpowder may, it need hardly be observed, be easily regulated by the introduction of modifications in the proportions of the carbon, sulphur, and saltpetre employed in its manufacture, and in the degree of intimacy with which the ingredients are mixed. Both of these expedients interfere, however, with the extent of force ultimately exerted by a given weight of the gunpowder; since, in either case, the chemical action between the ingredients would be modified. The rapidity of combustion of gunpowder may, however, be admirably regulated, without introducing any alteration in its composition or in the perfection of its manufacture, simply by increasing or diminishing the size of the particles or grains constituting a charge, and also by modifying the degree of compression to which the gunpowder is subject before, or at the time of, its conversion into grains or pellets.

By combining the application of uniform and accurately regulated pressure with modifications in the composition of gunpowder, and by thoroughly confining the material within a case or receptacle, so that, if ignited, it can only burn in one direction, admirable and valuable arrangements (known as fuzes and time-fuzes) are obtained for igniting charges of gunpowder in shells at any period during their flight, which may have been determined upon previous to the loading of the gun. By simple mechanical arrangements, regulating the amount of the compressed gunpowder which shall burn before the flame reaches the charge in the shell, the time of explosion is readily adjusted with the greatest nicety (subject, however, to variations depending upon the degree of density of the atmosphere, as recently shown by Dr. Frankland's researches). The principle of regulated compression, and of combustion in one direction, is applied to the preparation of rockets, signals, and numerous pyrotechnic arrangements, other explosive mixtures being, in some instances, substituted for the gunpowder.

The advantages offered by materials of a much more powerfully or rapidly explosive character than gunpowder, when employed simply as destructive agents (for instance, in many classes of mining operations), have led to repeated attempts at the application, as substitutes for gunpowder, of highly explosive mixtures, readily obtainable in large quantities, in which chlorate of potassa is employed, in the place of a nitrate, in conjunction with very oxidisable materials, such as the sulphides of arsenic and antimony, and compounds containing carbon and hydrogen (Callow's mining powder and white or German gunpowder are examples of such compounds). All attempts to manufacture and employ such mixtures have, however, invariably terminated in more or less disastrous results in consequence of the comparatively low temperature at which chlorate of potassa exerts its oxidising power. Very slight friction or percussion suffices to inflame many of these mixtures, and the violence of their explosive action is, in many instances, as difficult to control as that of explosive chemical compounds. Even in the manufacture and employment of comparatively so safe an agent as gunpowder, which may be subjected, without ignition, to tolerably powerful friction or percussion, and to the direct application of any temperature below that which suffices to ignite sulphur (about 550 deg. Fah.), the neglect of strict precautions, for

excluding the possibility of a particle of the powder being subjected to sudden and powerful friction, may, and frequently does, lead to accidental explosions. The occasional accidents in gunpowder manufactories are generally enveloped in mystery, in consequence of their fearfully destructive effects; in all cases, however, where it has been possible to trace the causes of such explosions, they have been found in the wilful or accidental neglect of simple precautionary measures, indispensable to the positive safety of the works and operators.

The more highly explosive mixtures, and some few explosive compounds, though inapplicable as substitutes for gunpowder, on account of their great sensitiveness to the effects of heat, have, in consequence of this very quality, received important applications in numerous ingenious contrivances for effecting the ignition of gunpowder. Well-known instances of such applications are:—The employment of fulminate of mercury in percussion-caps; of a mixture of chlorate of potassa and sulphide of antimony, in arrangements for firing cannon by percussion and by friction, and for exploding shells by percussion or concussion; and of the same mixture, exploded at will, by being brought into contact with a drop of strong sulphuric acid, for the ignition of submarine mines or of signals.

Other mixtures, combining a high degree of explosiveness with power of conducting electricity, have been successfully applied to the simultaneous ignition of numerous charges of gunpowder by electricity of high tension: by means of one of them, recently discovered, many mines may be simultaneously discharged, even by the employment of small magneto-electric machines; the necessity for the employment of voltaic arrangements in mining operations being thus entirely dispensed with.

One of the most highly explosive mixtures at present known, consisting of chlorate of potassa and amorphous phosphorus, has been most ingeniously applied by Sir William Armstrong to the ignition of his time-fuzes, and to the production of concussion and percussion-fuzes, remarkable for the great ease with which they are exploded. The above mixture may be ignited by the application of a gentle heat, or by submission to moderate pressure; if it is made up into a hard mass by mixture with a little shellac-varnish, the friction resulting from the rapid insertion of a pin's point into the material suffices to ignite it, even when it is well covered with varnish. Thus, in Armstrong's time-fuze, which, when fixed in its place in the head of the shell cannot, like ordinary fuzes employed in smooth-bore guns, be ignited by the flame of the exploding charge of powder (as the shell accurately fits the bore of the gun), the fuze-composition is inflamed, immediately upon the firing of the gun the gun, in the following manner:—A small quantity of the the phosphorus-mixture is deposited at the bottom of a cylindrical cavity in the centre of the fuze, and over it is fixed a small plug of metal, with a pin's point rojecting from its lower end. This plug is held in its place by a pin of soft metal, which by reason of the *vis inertiæ* of the plug, is broken when the gun is fired, and the pin then instantly pierces the pellet of detonating mixture, which, by its ignition, sets into action the time-fuze. The distance between the pin's point and the phosphorus-mixture, before the explosion, is only one-tenth of an inch. This arrangement exemplifies in a striking manner the delicacy of action which may be obtained by a judicious combination of simple mechanical arrangements and highly explosive materials.

The variety of work accomplished by the explosion of a charge of powder in an Armstrong gun loaded with a shell—no less than five distinct and important operations being thereby effected before the shell leaves the gun—affords a most interesting illustration of the progress made in the application of explosives, and of the comparatively great control which may be exercised over the operations of those destructive agents.

THOMAS' PROJECTILES.

This invention, by William Lynall Thomas, of Hill-street, Berkeley-square, consists in constructing an elongated projectile, as hereafter described, with a leaden or other suitable soft metal jacket, which is expanded by means of an iron or other hard metal sabot, in manner hereafter stated.

Fig. 1 is a longitudinal section of a shot made according to the invention; Fig. 2 is an elevation of the same with the soft metal removed; and Fig. 3 is a vertical section through the lines *x*, *y*, of Figs. 1 and 2.

FIG. 1.

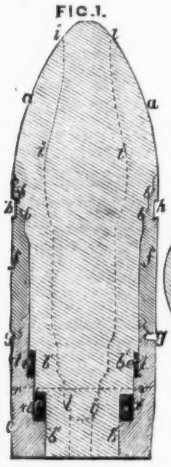


FIG. 3.

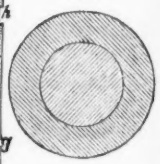
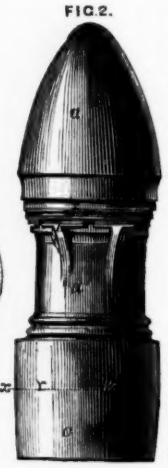


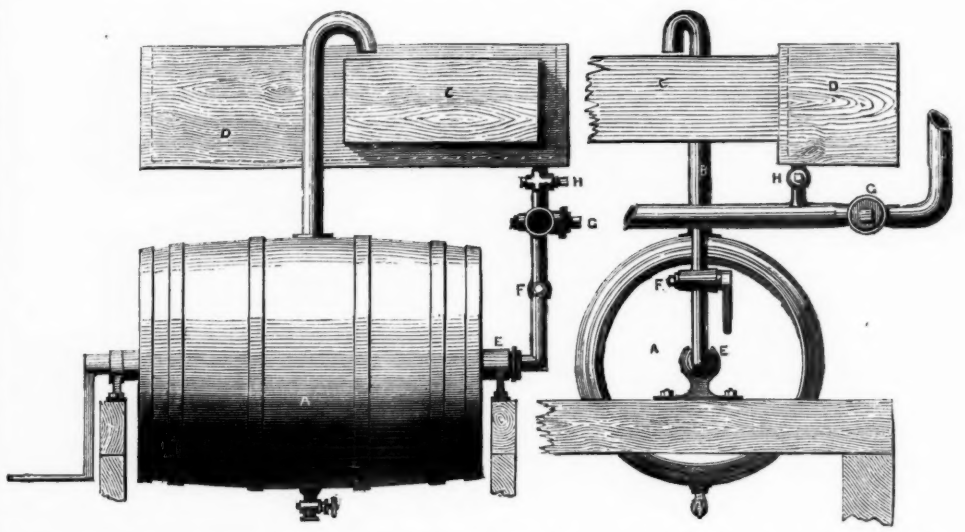
FIG. 2.



a is the body of the shot made of cast iron; *b*, *b*, are irregular surfaces for holding on a leaden jacket, and b^1, b^1, are steps at the rear end of the shot. The line *v*, *w*, indicates the ovalised portion both in the projectile and sabot; *c* is the iron sabot at the rear end of the shot, and *d*, *d*, are steps on it corresponding with those marked b^1, b^1, on the shot itself; *e*, *e*, are annular spaces between the tail of the shot and the sabot; *f* is the lead or other soft metal between the sabot and the head of the shot; the space *g* between the sabot and soft metal is filled with some lubricating material, as also the annular groove *h* in the soft metal. When the projectile is used as a shell, a space, included within the dotted lines *i*, *i*, is left in the casting for receiving the charge.

The New Railway Bridge at Blackfriars.—The Lords of the Admiralty report their opinion to Parliament that the alteration proposed by the London, Chatham, and Dover Railway Company in the intended railway bridge over the Thames at Blackfriars should not be permitted. Originally it was proposed that the clear height of the headway under the soffit of the bridge should be nowhere less than 27ft. above Trinity high-water-mark. It is now proposed to repeal that provision, and that the headway under each arch shall be such as the Conservators of the river Thames shall prescribe, not being more at the centre of each arch than 27ft., nor less than 20ft. The Admiralty require that the headway and waterway of the proposed bridge shall be made to correspond, as far as possible, with that proposed to be given in the new Blackfriars roadway bridge, to be built by the Corporation of London. Mr. Hartridge, a member of the Court of Common Council, has given notice of his intention to move at their next meeting a resolution to the effect that the court assent to the proposal of the London, Chatham, and Dover Railway Company to erect a bridge of five arches or spans across the Thames near Blackfriars Bridge.

PONTIFEX AND WOOD'S TUNNING CASKS.



Messrs. Pontifex and Wood, engineers, of Shoe-lane, Farringdon-street, have introduced an improved construction of tunning casks, or cleansing rounds, for breweries, and for which they have taken out a patent. By the old system three connections had to be made and broken every time the cask was used. The improvement mainly consists in the introduction of the supply from the squares and yeast troughs or elsewhere, into the tunning casks through a hollow axis upon which the cask revolves. It is thus rendered unnecessary to break any connection, the goose necks and racking cocks alone requiring removal.

In the illustration A is the tunning cask; B, the goose neck; C and D, yeast troughs; E, stuffing-box, through which the supply-pipe, both from squares and yeast troughs, passes into the casks; F, filling up cock for regulating supply to each cask; G, cock shutting off supply from squares; H, cock opening supply from yeast troughs.

GREAVES' APPARATUS FOR PREVENTING WASTE OF WATER.

This invention, by Charles Greaves, of the East London Waterworks, Old Ford, relates to a peculiar construction and arrangement of apparatus for preventing waste of water from service pipes or cisterns, and consists in the employment, for that purpose, of a closed air vessel, which is supplied with water from any ordinary service pipe, leading from the main, and is provided with a two-way cock, which is so constructed that, when turned in one direction, it will enable a supply of water to enter the air vessel, and partially fill the same, the air contained therein undergoing compression, and when turned in another direction it will shut off the supply entering the air vessel, and open the outlet from such vessel, the water then issuing therefrom with a certain pressure due to gravity and the pressure of the air in the air vessel.

FIG. 1

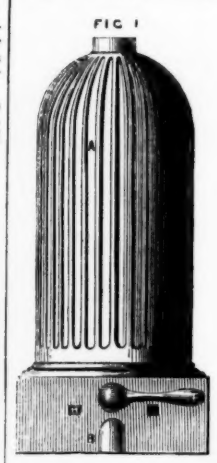


FIG. 2.

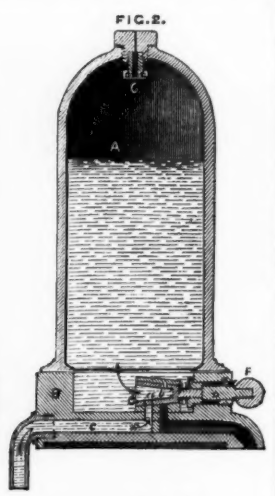


FIG. 3.

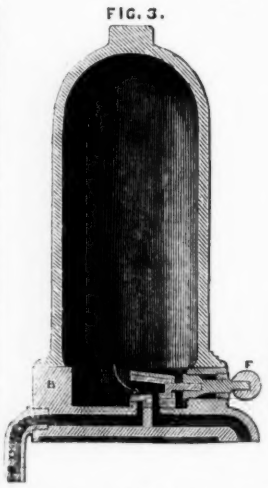


FIG. 4.

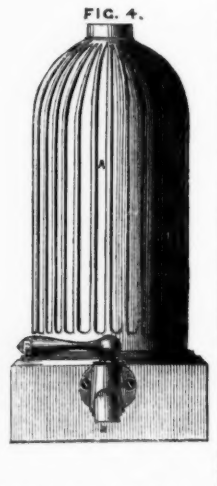


Fig. 1 represents a side elevation of the apparatus for preventing waste of water as adapted for domestic purposes, and having the supply and discharge cock situate inside the vessel. Fig. 2 is a corresponding vertical section taken along the axis of the cock, and showing the cock so turned as to admit water from the main or other source of supply into the air vessel, while it is shut off from the house service pipe. And Fig. 3 is a similar view, showing the cock in the reverse position, namely, with the supply from the main shut off, whilst that to the house service pipe is turned full on. Fig. 4 represents an elevation of the same apparatus having the cock placed externally thereto in lieu of inside, as in the preceding Figures.

In all these Figures, A represents a perfectly air-tight air vessel, bolted or otherwise secured at its lower end to a stand or base B. To this stand or base is fitted a two-way cock C, which may be either placed inside the stand or base, and near the bottom of the air vessel, with which it communicates, or it may be placed outside thereof, as shown in Fig. 4, or when applied to a closet the cock may be placed in any position convenient for use; the air vessel in such case being situate near the top of the closet, so as to increase the force of the jet entering the basin. In whatever position the cock may be placed, however, it should be constructed essentially in the manner shown in Figs. 2 and 3, namely, with two separate openings *a* and *b*, which are made to communicate respectively with the two passages or thoroughfares *c* and *d*. The inlet orifice, which admits water into the air vessel, is at *a*, and the outlet or supply orifice is at *b*, the one communicating, when open, with the passage *c* leading from the main or other source of original supply into the air vessel, and the other with the passage or pipe *d*, which conveys the water from the air vessel when required for use. These orifices *a* and *b* are so situated and formed in the plug of the cock in relation to their corresponding passages or thoroughfares *c* and *d*, that one of them only can be open at one time.

WILD'S SLUBBING AND ROVING FRAMES.

This invention, by William Wild, of Bury, relates to that portion of slubbing and roving frames known as the spindle and flyer, and is designed for the purpose of steadying the spindle during its rapid rotation.

The invention consists in the use of a long tube or "collar" extending upwards from a rail beneath the "copping rail" to that part of the spindle close beneath the "flyer;" the spindle passing through the tube is thereby steadied. The improvement consists in the use of this peculiar elongated form of "collar" in contradistinction to any of shorter description which do not afford support to the spindle closely beneath the flyer, such being a material advantage.

FIG. 1.

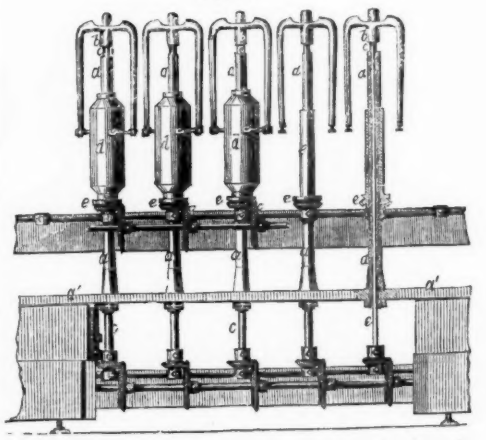


Fig. 1 is a front elevation of that portion of a roving frame to which the invention is applied, such being shown in section and exhibiting the long "steadying collar" *a*, extending from the rail a^1, to within a short distance beneath the flyer *b*, whereby great steadiness is given to the spindle in its revolutions. The spindle *c* revolves within the steadying "collar" and the bobbin *d* is placed upon a second tube *e*, which is driven by the bevel wheels *f*, and rotates upon the exterior of the steadying "collar" *a*.

The Royal Dockyards.—A return which has been presented to Parliament, on the motion of Mr. Laird, states that the Warrior can enter none of her Majesty's graving docks except two—Pembroke at average spring tides when drawing not more than 22ft. of water, and the Double Docks, Nos. 7 and 10, at Portsmouth six days each spring tide, fully loaded and ready for sea. But the New Long Dock at Devonport is being so constructed that the Warrior can be docked there on any day; the Queen's Dock at Keyham is under alterations the effect of which will be that the ship can be docked any day by raising the water in the basin; the North Inlet Dock, which is being constructed at Portsmouth, will be such that the ship will be able to enter any day when in the basin or when it can enter the basin; and No. 2 Dock at Chatham is being so altered that the ship will be able to enter there four days each spring tide when "light."

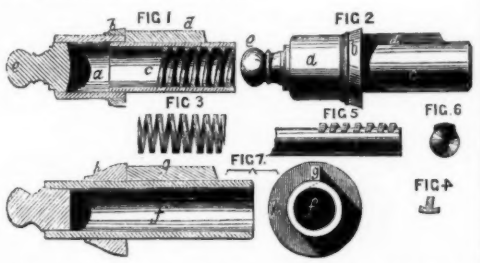
GREEN AND GLOVER'S VICE BOXES.

This invention, by Alfred Green and William H. Glover, of Stourbridge, consists of improvements in manufacturing the vice boxes of those kinds of vices commonly known as standing vices, which said vices are used by smiths, engineers, and others. The said vice boxes consist essentially of a hollow cylinder or cylindrical chamber having a concave or hollow screw on its internal cylindrical surface, the said screw extending along about one-half of the said box. The screwed pin or convex screw of the vice takes into or engages in the hollow screw in the vice box, as is well understood.

In manufacturing the said vice boxes according to one of their improvements the patentees proceed as follows:—

Fig. 1 represents in longitudinal section, and Fig. 2 in elevation, a vice box, with reference to which may be illustrated this part of the invention.

To form the back chamber *a* of the vice box a strip or plate of wrought iron, of the required length, breadth, and thickness, is heated to a red heat, and bent into a cylindrical or tube-like figure, and afterwards welded together at the overlapping edges of the said hollow cylinder or tube. To one end of the hollow cylinder *a* is next welded a thick ring or collar *b*, constituting the shoulder of the vice box. The barrel *c* of the vice box is made from a strip or plate of wrought iron of the required length, breadth, and thickness, bent into a tubular form and welded; or a piece of wrought iron gas tubing may be employed. The tubing to form the barrel *c* is of such a size that its end may be introduced into the back chamber *a*. Before connecting the barrel *c* with the back chamber *a* the rib *d* is welded on the barrel *c*. Or two of the ribs situated one opposite to the other may be welded on the barrel *c*. The barrel *c* being introduced into the back chamber *a* so far as to bring the end of the rib *d* against the shoulder *b*, the two parts *a* and *c* are welded together, the end of the rid *d* being also welded to the shoulder *b*. The knob, termination, or plug *e* is finally welded in the open end of the back chamber *a*, and a solid vice box, or box in one piece, but without a screw, is thus produced. The vice box is completed by inserting and fixing in the barrel *c* the thread or worm, which constitutes the concave or hollow screw. Fig. 3 represents in elevation the thread or hollow screw, formed by coiling a narrow strip or rod of iron upon a screwed pin, similar to that to be used with the vice box. Instead of making the worm or hollow screw, Fig. 3, of a strip of iron, square or nearly square in section, it may be made of T-iron, or iron having the figure represented in section in Fig. 4. In order to insert and fix the screw in the barrel *c* of the vice box, Figs. 1 and 2, the screw, supported upon the screwed pin, is introduced to the required distance into the barrel *c*, the screw being cold, and the barrel *c* heated to redness. The screw pin is unscrewed from the worm or screw in the barrel, leaving the screw or worm in the barrel. The screw or worm is fixed in its place by brazing. A quantity of scrap brass and scrap copper is introduced into the barrel *c*, which is heated to a degree sufficient to melt the brass and copper, the vice box being slowly turned round. After the brass and copper have been thoroughly melted and made to run all over the screw the excess is poured out; the screw is thus brazed to the barrel. The screw may be cleared of excess of brass by a scraping tool, but generally the screw is sufficiently smooth to permit of the screwed pin working freely therein. Brass alone may be used for brazing the screw, but it is preferred to add a little copper.



The advantage of making vice boxes by the method described is that when the worm or hollow screw is worn it can be removed by simply heating the barrel of the vice box, and a fresh one can be introduced and fixed in the barrel by brazing.

Figs. 5 and 6 show a mode of welding in the worm. Instead of forming the back chamber and barrel of the vice box separately and afterwards welding them together, the back chamber and barrel may be made in one tubular piece, the collar or shoulder of the vice box being welded, at the required distance, on the tubular piece, and the screw or worm afterwards fixed therein by brazing or welding. This mode of manufacture constitutes another of the improvements, and is shown in Fig. 7, which represents in longitudinal section and end elevation a vice box thus constructed. *f* is a tube which constitutes the back chamber and barrel of the box, which tube *f* may either be formed by bending a plate of iron into a tubular form and welding the overlapping edges, or may consist of a piece of wrought iron tubing made by rolling or otherwise. Upon the tube *f* the rib *g* is first welded, and afterwards the collar or shoulder *h* is welded to the tube *f* and rib *g*. The knob, termination, or plug *i*, is next welded in the open end of the back chamber, and finally the worm or screw is brazed or welded in the barrel end of the tube *f*, in the manner before explained. When the screw is welded in the barrel, the vice box, made in either of the ways before described, may, after the welding of the screw therein, be case-hardened by the ordinary case-hardening processes.

MOTT'S APPARATUS FOR DRAWING BEER FROM CASKS.

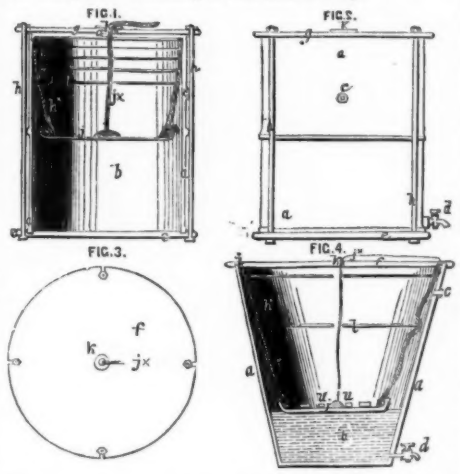
It is well known that the withdrawal of liquids from "vessels of capacity" cannot be effected unless there is a pressure on the said liquids equal to that of the atmosphere; and it is also well known that the admission of atmospheric air into contact with the surface of such liquids as beer and ale renders them "flat" and "sour."

The object of this invention, by Albert J. Mott, of Liverpool, is to prevent the air from coming in contact with fermented liquids when contained in casks and other vessels, and yet to allow the atmosphere to exercise a pressure on one side of a travelling medium interposed between such liquids and the air, which travelling medium will give or transmit the atmospheric pressure to the liquids.

The vessel and travelling apparatus must be air-tight, and both so arranged that they can be easily cleaned. They must be made of such materials, and in such manner, that the liquids will not be injuriously affected by them in taste or otherwise, and the travelling apparatus must expand with and float on the surface of the liquid, and so prevent any gases given off from rising into the vacated space.

The improvements, therefore, consists, firstly, in making the vessels when used in connection with an interposed medium or travelling apparatus of earthenware or porcelain, or the largest portion of the same of earthenware or porcelain; and it is preferred to make such vessels cylindrical, preferably with a top or bottom made of wood, so that the said travelling apparatus can be removed, and both it and the vessel easily cleaned.

Secondly, in introducing into or combining with the earthenware vessel above named, or to or with any other cask or vessel, the following travelling apparatus to permit the drawing off of fermented liquids from such casks or vessels through taps or other openings provided for that purpose, and to exclude the air from actual contact with the liquids in or remaining in the said vessel:—A flexible bag made of air-tight material, deprived as much as possible of smell, say india-rubber or gutta-percha cloth, or the two combined, or these or other cloths or fabrics coated with varnish, of a size and shape to fill or nearly fill the vessel when distended, but which will occupy small space when collapsed, is fastened to part of the top, cover, or uppermost part of the vessel, or to a disc near the top by cord, tacks, adhesive gum, or other mechanical or chemical means, so that the contact is entirely air-tight. The other end is fitted by like means to a dish-shaped utensil or basin, preferably made of earthenware, which will float on and be partially sunk into or amongst the liquids, and so give the necessary pressure by its own weight and that of the atmosphere which is admitted into the bag to allow withdrawal, and yet to prevent the flexible bag from being immersed in the liquids. A travelling apparatus or pressure medium of this class when fitted to a cylindrical earthenware or porcelain vessel would, when distended, have nearly the same external area as the inner surface of the liquid vessel; but, when collapsed, as would be the case more or less when the vessel was filled, or partially filled, it would be folded similar to a flexible gasholder or rivet bellows, and, like them, it might have discs or hoops to prevent the flexible part from twisting into the form of a rope.



Thirdly, in constructing a travelling piston medium suitable for earthenware and other vessels, but more particularly so for metallic vessels with a smooth surface, say such as have had their surfaces enamelled, two discs or dished utensils may be used, or one of each, made of wood, earthenware, or enamelled metal, and they may be connected by a flexible diaphragm attached to or near to the peripheries of both, so that the said discs or dished utensils, when pressed towards each other, will cause the diaphram to project beyond the circumference of both, and be, when in use, the part in contact with the internal surface of the vessel. To keep the discs or dished utensils forming the framework of this piston nearly parallel with, or about an equal distance from, each other, a bolt or pin is passed through the one in contact with the air, and it is fastened to the one floating on or in contact with the liquid, and to make the opening through which this bolt or pin has passed air-tight it is surrounded with flexible india-rubber tubing, the ends of which are made fast by any convenient means respectively to the discs or utensils before named. On the top of the bolt or pin is placed a movable pressure regulating nut, between which and the piston is inserted a spiral spring. When the piston has been charged (through an aperture having a plug or other apparatus for closing the same) with water or air, or part both, the nut is screwed down until the desired expansion of the diaphragm has been obtained, and if any irregularities of the surface of the liquid vessel have to be passed in the travelling of the piston with the liquids as withdrawn, then the spiral spring allows the diaphragm to contract or expand, and so maintains an equal contact all the way down.

Fig. 1 represents a vertical section of a combined travelling apparatus, as described under the second head, and earthenware vessel; the former being formed of a rigid disc secured to and through part of the top of the vessel, flexible bag, and earthenware floating pressure basin; the latter (or earthenware vessel) having a wooden bottom secured by iron tie-rods, which also serve, in connection with a top cover, as protectors from injury; Fig. 2 a side elevation of the same; Fig. 3 a plan also of the same; Fig. 4 a vertical section of a hopper-shaped earthenware vessel, with a wooden lid, to which is secured the top end of travelling apparatus tapered to suit the form of the vessel, but otherwise the same as shown in Fig. 1.

a, the vessels; *b*, the liquids; *c*, bung holes for cleaning and filling; *d*, outflow taps and apertures for same; *e* (Figs. 1 and 2), bottom of vessel; *f* (Fig. 4), tops or covers of vessels. The tops or bottoms of vessels when formed as here shown require to be made air-tight, and to secure this a groove is turned out in the disc, into which is fitted an india-rubber ring, gasket, or other packing (sometimes dipping in liquid shell-lac), which packing comes between the cylinder and the cover or bottom. *g*, protectors; *h*, tie-rods securing the protectors *g* and protectors *g* and bottom *e*, and making a transportable package; h^2, the flexible bag made fast at the various parts marked *i* at its top end; *j*, the earthenware dish-shaped float; j^2, cord or chain secured to the travelling apparatus and carried outside the vessels through the air-pressure apertures *k*, this cord is necessary for drawing all the travelling apparatus close up to the top when filling; *l*, discs or hoops for keeping the flexible bag in shape; *m*, the discs of the travelling piston; *n*, the diaphragm; *o*, the screw or pin; *p*, the regulating nut; *q*, the spring; *r*, the india-rubber tubing for making the screw or pin aperture air-tight; *s*, opening for charging the piston; *t*, guides to keep the piston level in the vessel. If the weight of either of these travelling apparatus is not sufficient to overcome the pressure of the gases from some kinds of fermented liquids, then weights *u* (as shown in Fig. 4) could be used, and such weights, if in sufficient quantity, could also be made to force liquids from close vessels through openings to a limited height.

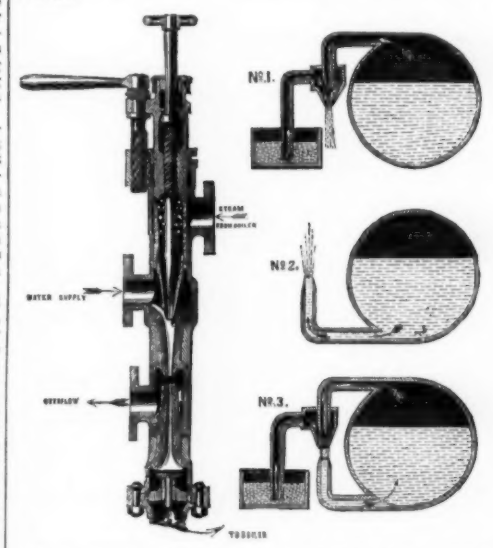
Steam Fire Engines.—Captain Shaw, the Superintendent of the London Fire Engine Establishment, has made an official report to the committee, upon the performance of the new steam fire engine, constructed by Messrs. Shand and Mason, and tried last week at Mr. Hodges' distillery, Lambeth. Captain Shaw reports that the engine started with steam of 60lb. pressure in 14½ minutes from lighting the fire, cold water being used. The hose was led to the base of Mr. Hodges' chimney, which is 140ft. high, notwithstanding the great force of the wind, which blew the water all over the yard and deluged the engine, a 1¼in. jet reached an elevation of at least 30ft. above the chimney, being a total height of 170ft., and it was the opinion of all present that on a calm day a much greater height would have been attained. The same jet was projected 190ft. in a horizontal direction, but as Captain Shaw measured solid water, and not spray, at least 15 per cent. ought to be added to this for the farthest point reached by the water, giving a total of 220ft. In like manner when two jets, each 1in. in diameter, were worked at the same time, the distance reached by the water was 150ft. In this engine, and in the other supplied by the same makers to the London Fire Brigade about eighteen months since, the water in the boilers is kept at boiling point by a jet of gas, and 50 lb. of steam is raised in five minutes from lighting the fire.

SOUTH WALES INSTITUTE OF ENGINEERS.

(*Concluded from p.* 236.)

It is astonishing to find that, even at the present time, men are kept underground in some places from fourteen to sixteen hours per day. In all well regulated collieries the hewers can do their work in about seven or eight hours, which is quite as long as a man can be expected to work with any degree of energy in a mine. Mr. Fryer then conclude his paper by urgently recommending the use of baths, and also that clubs should be established by proprietors for the purpose of procuring a proper supply of flannel clothing for the workmen. A change of clothes daily at the bath would necessitate the use of warm and clean flannels next the skin, especially in winter. The writer coincided with Mr. Davies that, by establishing proper places of recreation and amusement, where tennis, cricket, gymnastic, and other healthy exercises could be practised, would be a great boon to the working classes, and help to wean them from the ale-house even more than reading-rooms and mechanics' institutes can do. These fail owing to the small number of the studiously-inclined, while the gymnasium would attract the more active and more dangerous spirits from certain mischief and ruin.

Mr. R. Beddlington said he was very glad to find that, during a very short conversation which had taken place at the last meeting, when Mr. Fryar's paper was read, that the president had protested, on behalf of South Wales, that many of the remarks did not apply to this district. With regard to the ventilation of collieries, he (Mr. B.) believed it was well attended to in South Wales. Owing to the presence of fire-damp it was now made incumbent on colliery proprietors to see that proper ventilation was afforded, and he thought, therefore, that many of the remarks which Mr. Fryar made as to the coal mines were more strictly applicable to iron stone mines. It would be very difficult to ventilate the stalls in the iron stone mines, for if they had to drive headings between the stalls it would be almost tantamount to throwing up the mines altogether. The price of ironstones in this district was very high, so much so that large quantities are imported from other localities; and it would be a very serious expense to insist upon the driving of headings between the stalls. The only way to improve the condition of the ironstone mines was by adopting the long-work system, by which plan they would save the expense of the air-ways altogether. He had adopted that plan wherever he could, and where this could not be done he would recommend to work by means of double stalls. It is nearly as necessary to ventilate the ironstone mines as coal mines. True, they did not get the fire-damp in the ironstone mines, but there was a great deal more powder used, and the flames arising from powder was as injurious to health as anything which they could possibly have in coal mines. The writer then spoke of the men being kept in the collieries for fourteen or sixteen hours per day, but such remarks were not applicable to the South Wales district. When they took into account "casting day" and other slack times, he did not think they could reckon that the men remained in the collieries more than ten or eleven hours per day, except, perhaps, just before the "casting day," when the men were hurrying out a mine after the easy times they had had at the commencement of the month.—Mr. Fryar then remarked that many colliers were affected with rheumatism, which he attributed to the wetness of the pits, but much of this could not possibly be avoided, although he was ready to admit that many of the roadways could be kept in a much better condition, they could not, however, prevent the drippings from the roofs. Mr. Fryar next recommended in his paper the use of baths for the colliers, and spoke of the difficulty of bringing them into more general use. It was with the men, however, that the chief difficulty existed, for he believed that if baths were put up at the tops of the pits the men would not then use them. He had seen himself that such was the case. He believed, in a word, that great improvements could be made with respect to the ventilation of the ironstone mines; but, with regard to collieries, a proper ventilation had been forced upon them, whereas the ironstones mines are not yet under the operation of the Acts—at least those not in connection with collieries.



Mr. A. Bassett said he had very carefully read the paper of My. Fryar, who appeared to be in a great deal of trouble in producing a paper upon the sanitary condition of mines; but many of the remarks were theoretical, which would doubtless prove a very excellent thing if they could be carried out. With regard to the baths for the colliers, this was not a new idea; it had been tried in Monmouthshire, where the proprietors of some of the collieries went to considerable expense in erecting baths, the water being obtained from the waste steam; but, after a great outlay, the men seldom or never used them. They would rather go to their own homes to get their wash than at the top of the pits' mouths, where they would have all the trouble of re-dressing. With regard to the ventilation of mines, that of the iron-stone mines was deficient, and the collieries were much better ventilated; and with regard to the recommendation of the writer, that baths and recreation-grounds should be established, he could only say they had been tried, but found not to answer.

A member of the institute confirmed the remarks of Mr. Bassett. He knew that baths had been established in some districts, and proved a perfect failure.

Mr. Bassett said that at the Curnavon Works, Taibach, baths had been erected by the late manager, Mr. Gilbertson, and they were very nicely arranged, but the men only used them for a short time.

Mr. Nasmyth said that the ventilation of mines had exercised the attention and ingenuity of both ancient and modern engineers, and he did not know that the present system could be very much improved; at all events, it was a mere matter of pounds, shillings, and pence. They had two points to consider in the ventilation of mines; the safety of the men should certainly be the first, but as colliery owners they were anxious to get the coal out at as cheap a rate as possible. With reference to the means adopted he did not consider that it much mattered what process was adopted, whether the

long-wall system or any other—what system would suit one district would not suit another; and, therefore, the best plan for getting the coal must be left to the discretion and judgment of the various proprietors and their agents. With reference to the ventilation of ironstone mines, and even collieries, some of the suggestions made by the writer were very good, for probably ventilation had been too much neglected in some districts; but whether the ventilation should be carried on by means of a fan, or a furnace, or anything else, did not much matter. For his own part he had never seen the ventilation of a mine fail when there was a way made for the air to go in and another way out; but, if they did not provide for these two things, then the ventilation of any mine would be doubtful, if not dangerous. The question of baths for the men had been treated upon, and it had also been found in practice that the men did not appreciate them; and until the collier could be induced to take an interest in personal cleanliness there would be but little hope of improving him by the establishment of recreative-grounds or other means of improvement.

Mr. Beddlington said that they must ventilate mines as well as collieries, and he believed that the best plan was by the long-wall system. They could not ventilate between the headings unless at great expense; and it was impossible to head between the stalls in iron mines as in collieries, and, therefore, he recommended the long-wall system. He (Mr. B.) perfectly agreed with Mr. Fryar when he said in his paper that the best ventilated colliery was the best paying one.

A member remarked that he knew of a colliery near Tavistock—the Whealcrelic colliery—where baths had been erected, together with proper drying-houses; and there the men very generally appreciated these things.

Mr. Cox thought it was a very different class of men at Tavistock to what they had in this district. Mr. Fryar had written a paper with the view of proving the injurious effect of imperfect ventilation; and in some of the observations of the writer he (Mr. Cox), and he supposed others present, entirely agreed—in fact, he did not know that anybody in Wales would dispute that bad ventilation and uncleanliness was injurious to health. With regard to ventilation, however, he certainly understood that it was carried out in Wales as well as it possibly could be; and, with respect to baths for the colliers, it was a matter of great importance, but they must materially improve the habits and character of the people of this district before they would find the baths generally used. True, they may, by slow degrees, induce the colliers to use the baths; and if so they would unquestionably be of great advantage. Baths had been established in connection with some of the large railways, where they could be had for one penny each; some of the men availed themselves of the baths, but a great many more did not. Everybody in this district could see the advantages of good ventilation—in fact, where they had so much fire-damp, good ventilation was forced upon them, but there were other districts where this good ventilation was not enforced by the legislation, and he had seen men brought up out of some mines—not, however, in this district—so giddy that they could scarcely stand. Bad ventilation, all would admit, was injurious to health, but it did not apply with much force to the collieries of this district.

The President said that they were all agreed as to the advantages be derived from good ventilation, and also as to the necessity of using the bath; but, as Mr. Fryar himself seemed to anticipate, the chief difficulty would be to induce the men to use the bath. Unless they gave the collier a better education than they now unfortunately had—and he was glad to say that the education of the collier was being gradually carried on—they would have a great difficulty with the men in this respect. If they went to the Cornish and Devon mine-districts they would generally find that the miners were a more educated and intelligent class of men than in Wales; they were not there kept such a distinct class as the colliers of Wales. Still he (the President) hoped with Mr. Fryar that baths would be established in connection with collieries and ironstone mines, and that the day was not far distant when the men would be able to appreciate the benefits. Nobody would doubt the benefit of good ventilation; the purer the air a man breathed the better, of course, for his constitution. In some of the ironstone mines, the smoke produced by the powder was not out of the mouths of the men from month to month, and where men, day after day, breathed such an atmosphere it must produce chest diseases. There were great improvements being carried out in the ventilation of collieries and mines, both by means of double stalls, long walls, and other systems, and he hoped that soon the condition of the miner, both in collieries and ironstone mines, would be much improved.

This closed the discussion.

CANALS AND CANAL CARRIAGE.

There was no discussion upon this paper, Mr. Ashcroft being obliged to leave the meeting.

GIFFARD'S INJECTOR.

Mr. T. Dyne Steele's, C.E., paper upon this subject was next read. Mr. Steele says:—"Few mechanical contrivances of modern times have excited more general attention among engineers and scientific men than Giffard's injector, and few have so well deserved, or will so well repay, investigation as this eminently valuable and practical little instrument. The apparent paradox involved in its action, arising from the difficulty of reconciling principles upon which a continued flow of water into the boiler is kept up, and yet the beautiful simplicity and ease with which it performs its work combine to give it an interest which I do not doubt will be acknowledged by the scientific body to whom this paper is addressed. To French ingenuity we are indebted to this, as well as many other valuable contrivances. M. Giffard, of Paris, the inventor, first introduced it about the year 1859. He applied it with much success to the locomotives on several of the French railways, and it was at the same time brought out under the auspices of Messrs. Sharp, Stewart, and Co., the eminent engineers of Manchester. The method of ascertaining the velocity of the motion under pressure of an elastic fluid is to find the height of a homogeneous column of the same fluid, capable of producing an equivalent pressure to that to which the fluid is subjected; the fluid would then issue from an opening in the containing vessel into a vacuum with the velocity of a heavy body would acquire by falling through the height of such homogeneous column, suitable reduction being made for certain retarding influences hereafter referred to. If a communication is opened from vessels containing fluids, under pressure of different elastic forces, the velocity of the respective jets will be that which a heavy body would attain by falling through the heights of homogeneous columns equivalent to the respective elastic forces acting on the fluids; or, in other words, the velocity of an issuing jet of any fluid will be represented by a heavy body falling through the height of a homogeneous column of the same fluid, due to the pressure to which the fluid is subjected. From experiment it has been ascertained that the motion of elastic fluids is retarded in the same degree as that of water, by contraction of the passages through which it travels, by bends, angles, &c., and that eddies take place like those which, under similar circumstances, affect the passage of water. The practical velocity attainable will, therefore, differ from the theoretical to an extent of such retarding influences. A steam jet from a boiler with a given pressure, issuing into the atmosphere through a chamber connected by a pipe with a water cistern, exhausts the air both from the chamber and the pipes, partly by condensation of the steam, and mainly by the jet carrying particles of air with it in its passage, and causes the water to rise to the chamber to supply the place of air. As soon as this effect is produced, and the jet comes in contact with the cold water, condensation takes place, and the water is carried through the nozzle, the result being a jet of hot water, or water heated by steam.

A water jet issuing from a boiler at the same pressure as the steam jet referred to above does so at a velocity inversely proportionate to its density. Assuming a pressure of 10 lb. per square inch above that of the atmosphere, water being at that pressure 1,054 times the density of steam at the same pressure, and the velocity inversely proportionate to the square root of the density, then the velocity of the issuing jet will be $\sqrt{1{,}054}$, or 32 nearly, or 32 times less than the velocity of the steam jet from the same boiler. If we now place the two jets opposite one another, and assuming that the steam could impart its full velocity to the water brought in contact with it, the upper or combined jet of steam and water would meet the lower or water jet with a velocity 32 times as great; and if the water be considered non-elastic, and of the same weight in each jet, the result will be on the onward motion of the two jets in the direction of the flow of the upper or combined jet with the velocity of half the difference between the original opposed velocities, or $\frac{32-1}{2} = 15\frac{1}{2}$ times the velocity of the lower or water jet. As the upper or steam jet cannot, however, impart its full theoretical velocity to the water brought in contact with it, the latter will not be forced into the boiler at so great a velocity as is given in the calculation, but any excess of velocity in the upper over the lower jet will be sufficient to produce the desired effect, and force the water into a boiler having a pressure of steam considerably higher than that from which the acting jet is obtained. The extent of difference of pressure thus practical being dependent on the actual pressures, and the corresponding relation between the velocities of a jet of steam and water under the same pressure.

It will be found from actual experiments that with 100 lb. pressure of steam the difference of velocity between the steam and water jets is one-half that of 10 lb. pressure, and as this proportion is constantly diminishing as the pressure is increased, it follows that the theoretical limit to the action of the injector is that pressure at which the density of the steam approximates nearly to that of water, and the difference of velocity between the two jets consequently ceases. For similar reasons the power of the injector as an elevator for raising the water is limited to a column of water equal in height to a homogeneous column of steam, of similar weight to the column of water, or to the height at which the pressure becomes equalised. By means of Giffard's injectors boilers are made self-supporting, and wholly independent of the machinery in connection with them. Force pumps driven by the engine having been found both inconvenient and occasionally incapable of supplying sufficient feed water for the boilers of engines of intermittent action, such as pit winding engines, locomotives, and agricultural engines, pumps worked by independent donkey engines have, of late years, been largely substituted for them, but from various causes well known to the employers of steam power these donkey engines have been unsatisfactory in working, and under the most favourable circumstances cannot be considered an economical mode of obtaining the end. It cannot be urged that the exhaust steam from the engine cannot be made available for heating the feed water where injectors are employed, and that, consequently, the source of economy is lost. There is at the first glance reasonable grounds for the objection, but when it is considered that the whole of the heat abstracted from the boiler in the shape of steam for working the injector, with the exception of a small portion lost in radiation, is returned to the boiler with the feeding jet, it may be fairly claimed for the injector system that it is by far the most economical plan of the two. After taking into account the absence of the latter of moving parts, consequent wear and tear, liability to stoppage or derangement from break-downs, frost, or other constructions to which feed pumps of all descriptions are constantly liable. The injector will commence working with a pressure of steam of from 3 lb. to 5 lb. per square inch, and continue working uninterruptedly so long as feed water is supplied. The nozzles do not fur or become choked, the velocity of the jet sweeping all before it. The writer had seen a No. 8 injector feeding a boiler with water so foul, that a force pump in the same yard was speedily choked by it. For locomotive engines, where the leads are short and stoppages frequent, the advantages of the injector are particularly apparent. From the first start in the morning, so soon as 5 lb. pressure of steam is got up, the water supply is as well maintained in the shed as when running on the road. During shunting, waiting for trains, or break-downs, a driver, with an injector fitted to his engine, is never for a moment uneasy about his firebox or tubes; and a vast amount of wear and tear to both engine and road, to say nothing of oil, stores, and fuel, is saved by avoiding the usual and constant running idle to fill up the boiler. The principle of the injector has been employed with much success to an instrument termed an "elevator," for draining deep headings in mines. The application of these instruments has recently formed the subject of a paper read before the Birmingham Institute of Engineers, by Mr. Wardle, of Leeds. The quantity of steam used in proportion to the effect will, it appears to the writer, be too great to admit of this system of raising water being extensively adopted under ordinary circumstances, but as a temporary expedient for draining deeps he is strongly of opinion it will be found of essential advantage in many cases where the erection of pumping machinery would not be warranted, or in other words would not pay. The whole apparatus may be applied with great rapidity; a length of gas piping carried from a surface or underground boiler to the elevator will be all that will be required, the steam being turned on a constant flow of water is produced so long as the steam pressure is continued, the height of the delivery column of water being 1ft. for every effective pound pressure of steam at the elevator. Allusion having been made in several public prints to the supposed failure of the injectors fitted on board the Great Eastern steamship it may not be considered out of place to give the true facts of the matter here. There is not, and never was, the slightest ground for the disparaging statements made with respect to the injectors on board the Great Eastern. The only fault, if fault it can be called, was that the injectors were insufficient in number, two only having been fitted as a trial. Although they were equal to the evaporation of the boilers to which they were applied, they were unable to provide for the large quantity of water blown off through the brine cocks. In other respects they were all that could be desired, and worked satisfactorily. The feed-water was taken from the hot well at a temperature of 100 deg. When the great ship was last in Liverpool, previous to her recent disaster, Mr. Robison, the engineer, reported the injectors to be giving satisfaction. It may be interesting to state, as a proof of the rapid success of this ingenious contrivance, that the makers for Great Britain have sent out an injector bearing the progressive number, 1,844, and have on their order-book number 2,029.

Mr. T. Dyne Steel said that his principal object in writing this paper was to provoke discussion, and he hoped it would be discussed that day by the members. It appeared to him that the chief difficulty on the part of the injector was applying it to high temperatures. A series of experiments had recently been made at the Atlas works on the temperature of the feed water entering the boiler, and they differed from all the others which had been made, and were very valuable, because strict reliance could be placed upon them. The bulb of the thermometer had been actually inserted in the current passage to the boiler, whereas in all former experiments the temperature had been taken at the overflow pipe of the injector. The maxim temperature of the feed water in these experiments was 130 deg., but he had been able to work an injector at 138 deg., the pressure of steam being about 30 lb.

Mr. Tomlinson, the locomotive superintendent to the Taff Vale Railway Company, said that they had had two injectors put up for some time past, and they had been found to work well. He could not tell the reason why they worked; all he could give was the simple fact that they did their work well. They found in practice that if they regulated the injector to 20 lb. pressure, it would feed a boiler of 40 lb. pressure, or, in other words, it would lift twice the power of its own steam. One had worked with the most perfect regularity for the past twelve months, feeding a boiler without any trouble whatever. For his own part, he did not attach much importance to the position of the pipes, which some seemed to think of such great importance; he fixed them just where it suited him, and he found them to work admirably. When they got above 120 deg. they would find that the injectors would not work so well or regularly; but with a temperature of about 90 or 100 deg., they were most efficient. It would be found a most economical mode of pumping water into boilers and saving steam; and for brewers and others, who required hot water at some height, it must prove of very great advantage.

Mr. E. Williams asked Mr. Steel if it was found in practice that the injector would not work with regularity above 90 deg. or 100 deg.? Would they not lose its economy, and would they not waste much steam?

Mr. Steel said that if the injector was fed with a head of water that difficulty would be overcome.

Mr. Williams: Will the injector work with any kind of water, because in Merthyr particularly, during hot and dry weather, I find that water is exceedingly scarce, and some of the water which worked the engine was quite black and thick, being used three or four times over?

Mr. Steel: Oh! the injector will work perfectly well with any sort of water, the only thing being, of course, not to allow any substance to get in so large as to choke the pipe, and that can be easily managed by putting a rose over the nozzle.

Mr. Williams said they had just received two injectors at Dowlais, and he was glad to hear that they answered so well.

The president said that he was in hopes that Mr. Richards, the superintendent engineer at the Ebbw Vale, would be present, who would, perhaps, have been able to explain the working of the injector. They had four injectors at the works, one of which drove four boilers, and it had been found to work admirably ever since it had been put up, which was now at least twelve months. The men said there was no difficulty whatever with it, for it worked with the greatest regularity. They had also three others, of different sizes, and were about to erect two more—one at the top of a pit to carry steam down the pit. Even with the greatest dearth of water they had found no difficulty in working the injector—in fact he had never known a case of failure, and they were constantly working from Monday morning to Saturday night.

Mr. Williams said he had been informed that the injector was being applied to some of the locomotives on the railways.

The president said that such was the case on the London and North Western, and they had answered very well.

Mr. Tomlinson said he was putting on an injector to a railway engine and taking off the pump, and when the men got used to the injector he should put another on instead of the other pump. He was quite sure that when the men got used to the injector they would prefer it over the pump.

Mr. Steel said that there were 20 or 30 engines worked with injectors on the Eastern Counties Railway, and he believed that the pumps would be dropped very speedily.

The president said that they all seemed to acknowledge the practical benefit of the injector; but why did it work? That was the question which he should like to hear answered or discussed.

Mr. Steel said he could scarcely explain the action of the injector, but it appeared to him to be a sort of repetition of blows, the steam being forced into a smaller space and then again returning into a larger space, and this was continually carried on. The diminished action of the injector in drawing the feed water, when at a high temperature, was caused from the density of such feed water being diminished by the heat, and also from the loss of effect of the impact of the steam when feeding with cold water. With hot water the condensation of steam did not take place so rapidly, and the full effect was not, therefore, obtained.

Mr. Tomlinson said he had found that 5ft. was the highest which the injector would lift with cold water; at 5ft. and half an inch it ceased to work altogether.

This brought the discussion to a close.

THE SELECTION AND TREATMENT OF COAL FOR THE BLAST FURNACE AND CUPOLA.

Mr. Cox next read his paper upon this important subject, and certainly it is one of the most valuable and interesting yet presented to the Institute. Mr. Cox said the object of the paper was to show that not only were the differences in coal (applicable to iron manufacture) much greater than supposed, but also that they were of such a nature and extent that the full value and benefit of coal could only be obtained after previous and complete manipulation. In consequence of the spread of manufactures the economy, the use, and the full development of fuel have deserved and secured the utmost attention of all classes. Of late years the chemist had come to the aid of the mechanical engineer, and by various experiments had proved the relative value of coals in the manufacture of certain articles, and had shown what was the best description of fuel to be used in the manufacture of various articles. It is a well-ascertained fact that in all works celebrated for their "pigs" some of the most excellent coal was used—in fact it was a *sine quâ non* that for the make of good and superior iron good and superior coal should be used. It was not to be supposed, however, that iron of the best quality could not be produced with inferior coal, but it was always best and most economical to use the best kind of iron. Chemistry had not yet proved wherein the excellence of certain coal consisted in the manufacture of the various articles, but it was hoped by and by there would be such an addition to their knowledge as would enable the manufacturer to satisfy himself upon that point. The paper was ordered to be printed, and will be discussed at the next meeting of the Institute. A vote of thanks was awarded to Mr. Cox, and to Mr. Cope Pearce, and Mr. Ashcroft, for their papers.

Mr. Parry was announced to read a paper upon puddled steel, but, in consequence of severe illness, was unable to do so.

A vote of thanks was then given to the chairman for presiding, and to the Mayor of Cardiff for the use of the town hall, which brought the proceedings to a close.

The members afterwards dined together at the Angel Hotel, Mr. Adams presiding, and Mr. A. Bassett occupying the vice-chair. Several appropriate toasts were proposed and duly responded to, some of the speakers saying that they believed that the iron trade would soon receive a great impetus, in consequence of the requirements of the Government in iron-clad ships; and that the requisite plates would be produced in Wales of a make and character equal, if not superior, to any other part of the country.

Traffic Receipts.—The traffic receipts of railways in the United Kingdom amounted for the week ending the 12th of April, on 10,145 miles, to £494,695, and for the corresponding week of last year, on 9,911 miles, to £524,427, showing an increase of 234 miles and a decrease of £29,732. The gross receipts on the following fourteen railways amounted in the aggregate, on 6,618 miles, to £375,793; and for the corresponding week of 1861, on 6,458 miles, to £403,544, showing an increase of 160 miles and a decrease of £27,751. The decrease on the Caledonian Railway amounted to £445; on the Eastern Counties to £1,857; on the Great Northern to £2,079; on the Great Southern and Western to £139; on the Great Western to £3,442; on the Lancashire and Yorkshire to £5,289; on the London and North-Western to £3,068; on the London, Brighton, and South Coast to £2,077; on the London and South-Western to £900; on the Manchester, Sheffield, and Lincolnshire to £2,029; on the Midland to £861; on the North-Eastern to £2,808; and on the South-Eastern to £2,759—total, £27,753. But from this must be deducted £2, the increase on the North British; leaving the decrease, as above, £27,751. The goods and mineral traffic on those lines amounted to £205,442, and for the corresponding week of 1861 to £216,370, showing a decrease of £10,928. The receipts for passengers, parcels, &c., amounted to £170,351, against £187,174, showing a decrease of £16,823. The traffic receipts on 66 other lines amounted, on 3,527 miles, to £118,902, and for the corresponding week of last year, on 3,453 miles, to £120,883, showing an increase of 74 miles and a decrease of £1,981. The falling off in the traffic of the past week as compared with the corresponding period of 1861 is considerable both in the passenger and goods traffic of the great lines, chiefly in consequence of the depression of trade in the manufacturing districts. The traffic receipts of the past week show an increase of £2,975 as compared with those of the preceding week ending the 5th inst.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

THE MONITOR AND THE MERRIMAC.

SIR,—The recent naval engagement between the Monitor and the Merrimac, now so fully reported by the press of this country, will no doubt attract the remarks of many of your correspondents. In that case I have no wish to press this letter on your valuable space. I should be glad, however, if you can conveniently find room for it. I was pleased to observe that on the 4th inst. a member of the House of Commons did full justice to the claims of Captain Coles, and to his advocacy for several years past of the principles which have been partially adopted in the Monitor. For the credit of England I trust that the Monitor will never be accepted as a "Yankee notion." The force of circumstances having brought about the first engagement on record between iron-clad "American" ships, it is only in accordance with what is known of the Yankee character that there should be the most extravagant self-laudation and vain-glorious anticipations in connection with the contest. Whatever may occur, we can with certainty count upon one event—that the constant and irrepressible tendency to "brag" will come out powerfully on every occasion, and throw a flashy halo of make-believe glory over the most disastrous defeats. If people would more truly appreciate the distinction between "talking" and "doing," the impetus of "Yankee bounce" would not carry them so far as it has done. The Merrimac, we are told, was plated in the rudest manner with bars of railway iron. But for this I should consider her the most formidable vessel of the two. Her stem, so far as I can understand its configuration from the views in the illustrated papers, though well fitted to run down wooden vessels in the Roman trireme fashion, is not at all suited to damage an iron-plated assailant. If strongly built, however, and with a considerable rake outwards, provided that she could strike at a velocity of ten to twelve knots, I think the chances are that she would fairly run under water a vessel constructed like the Monitor, which has very little extra displacement to spare. I attribute her want of success, when attempting this manœuvre, solely to her inherent weakness, the unsuitable form of prow, and limited speed. I should not be surprised however, to hear that the Merrimac had captured the Monitor in some subsequent engagement. The latter appears to me decidedly defective from the absence of means for keeping her deck free from boarders, and these, by proper management, would soon make the "'tween-decks" of the Monitor untenable. It is said that the Monitor was actually boarded, but those who reached the low deck of the battery found no means apparent of getting below, and retreated hastily on observing the circular gun-tower commence to revolve. Much allowance must be made for nervousness on the part of those who deal for the first time with a novel engine of destruction. Custom, however, would soon produce composure, and there does not appear to be any obstacle to prevent boarders from remaining close under the very muzzle of the guns within the tower. This tower should be provided with a projecting curtain for riflemen, and there should also be the power of sweeping every part of the deck with grape. Had a party of boarders, provided with a few heavy sledge hammers and a score or two of hard wood and wrought iron wedges, gained the deck of the Monitor, I can see nothing to prevent their "jamming" the circular tower between the decks, so that no power, short of that sufficient to break the gearing below, could have turned it. In that case the Monitor would have been nearly helpless, or at least much weakened in offensive power, and then a small keg or two of gunpowder, with slow match attached, thrown down the short funnel, which projects but a few feet above deck, together with a few live shells dropped through the air-pipes piercing the deck, would have completed the discomfiture of her crew. It seems to be very essential in such structures that the most forcible means should be available to prevent boarders remaining for any length of time on their upper deck—otherwise I can hardly imagine that any vessel, however strong and massive, should be considered impregnable.

A. ALEXANDER.

13, Gresham-street, London, E.C.,
April 5, 1862.

CAST STEEL FOR GUNS.

SIR,—No practical man who has had opportunities of examining and testing the nature and quality of cast steel can for a moment doubt that cast steel alone is the proper material from which cannon ought to be manufactured. Nothing but strong prejudice, backed by stronger private interest in high quarters, could for a moment sanction the adoption of built-up wrought iron and steel guns, and cast iron cannon, with all their notorious imperfections, in place of the cheap and perfect artillery which can be forged out of cast steel.

Nevertheless time passes on, and built-up guns and cast iron cannon divide the attention of Government, and swallow up millions of the national income, while the object to be attained remains as distant as ever. Smooth-bore cast steel guns are all that are required unless as merely matters of curiosity; for, except as regards their extraordinary range, the rifled cannon are, in all other respects, inferior to the smooth-bore guns; while to suppose that battles are to be hereafter fought between armies separated by a distance of several miles is simply absurd, and the great length of range is consequently unimportant.

Ultimately, no doubt, the smooth-bore will be adopted, and cast steel alone will be the material from which guns hereafter will be forged.

The best cast steel for guns is that which possesses an intermediate quality, neither exhibiting the brittleness of cast-iron nor the toughness accompanied with the softness of copper.

There should be a sufficient degree of tenacity to render the gun perfectly secure from bursting, and the metal should at the same time be hard enough to ensure that amount of resilient elasticity which alone can ensure the bore of the gun remaining uninjured and unaltered after repeated discharges.

The Bessemer metal does not, I think, possess those requisites. It is as tough as copper: but nearly as soft also, and guns made from it would soon stretch and widen in the bore from the expansive force of the discharge, for they would in fact be far softer than wrought iron of good quality, such, for instance, as the Lowmoor iron.

The blooms or ingots of Bessemer steel are also exceedingly hollow and cellular, as the annexed examples will serve to show; and, though the hollows or cells are more or less closed up in the forging of the blooms or ingots, their surfaces do not unite, and they remain as so many imperfections in the forgings produced from these ingots.

Bessemer ingot	No. 1.	Length 29in.	Area 6in.	×	6in.
,,	No. 2.	,, 30in.	,, 6in.	×	7in.
,,	No. 3.	,, 31in.	,, 6in.	×	6in.
,,	No. 4.	,, 31in.	,, 6in.	×	6in.
,,	No. 5.	,, 24in.	,, 12in.	×	12in.
,,	No. 6.	,, 24in.	,, 12in.	×	12in.

	Weight if solid.	Actual weight.	Deficiency.
No. 1 ingot	498 lb.	370 lb.	128 lb.
No. 2 ,,	300 lb.	292 lb.	158 lb.
No. 3 ,,	318 lb.	208 lb.	110 lb.
No. 4 ,,	318 lb.	190 lb.	128 lb.
No. 5 ,,	988 lb.	766 lb.	222 lb.
No. 6 ,,	988 lb.	718 lb.	270 lb.

In these examples I give the length and dimensions of each ingot and its actual weight given, also its proper weight if solid, the difference in these weights indicating the amount of honeycomb or cellular structure in each ingot. It is evident that a gun forged from a similar ingot of steel would necessarily be very unsound and not at all to be relied upon, even if the extreme softness of the metal itself did not render the gun liable to stretch under the expansive force of the discharge. It does not therefore seem at all probable that the Bessemer process is going to supply that quality of cast steel best adapted for artillery.

W. S. P.

April 21st, 1862.

STEAM CULTURE.

SIR,—I should be much interested and edified if some known engineer, whose opinion would be entitled to respect, would take up the cudgels on behalf of the much maligned traction engine as adapted to agriculture. But as no champion appears to pick up the gauntlet thrown down by Mr. Howard I trust you will give your obscure correspondent another corner in your world-read publication.

"Steam culture" means the application of the power of the steam engine to the effective tillage of the soil, in place of horse power. It does not mean a partial and insufficient stirring of the land, but a thorough and honest cultivation of it in the true sense of the word. How far does Mr. Howard's "system" fulfil this? We will see. The cultivators he uses (only tined implements) merely tickle the soil, they do not cultivate it. Every agriculturist will tell you, and Mr. Howard will be the last to deny it, that the plough is a necessity to good farming; no other implement will bury the manure, or the stubble and roots of the plants, without which a good and rich seed bed cannot be produced. Mr. Howard is the best plough maker in the world. Why, then, does he not attach half a dozen of his pet implements to the rope and do some really valuable work? Because he knows full well that the resistance would be too great either for the power of the engine or the strength of the "tackle" it works.

The friction of the rope, the distance of the implement from the power, and the intricacy of the details being fatal to success.

I quite agree with your correspondent, Mr. H. C. Homersham, that a "goodly speed" to a cultivator is advantageous; but some of the best ploughing that has or ever will be made has been turned out by two horses at two and a half miles an hour—a speed quite sufficient for all practical purposes.

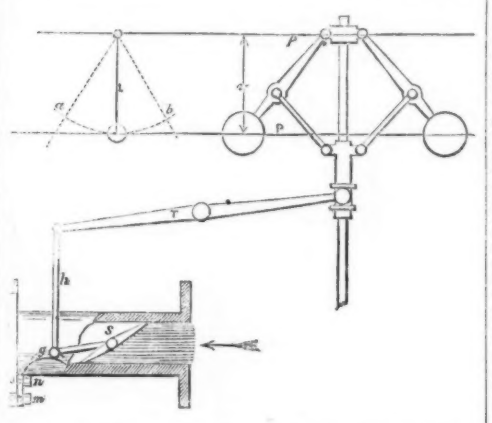
The "rope traction system" is useless, except as a secondary agent, on a farm. It has failed to take its stand, like all other applications of steam power, as the primary one, through its inherent defects.

The day is not distant when the "steam horse" (facetiously so called) will walk majestically to his work, snorting with contempt as he passes his stuck-in-the-mud rival in the corner of the adjacent field. He will plough ten acres a day, and, when "called upon," will clod-crush, sow, harrow in, and roll, in one operation, double that quantity in a like period. Then, and not till then, will the true era of steam cultivation commence; then will the stationary engine, with its windlass and steel rope, its anchors, posters, and paraphernalia be consigned to the companionship of those splendid specimens of engineering imbecility—the Blackwall rope traction, and the atmospheric tube.

ROBERT BLACKBURN.

GOVERNORS.

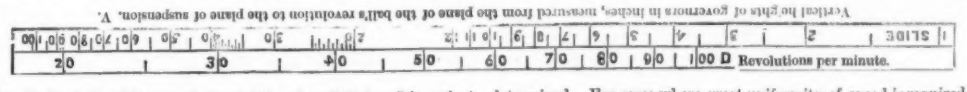
SIR,—In your number of the 21st inst., a correspondent, L. O., gives a formula for calculating the speed of governors. Questions relating to this subject are constantly being asked, though in many of our mechanical books there are copious rules laid down for the



purpose. In "Bourne on the Steam Engine," pages 18, 34, 35, 167, 168, and 169, there is a great deal of information concerning governors, and in fact, theoretically speaking, more cannot be desired. As these works are accessible to every one who wishes to consult them, we may naturally suppose that the rules given are not simple enough for the generality of practical mechanics. Though the simplest and readiest way of laying down rules for mathematicians, algebraic symbols are a stumbling block to the uninitiated; neither is it of much use to tell them that the governor's speed in seconds may be found by multiplying the square root of the vertical height in inches from ball centre to suspension plane by 0·31,986, if they don't know what a square root is. A little practical information on the subject will perhaps prove acceptable to many of your readers to whom mathematics are a dead letter.

The enclosed sketch shows the common arrangement of governor and throttle-valve, the valve being closed, and the balls in their highest position. Making a pendulum L, with a bit of thread and a bullet, and hanging it from a nail, taking care to make the length from the nail to the bullet's centre exactly equal to the vertical height V. P being the plan of the ball's revolution and p that of suspension, it will, on being made to vibrate, show at once the proper speed for the governor. Thus, for every double vibration of the pendulum L, that is for every time the bullet travels from a to b and back again, the governor must make one revolution. So that if on counting by a watch it is found that the bullet makes, say, 40 double vibrations in a minute the governor must make 40 revolutions a minute, at which speed the balls will be in equilibrium at their highest position, and the engine at its highest speed. The slide rule furnishes a complete and excellent table for the speed of governors. Thus, reverse the slide, making the line B correspond with the

Vertical heights of governors in inches, measured from the plane of the ball's revolution to the plane of suspension, V.



line D. Push the slide towards the right hand until 39·1 on B is against 30 on D. B is then a line of vertical heights, V of governors measured in inches, and D a line of their corresponding revolutions per minutes; and against the vertical height of any governor on B will be found its proper speed on D; or against any given number of revolutions per minute on D, will be the governor's vertical height in inches on B. Beginning at the middle of the line D with 3, which call 30, and counting towards the right, we have against 40 revolutions per minute on D, a vertical height, V, of 22 inches on B. Against a vertical height of 7in. on B we have 71 revolutions per minute on D. To the left of the starting point we have against 20 revolutions on D, a vertical height of 88in. on B, &c. &c. The enclosed scale shows the proper position of the slide and the notation for this table.

By either of these simple methods a practical mechanic with no knowledge of mathematics can determine at once the proper speed for a governor, or the proper height for a given speed.

From the difficulty found in making this apparatus regulate the speed of an engine working under a variable load people are apt to think that the pulleys or wheels of the governor are not properly proportioned, when the irregularity is, perhaps, due entirely to defects proper to the thing itself. The way in which an engine usually behaves when suddenly relieved of a considerable portion of its load is this: it starts off, increasing its speed until the governor closes the throttle valve; then the speed gradually falls considerably below the working rate, until the balls which have been hanging during this slackening of speed in their highest position liberate themselves, and come down with a bang, when the engine starts off again as before, continuing the operation until some one partially closes the steam valve, which has again to be opened when more load is put on the engine. The main cause of this irregularity is in the throttle valve. When this valve is shut by the governor and the engine running, it has to withstand the whole pressure of the steam in the pipe, as shown in the sketch. The consequence is that, say, on a 3-in. valve working steam at 60 lb. per square inch, there is at least 420 lb. pressure on the valve spindle, and this comparatively enormous strain causes so much friction on the spindle's bearings that it jams it, and requires the equilibrium of the balls to be almost completely destroyed before they acquire weight enough to overcome the resistance. The true remedy for this defect is the employment of an equilibrium valve, and a reporter of THE ENGINEER stated it was introduced for the throttle on some of the engines at the last Smithfield Cattle Show. The common throttle-valve may, however, be made to act tolerably well for ordinary purposes, and most practical engineers, experienced in the getting to work of new machinery, have some plan of their own for overcoming this difficulty, but which they generally keep secret. The plan I have found most efficacious in practice is the following:—Make a spring (of about the strength of the blade of a common table-knife for a 10-horse engine, for example); set and temper it to the shape shown in the sketch, fixing it to act upon the valve lever, as represented at g, either to the flange, or in any other way, according to circumstances. To regulate the spring insert a bit of metal between it and the flange, as shown at o; then, by alternately screwing the bolts s, s, the pressure on the lever at g may be varied as required. Set the engine to work at about its ordinary speed, the link h being removed; then regulate the spring, as explained, until it has just power enough, and no more, to force the valve open when it has been closed by hand. Fill up the spaces between the spring and the flange, and screw up the bolts. On connecting the governor again it will be found that the engine's highest speed will be somewhat augmented, but the alternate racing and slowing will be cured. This simple plan, which is inexpensive, and can be applied by any intelligent blacksmith, has the advantage of not interfering with the action of the governor when the engine is working under its full load; and in cases where heavy loads are suddenly thrown upon the engine, as when driving circular saws, or a rolling mill, gives it a fair chance of getting through with its piece, as the fly-wheel will be running somewhat faster than its working rate when the strain comes on the engine. The speed of the engine may be increased by lapping a piece of leather strap round the pulley on the governor, or it may be decreased by lapping it on the driving pulley on the engine shaft. The proper dimensions of the pulleys, by a few experiments, can thus be readily determined. For cases where great uniformity of speed is required, and the load variable, the common governor is almost useless. To make an engine beat uniform time under a variable load is a more difficult operation than to make a clock do so, where the power and resistance are uniform and steady. It can, however, be done—at least so nearly that the variations cannot be detected by the eye. If you will grant me space, sir, in your valuable journal for an invention of my own I will show by what means it can be accomplished, and under variations of load ranging from the full power of the engine down to nothing.

J. S.

FIXED AND CONTINUOUS GIRDERS.

SIR,—I have read with much pleasure the valuable remarks of Mr. Birckel in your last impression, and beg to express the coincidence of my views with his, but I should feel obliged by your allowing me to rectify a misunderstanding as to the intention of my paper, to which he refers. The formula,

$$S = \frac{w}{2}\frac{x}{d}(x - l),$$

of which Mr. Birckel gives me the credit, I have no right to, and my intention was not so much to show the practical use of the curve therefrom obtained as to illustrate a practical mode of approximating to that curve, for I think it is commonly used as a guide in proportioning flanges as far as the horizontal stress is concerned. The vertical stress I usually provide for in the web, whether plate or lattice; and in the latter, when the cross girders are fixed at the points of junction of the diagonals, there can be no shearing strain upon the intermediate parts of the main girders.

4, Great Queen-street, Westminster, FRANCIS CAMPIN.
April 21st, 1862.

PRACTICAL NOTES.—BILGE PUMPS.

SIR—Few subjects connected with the practice of marine engineering are of more importance than the too frequently despised one of bilge pumps. Among the first essential requisites is size. There is a great difference in the practice of makers in this respect, but the usual plan is to make them the same as the feed pumps. Messrs. Maudslay, who make their feed pumps so large that one pump can supply their boilers, also make the largest and most easily accessible bilge pumps that have come under the writer's notice. A practice is beginning to prevail with some of the makers of direct-acting screw engines, of fitting only one bilge, and one feed pump, to a pair of engines. This appears to be rather a dangerous plan, as depriving a ship of one-half of its most valuable adjuncts. For instance, we have the case of the Himalaya, coming home in 1855, with only one engine, which would have been awkwardly situated had it only a bilge pump or feed pump singly attached to it. The valves attached to bilge pumps should be placed in some position easily accessible, never below platforms, and, on the other hand, not placed too high. The writer has had a great deal of trouble with the bilge valves of one ship that had the valves of the bilge pumps placed on a level with the top ends of the pumps beside the air pump cover. These pumps worked well enough, as long as they had solid water to draw from, but, as soon as the air had access to them, they immediately ceased working, till the valve bonnets were taken off and the pumps fanged, by pouring water down them. This was remedied by fitting foot valves, a plan which, though suitable for a wooden ship, is not to be recommended for an iron one. Bilge pumps should never, on any account, be allowed to discharge into hot wells, or, if at all possible to be avoided, anywhere under the load line. Instances have occurred where ships have had to be beached or docked, valuable cargo damaged, and heavy losses incurred, solely on account of the bilge discharge being under water—the valves getting gagged up, water in consequence running into the ship, and perhaps not noticed till the bilge valve chests were covered, and could not be got at. Where there are two or more pumps it is also preferable that the discharges should be separate and not thrown into one pipe. A check valve fitted into a chest should also be fixed at the point of outlet, so as to enable any repairs to be done to pipes or pumps, without the sea-water rushing in. With fast going engines it would tend to remove greatly the shock of the pumps working with their full capacity of water, if the suction and discharge pipes, and all the passages, were made the full size of the pump plunger. Bilge pumps appear to work equally well with flap or conical valves. The three winged form of conical valve has the advantage of admitting a man's arm down to clear any ob-

EFFERTZ'S MACHINERY FOR MAKING BRICKS AND TILES.

FIG. 1

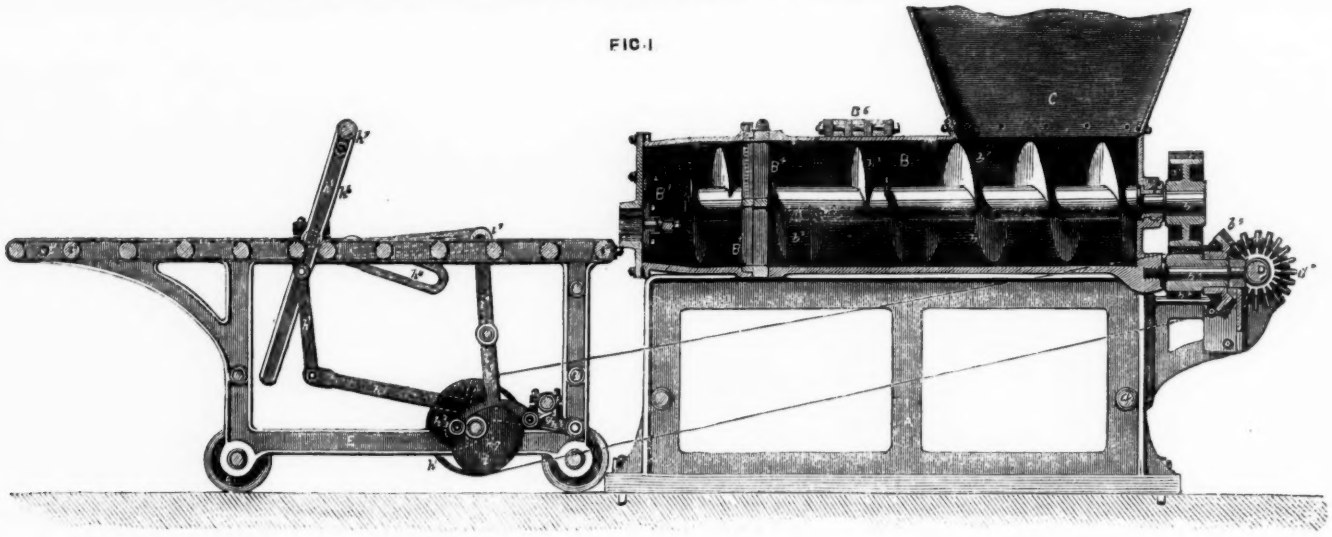
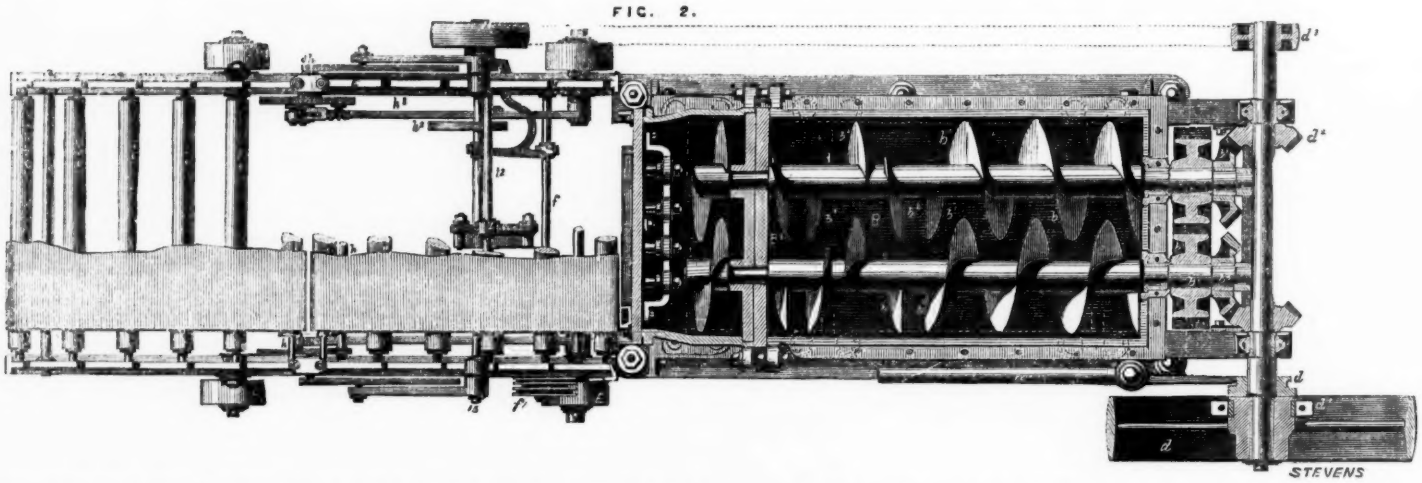
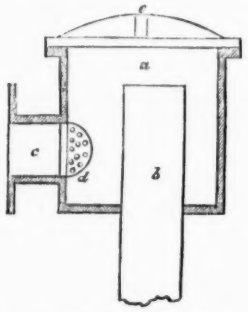


FIG. 2.



struction, but the edges of the wings should be made pretty broad to prevent their cutting into the chamber.

Nothing is so destructive to copper pipes as bilge water, and strong lead appears to be the best material, but even cast iron stands the wear infinitely better than copper.



In iron ships the rose for the bilge suction should on no account be formed on the pipe itself, as it is certain to get clogged up with grease and dirt, and, from the closeness and depth of the frames in iron ships, is practically inaccessible. It is better to enclose at least three frames to form a pump well, putting the suction pipe down the middle one, and covering the well on the top with a perforated wrought iron plate, and also fitting rose plates to slip out and in between the frames. Wrought iron is to be preferred for these rose plates, as they can be cleared in the stokehole by putting a shovelful of fire or hot ashes over them, without risk of breaking.

A very simple and ingenious plan of bringing the suction rose within easy reach was invented by Mr. James Logan, when attached to the steamship Oneida, in 1855. The sketch annexed will give an idea of it. A box *a*, of any convenient size, is placed as close as possible to the bilge pumps, where always in sight and easily got at; *b* is the pipe, quite open at the bottom end, leading down to the bilge, and as straight as possible, so as to be able to pass a bar down in case of any extraordinary obstruction; *c* is the suction pipe leading to the valve chest, and protected by the rose *d*. The cover *e*, from there being always a vacuum, more or less, inside the box, may be simply put on with a strand of greased spun yarn, or as may be thought best. It is quite evident that whatever substance may come up the pipe *b* will be intercepted by the rose *d*, and retained in the box *a*, from whence it can be taken at any time by taking off the lid *e*. The valve of this beautiful and simple invention will be at once appreciated by those who have known the annoyance and vexation of bilge pump valves and roses getting choked.

Pet cocks with reverse valves fitted to allow air to be blown out of the chamber of the pump, but none to return, facilitate the starting of the pumps when they have ceased working.

Some makers connect their suction pipes so as to enable both pumps to work out of any desired place, but it is generally found that pumps work best independently of each other.

With regard to pumping from water-tight compartments by means of the engine pumps, it appears to be the better way to allow the water from the fire and after compartments to run into the engine-room by a cock or cocks situated as low as possible. This saves an immense amount of piping and complication of cocks in the bilges, and with such long lengths of suction pipes it is very difficult to get the pumps to draw from places at a great distance, and the chances of air leaks are very much increased.

Cast iron plungers appear to stand the action of bilge water better than brass, which is apt to be much cut up from the foreign matters mixed with the water. Bilge pump glands should never be screwed tight, as the plungers are sure in such cases to get very hot indeed.

It is always desirable to have the pumps made so as to be easily disengaged, and in ordinary circumstances to work them on alternate days. The height of water in the bilges should invariably be one of the first things that an engineer on taking charge of his watch should look to, especially in heavy weather. Good working bilge pumps, easy of access, with accessible roses, are really among the most important requirements of an engine-room, and nothing contributes more to the safety of a ship. Still it is always requisite that the marine engineer should keep a watchful eye on the bilges and pumps, and keep in mind the maxim, *Principiis obsta*, "A stitch in time saves nine."

A Seagoing Engineer.

EFFERTZ'S MACHINERY FOR MAKING BRICKS AND TILES.

This machine is the invention of Peter Effertz, of Manchester, and is for producing perforated, solid, and paving bricks, gutter tiles, roofing tiles, cornice tiles, pantiles, drain pipes, and other similar articles.

The clay is fed into the machine through a hopper, mixed by a combination of screws passed through a grate to be cleansed from stones and other objectionable matters modelled or moulded by pressure to the desired shape, and received as an endless band by a rolling table in front of the machine. This rolling table is provided with a self-acting cutter put in motion by the band of clay emerging from the machine, and cutting the said band into any length desired at right angles to the surface, or at an angle proportionate with the velocity. The necessary pressure is exerted through a combination of screws requiring less power than any other now in use.

The machine consists of two main parts or divisions; first, the press for mixing, cleansing, and shaping the clay; secondly, the self-acting cutting table, on which the band of clay emerging from the mould is cut.

Fig. 1 represents a longitudinal section; and Fig. 2 a sectional plan of the machine.

A, A, are two side frames, which, connected by the tie rods or cross bars *a*, form a framework, upon which is screwed the hollow cylinder B, of an elliptical shape and closed behind. This cylinder is formed of two halves bolted together. The upper half has two square apertures, to one of which a hopper C is fitted, and the other is closed by the door B^6 by means of the handle B^7. In front of the cylinder B is an elliptical conical mouthpiece B^1, to which the plate B^2 containing the mould is screwed. In the interior of the cylinder B are the two shafts *b*, to which are fastened screws b^1, and spiral knives b^2, in such a manner that the worm of one is to the right and that of the other to the left, and the pitch of the knives is smaller than that of the screws, thus forming two screwed mandrils working against each other, the bearings at one end of which are in the grate B^3, within the cylinder B^1, and at the other end in the back of the cylinder B. At the back of the grate B^3 is the frame B^4, provided with a handle, and working on a bolt as a centre; this frame can be moved out of the cylinder B by means of the lever B^5, connected to the said frame B^4. On the outside of the bearings the shafts *b* carry the spur wheels b^3, geared into the spur pinions b^4, working loose on the studs or pivots b^5, which receive their revolving motion from the shaft D, by means of the bevel wheels d^2, geared into the bevel wheels b^6, fixed on the bosses of the spur pinions b^4. The shaft D works in bearings bolted on the side frames A, and carries the drums *d* and d^3, one at each end. The drum *d* revolves on the shaft, receiving its motive power from the motor, and is connected by a friction coupling d^1 with the shaft D. The drum d^3 is keyed to the shaft D, and serves to put in motion the cutting apparatus in front of the machine. The friction coupling d^1 is put in and out of gear by the lever a^1. The cutting apparatus consists of the two side frames E, which are connected by tie rods or cross bars e^1, and form a frame running on the wheels E^1, the said side frames carrying between them the rollers e^2 and e^3. The roller e^3 carries a band pulley e^4 keyed to one end of the shaft of the roller outside one of the frames E. The said pulley e^4, by means of a band passing over it and the pulley f^1, gives motion to the shaft *f*, on which there is a knob or projection. At each revolution of the shaft *f* this knob or projection strikes against one end of the lever *g*, for the purpose of shifting a clutch, so as to gear into the loose pulley h^1 on the shaft *h*, which is provided with two knobs or projections for disconnecting the clutch from the pulley by striking against the other end of the lever *g*. This pulley is made to revolve by the shaft D being connected by a strap with the pulley d^2 upon the shaft D. Upon the shaft *h* are fastened three eccentric discs h^2 and *i*, of which the two outer eccentrics h^2 strike against the bowls h^9 on the levers h^3, and by means of the connecting rods h^4 cause the ascending and descending motion of the two slide bars h^5. The wire for cutting the band of clay is stretched between the slide bars, which slide in the guide bars h^6 fixed to the rod h^7. The eccentric *i* in the centre of the shaft *h* acts upon the bowls i^3 on the fork-shaped lever i^1, fastened to the rod i^2, to which are fixed on the outsides of the frames E the arms i^4, working on studs i^5 fixed to the frames, and connected to the guide bars h^6 by the slotted arms or links h^8, which are jointed together at any required position by pins having screws and nuts, so as to give greater or less movement to the guide bars h^6.

The operation of the machine is as follows:—The clay fed into the machine by the hopper C is seized by the spiral screws b^1 and pushed forward until it comes within reach of the knives b^2, which mix it by working into each other, and, in consequence of their spiral form, press it through the grate B^3. The screws b^2 in front of this grate seize it and press it through the moulds in the plate B^2. The clay thus formed into the desired shape leaves the machine as an endless band, arrives at the rolling table formed by the rollers e^2, and by advancing causes them to revolve. All the power thus developed is caught up by the roller e^3, in consequence of its being connected by the endless band of clay with the rollers e^2, and is transferred to the pulley e^4, and from thence to the shaft *f* by means of a band passing over the pulley f^1. During the revolution of the shaft *f* the knob or projection on it strikes against one end of the lever *g*, for putting a clutch into gear with the pulley h^1, which serves for putting in motion the cutting apparatus, and which receives its motion from the shaft D. The eccentrics h^2, thereby set in motion, act upon the bowls h^9, on the levers h^3, and move the levers downwards and upwards alternately, and, by means of the connecting rods h^4, move the slide bars h^5 downwards and upwards alternately, and also the cutting wire connected to them. Thus, when the cutting of the endless band of clay has been effected in a downward direction the fork-shaped lever i^1 is put in motion by the eccentric *i*, after which the guide bars h^6 are brought into an angle the reverse of the former by means of the arms h^8, which connect the arms i^4 with the guide bars h^6, after which one of the knobs or projections on the shaft *h* strikes against the other end of the lever *g*, and thereby shifts the clutch and puts the pulley h^1 out of gear, and causes the cutter to stop until the knob on the shaft *f* comes again into contact with the lever *g*, and causes the cutter to move in the upward direction, after which the angle of the guide bars are again reversed, and the process is repeated. The stones and other objectionable matter contained in the clay remain before the grate B, and are removed from time to time by withdrawing the frame B^4. By changing the band to different grooves in the pulleys e^4 and f^1, and thus altering the speed of the pulley f^1 to any desired extent, as well as by changing the positions of the screwed pin in the slotted arms h^8, the movement of the cutting is regulated, so as to agree with the motion of the band of clay, and cut the bricks or other articles at right angles, or at any other angle required.

Experiments at Shoeburyness.—Since the last experiments tried with the new wrought iron smooth-bore Armstrong gun, other trials have been made with the same piece of ordnance to prove its power. During the course of these it has been tried with a 50 lb. charge of powder against a target of three 5in. plates of wrought iron bolted together—a mass of wrought iron, in all, of 15in. thick—or, nearly as possible, four times the thickness of the Warrior's plates. Two or three shots were fired against this, and each broke all three plates, crushing the first, ripping and splitting the second, and ripping the third in such a way as to show that even 15in. of metal was an insufficient protection against ordnance of this description at close ranges.—*Times*.

TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

The Engineer *of next week will be issued as a double number, containing numerous illustrations and descriptive notices of the machinery and kindred objects in the International Exhibition. Price 6d.; stamped copies 7d.*

D. A.—*In type and will appear next week.*

J. B. (Watford.)—*We do not think that you could hold a patent for such a contrivance.*

W. B.—*The £50 stamp has not been paid on W. A. Clarke's patent, No. 2154, and dated August 12th, 1857.*

R. N.—*Messrs. Parsons and Pilgrim have an office in the Adelphi terrace. We are not quite sure of the number, but believe it is 8.*

J. C.—*Humber's work, published by Messrs. Spon, of Bucklersbury (price £6 16s. 6d.), is the best. A useful little work on bridges is published by Mr. Weale for a few shillings.*

Atlantic.—*For the Cunard line you would require to apply to Mr. Thomson or Mr. Muir, at Messrs. Burns and McIver's, Liverpool; for the Philadelphia line, to Mr. Inman, of Water-street, Liverpool; for the Canadian line, to Allan Brothers, Liverpool; for the Peninsular and Oriental fleet to Captain Engelue, at Southampton; and for the Royal Mail, to Captain Vincent, Southampton. A fitness for the position is the proper qualification.*

A Constant Reader.—*What is a "pen," as applied to a safety-valve? As for your question, it is very plain that any upward pressure of steam under a safety valve is to be opposed by an equal downward pressure, produced conjointly by the suspended ball and the lever itself. Therefore, whatever may be the total force required to hold down the valve, the effective weight of the lever must form part of it; and this being deducted from the whole pressure on the valve, the remainder represents the resistance to be overcome by the ball applied at the end of lever. Your mode of proceeding in adding the weight of the lever may result some day in blowing up a boiler.*

Cotton.—*According to the rules for constructing governors (see* The Engineer, *page* 186, 1862), *you will find that a governor making twenty revolutions per minute ought to have a vertical distance between the point of suspension and plan of revolution of centre of balls of 39·1393in., whereas yours has only 38·625in. The lowest number of revolutions your governor ought to make is about thirty-two, which you can easily obtain by altering the size of the driving-pulleys or bevel-wheel. The weight of the balls does not in any way affect the action of a governor, if it is only sufficient to overcome the friction of the throttle-valve spindle and the intermediate levers.*

Hammer.—*We are unable to give you much information of Herr Krupp's hammers. He publishes nothing, and allows no visitors in his works. His representative in this country informs us, however, that the hammer now up has a head weighing 40 tons, and falling 10ft. The anvil block weighs 185 tons, and was cast in a single piece. It is supported by eight castings, weighing each from 130 to 140 tons, the whole mass going 38ft. into the ground, and weighing about 1,250 tons. The top of the steam cylinder is 55ft. above ground, and the total weight is given as upwards of 3,000 tons. Herr Krupp, we learn, contemplates erecting another with a head of 100 tons. We are not able to give the information you require as to Captain Penrice's machine. He has taken a considerable number of patents.*

R. B.—*The pay of engineers in the navy, in* 1859 *(since which, we presume, it has not been changed), was as follows:—Chief engineer, in service from 1 to 6 years, 10s. a day; from 6 to 10 years, 11s. 6d. a day; from 10 to 15 years, 13s. a day; from 15 to 20 years, 15s. a day; and for engineers over 20 years (as chief) in the service, 18s. a day. First assistant-engineers 8s. 6d. a day, second assistants 6s. 11d., and third assistants 5s. 10d. There are no "third assistants" or fourth engineers now. The pay in the merchant service is about one-half better than in the navy. There is such a work published as you speak of, but we are unable to refer you to it just now. Main and Brown's book on the marine engine is the one most in favour, we believe, with the Admiralty engineers. As to which service is best that is a matter more of taste than absolute fact. You can apply to the Secretary of the Admiralty to see if you can enter the service.*

SUCKOW AND HABEL'S BLOWING MACHINERY.

(To the Editor of the Engineer.)

Sir,—In The Engineer of yesterday is an illustration of the above. If these gentlemen will turn to No. 622 of the *Mechanics' Magazine*, for 1835, they will there find the engraving and description of an arrangement for c eating a blast by the use of an Archimedian screw, which will show them that the plan is not by any means new. L. E.

London, 19th April, 1862.

(To the Editor of The Engineer.)

Sir,—Observing in your impression of Saturday, 19th inst., a notice of a "Screw Fan Blast," purporting to be the invention of E. Suckow and E. Habel, of Oldham, I beg leave to inform you and your readers that a model of this screw blowing machine was made by me twenty-two or twenty-three years ago, and used to blow the house fire with it, which I can prove to the satisfaction of any person, should it be required; but feeling, like many working men of my acquaintance, a reluctance to seek after moneyed patronage to bring out, before the public, ideas we may conceive, it, like many other things, got laid aside until this brought it before my notice again. I may add that the principle was tested by me at that time in nearly every particular. George Hemsley.

Swindon Works, Great Western Railway, 23rd April, 1862.

M. FOUCAULT'S PENDULUM.

(To the Editor of The Engineer.)

Sir,—Would any of your astronomical correspondents be good enough to say whether there is any method of continuing the movement of the pendulum without affecting its inclination to deviate from the meridian where it may be set a going; and, granting that the result verifies the theory, how many degrees would it deviate from that meridian at the end of six hours in latitude 55 deg. north. Parallelism.

HOW TO TAKE THE MONITOR.

(To the Editor of The Engineer.)

Sir,—In a letter to the *Times*, "S" gives a description of "how to take the Monitor." I think he has omitted something, which I will, with your permission, supply as follows:—

The iron tower will revolve upon an iron ring on the deck, or on one sunk a little below the level of the deck. To make sure of their prey, and render the firing from the tower useless, the boarders could take a couple of sledge hammers and some small iron wedges with them. By driving these wedges in horizontally or vertically, as might be found necessary, the tower would be "jammed" and effectually prevented from revolving.

This done, and the tower "scotched" with the guns pointing athwartships, so as to render them harmless, boats could take the big ship in tow and do what they like with her.

Captain Coles' ships will be higher out of water, and more difficult to board; yet, when once on, cannot his cupolas be thrown out of gear in the same way? T. M.

Preston, 16th April, 1862.

MEETINGS NEXT WEEK.

Institution of Civil Engineers.—Tuesday, April 29, at 8 p.m., "On Reclaiming Lands from Seas and Estuaries," by James Oldham, M.I.C.E. "On the Reclamation of Land from Seas and Estuaries," by J. H. Muller. "On the Sea Dykes of Slesvig and Holstein, and Reclamation of Land from the Sea," by John Paton, M.I.C.E.

Society of Arts.—Wednesday, 8 p.m., "On the Silk Department of the Italian Exhibition held at Florence in 1861," by Thomas Winkworth.

Advertisements cannot be guaranteed insertion unless delivered before eight o'clock on Thursday evening in each week. The charge for four lines and under is half-a-crown; each line afterwards, sixpence. The line averages nine words; blocks are charged the same rate for the space they fill. All single advertisements from the country must be accompanied by stamps in payment.

The Engineer *is registered for transmission abroad.*

Letters relating to the advertisement and publishing department of this paper are to be addressed to the publisher, Mr. Bernard Luxton; *all other letters and communications to be addressed to the Editor of* The Engineer, *163, Strand, London, W.C.*

THE ENGINEER.

FRIDAY, APRIL 25, 1862.

THE INTERNATIONAL EXHIBITION.

Within less than a week the International Exhibition of 1862 will be an accomplished fact. It will open, although in an incomplete state, on Thursday next, when the interest which all must have felt in this great undertaking will culminate in one of the most wonderful displays of human industry, ingenuity and taste ever brought together within the walls of a single building. Gradually and almost insensibly as we have progressed for eleven years in the useful and ornamental arts, the great occasion of the coming week will bring into one focus, and revive as in a new creation, the great aggregate of our practical and artistic effort since 1851. Those who, ever thirsting for novelty, are impatient of the last achievement, will assuredly stay to review, from a new stand point, the progress which, consisting of innumerable details, is so overwhelming in its amount.

As engineers we shall take a practical view of whatever the coming display may present. We must own that, in the design and construction of exhibition buildings, Captain Fowke's creation shows anything but progress since 1851, and the temporary portions of the work—the annexes—are a disgrace to our national reputation as practical builders and constructors. But within them, and let us hope they may stand until the Exhibition is over, the display will be worthy of the occasion. In the steam engine and in the locomotive we have gained ground. The screw propeller has been much improved, and steam has been set to work at the plough and in the heavy traffic of our streets. The iron manufacture has been somewhat improved by the practice in coking slack, and in utilising the waste gases from the blast furnace, and a discovery has been made which is likely to revolutionise the whole business of steel-making. Some of the most brilliant chemical discoveries have been made in dyeing, and in many branches of practical chemistry. We have obtained new oils from coal, and almost every illuminating agent has been the subject of some discovery or improvement. Thus candle making has advanced well nigh to perfection, and the introduction of clay retorts and of innocuous substances for purification has wrought great changes in gas making. Machinery, embodying some beautiful applications of what is known as the "copying principle," has been introduced into many trades where hand labour only was formerly employed, as in gun making, lock making, &c. Wood working machinery has been revolutionised, and machinery for making bricks has been brought into use with important results. Files are now cut by machinery, and on the practical scale of a great manufacture. The sewing machine has reformed a great branch of handicraft, and even cotton machinery, which seemed to have been perfected many years ago, has been the subject of improvements since 1851 which have cheapened the manufacture of the goods some 20 per cent. In engineers' tools, too, some improvements have been made, the traverse drill being one of them. The boiler injector, too, is a striking example of recent discovery.

The improvements in steel making can hardly be over estimated, Krupp's contribution to the Exhibition being one of the most extraordinary visible illustrations of progress in this respect. Enormous as are the ingots and forgings of steel which he has sent, the resources of the atmospheric or Bessemer process are such that it would not have been difficult to have quite overshadowed them. It is probable that, before another ten years are over, the great Prussian works will produce steel by the beautiful process only of decarbonising cast iron in the liquid state, and by the forcible injection of atmospheric air into its mass.

In weapons of war our progress is notorious; and none can doubt that the examples of our modern engines of offence will prove among the most attractive objects in the Exhibition.

In numberless details, therefore, will the great display now close at hand illustrate our industrial advancement since 1851, and few visitors can fail to go back, mentally, to the memorable occasion of that year, deriving fresh lessons from the contrast. It will be our aim to chronicle with especial care the nature and details of every practical improvement exemplified by the present Exhibition, thus placing before our readers, in a succession of illustrations, a fitting memorial of one of the greatest practical eras of the present century. Our task will commence with the opening ceremony next week, and it will not cease until after the International Exhibition of 1862 has taken its place in history.

STEAM ENGINE CONSTRUCTION.

The beam engine at one time commanded the suffrages of all engineers, but it enjoys no such exclusive favour now. Direct action engines have, for a long time, been gradually gaining a preference for pumping. When, in consequence of the Water Act of 1852, the Thames companies were compelled to remove their pumps to above Teddington lock, the Southwark and Vauxhall, the Grand Junction and the West Middlesex companies set up, each, a couple of Bull engines at Hampton, the Grand Junction having two Bull engines also at Campden Hill, and the Southwark and Vauxhall one at Battersea Fields. The New River Company also have a 66in. Bull engine at Tottenham. All of these engines have cylinders of 60in. diameter and upwards, but much larger direct acting pumping engines have been made, the Bull engine at the Mostyn colliery, made by the Haigh Foundry Company, having a 100in. cylinder and a stroke of the great length of 14ft. In every case, we believe, these engines have given results of the most satisfactory character. The increasing use of the screw—indeed the almost complete supercession of the paddle—has brought direct acting engines into favour for marine purposes, they being almost indispensable for screw ships of war. In the case of the new frigates we have trunk engines with 112in. cylinders and 4ft. stroke, and others with cylinders of the same bore, and 4ft. 4in. stroke. The double piston rod engines, also, making for the same class of vessels, have 101in. cylinders and 4ft. 6in. stroke. Messrs. Caird and Co. have made inverted cylinder engines with 90in. cylinders and 3ft. 6in. stroke, and indeed there is no limit to the size of such engines. Even in the case of paddle steamships, we have examples of 74in. oscillating cylinders, and 14ft. stroke on the Great Eastern, 101in. cylinders and 12ft. stroke on the Adriatic, 97in. cylinders and 10ft. stroke on the Seine, 98in. cylinders on the Anglia and Columbia, and 90in. cylinders on the Holyhead boats, all these being oscillating engines. When side lever engines, with 100in. cylinders and 12ft. stroke, were being fitted in the Scotia, it appeared to be a general opinion among mechanical engineers, that an already antiquated system was being needlessly perpetuated.

For land purposes, horizontal direct-acting engines are being adopted even for cotton mills, and, as will be supposed after this fact has been stated, for numberless other purposes. In some of our best engineering workshops, also, wall engines are employed, one to each line of shafting, the connecting rod taking hold of a crank on the shaft itself, without intermediate gearing.

If beam engines continue to be made it is to be hoped that they may have wrought iron rivetted plate beams, or else rolled beams of the kind supplied by the Butterly Iron Company for the steamship Scotia (the engines of which had been first made with cast iron beams, one of which split in two after being keyed upon the main centre). One of these rolled beams, in the rough, is to be seen in the eastern annexe of the Exhibition. Even for cast iron beams much better proportions might be adopted than in that for the Hartley engine, the lamentable failure of which is likely to result in the compulsory adoption of wrought iron beams in colliery engines. In that casting nearly all the strength was in the plate, the flanges being comparatively very light. The main centre, moreover, was of a hexagonal form where it went through the beam, there being, therefore, six internal angles, each inviting fracture in that part of the beam subjected to the greatest strain. The great beam of Harvey's 112-in. pumping-engine at Battersea Fields is about 3in. thick in each plate, the flange being nearly 10in. wide on the edge of the beam and averaging about 7in. deep, these dimensions being those only which would be taken by an ordinarily practical eye while the beam is vibrating nine or ten times each way per minute. In Boulton, Watt, and Co.'s large pumping engines at Stoke Newington the flanges of the beams are very light, nearly the whole strength residing in the plates. We have seen, on the other hand, cast iron beams over 30ft. long, the thickness of each web of which was only 1¾in., while the flanges were 10in. wide on the edge of the beam and 4in. deep. Such a casting, no doubt, must be difficult to make, and it would require a good deal of precaution to prevent it from being strained in cooling. The best beam of all, we believe, is that made by the American engineers, and shown on page 336 of the last edition of Mr. Bourne's work on the Steam Engine. The central portion of the beam is of cast iron, the principal strength being in a heavy wrought iron strap encircling the whole. The depth of the American beam, in the centre, is generally one-half of its length, the wrought iron hoop being formed to a lozenge shape.

In the great attempt now being made to reform our steam engine practice by working high pressure steam more expansively, compound engines will command the favour of the majority of engineers. The system, too, of exhausting from a single high pressure cylinder into a large receiver and thence into the low pressure cylinder, the respective cranks being placed at right angles, is likely to be preferred to that generally adopted by most builders of compound engines, to wit:—the use of four or more cylinders for the two cranks working at right angles. In this arrangement, too, the steam will be best superheated in the intermediate receiver, according to Mr. Wenham's plan of superheating between a high pressure and a low pressure engine. No engine need, we think, have more than two cylinders, although even without right-angled cranks, Messrs. Perkins employ three cylinders, while Mr. Adamson has patented the use of four or more in which the steam is worked successively from one to another.

Superheating the steam, it appears, is not enough to satisfy those who are striving to obtain the utmost work from each pound of fuel, and so steam cylinders are being occasionally applied in conjunction with superheated steam. Superheating, one would suppose, should accomplish all if not more than steam jacketting, for the only object of steam jacketting, so far as we can see, is to prevent, not so much the radiation of heat from the exterior of the cylinder, as the prevention of condensation within it, when fresh steam is admitted, at each stroke, immediately after the interior of the cylinder has been exposed to the low temperature of the condenser. As for external radiation, a thick coating of felt would effectually protect any cylinder, and in this respect a steam jacketted cylinder should be as well clothed as any other. It is a hopeful sign (although it is no more than a return to the original practice of Watt) to find steam jackets adopted in marine engines for the Government, and where superheating apparatus has hardly, as yet, obtained a footing. The pair of 800 horse engines exhibited by Messrs. Maudslay, Sons, and Field, in the International Exhibition, have steam jackets around the cylinders, and—what is more in this case, with large cylinders and a short stroke—over both cylinder covers also. Should superheated steam be used at all, it would be admitted also to the jackets, as in the engines of the Octavia. After all, there is very little difference of opinion among engineers as to the means of economising fuel in steam engines, where a slavish devotion to some one particular pattern of engine does not already prevail. Whenever prejudice of construction is overthrown the means of economy will be quickly adopted.

STEAM BOILER EXPLOSIONS.

It would be a matter of somewhat anxious interest to ascertain how many huge bombshells, called steam boilers, and having a diameter of from 9ft. to 10ft. 6in., are at work in the mining and manufacturing districts. Made originally of $\frac{3}{8}$in., or $\frac{7}{16}$in. iron, these great vessels are worked, after fifteen or twenty years' use, at pressures of 35 lb. and 40 lb. per square inch. Anything like thorough inspection by really competent men they seldom receive, and the engine-men are generally ignorant and poorly paid, being selected from among the labourers about the works. Only last week, at Priestfield, near Wolverhampton, a boiler 10ft. 6in. diameter and about 30ft. high, made eight or nine years ago of ⅜in. iron, and "considered safe" at 50 lb. pressure, being often worked at 40 lb., blew up without warning, and no less than twenty-eight men were

either killed on the spot or have since died, ten more having suffered injuries from which some of them may never recover. But a few weeks since a boiler 9ft. in diameter, 21ft. 3in. high, made of $\frac{7}{16}$in. plates, and worked eight years under a pressure of 50 lb., blew up, killing six men. Here, however, there could be little doubt as to the cause of the explosion, for there was a vertical internal flue no less than 4ft. 8in. in diameter, the nearly flat head of which was not stayed at all. Something was said about low water, but as the ordinary level of the water was 4ft. 6in. above the highest point to which the fire could reach, and as the head of the internal flue was inherently weak, it was as likely to have been a case of high water as of low water. A few years ago, at Bury, a boiler 36ft. 6in. long, 9ft. 1in. in diameter, made of $\frac{7}{8}$in. plates, and which had been worked for eleven years at a pressure of 40 lb. per square inch, blew up with great violence. It had been twice patched, but after the explosion a considerable surface was found to have been corroded to a thickness of only $\frac{1}{16}$in. A few months later a boiler 24ft. long and 10ft. in diameter, made eighteen years before of $\frac{7}{8}$in. plates, exploded at Tipton. Surely there is nothing mysterious in these explosions. Such great vessels are hardly more fit than gasholders would be for generating steam. Out of all proportion in size, made of ordinary and often inferior iron, old, neglected, under the care of ignorant men, and in some cases, in the mining districts, exposed to the insidious action of corrosive water, what but final explosion is to be expected? The terrible magnitude, however, of the recent disaster at Priestfield should at last rouse the owners of steam boilers, if not the members of both Houses of Parliament, to take measures for the prevention of such entirely preventible calamities in future.

The time will doubtless come when the question of the size of steam boilers, as affecting their safety, will be better considered than it appears to have been heretofore. In all boiler explosions, the pressure of steam is instantaneously liberated from the surface of the greater or less quantity of hot water present. If the boiler be at work at a pressure of 45 lb. this water must be at a temperature of about 290 deg., but it is, we presume, sufficiently known that fresh water cannot for an instant be maintained at a temperature much greater than 212 deg. under the ordinary pressure of the atmosphere. It may be true that, with great care and delicate apparatus, water may be heated to a little above this point without boiling, but, upon the least agitation, a portion will instantly flash into steam, and the temperature of the water will fall to 212 deg. For all practical purposes a body of fresh water cannot be kept a moment in the open air at a temperature above 212 deg., while, if the pressure upon it be liberated when it is heated to say 290 deg., a most violent disengagement of steam, and projection of water along with it, must inevitably take place. The force with which disengaging steam must carry water before it and along with it, must exceed any known force of the waves of the sea, notwithstanding that the waves occasionally beat down some of the strongest constructions of man. High pressure steam rushes into the air with a velocity of from 1,500ft. to 2,000ft. per second, a fact not only demonstrable from natural principles, but proved by the exhaustion, within the fiftieth part of a single second, of a cylinder full of steam in locomotives running at high speeds. The force with which it must hurl masses of water on all sides, like the fragments of an exploding shell, may be conjectured from this fact, and it is well known that, when moving with great velocity, a mass of water will strike with nearly the force of an equal weight of iron. For in firing a bullet from a gun down upon a surface of water—the concussion being necessarily identical with that which would result if the water were made to strike at the same velocity upon a stationary bullet—the bullet is flattened.

Inasmuch, then, as all boilers are constantly liable to rupture, from original unsoundness of the iron, bad rivetting, corrosion by bad water, or by the somewhat mysterious action of "furrowing," what is to be expected when, the steam pressure being thus suddenly liberated through a rent of moderate dimensions, 30, 40, or even 60 tons of heated water are waiting below to burst partly into steam?

That the explosion of boilers is due chiefly to the combined percussion of the steam and water, leaping up on the sudden removal of the steam previously resting on the surface of the water, is supported by every probability. That it is in no respect attributable to electricity may be abundantly proved by a brief period of working with one of Armstrong's "hydro-electro machines," in which a steam boiler forms part of the apparatus employed for the generation of electricity. That overheating is seldom the cause is proved by the appearance of many boilers subsequent to explosion, no traces of overheating being discoverable, notwithstanding that, if a boiler had been scorched, the indication would be unmistakeable. A red hot boiler, too, may be as safely filled with cold water as a hot railway tyre may be quenched in a cistern. Overheating, it is true, may lead, by weakening the plates, to a rupture, but then other causes must concur to complete the explosion. Brittle cast iron steam cylinders are seldom if ever exploded. But, which is not less significant, boilers frequently rupture without exploding, the rupture, however, being almost always well below the water line. A case of this kind occurred a fortnight or three weeks ago at the office of the *Western Times*, a newspaper published in Exeter. The plates near an angle-iron junction had "furrowed," or become corroded in a deep groove, whereby the thickness had been reduced to about one-sixteenth inch, and here the iron finally gave way, making a rent perhaps 20in. long and $\frac{1}{2}$in. wide. The result was the escape of the water, without, however, the sudden removal of the pressure of the steam from its surface within the boiler. Unhappily, a girl who, with a number of other work-people, happened to be in the boiler-room at the time, was scalded to death, but for which circumstance the rupture, like many others which are constantly taking place under like circumstances, would never have been publicly heard of. The boiler, it is hardly necessary to state, was not disturbed in any way, nor was it injured in any respect save the rent already mentioned.

The conclusion is sufficiently clear, that there is always more or less danger in working boilers which are made to contain a great quantity of water. Safety lies in the use of numerous small water spaces, as in the duplicate retort boiler, the water tube boiler, &c. In the latter class of boilers one or more tubes, where they happen to have been originally unsound, will now and then burst open, but so limited is the quantity of explosive water (as it may justly be termed when highly heated) that nothing like a violent explosion, disturbing the boiler as a whole, ever takes place in such cases.

In any case, the explosion of boilers being often traceable to original unsoundness of material or construction, or to subsequent burning, corrosion, or other injuries, a systematic, careful inspection should be periodically made of all boilers, as is now done in the case of many hundreds of steam boilers under the care of the Manchester Boiler Association. Had the boilers at the Millfields works been thus examined, by a competent man, we have not the least doubt that it would have been found defective, and that, whether it had been repaired or removed altogether, the works would have now been in their accustomed operation, and the lives of nearly thirty workmen have been spared.

LIVERPOOL POLYTECHNIC SOCIETY.

The monthly meeting of this society was held last week in the theatre of the Royal Institution, Colquitt-street, Liverpool, Mr. Arnott, president, in the chair.

Among the papers read was one by Colonel Clay on "Projectiles and Iron-plated Vessels." He said, in submitting any remarks he might make to the meeting, he must, in the first place, beg their indulgence for what would be but a very hurried glance at the important subject designated by the title of "Projectiles and Iron-plated Vessels;" for, having only been called upon a few days ago, there had been but little time to prepare such a paper as he should wish to have done. The paper which he should read was only intended in a manner to introduce the subject, so as to elicit discussion from gentlemen more competent to deal with it. The subject of projectiles versus armour had lately assumed a very important position with respect to England's national supremacy as mistress of the ocean and to her coast defences. The question of armaments against iron projectiles had been considerably discussed of late, and the public mind had been, so to speak, oscillating between the superiority of offence and defence. At one time we had reports from Shoeburyness that no guns could pierce the iron plates of vessels. A few weeks later and we learnt that the shot had gone through them with great facility; and, in fact, it appeared we were as much at sea now as we were at first. With respect to the recent experiments at Shoeburyness, we must bear in mind that the target tested was a shattered one, and therefore too much weight ought not to be placed on the fact that certain charges had gone through it. He had hoped that Mr. Laird would have been present that evening, and have given them the benefit of his great experience, he having been present at the late trials. The lecturer then proceeded to illustrate his remarks by reference to a large diagram—and which gave the result at different degrees of elevation of the force of the projectiles from that good old gun the 68-pounder, the Armstrong 100-pounder gun, and the 13-inch gun respectively—each of the guns being represented by a different coloured line. The figures he should adduce were not founded on any theory or any deduction of what the range would be, but he had the chapter and verse of every range from official government sources. The guns were all tried at Shoeburyness, he had got the data of the results, and they were trustworthy. At point blanks the 68-pounder ranged 316 yards, the Armstrong 345, and the 13-in. gun 600, being nearly double the range of either of the others. At 1 deg. of elevation the 68-pounder ranged 720 yards, the Armstrong nearly 680, and the 13-in. 1,023. At 3 deg. the 68-pounder ranged 1,470 yards, the Armstrong 1,335, while the 13-in. ranged 1,800. At 5 deg. the 68-pounder ranged 2,000, the Armstrong 1,970, the 13-in. 2,433. At 7 deg. the 68-pounder ranged 2,430, the Armstrong then went considerably ahead, ranging 2,585, and the 13-in. gun still kept the lead, ranging 2,988. At 10 deg. the 68-pounder ranged 2,930, the Armstrong 3,470, and the monster gun 3,523. At 12 deg. the Armstrong went ahead of the monster gun, the range being—68-pounder 3,200, the Armstrong 4,035, the 13-in. 3,883. He must mention that he had only drawn the diagram up to 12 deg. of elevation, and he at once admitted that beyond that range the Armstrong gun had clearly the advantage. Sailors, however, liked to have the most effective weapons at short distances. It appeared that the 68-pounder, up to 5 deg. of elevation, ranged rather farther than the Armstrong gun. At 700 yards it was neck and neck, but when we came to the extreme range its velocity was very much less, and the service ordinary smooth-bore lost its effect. In the Armstrong gun there was hardly any appreciable diminution in the velocity; and if Sir William could produce a gun, as he was endeavouring to do, which would be as effective as a rifle shot at 1,000 yards, it would be a very great improvement. The question of damaging or smashing ships which were coated with iron-plates would naturally divide itself into two systems—one, the American; and the other, the English. The English system was the driving of a comparatively small shot at a high velocity, and the American was a system of propelling of a large projectile at a low velocity. At Shoeburyness lately the English system had apparently great success against a target representing the Warrior, although it must be borne in mind that that target had been subjected to a great hardship before, and that the section of iron there represented 4½in. had already been superseded by 5½in. in the steam rams now building. The American system had not yet been fairly tested; for although Dahlgren guns of considerable bore were used with small charges of powder, the effect of monster guns, with correspondingly small charges, had yet to be tried on a large scale. The extreme of that system was most effectually tried when the Merrimac ran down the Cumberland: for the former then represented a most monstrous shot propelled at a very low velocity indeed; and as the Duke of Somerset, in the House of Lords, stated the armour of our steam rams or batteries did not impart any strength to the fabric of the ship, 'twas reasonable to argue that our steam rams of more than double the weight of the Merrimac, and propelled at double the velocity, would prove too much for any floating opponent, whether of wood or iron. After quoting from Mallett, who asserted that we should return to "bombards," he said the reason why rifled guns had so little effect on armour, whilst old smooth bores had so much greater effect, was that the charge of powder was so much greater in proportion, and that the projectile of the smooth-bore left the muzzle at much greater velocity. He said the authorities in America seemed bent upon producing guns of enormous diameter; and in our own country Sir Wm. Armstrong had undertaken to make guns of very much larger bore than he had hitherto made. With respect to the question of any particular form of iron-plated vessels he did not feel himself at liberty to pronounce any opinion, and he was only sorry Mr. Laird was not present, as the subject was peculiarly within the province of the iron shipbuilder. There were three classes of vessels before the public, one of which was constructed like the Warrior, another was the cupola ship invented by Captain Cowper Coles, and the third was the angulated steam ram. He thought that experiments as to the value respectively should be made on the fullest and largest scale. To test a model only gave no satisfactory information. The papers had recently been full of the subject of floating batteries; and he had no doubt that we could increase the size both of our means of offence and of defence. He did not see any limit to the size of iron plates, and he alluded to one made by his own firm, which was 21ft. 3in. long, 6ft. 3in. in width, and 5½in. thick, weighing above 13 tons. He was satisfied that the plates might be made much larger than they were at present. It was of the greatest importance to have them of as large an area as possible; and he was satisfied that, as far as the naval architect required the skill and industry of the ironmaster, they would at all times be placed at his disposal, even though he might require mammoth forgings and plates such as even now were deemed almost impossible. The question of the Spithead fortifications was hardly within the scope of the present paper, and was one, perhaps, which could only be determined by the Defence Commission after duly considering the altered state of affairs which had recently come to light. In conclusion he said, although our very unstable friends on the other side of the Atlantic have sung their pæans on the downfall of England in all the difficulties and doubts of the present unsettlement of the question of Artillery v. Armour, we had the happiness to know that England had the greatest possible resources of all countries of coal and iron; and so long as her sons, as at present, grudge not their time, their money, and their blood, so long will England remain the first and foremost of the nations of the world, and the "home of the brave and the free." (Loud applause.)

In reply to a question Colonel Clay said he had recently made a gun from one solid mass of iron. It was forged hollow, and was perfectly sound. With respect to breech-loading guns, Sir William Armstrong had, by a very simple device, obviated the breech being blown out. One great fault with breech-loading guns for sea service was that there was, more or less, an escape of gas. The chief evil, viz., the blowing out of the breech-piece, was, however, now abated by a simple expedient.

Mr. Maxwell Scott asked if he had not some time back made a few experiments on a target near Bootle.

Colonel Clay said he had, several months ago, made experiments a mile beyond Crosby, where he erected a plated target. The results showed that a 4½-in. plate would be very easily penetrated by a large gun. He also said that he heard Sir William Armstrong intended to use a very much larger proportion of powder in his new rifle guns than he had hitherto done, and he expected to get a greater penetrating power at 1,000 yards than he now got at 200. A tower to represent the Monitor, and plated as was that vessel, had been constructed, for the purpose of being tested, at Shoeburyness, and was knocked to pieces by a 68-pounder.

Mr. Ward would like to know what effect the shots would have on a yielding substance at the back of the armour plates.

The chairman thought the quality of the powder used might become a material question, and thus the chemist might have to be consulted.

Colonel Clay said a short stout gun would bear a very powerful powder, but for a very long gun a slow burning powder would be required. If the strongest description of powder were used with any rifle gun it would burst it.

After some further discussion, in which Colonel Clay, Messrs. Smith, Maxwell Scott, and other gentlemen took part, Mr. Salt moved a cordial vote of thanks to the colonel for his very valuable and interesting address, and expressed a hope that at some future time he would favour them with a statement of the result of the experiments he might be about to make.

The chairman, in putting the resolution, said they had had a most valuable address, and they must all feel greatly indebted to Colonel Clay for the information he had given them.

The motion having been carried by acclamation, the proceedings terminated.

THE RECLAMATION OF LAND FROM THE SEA.

Mr Thos. R. Arnott, President of the Liverpool Polytechnic Society, read a paper before that society, at its monthly meeting on Monday week, on the subject of the "Drainage of Haarlem Lake in connection with the Embankment and Gain of Land in Great Britain." Mr. Arnott showed diagrams, and said:—This subject has occupied far too little attention in an old and thickly peopled country like ours, where the value of land has outrun that of nearly everything else; fettered, too, as it too often is, with leases and other tenures which reduce it to a mere loan from the superior after all. And this, taken in connection with the extension of railways along our seaboard, as the means of making much land now overflowed available for culture or pasture for cattle, attracted my attention to the matter as one worthy of some consideration and notice. In the Netherlands we see thrift and plenty, and no people more respect the dignity of labour than the Dutch; and their cities, too, are well built, neat, and clean, and the people patterns of intelligence, industry, and moral worth; and Brougham has said, in proof of their industry, that they inhabit a sandbank reclaimed from old Ocean. And certainly the lowes part of the immense alluvial tract of Western Europe lies between the mouths of the Scheldt and the Ems; and while it is matter of history that much of our own eastern counties have been submerged, off the Rhine and the Meuse the remains of forests are covered by the German Ocean, and paved roads, villages, and the traces of former tillage lie buried in the neighbouring morasses, and dikes and embankments hem in the land all around. The hydraulic works of canals, &c., are said to have cost Holland £300,000,000, and the Waterstaat, or Board of Marine Engineers, has been maintained for centuries by that Government. The ocean dikes are 30ft high by 70ft. base, faced landward with wood and stone, and seaward with mats of rushes and flags staked to high water mark. Amsterdam is built on piles, and so intersected by canals as to form ninety islands, requiring 280 stone and wooden bridges, one of them 600ft. long. The polders are tracts of country lying under the water level of the adjacent country, and exceed 1,000 in Mid-Holland, some 20ft. under sea level, and in Rhineland, while there are only 76,000 acres of reclaimed, there are 173,000 acres of polder land, and 56,000 still redeemable. Four plans are adopted of reclaiming polders: First, by gaining it from the sea by engineering skill; second, of ground gained from the rivers by circumscribing, diverting, and deepening their currents; third, by draining off lakes; fourth, by digging of turf for fuel in such quantities as to make extensive depressions, and draining it off—all requiring an extensive system of drainage, sluices, ditches, canals, and embankments, with extraordinary mechanical agencies to elevate the water above the surface of the contiguous rivers, &c. Haarlem Meer was formerly an inlet of the Zuyder Zee, thirty-three miles in circumference, and 13ft. below the lowest tides, and, owing to the soft alluvial of the surrounding country, it had more than once threatened damage both to Amsterdam and Leyden in gales. In 1839 a dike and canal were built around the entire area to intercept drainage from higher level, to provide navigation in lieu of the lake, and to form a channel of outlet for the water pumped out. The canal is forty miles long, 9ft. deep, and widening from 125ft. to 148ft. Three main sluices were placed at Katwyke, Halfego, and Spaarndam, the first and second merely self-closing floodgates; but at Spaarndam a propelling engine was used, and the lake was closed in 1848, when the three engines were erected on piles driven down 40ft., and called Leegwator, Cruquius, and Lynden, after three distinguished promoters, each of 400 horse-power, and 39 months were occupied in draining. The additional engine at Spaarndam was of 360-horsepower, and propelled ten waterwheels for forcing the water to the sea. What was formerly a waste expanse of water is now exceedingly fertile land, in fine cultivation, enlivened by farms, villages, and a thriving population, and in proportion to the other inhabitants of Holland, this old bed of the lake is capable of sustaining 50,000 people in comfort; and the area of this polder is equal to the tongue of land in Cheshire stretching from Eastham to New Brighton, and thence round above Parkgate. That thoroughly practical and energetic people, the American, much in the spirit of the early Dutch settlers there, in addition to the many hundreds of miles of embankments along their alluvial rivers to save the land, and connecting so many of their vast rivers by canals, have also gained on the seaboard, as exemplified by the frontage of new streets at New York, Boston, San Francisco, and elsewhere. But no land promises better

opportunities and returns than our own for works of this nature, for the Swash alone, off Norfolk, occupies twice the space of Haarlem, and is very shallow. There is also Morecambe Bay, the mouth of the Dee, and many other points worth millions, along the sea walls of which railways might be carried, and thus pay for themselves. And in Ireland there is Loch Neagh, ten times the extent of Dublin Bay—fifteen miles by seven—and not far from the coast, and considerably above the tide water; and the same remark applies to nearly all the lakes in the north-west of that island. Indeed, 467,000 acres are covered by water there, and 6,000,000 acres still unoccupied bogs and mountain land, to the reclamation of which public money could not be better or more profitably turned in times of a famine of food or labour.

The works of Vauban and other French engineers show how much attention has been directed to sea walls and embankments in that country, and at the mouth of the Seine and elsewhere along their exposed coast the trumpet-mouthed and wave-line harbour entrances are so well adapted that I have seen a large transatlantic steamer come into Havre nearly at full speed, through a heavy and dangerous outside swell, and pass into the docks; and the plan of having open spaces, with piles driven at a great incline, serves well to spend the force of the waves and save the masonry. I would suggest that funnel-shaped embankments are best adapted in entering from an open seaboard, and to leave ample room inside for water storage, which can alone keep open any port, and is, no doubt, the source of the advantage we have in the scouring out of the channels of the Mersey; and if we ever allow a silt up in the estuary higher up, it will affect the channel outside.

LAW INTELLIGENCE.

COURT OF CHANCERY, Lincoln's-inn, April 17.

(*Before the* Lord Chancellor.)

HILLS *v.* THE LIVERPOOL UNITED GASLIGHT COMPANY.

The arguments in this part-heard appeal from an order of Vice-Chancellor Wood, relating to an alleged infringement of the plaintiff's patent for purifying gas, were this morning resumed. The order complained of directed an issue at law to ascertain whether the material used by the defendants in the first instance for purifying gas was a precipitated oxide, and also granted an injunction restraining the defendants from making use of the plaintiff's invention in renovating the materials used by them for the purifying of gas, whether the same be a precipitated or other hydrated oxide of iron, so that they may be used over and over again to purify the gas. It appeared that the material used by the defendants for purifying the gas was "bog iron ore," an oxide of iron, the use of which, the plaintiff contended, was an infringement of his patent. The defendants, on the other hand, insisted that the material was a native or natural oxide, and that the letters patent of the plaintiff only embraced the use of artificial oxides. The question mainly depended upon the meaning of the scientific terms employed by the plaintiff in his specification as compared with their universal or general sense.

Sir H. Cairns and Mr. Druce appeared for the appellants (the defendants); Mr. Rolt, Mr. Grove (of the common law bar), and Mr. Marten supported the order of the court below.

The Lord Chancellor, anterior to the reply, said that the injunction in its prefent form could not stand, as it was founded upon a misapprehension of the plaintiff's patent, but whether another injunction having the same effect ought to be substituted was a question for grave consideration. He had no hesitation, therefore, in dissolving the injunction, and would suggest to counsel in his reply to direct his arguments to what was the meaning intended by the plaintiff in the phraseology of his specification, and also whether it was within human power and within the scope of human testimony to predicate of the material used by the defendants, that it was a "precipitated oxide" within the meaning of the plaintiff's patent. A third point also arose, whether by the revivifying process used by the defendants a "hydrated oxide" was not formed within the meaning of that term as described in the specification of the plaintiff, and therefore amounted to an infringement of his letters patent.

Sir H. Cairns replied, and

The Lord Chancellor reserved his judgment on the other part of the motion, and dissolved the injunction.

The Fall of Towers and Spires.—After cursorily looking over "Murray's Handbook," and Dr. Willis's paper published in the *Builder*, on April 13th, 1861, I have jotted down a few evidences of the instability of human grandeur, which I beg to subjoin. It would be profitable if your readers would be so good as to extend the list which I have only just commenced. I believe that the list would be alarmingly lengthened were the inquiry extended to parochial churches. An awful catalogue would be the result of a similar search among the writings of Viollet le Duc and others respecting French and German casualties. As to Italy, not a spire now survives. Dr. Willis says:—"In examining the history of Norman cathedrals, it would be found that *falls* were the *characteristics* of several of them;" in short, that tails falling was a way they had got into, and they could not help it. Winchester Cathedral,—Tower fell in 1107; Ely Cathedral,—Central tower fell suddenly in 1321 or 1341; Gloucester Cathedral,—Tower fell suddenly in 1160; Worcester Cathedral,—Tower fell in 1175. Worcester Cathedral,—Two Towers fell in 1222. Lincoln Cathedral,—Tower fell in 1240. Norwich Cathedral,—Spire and tower fell in 1361, destroying the choir. Hereford Cathedral,—Western towers and front fell within the last century. Wells Cathedral,—Prevented from falling in 1321 by inverts and buttresses, "in gross violation of all taste and architectural propriety." (See Dr. Willis's paper.) Chichester Cathedral,—Tower and spire fell in 1861. Dunstable Priory Church,—Two towers fell in 1221. Evesham Priory Church,—One tower fell in 1213. Canterbury Cathedral,—Tower saved from destruction, in Dr. Willis's opinion, by means similar to those at Wells. Salisbury Cathedral,—The spire 23in. out of the perpendicular: its fall predicted in the *Builder*, April, 1861. St. Nicholas, Hereford; St. Mary's, Redcliff, Bristol,—Both with truncated spires, owing either to their upper part having fallen, or to their being left incomplete in apprehension of a fall.—*Correspondent of Builder*.

Wire Rope Testing.—*The Liverpool Mercury* of the 17th inst. says, "Yesterday morning, some specimens of wire rope were tested at the public testing machine, King's Dock. The first test was applied to a piece of 3½in. rope sent by the Coppa Colliery Company. It was cut from a piece of rope supplied to the company by Messrs. Garnock, Bibby, and Co., of this town, and was what is known as a wire core rope. The rope broke at a strain of 20 tons 15 cwt., the Admiralty strain being 15 tons 6 cwt. The rope had been for some time in use, and the result of the test was considered highly satisfactory. A piece of 2in. rope, being part of the rigging of the ship Bogota, belonging to Messrs. Blythe Brothers, was next submitted to the test. This rope had been in use for four years and a half, and was also from the manufactory of Messrs. Garnock, Bibby, and Co. It broke at a strain of 5 tons 15 cwt., the Admiralty test being 4 tons 6 cwt. In this instance the test was even more satisfactory than in the former experiment, from the circumstance that the rope, though it had been so long a time in use, sustained a strain of more than 30 per cent. above the test fixed by the Admiralty. Another rope by the same makers, of 1¼in., sustained a strain of 2 tons 12½ cwt.; this exceeded the Admiralty test, which is 2 tons 5 cwt. This rope was from the ship Istria, and had been in use during one voyage. Two other samples of rope were afterwards tested at the instance of Messrs. J. Dickinson and Son, with the object of ascertaining whether the wire rope made by the usual method, namely, in six strands, or the formed rope as supplied to the Admiralty, was the strongest. The result was that a 3¼in. rope, of Liverpool manufacture, stood a test of 17 tons 15 cwt., while a piece of the same circumference, known as the formed or London-made rope, broke at a strain of 12 tons 5 cwt. The testing was conducted under the tion of Mr M'Donald, who carefully recorded the results."

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

3068. George Clark, Craven-street, Strand, London, "Improvements in the use, application, and manufacture of iron or steel as armour for ships or batteries."—*Petition recorded 7th September*, 1861.

3163. John Dale, Manchester, "Improvements in the manufacture of glue or size."—*Petition recorded 17th December*, 1861.

17. John Jacob Gutknecht, Neuhof, near Fizers, Switzerland, "Improvements in meters for measuring gas, water, and other fluids."—*Petition recorded 1st January*, 1862.

118. John Adams Knight, Symond's-inn, Chancery-lane, London, "Improvements in machinery for dressing millstones by means of a diamond cutter."—A communication from John Dickinson, New York, U.S.—*Petition recorded 16th January*, 1862.

238. Benjamin Foster and John Moore, Denholme, Yorkshire, "Improvements in machinery or apparatus for spinning and doubling wool and other fibrous materials."—*Petition recorded 29th January*, 1862.

521. Jacques Dothee, Paris, "Improvements in the colouring or dyeing of horsehair tresses, hats, or ornaments."—*Petition recorded 26th February*, 1862.

605. George Lawrence, Newton-terrace, Westbourne-grove, London, "Improvements in the manufacture of flesh gloves and flesh straps."—*Petition recorded 6th March*, 1862.

639. Charles Massi, Greville-street, Holborn, London, "Improvements in means and apparatus for retarding and stopping carriages used on railways or common roads."—*Petition recorded 10th March*, 1862.

666. John Fawcett, New Swindon, Wiltshire, "Certain improvements in the manufacture of cranks and crank axles for locomotive and other engines."

673. Paul Gondolo, Boulevart St. Martin, Paris, "A new or improved baking oven."—*Petition recorded 12th March*, 1862.

681. Fortune Hippolyte Fontaine, Passage des Petites Ecuries, Paris, "A process for reproducing photographies, drawings, paintings, and engravings engraved on metal."—*Petition recorded 13th March*, 1862.

742. William Gossage, Widnes, Lancashire, "Improvements in the manufacture of soda and potash."—*Petition recorded 17th March*, 1862.

754. Andre Alexandre Beaumont and Joseph Augustin Escalier, South-street, Finsbury, London, "A new kind of flying top."—*Petition recorded 18th March*, 1862.

780. William Clark, Chancery-lane, London, "Improvements in the manufacture of soap."—A communication from Mr. Antoine Auguste Mollard, Boulevart St. Martin, Paris.—*Petition recorded 20th March*, 1862.

814. John Topham, Nottingham, "Improvements in apparatus used for cleansing out the scum and removing the sediment from the water in steam boilers, and preventing incrustation therein."

817. John Stewart, Glasgow, Lanarkshire, N.B., "Improvements in the manufacture of cards for jacquard weaving."—A communication from Louis Joseph Fillion, Grongis, Aisne, France.—*Petitions recorded 24th March*, 1862.

841. William Louis Winans, Brighton, Sussex, "A new or improved mode of mounting, and apparatus for manœuvring ordnance in land fortifications."

851. Edward Henry Cradock Monckton, Thurloe-place, South Kensington, London, "Improvements in the manufacture of effervescing liquids."

853. Richard Archibald Brooman, Fleet-street, London, "Improvements in machinery for preparing, combing, and dressing vegetable fibres."—A communication from John Andrew de Brame, New York, U.S.

855. John Easterbrook and James Hobson Allcard, Sheffield, Yorkshire, "Improvements in vices."

857. Samuel Anderson Emery, Arundel-street, Coventry-street, Westminster, "Improvements in the manufacture of soap."

859. William Ford Smith and Arthur Coventry, Gresley Ironworks, Orsdal-lane, Salford, "Improvements in and applicable to lathes and machines for turning and for cutting screws."—*Petitions recorded 27th March*, 1862.

861. George Allcroft, Church-row, Camberwell, Surrey, "Improvements in pressure and vacuum gauges."

863. William Austin Ashe, Bolton-place, London, "An improved mode of and apparatus for driving the propelling shafts of ships or vessels."—A communication from Edward David Ashe, Quebec, Lower Canada.

864. William Bryer Nation, Bagley Works, Battersea, Surrey, "Improvements in manufacturing boxes or cases, and in the machinery or apparatus employed therein."

865. Robert Alexander Owen, Manchester, "Improvements in feathering and varying the pitch of screw propellers for steamships."

866. Eugene Theodore Nouailher, Paris, "An improved ventilator."

867. Antonio Lucetti, Glasgow, N.B., "Improvements in apparatus for expressing the juice from pulpy fruit."

869. Edmund Smith, Hamburgh, "Improvements in wet gas-meters."—*Petitions recorded 28th March*, 1862.

871. Robert Kay, Castleton Print Works, Blue Pits, Lancashire, "Certain improvements in printing calicoes and other surfaces, and in apparatus connected therewith."

873. Youngs Parfrey, Upper Belgrave-place, Pimlico, London, "Improvements in breech-loading fire-arms."

875. Israel Morris, Essington, near Wolverhampton, Staffordshire, "A new or improved machine for breaking up or cultivating land."

876. Charles Henry Townsend, James Young, and James Hawkins, Bristol, "An improved method of removing and preventing incrustation in steam boilers."

879. Thomas Cole, Coventry, "Improvements in the manufacture of figured ribbons and other textile fabrics."

881. Richard Smith, Shaw House, Melksham, Wiltshire, "Improvements in roller blind apparatus."

883. Emanuel Bernard Hart, London, "Improved machinery for cutting cork so as to render the same suitable for stuffing purposes."—A communication from Isachar Zacharie, New York, U.S.

885. William Edward Newton, Chancery-lane, London, "An improved mode of applying acoustic apparatus in churches and other buildings and apartments."—A communication from David Dunham Stelle, New Brunswick, and Abram Van Arsdale, Newark, New Jersey, U.S.—*Petitions recorded 29th March*, 1862.

889. Robert Young, Glasgow, Lanarkshire, N.B., "Improvements in apparatus for cleaning, separating, washing, and drying grain."

890. Nathan Frankenstein, Clarendon-villas, Mildmay Park, London, "Improvements in machinery for cutting pointed, conical, and cylindrical corks."—A communication from Mr. H. Hubert, Linden, Hanover.

891. William Tyler, Birmingham, "A new or improved mixture or composition for feeding dogs and other animals, and poultry."

895. William Barry Lord, Plymouth, Devonshire, and Frederic Hughes Gilbart, Brixton, Surrey, "Improvements in loading fire-arms."

897. Robert Charles Ransome, Ipswich, Suffolk, "Improvements in thrashing and other machinery where corn or grain is required to be raised from one level to another."

903. Henry Pooley, jun., "Improvements in the construction of weighing machines and weigh bridges."—*Petitions recorded 31st March*, 1862.

905. John Taylor Gurney Stone, St. John's-road, Hoxton, London, "An improved bustle and petticoat."

906. Pierre Raymond Couchoud, Rue de Rambuteau, Paris, "A new or improved loom for manufacturing chenille and other lace-work."

907. Celestin Philippe Gontard, Besançon, France, "An improved stopping piece for watches and other time-keepers, intended to limit the winding-up of the moving spring."

913. Henry Smith, Teesdale Ironworks, Stockton-on-Tees, Durham, "Improvements in apparatus used when casting iron or other metal."

915. Henry William Carlon and George Fagg, Chiswell-street, London, "Improvements in casting printing types, and in apparatus for rubbing the same."

917. Edmund Hartley, George Little, and John Hinchcliffe, Oldham, Lancashire, "Improvements in rolling or straightening metal spindles, shafts, or rods of a cylindrical or tapered form."

919. Henry Joseph Madge, Swansea, Glamorganshire, "Improvements in coating iron sheets or plates, to be used as a substitute for tin or terne plates."—*Petitions recorded 1st April*, 1862.

925. Samuel Warren, Ledbury, Herefordshire, "Improvements in machinery for transmitting motion obtained by animal power to agricultural and other machines."

927. William Malam, Skinner-street, London, "An improvement in the manufacture of gas, and improved apparatus to be employed in such manufacture."

929. George Collier and John Collier, Halifax, Yorkshire, "Improvements in looms for weaving carpets and other pile fabrics."

931. Samuel Hunter, Grey-street, Newcastle-upon-Tyne, "Improvements in anchors."

933. John Thomas Loft, Berwick-street, Pimlico, London, "Improved machinery for printing in colours."—*Petitions recorded 2nd April*, 1862.

952. James Clarkson Kay and William Hartley, Bury, Lancashire, "Certain improvements in steam engines."

958. Henry Fletcher, Cornwall-crescent, Camden-road, London, "Improvements in valves for hydraulic presses, and in apparatus connected therewith for making or pressing blocks or bricks of coal, or other material."

960. Andrew Woodhouse and Thomas Hunter, Hindpool, Barrow-in-Furness, Lancashire, "Improvements in the arrangement of kilns and flues for burning bricks, tiles, quarries, and other like articles, and in utilising the waste heat of the said kilns, and in stoves for drying bricks, tiles, quarries, and other like articles."

964. Richard Archibald Brooman, Fleet-street, London, "An improved case for holding balls and reels of cotton, silk, and other threads."—A communication from Théophile Denis Gustave Baudouin, Rue St. Denis, Paris.

968. William Edward Newton, Chancery-lane, London, "An improvement in projectiles for ordnance."—A communication from Henry Tatem Potter, Sprague, New London, Connecticut, U.S.—*Petitions recorded 4th April*, 1862.

970. John Doddridge Humphreys, Aldhous-terrace, Barnsbury, London, "Improvements in furnaces and machinery employed in the manufacture of compressed fuel and other matters."

972. William Begg, Marsh-lane Foundry, Preston, Lancashire, "Improvements in consuming smoke, and in furnace bars and bridges for effecting the same.

974. John Collins, Seaham, Durham, "Improvements in apparatus for reefing ships' sails."

978. Thomas Critchlow, Bolton-le-Moors, Lancashire, "Improvements in planing machines."—*Petitions recorded 5th April*, 1862.

980. Charles Stewart Duncan, Monmouth-road North, Bayswater, London, "An improved method of and apparatus for ventilating, cooling, or suppressing fire in public and private buildings or rooms."

982. William Simons, Renfrew, N.B., "Improvements in constructing ships or vessels."

984. Edward Welch, Stratford-on-Avon, Warwickshire, "Improvements in register stoves and fire-grates, and in ovens and kitchen ranges."—*Petitions recorded 7th April*, 1862.

990. William Stevens, Glasgow, Lanarkshire, N.B., "Improvements in apparatus for moulding or shaping clay for bricks or other like articles."

992. William Beardmore, Glasgow, Lanarkshire, N.B., "Improvements in steam rams for naval purposes."

994. John Whitehouse, Birmingham, "Improvements in the manufacture of metallic door and other knobs, and the ornaments of the pillars of metallic bedsteads, and other articles of like manufacture, and in attaching metallic mounts to china or earthenware knobs and ornaments, and roses for knobs."

996. Charles Pemberton Carter, Kennington Hall, near Ashford, Kent "An instrument for inserting photographic or other pictures into, or removing them from, between the 'mounts' of photographic albums or other flat spaces into which the fingers cannot be inserted."

998. Edward Henry Cradock Monckton, Thurloe-place, South Kensington, London, "Improvements in time-keepers."

1000. Benjamin Sharpe, Hanwell Park, London, "Improvements in harrows and rakes."

1002. Edward Barnard Sampson, Ham-mills, Stroud, Gloucestershire, "Improvements in apparatus for supplying oil or other liquid to wool, as the same is fed into carding engines."

1004. James Wright, Bridge-street, Blackfriars, London, "Improvements in joining together armour and other thick metal plates, beams, and girders."—*Petitions recorded 8th April*, 1862.

1006. Samuel Roberts, Blackburn, Lancashire, "Certain improvements in power looms for weaving."

1008. Squire Farrow, Ashton-under-Lyne, Lancashire, "Improvements in machinery or apparatus for regulating the supply of steam from the boiler to the cylinder or pipes of steam engines, which improvements are also applicable to gases or fluids."

1012. William Davies, Llanelly, Carmarthenshire, South Wales, "Improvements in puddling, balling, and re-heating furnaces."

1014. John Langston, North-street, Strood, Kent, "Improvements in the manufacture of Portland cement."

1016. John Knowelden, Southwark, Surrey, "Improvements in steam, water, and other fluid engines."

1018. William Mays, Joseph-street, Back-road, Shadwell, London, "Improvements in machinery for grinding corn, grain, and other substances."—*Petitions recorded 9th April*, 1862.

1022. William Armitage, Manchester, "Improvements in looms for weaving."

1024. John Houghton, Foster-lane, Cheapside, London, "An improved haversack."

1028. George Dirs Mertens, Royal-crescent, Margate, Kent, "Improvements in the preparation of materials to be employed in the making of beer, and in the machinery or apparatus employed therein."—A communication from Charles Theodore Aulhorn, Dippoldswalde, Saxony.

1030. Henry Deacon, Appleton House, Appleton, Lancashire, "Improvements in the manufacture of caustic soda."

1032. John Petrie, jun., Rochdale, Lancashire, "Improvements in machinery or apparatus for blowing and exhausting air."

1034. Charles Bartholomew, Broxholme, Wheatley, near Doncaster, and John Heptinstall, Masbrough, near Rotherham, Yorkshire, "Improvements in making circular blooms, such as are used in the manufacture of tyres, and for other purposes."—*Petitions recorded 10th April*, 1862.

Invention Protected for Six Months by the Deposit of a Complete Specification.

1065. Frederick Tolhausen, Rue du Faubourg Montmartre, Paris, "A telegraphic dial printing apparatus."—A communication.—*Deposited and recorded 14th April*, 1862.

Notices to Proceed.

3008. George Clark, Craven-street, Strand, London, "Improvements in the use, application, and manufacture of iron or steel as armour for ships or batteries."—*Petition recorded 7th December*, 1861.

3110. John Leeming, North Holme-mill, Bradford, Yorkshire, "Improvements in looms for weaving."—*Petition recorded 11th December*, 1861.

3111. Richard Searle, Woodford Wells, Essex, "Improvements in the treatment, preparation, and combination of metals used for sheathing ships and marine erections, also for roofing buildings and other purposes."

3113. William Lightfoot, Harwell, Berkshire, "An improved bridle."

3119. John William Scott, Worcester, "Improvements in wads for fire-arms."—*Petitions recorded 12th December*, 1861.

3123. Stephen Barber Hewett, Railway-cottage, Fairfield-road, Bow, Middlesex, "Improvements in the construction of boilers or generators for steam engines and other uses, applicable also to evaporators, and in pumps used therewith or otherwise used, some of which improvements in pumps are applicable to pistons and piston-rods generally."

3126. Henry John Olding, Smith-square, Westminster, "Improvements in the mode of, and apparatus for, feeding steam boilers, also in apparatus for supplying fluids for other purposes, and in apparatus for raising fluids."

3131. Thomas Bow Gibson, Glasgow, Lanarkshire, N.B., "A new or improved method of ornamenting certain fabrics."

3133. Pierre Quantin, Bouscat, near Bourdeaux, France, "Manufacturing moulded earthen or stoneware cross sleepers, for superseding wooden ones in the construction of railways."

3136. John Hetherington, Manchester, Thomas Webb, Smallwood Manor, Uttoxeter, and James Craig, Tutbury, Staffordshire, "Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous materials."

3140. Richard Archibald Brooman, Fleet-street, London, "Improvements in, and apparatus for, the production and application of motive power in locomotive and other steam engines."—A communication from Felix Alexander Testud de Beauregard, Paris.

3141. Richard Archibald Brooman, Fleet-street, London, "Improvements in blowers, or apparatuses for superheating steam and other gases, and for projecting them combined with atmospheric air upon ignited combustible matter."—A communication from Felix Alexander Testud de Beauregard, Paris.—*Petitions recorded 11th December*, 1861.

3141. John Wallis, jun., Newcastle-on-Tyne, "Improvements in the preparation of materials applicable to the manufacture of paper."

3152. George Peirce Vallas, Kentish-town-road, Camden-town, London, "Improvements upon, or additions to, certain description of portable baths, with the object of rendering them available for use as trunks or boxes."

3156. John Aitken, Lasswade, near Edinburgh, "Improvements in supplying water to water-wheels."

3157. William George Laws, Tynemouth, Northumberland, "Improvements in railway point signals."—*Petitions recorded 16th December*, 1861.

3167. Samuel Sheppard, Birmingham, "A new or improved tap or stop-cock."

3178. James Bannehr, High-street, Exeter, "Improvements in apparatus for desiccating grain, seeds, and other articles."—*Petitions recorded 17th December*, 1861.

3180. William Betts, Wharf-road, City-road, London, "Improvements in the manufacture of coverings for the ends of cigars."

3185. Alphonse Treuille and Francois Xavier Traxler, Chancery-lane, London, "Improvements in the manufacture of paper and card paper or cardboard, with the object of preventing forgery and alterations in cheques and other documents, and which improvements are also applicable to the manufacture of playing cards and railway and other tickets."—A communication from M. Joseph Prosper Olier, Rue le Banque, Paris.—*Petitions recorded 19th December*, 1861.

3203. Dudley Charles le Sourf, Twickenham, Middlesex, "An improvement in cylinders used in printing calicoes and other textile fabrics."—A communication from Henry Rundig, George Bertaclay, and Joseph Porges de Porthelm, Prague, Austria.—*Petition recorded 20th December*, 1861.

3205. Timothy Morris and Robert Weare, Birmingham, and Edward Henry Cradock Monckton, Fineshade, Northamptonshire, "Improvements in submarine and other telegraphic communication, and in apparatus connected therewith."

3206. William Bennetts, Tucking-mill, Camborne, Cornwall, "Improvements in the mechanism required for, and in the manufacture and composition of, gunpowder."—*Petitions recorded 21st December*, 1861.
3214. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in apparatus for cleaning wheat and other grain."—A communication from Jean Pierre Fili, Paris.—*Petition recorded 24th December*, 1861.
3267. William Spence, Chancery-lane, London, "Improvements in deflectors for lamps."—A communication from Lemuel Beers, Newtown, Fairfield, Connecticut, U.S.
3274. Edward Thomas Hughes, Chancery-lane, London, "Improvements in saddles."—A communication from John Bloodgood Peck, Yonkers, Westchester, and Thomas Bloodgood Peck, New York, U.S.—*Petitions recorded 31st December*, 1861.
4. Thomas Hall, Odiham Wharf, Odiham, Hampshire, "An improved apparatus for removing weeds from canals, rivers, and lakes, after such weeds have been cut with a chain scythe or other machine or implement applicable to that purpose."
17. John Jacob, Gutknecht, Neuhof, near Tizers, Switzerland, "Improvements in meters for measuring gas, water, and other fluids."—*Petitions recorded 1st January*, 1862.
70. Alphonse René le Mire de Normandy, Odin Lodge, King's-road, Clapham Park, Surrey, "An improved method of fixing tubes in tube-plates."—*Petition recorded 10th January*, 1862.
158. Alfred Joseph Martin, High-street, Bow, Middlesex, "Improvements in the treatment of fusil oil, and for various applications of the same to useful purposes."—*Petition recorded 21st January*, 1862.
742. William Gossage, Widnes, Lancashire, "Improvements in the manufacture of soda and potash."—*Petition recorded 17th March*, 1862.
794. Thomas Marsh, West Bromwich, Staffordshire, "An improvement or improvements in hames for horses and other draught animals."—*Petition recorded 22nd March*, 1862.
869. Edmund Smith, Hamburgh, "Improvements in wet gas-meters."—*Petition recorded 28th March*, 1862.
903. Henry Pooley, jun., Liverpool, "Improvements in the construction of weighing machines and weigh bridges."—*Petition recorded 31st March*, 1862.
933. John Thomas Loft, Berwick-street, Pimlico, London, "Improved machinery for printing in colours."—*Petition recorded 2nd April*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

943. Alexander McDougall, Manchester.—Dated 14th April, 1859.
949. George Ashcroft, Cardiff, Glamorganshire.—Dated 15th April, 1859.
1002. James Napier, Partick, Glasgow, Lanarkshire, N.B.—Dated 21st April, 1859.
924. William Arena Martin and James Purdie, Woolwich, Kent.—Dated 13th April, 1859.
972. Joseph Seaman, Linslade, Buckinghamshire.—Dated 18th April, 1859.
977. John Freer, Rothley, Leicestershire.—Dated 18th April, 1859.
1033. Thomas Aldridge Weston, King's Norton, Worcestershire.—Dated 25th April, 1859.
1046. Robert Main, Birkenhead, Cheshire.—Dated 26th April, 1859.
1008. Edward Clark, Morley's Hotel, Westminster.—A communication.—Dated 21st April, 1859.
1010. Thomas Seaville Truss, Darlington, Durham.—Dated 21st April, 1859.
1037. Edward Humphrys, Deptford, Kent.—Dated 25th April, 1859.
1060. James Holroyd, Leeds, Yorkshire.—Dated 27th April, 1859.
1031. George Ward, Blackburn, Lancashire.—Dated 25th April, 1859.

Patents on which the Stamp Duty of £100 has been paid.

903. Joseph Whitworth, Manchester.—Dated 23rd April, 1855.
886. Richard Bright, Bruton-street, Westminster.—Dated 20th April, 1855.
880. Hyfolite Mace, Paris.—A communication.—Dated 20th April, 1855.

And notice is hereby further given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days next after the date of the Gazette (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending April 19th, 1862.

2245, 1s. 4d.; 2246, 3s. 2d.; 2247, 3d.; 2248, 1s. 11d.; 2249, 1s. 1d.; 2250, 3d.; 2251, 1s. 4d.; 2252, 3d.; 2253, 2d.; 2254, 6d.; 2256, 3d.; 2257, 1s. 1d.; 2258, 7d.; 2259, 3d.; 2260, 6d.; 2261, 10d.; 2262, 5d.; 2263, 2d.; 2264, 7d.; 2265, 9d.; 2266, 3d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for The Engineer, *at the office of her Majesty's Commissioners of Patents.*

Class 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2455. J. Dairs *and* T. Evans, *Ulverstone*, "*Engines.*"—*Dated 2nd October*, 1861.

This invention relates to the construction of those engines where the admission of the steam is regulated by the oscillation of the cylinder, and consists in the peculiar form and arrangement of the valve which opens and closes the steam and exhaust ports, and also in the peculiar mechanism by which the motion of the valve is regulated. The cylinder is mounted and oscillates upon hollow axles or trunnions, through which the steam is admitted, and the valve-chest cast with it. The valve has steam-ports upon it corresponding with those in the cylinder; and when the patentees use an oscillatory valve, a recess is formed for covering the exhaust, the valve is held upon its seat by the pressure of the steam on its opposite face, and is moved by means of a spindle connected with it; the other end of the spindle is fitted with a friction roller, or some semi-equivalent, which works in a slot link fixed upon a centre, which admits of the direction or position of the link being varied. When it is required to reverse the motion of the engine by means of a lever attached thereto, which, by being elevated or depressed, causes the friction roller to travel on one end or the other of the slot link, the friction roller traverses the slot link, each oscillation of the cylinder thus giving the necessary movement to the valve without the intervention of any eccentric or other gearing. As before mentioned the steam is admitted to the valve-chest through a steam pipe working in a gland and stuffing-box; the valve above-described resembles in shape and acting the ordinary slide-valve, the chief peculiarity being that by which the reciprocating motion of the valve is obtained. Instead of using, however, a valve which slides horizontally on the face of the seating the patentees propose to effect the same purpose by means of a circular-fixed valve placed in the valve chamber, the inner face fitting close over the steam and exhaust ports in the side of the cylinder, the other exposed to the steam which supplies the cylinder. The ports in this valve are so arranged that, while one port is over a corresponding port in the cylinder, the other is upon the blank face of the seat; the valve is prevented from rotating with the cylinder by means of a spindle which passes through it, and upon which it turns or slides in such a way so as to allow of its being continuously pressed close to the face of its seat. The end of the spindle next the valve is sometimes formed with a double joint, in order to allow of a little play; the other end passes through a small gland in the steam pipe, and a collar fitted to it prevents it from being drawn out, and a lever fixes it in position. As before mentioned, the valve has ports cut on its face at regulated distances to fit the ports of the steam cylinder, and has also a sunk or hollow portion which places the exhaust in communication with either steam port. The steam passages are formed in the usual way, and the exhaust consists of a passage in a belt cast partly round the cylinder. It will be seen from this description that the valve remaining stationary while the cylinder oscillates, one of the steam nozzles of the cylinder will gradually cover over one of the ports of the valve, and steam will be admitted into the said passage, while the other nozzle will gradually come under the hollow recess of the valve, and the steam from the cylinder will escape to the exhaust, and the contrary will be the action with the return oscillation of the cylinder; this, then, will be effected without any motion of the valve. In order, however, to open the ports of the valve more quickly, so as to cut off and admit the steam, they propose to fix a small wheel on the end of the valve spindle, and upon this wheel is fixed two studs, one on either side of its face, half a circle apart: upon the trunnion or on the cylinder, or any of the motive parts, is fixed a stud, from which passes a link which moves one end of a rocking shaft; to the other end of the shaft is fixed a gab or fork, which works on the stud of the valve spindle; the oscillation of the cylinder causes the stud to move the rocking shaft in an opposite direction, transmitting its motion to the gab, which, in its turn, acting upon the stud face of the valve spindle wheel, urges the valve in a direction opposite to that of the motion of the cylinder, and thus accelerates the opening and shutting of the valves.

2536. W. E. Newton, *Chancery-lane, London*, "*Heating the feed water of steam engines.*"—*A communication.*—*Dated 10th October*, 1861.

The object of the present invention is to heat the feed water of condensing or non condensing engines in which the steam is used expansively. This is effected by withdrawing a portion of the steam from the induction side of the piston by means of additional eduction valves, after the passage of the steam from the boiler to the cylinder has been intercepted, but before the end of the stroke of the piston, and before the eduction valve begins to open; by means of the steam thus withdrawn the feed water is heated in a vessel closed against the atmosphere. These additional eduction valves are opened and closed within the period of time mentioned, and the feed water is injected into the closed vessel, which is called the heater, and then, when heated, the water is withdrawn by a pump in the same manner that the water is withdrawn by the air pump from the condenser of an ordinary low-pressure engine.

2543. W. E. Newton, *Chancery-lane, London*, "*Condensers and condensing apparatus of steam engines.*"—*A communication.*—*Dated 11th October*, 1861.

The patentee claims the combination of a surface or external condenser placed between the side pipes and the ordinary condenser of a steam engine with a cooler for cooling the water from the hot well. This cooler is placed between the hot well and the ordinary condenser, so that the steam, after being partially condensed by the external condenser, will then be further condensed by means of the injection of the cooled water from the hot well into the ordinary condenser.

2499. A. Chaplin, *Glasgow*, "*Improved combined winding engine, boiler, and cooking and distilling apparatus, including improvements also applicable separately.*"—*Dated 7th October*, 1861.

This invention cannot be described without reference to the drawings.

2502. G. K. Stothert, *Bristol*, "*Condensing apparatus.*"—*Dated 7th October*, 1861.

For the purposes of this invention it is preferred to construct a condenser in a cylindrical form, the cylinder being somewhat longer than the tubes contained therein. The two ends of the cylinder are made with flanges, and external of the cylinder is a jacket or casing, extending nearly the whole length of the cylinder, leaving a water space between the external surface of the cylinder and the interior of the jacket, which water space communicates with the interior of the cylinder by openings near the two ends of the cylinder, and the other is arranged to slide within the cylinder near its other end, a gland or ring and packing being used to keep the same steam and water-tight.

Class 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2467. H. Law, *Essex-street, Strand, London*, "*Apparatus for raising ships and other vessels out of the water.*"—*Dated 3rd October*, 1861.

In carrying out this invention the patentee attaches the machinery, by means of which the cradle is to be moved, to the cradle itself, so that the two move together without the use or any rope or chain (otherwise than such as may be employed as the means of connection); and he effects this by constructing a powerful rack upon the slipway, against the teeth of which a pinion or an endless screw, moved by the machinery attached to the cradle, is made to bear, and thus a continuous progressive motion is imparted to the cradle, either to raise or lower it along the slipway; or he effects the same object by means of traction-rods so formed as to lay hold of the teeth of the rack, or of studs or projections upon the slipway, and which being moved alternately backwards and forwards by hydraulic pressure, or by cranks, or by any other known mechanical means, lay hold of the successive teeth or projections, and thus produce a progressive motion in the cradle, and by having two or more of such traction rods suitably arranged, such progressive motion may be made continuous. For convenience he places the moving power and machinery in a water-tight vessel attached to the cradle, and carries the shaft or traction rods by which the connection with the slipway is effected through stuffing-boxes or glands, so as to exclude the water. And, furthermore, he constructs an air-tight chamber open at the bottom, forming a species of diving bell, which is attached to the fore part of the cradle in such a position as to cover the portion of the rack or slipway against which the pinion screw or traction rods are working, so as to enable them to be constantly under inspection, and to allow of a workman removing any extraneous substance which might otherwise obstruct the working of the machinery and the progressive motion of the cradle; and he forms the entrance to such air-tight chamber by a species of air-lock, so as to enable a workman to pass into or out of the same without allowing the admission of water, and he maintains the requisite pressure of air by means of an air pump. The Second part of the said invention consists in constructing the apparatus for the immediate support of the sides of the ship or other vessel when grounded upon a cradle, or in a dry dock of hinged levers, or jointed or flexible straps, capable of adapting themselves to the form of the vessel, so that, by raising up or tightening the extremities of such levers or straps, a uniform support is afforded to the vessel, and the pressure is more evenly distributed over its surface. In some cases he connects such levers and straps with each other laterally by means of rods or ties arranged in such a manner as to form a species of network, by tightening up the extremities of which the sides of the vessels would be perfectly embraced, so as to afford a uniform and evenly distributed support. The Third part of the said invention consists in constructing the blocks or supports upon which the vessel is intended to rest when grounded either upon a cradle or in a dry dock, in such a manner as to show whether a vessel is bearing upon or in contact with each block, and also to show the moment at which such contact takes place with each particular block or support; and this he effects by attaching to each block an electrical apparatus, so contrived that the contact between the block and the vessel either makes or breaks an electric or voltaic circuit, and so indicates to a person above the water by striking a bell, deflecting a magnetic needle, or by any other of the well known means of giving a signal, that the vessel has taken a bearing upon the block. Or he effects the same purpose by having a tube or other vessel capable of being compressed and filled with either oil, water, or any other suitable fluid attached to each block, and so arranged that, when the ship comes in contact with the block, the compression of the tube or other vessel containing the fluid shall be transmitted to a pressure gauge or other indicator placed above the water. Or he effects it by having a wire connected to each block in such a manner that the grounding of the vessel upon the block shall give motion to the wire, which latter being carried to any convenient point above the water, in a similar manner to the wires of ordinary dwelling house bells, shall, by ringing a bell, or moving an index or other indicator, show that the vessel is in contact with the block. The Fourth part of the said invention consists in constructing the blocks or supports upon which the vessel is intended to rest when grounded either upon a [cradle or in a dry dock in such a manner that, when the form of the vessel is not known, or is supposed to have become altered from its having been strained or hogged, or in any other case where a difficulty might occur in knowing how to adjust the several blocks so as to injure each one receiving a due share of the weight of the vessel, in any of such cases, the vessel being first grounded upon the cradle or in the dock, and then removed, shall show what space, if any, was left between the vessel and each particular block, giving, as it were, a perfect impression of her form, so as to enable each block to be raised to such a height as to insure its taking its due share in the support of the vessel, and so to prevent the latter from being injuriously strained; and this he effects by attaching to each block a movable rod projecting above its upper surface, and so arranged as to admit of its being pushed downwards by the vessel when in the act of grounding, and remaining in whatever position it may so have been placed, and so indicating by the height of its upper surface above the block what distance, if any, existed between the vessel and the block.

2471. C. Mauvernay, *Lyons, France*, "*Signalling the passage of trains upon railways.*"—*Dated 3rd October*, 1861.

This invention consists in placing along the side of every line of railway, and at intervals between two points where attendants are situated, two vessels, so that the same water level is maintained in each. On varying the level by liquid being poured into or withdrawn from one vessel the level will be altered in the other vessel, and thus the passage of trains may be signalled from attendant to attendant all along the line. The inventor provides each vessel with a tap for drawing off liquid as required. The signals may be variously made. For instance, when the standard or ordinary level is maintained, "all clear" may be indicated. When the level is below the ordinary point, "stop the train," and when the level is raised above the standard level, it may indicate "danger." And, in fact, any required signal may be agreed upon, the whole system being based upon signalling from attendant to attendant along a line of railway by changing the water level in vessels in charge of the attendants. In winter spirit may be added to the liquid to prevent its freezing.—*Not proceeded with.*

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2475. P. Knowles, *Bolton-le-Moors*, "*Machinery for opening and cleansing cotton, &c.*"—*Dated 4th October*, 1861.

This invention consists in an improved arrangement of parts forming an opening machine to which lapping rollers are applied or not; the cotton or other fibrous materials are first acted on by a cylinder or drum with teeth, which are constructed so as to act in both directions, and beneath this is a toothed cylinder which operates upon the fibres after they have been partially opened by the first cylinder. Both these cylinders are partially surrounded by grids, and a partial vacuum is formed in the space behind one or more of the grids to assist in removing the light impurities from the fibres. The first or upper cylinder may be driven in either direction, and a swivel bar is applied for diverting the current of the fibres towards the second cylinder. The Second part of the invention is applicable to openers, blowers, scutchers, or other machines for opening and cleaning fibrous materials, and it consists in an improved feeding apparatus for supplying cotton and other fibres to such machines. The patentee employs two pairs of feed rollers, one fluted as usual, and the other with annular grooves and ribs, either square or diagonal, and fluted or plain; under the second pair of fluted rollers is a pair of serrated blades of metal, one of which has a slight lateral to-and-fro motion. When the fibres are supplied to the machine the second pair of feed rollers delivers them to the cylinder or beater which carries them over the edges of the serrated blades, the action of which loosens the dirt and other impurities, and assists in laying the fibres parallel. The last part of this invention consists in applying toothed rollers between the beaters or cylinders in those openers in which two or more beaters or cylinders are used. These toothed rollers act against stationary toothed ribs, or against movable serrated blades, as described in the Second part of this invention.

2483. J. Pratt, *Coventry*, "*Shuttles for weaving ribbons.*"—*Dated 4th October*, 1861.

This invention consists in forming the shuttle for and disposing the bobbin or spool containing the weft thread therein in a position behind the grooves, instead of in front, as heretofore, by which means the inventor is enabled to introduce sufficient thread to weave half a piece of ribbon, and about twelve times the quantity now introduced.—*Not proceeded with.*

2486. J. Tweedale, *Milkstone, Rochdale*, "*Preparing and spinning cotton, &c.*"—*Dated 4th October*, 1861.

This invention consists, First, in balancing the combs that doff the doffers of carding engines by having the centre of gravity of the shaft or bar (to which the arms that carry the combs are fastened) on the opposite side of the centre of motion to that on which the combs are, or balancing the combs when they are screwed or rivetted to the arms or plate, by means of a rod or bar fastened on the opposite side of the shaft to that on which the combs are. Also in having the connecting rod that connects the comb with the stud or eccentric that produces the vibratory motion horizontal, or at an angle less than 45 deg. to the horizon. Also in driving the combs by means of wheels or friction pulleys.

2506. A. Ford, *Priory, Battersea*, "*Forming waterproof fabrics by combining paper with woven or spun fabrics.*"—*Dated 8th October*, 1861.

The patentee claims the formation of compound waterproof fabrics consisting partly of woven or spun fabrics, and partly of paper, the paper alone being directly coated with a waterproofing agent, and its combination with other substances being effected subsequently.

2507. W. Catford, *Chard, Somerset, and* J. S. Wheatley, *Nottingham*, "*Manufacture of bobbin net or twist lace.*"—*Dated 8th October*, 1861.

This invention relates to that description of net known as "traverse net," in which the bobbin threads in making the ground of the fabric are capable of traversing from selvage to selvage, and these improvements consist in introducing ornamenting threads which are so governed as to twist or plait with the bobbin threads of the upper set of carriages, thus forming part of the groundwork of the fabric when they are not working to produce figuring or ornamental work thereon.

2490. W. Rowan, *Belfast, Cylinders or drums and beaters for machines for scutching and preparing flax and other fibres.*"—*Dated 5th October*, 1861.

This invention consists in forming the cylinders or drums in segments, and in making one end of each segment fast to the frames, while play is allowed to the other end, limited by stop pins or otherwise; the free end of the segments, or those to which the play is allowed, carry the combs and beaters, or other tools or apparatuses intended to act upon the fibres, and the rapid rotary motion imparted to the drum causes the combs, beaters, or other apparatuses to be thrown by centrifugal force with a spring-like action into and amongst the fibres.

Class 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

2487. J. Lansley, *Brown-Candover, Hants*, "*Ploughs, drills, scarifiers, &c.*"—*Dated 5th October*, 1861.

This invention relates more particularly to the peculiar arrangements and mechanism adopted for guiding and steering the implements, and also the peculiar arrangements adopted for the purpose of setting and adjusting those parts of the same which regulate the depth of the work done, and the position of the line of draught for the horses. To effect these objects the patentee proposes to form the head of the beam of ploughs (and the same is applicable to all implements having to produce work of a similar kind) detached from the other portion, but connected with it in such a manner that the driver can at will set it free, so as to enable the share to be turned out of the furrows by throwing it down without affecting the front or steering and guiding portion, and hence enable the implement to turn or be guided or steered in a much more simple and effectual manner than heretofore, that is to say, when at work in a straight line the beam is perfectly rigid, but, when it is wished to turn, the head can be detached from the main part without the driver leaving his position, and thus the guiding or steering of the implement is rendered much more effective. He effects this by forming the head portion of the plough, so as to work after the manner of a swivel in the other portion, and by means of a catch, which throws it in and out of gear at the will of the ploughman. The next part of the invention relates to the method of setting the plough to a proper depth, and at the same time regulating the line of draught. To obtain these objects the head of the plough is formed so as to terminate in an eye; upon upright bearers, which rest upon the axles of the wheels, there slides a small square draught frame, so as to move upwards and downwards; centrically in this frame is placed the eye-head of the beam, and the regulating screw then passes through both the draught frame and the head of the collar above both; hence, by adjusting the screw, the beam and the draught frame are at the same time raised or lowered, as may be wished.

2505. J. C. Willsher, *Petches, Finchingfield*, "*Combined threshing and dressing machines.*"—*Dated 7th October*, 1861.

The object of this invention is to simplify the construction of threshing machines. This the patentee proposes to effect by connecting the screens or riddles with the shaker-bars in such a manner that the requisite motions for the screens or riddles will be communicated through the shaker-bars, instead of through the mechanical appliances usually provided for that purpose.

Class 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

2509. G. Glover, *Lowestoft*, "*Fire-proof doors and window shutters.*"—*Dated 8th October*, 1861.

In constructing fire-proof doors the inventor forms them of fire-clay moulded to the required form, with or without a lattice of hoop iron in the middle of the thickness. The doors are arranged to hang on pivots and cups, and the pivots are to be moulded on and to form part of the door, and are to be tipped with gun metal; the cup is to be of the same material, and the fasteners are also to be of fire-clay. The doors are to be arranged to close against plugs of india-rubber or felt, so as to prevent undue concussion. Doors for trap-ways may also be made in the same manner.—*Not proceeded with.*

2518. J. Walker, *Knockagh, Carrickfergus, Antrim, Ireland*, "*Chimney top, cap, or cowl.*"—*Dated 9th October*, 1861.

This invention consists, First, in the construction of pots, cowls, or wind guards full of small holes or slits, so that the wind, when bounding against the pot, has its force broken up, and is minutely subdivided, so that, in mixing with the heated air within the pot, it accelerates the expulsion of the same. Secondly, to prevent downward draughts, and to facilitate the expulsion of the smoke the inventor adds to the above pot an elastic top, which bends over with the force of the wind, and readjusts itself when the wind ceases, which constant motion also prevents the soot being deposited.—*Not proceeded with.*

Class 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

2465. J. C. Haddan, *Bessborough-gardens, Pimlico, and* C. Minasi, *St James's-terrace, Kentish-town-road*, "*Improvements in the mode of discharging cannon, and in apparatus for facilitating the proper aiming with fire-arms.*"—*Dated 3rd October*, 1861.

This invention has reference to an improved mode of discharging cannon, and comprises the adaptation and use of a rod or sliding plunger passing through the vent of the vent pieces of breech loaders, such as the Armstrong guns, or through the vent of other cannon, which rod may carry on it a percussion cap, or other igniting contrivance, or which may be caused to strike on or against a cap or igniting contrivance placed on a nipple, or otherwise placed within the vent piece of the gun itself, the intended effect of which is to prevent or lessen the injurious heating of the vent. Also the invention comprises the constructing the stocks or supports to or upon which the barrels of rifles are mounted, with the butt or a part of the butt hinged or jointed to the remainder or barrel holding portion of the stock, so that, by adjusting the position of the butt, the rifleman, whether firing at short range or at long, or at long intermediate range, may be enabled, while properly sighting the object aimed at, to place his eye or cheek low down, or as nearly against his shoulder as may be convenient, instead of as at present (when firing at other than short ranges) being obliged to raise the eye or cheek for properly sighting the object.—*Not proceeded with.*

2522. F. Curtis, *Newton, Massachusetts, U.S.*, "*Fire-arms.*"—*Dated 9th October*, 1861.

This invention cannot be described without reference to the drawings. The patentee claims making a fire-arm with an expanding tube or breech pin, which shall be permanent with or form part of the arm itself. He also claims constructing the breech pin and breech carrier of a fire-arm in two parts, and so connecting them together as to be enabled to introduce into, and withdraw the said breech pin from, the bore of the barrel in the line of its axis, substantially as described. He also claims, in combination with the breech carrier and breech proper, when the two are jointed together as described, a spring, so arranged in relation to the said breech as to retain it in the same position with regard to the breech carrier that it has when it leaves the barrel, so as to establish a yielding connection of the parts, as set forth.

2501. W. Keiller, *Perth*, "*Signalling for rifle practice.*"—*Dated 7th October*, 1861.

This invention consists of a ball or disc made to move from place to place on the target, or on a signal board erected for the purpose, so as to indicate to the shooting party the precise point of the target which the ball has struck.—*Not proceeded with.*

2514. R. W. Sievier, *Guildford-street, Russell-square, London*, "*Batteries for the purposes of war.*"—*Dated 9th October*, 1861.

This invention cannot be described without reference to the drawings.

2498. R. P. Walker, *Wolverhampton*, "*Improvements in rifle sights and rifle sight-guards, and a new or improved rifle cleaner.*"—*Dated 7th October*, 1861.

In making rifle sights according to this invention the inventor cuts away that part of the sight situated under the V-shaped or other notch through which the aim is taken, by which construction the object aimed at is seen underneath the said notch, that is to say, the said notch, instead of being cut out of a solid piece or bar of metal, is of a skeleton form. This part of the invention is applicable to all kinds of rifle sights, and to the fore sights as well as the back sights. The invention consists, Secondly, of a rifle sight-guard made of a strip of tempered steel. The said strip is bent into a tubular form, one end of the said strip being made into an arch. The tubular part springs on the end of the rifle barrel, and the arch part covers the fixed sight. By means of a slight projecting tongue cut in the tubular part, and near the arch part, the said tubular part can be readily sprung open so far as to permit of its ready removal from the barrel. The invention consists, Thirdly, of a rifle cleaner constructed as follows:—The said rifle cleaner resembles the ordinary rifle cleaner, excepting that, at its acting part, it carries a piece of tubular vulcanised india-rubber held by its middle. The free ends of the said tubular piece of vulcanised india-rubber expand during use, similar to the manner in which the cupped leather of a pump-bucket expands, and the cleaning of the rifle is thereby more effectually accomplished than by rifle cleansers of the ordinary construction.—*Not proceeded with.*

Class 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

2523. W. Palmer, *Sutton-street, Clerkenwell, London*, "*Lamps and lamp wicks.*"—*Dated 9th October*, 1861.

For the purposes of this invention in place of constructing the wick tubes or pipes of lamps in an upright position, as heretofore, they are constructed in such manner that the wicks pass out in a lateral direction, two wick-tubes or pipes being used. The wick rises up one wick-tube or pipe, and passes out laterally, and then enters the mouth of the other wick-tube or pipe, so that the wick stands horizontally, or nearly so, across a space between the two wick-tubes or pipes, and it is in this portion that it is lighted. The wicks each contain a wire or wires of copper or other material which will not turn, so that a wick may be moved a distance across the space between the two wick-tubes or pipes, by the wick in the second-mentioned tube or pipe being caused to draw a fresh portion of the wick out of the first-mentioned tube or pipe.

2508. H. Willis, *Albany-street, Regent's Park, London*, "*Organs.*"—*Dated 8th October*, 1861.

This invention relates, First, to the employment of certain means for overcoming the resistance caused by the pressure of the air upon the valves of the organ, and for reducing the noise occasioned by their closing, the object being at the same time to retain the simplicity of action of the ordinary valve. The invention relates, further, to certain means for operating the "swell," the object being to enable the performer to obtain with facility a crescendo and diminuendo when his feet are already fully employed on the pedals. To this end the patentee provides a mouth piece attached to a flexible tube leading to a pneumatic apparatus in connection with the organ swell, and he so arranges the pneumatic apparatus that the performer, by blowing into the tube, will be enabled to set in motion and cause it to open the shutters of the swell to any required extent. The invention cannot be described in detail without reference to the drawings.

Class 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting Glass, Pottery, Cements, Paint, Paper, Manures, &c.

2435. J. Lush, *Portsea*, "*Mashing attemperators.*"—*Dated 30th September*, 1861.

The object of this invention is to avoid the injurious effects of what are known in brewings as "raw worts," by which much of the useful portion of the malt is lost, and the quality of the beer is deteriorated. This is obviated by the use of this invention, which raises the temperature of the mash to any required heat, and retains it at such temperature as long as may be required, and in a manner which produces no damage to the mash, as is the case with most, if not all, mashing attemperators at present in use. For the purpose of carrying out these improvements the patentee fixes in the mash tun an upright shaft, which is carried at the top by suitable bearings, and at the bottom by a shoe or step fixed in the bottom of the mash tun; this shaft is caused to revolve by gearing driven by steam or other motive power, and it is made hollow for a portion of its length to carry the steam and water required in using the attemperator. On to this shaft are bolted or otherwise secured one or more arms, which are placed at right angles to the upright shaft, close to the false bottom of the mash tun, and are carried nearly to the length of the inside diameter of the mash tun. On to each of these arms are cast one or more flanges, and to these flanges are fixed by bolts or otherwise vessels of copper or other material of suitable shape (which may be either round or oval, parallel, coned, or otherwise), which stand upright on the arm or arms, and which are therefore parallel with the upright shaft; these copper vessels are connected at the top to an arm which is fixed above them in the upright shaft, and which is perfectly parallel with the lower arm, and where more than one copper vessel is used on each arm, they are formed hollow, so that the copper vessels may be in communication with one another; these vessels are filled with heated water up to a point indicated by a gauge cock fixed in the side of the vessel, and they are furnished with a safety valve to remove any superfluous pressure, and a thermometer to indicate the temperature of the water in the interior of them. Each copper vessel is furnished with a pipe descending from the top arm nearly to the bottom inside of it, and connected with a regulating cock to the upright hollow shaft. The top of this upright hollow shaft is furnished with a stuffing box and gland, forming a joint for the pipe or pipes supplying steam or water as required to the attemperator.

2438. E. Reoche, *Paris*, "*A new medicinal preparation.*"—*Dated 30th September*, 1861.

This invention consists of a medicine to be applied internally, which is beneficial for rheumatism, neuralgia, gout, stomach chest, and liver complaints, cramps, flatulence, cholera, and to diseases in general, contagious or otherwise. The inventor prepares it from the roots of the pomegranate tree and date tree, to which may or may not be added that of a plant known in France as "Santoreé." These he macerates in brandy or other spirit alone, or it may be in brandy and wine mixed, or in wine alone. He allows the whole to ferment, and then bottles off and keeps for use as required.—*Not proceeded with.*

2441. P. A. Bobœuf, *Paris*, "*The preparation and application of certain new hæmostatic and antiseptic agents.*"—*Dated 30th September*, 1861.

This invention relates to the manufacture and application as hæmostatic gents of alkaline "phenates" and salts, obtained by means of mineral and vegetable essential oils soluble in caustic potash or soda. By this invention the patentee obtains new hæmostatic agents, superior to any hitherto known, by using alkaline salts produced either by phenic acid (no matter the nature of the substances from which the acid is derived), or by acid oils saponifiable and soluble in caustic soda or potash derived from vegetable and mineral essential oils, especially coal, peat, wood and ligneous oils, acid oils which, when not actually phenic acid, are analagous or homologous (such as creosote) and possess, like phenic acid, the same hæmostatic properties.

2456. W. Maltby, *De Crespigny Park, Camberwell*, "*Starch.*"—*Dated 2nd October*, 1861.

In carrying out this invention the patentee takes rice and puts it into a vessel, preferably conical or bell shaped, and having a false perforated bottom or strainer. This vessel is fitted with two outlets, one in or near the bottom, the other in the side near the top. He also has in it an inlet pipe in or near the bottom. He introduces with the rice a dilute alkaline solution of a strength similar to that usually employed by starch makers, and in such a quantity as to cover the rice. When the solution has remained about the usual time with the rice it is allowed to run off through the bottom outlet. He there washes the rice with clear water by passing the latter through the outlet pipe among the rice, until it passes off clear at the outlet near the top. He then adds more alkaline solution to the rice, and repeats the operation above described, until, by adding an acid to a small quantity of the liquor, no precipitate is produced, or the rice does not colour the alkaline solution. The liquor is now allowed to run off, after which he introduces at the inlet pipe, and passes through the mass, a solution of alum, or of bisulphate of soda or potash, or any such earthy or metallic salts as will produce a white precipitate by the addition of an alkali, until the starch becomes white, and the alkali it contains is neutralised. He then washes the rice thus treated with clear water, dries it, and, after grinding, it is ready for use. The next part of the invention relates to the method and means adopted in treating starch, rice, flour, or any other such like substance containing starch, in order to render it more soluble, and capable of producing a better glaze, or more gummy. He takes from one to four pounds of malt, flour or ground malt, or, say the husks of malt with just sufficient water to obtain a solution of the diastase, and combines this with about thirty-two pounds (or more or less, according to the material used, and the quality of it) of starch, rice, flour, or other starchy substances; after standing some time at an increased temperature he dries the mass, and, after being ground, it is ready for use. In order to improve the colour he decolourises the solution of diastase with alumina.

2474. J. Stuart, *Poplar, London*, "*Treatment of oils obtained by the distillation of bones, &c.*"—*Dated 4th October*, 1861.

This process is to treat common bone oil with hydrochloric acid, or a solution of sulphuric acid; then to separate the dirty acid, and treat it with alkalis, when a substance is deposited which forms a brown pigment. The oil so treated is then placed in a retort, with certain proportions of oxide of iron and carbonate of potash, and the whole is then distilled over until perfectly dry, the product being refined bone oil, and the residuum left ferri cyanide of potash, and may be used as such or converted into Prussian blue. The proportions used may be, to each gallon of oil, one pound of hydrochloric acid, or dilute sulphuric acid, six ounces of oxide of iron, and eight ounces of carbonate of potash, but the inventor does not bind himself to the above proportions.—*Not proceeded with.*

2480. G. Knox, *Skinner's-place, London*, "*Paper making machines.*"—*Dated 4th October*, 1861.

The object of this invention is the production of a readily cleansing "knotter." The patentee makes a circular knotter plate of brass or other metal, or he puts together a number of segmental plates, say eight or any other number, so as to form a circular knotter plate, the cuts or slits being of the dimension and size commonly in use. He fixes this knotter plate in a bed or framework of convenient depth to admit of a continuous flow of pulp from the pulp chest being distributed over the part of the surface exposed thereto, and underneath which is placed a trough to receive the pulp and pass it to the machine. By means of some convenient mechanical arrangement he makes the knotter thus completed to rotate horizontally, and he communicates to the same, by appliances to the axis or shaft through the centre, the jumping motion which is now generally given to knotters, for the purpose of shaking the fibre through the knotter plate, and thereby supplying the wire of the machine. This trough which he places for the supply of the machine at the end thereof, and contiguous thereto, is the shape and size of one half of the circle by a line drawn through the centre, although it may be of other proportions, and he places another trough forming a like semicircle underneath the other portion of the knotter plate, the contents of this trough being conveyed by means of a pump to the beating engines. He also divides the upper surface of the knotter plate into two parts, one of which includes the entire semicircle or other proportion of the knotter plate placed above the trough for the supply of the machine, and one fourth or other proportion of the other semicircle (making five eighths of the entire circle), and this division he effects by means of a belt or cushion of vulcanised india-rubber, or other suitable material, of the depth of the knotter bed fastened to a frame, so that the india-rubber, by means of a spring applied to the frame, presses firmly against the knotter plate, and is kept in a slightly inclined position towards the same, and which frame has communicated to it the same jumping motion as the knotter. He applies to the three eighths, or other proportion of the knotter plate which is thus kept free from pulp, a constant stream or shower of water, with such a degree of force as will entirely cleanse the cuts of the knotter plate as they come under its operation by the circular motion of the knotter, and the part thus cleaned passes under the india-rubber belt, and is brought again as clean as a new knotter plate to receive fresh pulp. On the small section of the knotter plate, viz., one eighth or other portion which receives the pulp on the upper surface but is always moving over the water trough and never over the machine trough, the knots will accumulate as the plate moves round, but they are kept back by the india-rubber belt, and as often as may be necessary are removed with an india-rubber scoop or other contrivance, care being taken not to approach too near the part over the machine trough so as to injure the quality or disturb the weight of the paper.

Class 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

2464. W. T. Henley, *St. John's-street-road, Clerkenwell*, "*Magnetic and electric telegraph apparatus.*"—*Dated 3rd October*, 1861.

This invention has reference to two previous patents, dated respectively 22nd November, 1856 (No 2769), and 23rd March, 1861 (No 734), and consists in dispensing with the crank wheel and pinion or cam wheel and roller, and simply having a wheel or two wheels fixed together and turning on a central stud, such wheel or wheels having pieces of iron fixed on the periphery or near the edge, which pieces make connection between the permanent magnet and the detached armature, thereby conveying magnetism from one to the other, the movable pieces being rendered magnets by the permanent magnets in turn rendering magnetism in the stationary soft iron, the pieces on the wheel corresponding with the letters on the dial, there being half as many pieces on each wheel as there are letters, each piece on the upper wheel connecting the upper end of the temporary magnet alternately with each pole of the permanent magnet, each piece on the lower wheel doing the same with the lower half of the temporary magnet; in this way all complicated machinery is dispensed with; the wheel being caused to turn on the central stud, without quite touching the magnet, produces as many currents in one revolution as there are letters engraved on the dial, and causes the indicator to make one revolution on the letter.

Class 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

2366. A. Parkes, *Birmingham*, "*Manufacture of castings, rods, bars, bolts, nails, rivets, and sheets when alloys of copper are used.*"—*Dated 21st September*, 1861.

For the purposes of this invention it is preferred that the alloy should consist of fifty-five parts of the best and purest copper, forty five parts of the best and purest zinc, and from a quarter per cent. to two per cent. of tin or aluminium.—*Not proceeded with.*

2368. S. Desborough, *Noble-street, London*, "*Pins for hair, dress, jewellery &c.*"—*Dated 21st September*, 1861.

This invention consists in manufacturing the said pins from spirally formed wire.

2448. J. Dellagana, *Shoe-lane, Holborn, London*, "*Finishing and perfecting curved or circular stereotype plates.*"—*Dated 4th October*, 1861.

This invention relates to thin stereotype plates used in printing machines, in which they are fixed on a cylinder, and form a cylindrical surface. In these plates it is of the utmost importance that they should have a truly cylindrical form or part thereof, and also that they be of uniform thickness, to produce which the inventor subjects curved stereotype plates to a planing, smoothing, and compressing process, placing them on a metal bed smoothly and truly prepared of the form desired, over which a curved instrument travels in a longitudinal direction, being forcibly impelled and rigidly confined by suitable guides in its course over the stereotype plate. The plate being held by suitable stops, the instrument, in passing over the plate, forces every part of its surface down on the curved bed, by which it receives its true form. The instrument, at the same time, shaves or removes from the back part of the plate any excess of thickness, and reduces the whole to a uniform thickness.—*Not proceeded with.*

2188. J. Edwards, *Aldermanbury, London*, "*Buttons.*"—*Dated 5th October*, 1861.

This invention consists in the application of brass, copper, or zinc coated with German silver in any way to the manufacture of buttons, or parts of buttons; also in the application of a metal face to bone buttons, when such buttons are made with a projecting shank or neck for the button hole to work on.

2489. E. Partridge, *Southwick, Staffordshire*, "*Hardening iron and steel.*"—*Dated 5th October*, 1861.

This invention consists in first heating the article to be hardened in a bath of lead or other suitable molten metal, or in a retort or vessel, so as to be protected from the direct action of fire in applying to it, either in the bath, or immediately on its withdrawal therefrom, the following composition or substance, either in a state of powder, or in a liquid state, and in some cases in returning the article to the bath or retort after such application. The invention also consists in preparing the composition or substance for hardening iron and steel with the materials, and in manner following:—The inventor takes prussiate of potash or other substance containing cyanogen, or possessing like chemical properties, and reduces it to powder; he mixes with it powdered nitre and common salt, and fires it or sets fire to the composition. He takes the resulting ashes or substance remaining after the firing and powders it; this powder liquifies under heat, and he uses it alone or mixed with charcoal, animal or vegetable, or other suitable form of carbon; or he liquifies the powder by dissolving it in liquid ammonia, or other suitable solvent, and applies it to the articles to be hardened in a liquid state.—*Not proceeded with.*

2493. J. Turner, *Upper Thames-street, London*, "*Machine for mincing, mixing, and pounding.*"—*Dated 5th October*, 1861.

This machine is constructed and arranged out as follows:—A mixing receptacle is employed to contain the articles to be operated upon; it is supported on a central pivot, and is free to revolve thereon. Motion is communicated to the receptacle by a handle placed on a horizontal shaft, carrying an endless screw gearing into a circular rack on the outside of the said receptacle. Pulleys are keyed on each end of the said horizontal shaft, and convey the motion, by means of bands, to fly-wheels placed on each side of the machine, and connecting rods attached to each of the fly-wheels communicate motion to a crosshead working over the said receptacle. To the said crosshead is attached the mixing or other instrument required for use in the different purposes to which the machine is applied for mixing purposes; a pair of whisks are used, the prongs of which pass between each other as the whisks revolve within the said receptacle.—*Not proceeded with.*

Iron Armour. Ordnance.—The subject of iron armour for ships' and the best mode of piercing it, is every day occupying public attention more and more in Paris. It is said that at a trial made at Vincennes on Monday week with a newly-invented rifle cannon the ball traversed iron plates 12in. thick.

Foreign and Colonial Jottings. — The British South Pacific Mail Company is likely to obtain a subsidy from the Government of Chili for the purpose of enabling it to establish a connection with the Brazil and Southampton line from Valparaiso through the Straits of Magellan. A line of steamers connecting Chili with Uruguay and the River Plate provinces is also projected.—A very expensive commission has been sitting at the Hague for five months for the purpose of inquiring into the best means of improving the Dutch navy, and the affair between the Monitor and the Merrimac, it is mournfully observed, has rendered the investigation perfectly useless.—It is stated that six different plans have been submitted to the French Minister of Marine for the transformation of the wooden steam-ships of war in the Imperial navy into iron-cased ships of the most powerful class. It is said that one ship of war will be armed with a spur which alone will weigh 30,000 kilogrammes. The *Courrier de Lorient* contains the following remarks on the new iron-plated frigate the Couronne: — "This terrible engine of war, of superior speed, has no rival on the seas. Iron-plated all over, she can strike a vessel with a speed of 14 knots an hour. Her 40 rifled guns can be fired during the worst weather. She answers her helm admirably, and rises on the waves like the lightest wooden ship. In a word, the Couronne combines all the qualities required to constitute a formidable ship of war, as well as those of a fast sailing packet for the transatlantic service."—The *Northern German Gazette* states that the naval encounter between the Merrimac and Monitor has created great excitement at Hamburgh. Public opinion calls upon the Senate to come to an understanding with Bremen for the immediate construction of several iron-cased gun-boats for the protection of the coasts of Northern Germany.

Iron-plated Ships of War.—We are informed that a step of great importance in the existing state of our naval affairs has just been taken by the Board of Admiralty. It is well known that at the present moment our entire fleet of small vessels of war is built of wood, and is wholly unprotected by armour plating. Every corvette, sloop, and gunboat in the service is liable, therefore, to sudden and complete destruction by the shell fire of an enemy. In view of these facts a complete stop has recently been put to the construction of further vessels of this kind in the royal dockyards. In France, for some years past, and in America during the last year, small iron-plated craft have been designed and built; but in all cases these have been fit to operate upon home coasts and harbours only, and have been wholly incapable of performing general sea service. Our own Admiralty and their constructors have naturally been averse to the building of similar vessels, but, at the same time, no means of producing sea-going plated ships of moderate dimensions have been devised. At length, however, a method of construction has been devised, which is said to afford great security with a comparatively small amount of plating, and which has met with the full approval of the Board. The new design has been made by Mr. E. J. Reed, formerly of the School of Naval Construction, Portsmouth, now secretary to the Institution of Naval Architects, under the general supervision of Admiral Robinson, the Controller of the Navy. It is applicable to ships of various classes, and provides for the use of a powerful plated battery of Armstrong guns, with a great range of fire; for the security of the ship from penetration between wind and water; for steaming power scarcely inferior to that of the present unprotected vessels; and for the protection of boilers, engines, rudder-head and steering apparatus. These advantages are said to be secured without at all compromising the fitness of the ship to receive a complete rig and equipment, so that she may be fit for sea service in any part of the world. The design, we understand, has been placed unreservedly at the disposal of the Admiralty, who have issued an order for its immediate adoption, and have appointed the inventor, Mr. Reed, to superintend the construction of the vessels in her Majesty's dockyards. The timber now in store, and even that already converted, will be available for the new vessels, which are to be timber-built below the water, but incombustible at the upper part. Although the design was only completed a week ago, all the preliminary arrangements for carrying it out have already been made, under the immediate care of the Controller and the Duke of Somerset. The first vessel is to be commenced forthwith at Deptford dockyard, and is to be named the Enterprise.

The London Drawing Association.—We have much pleasure in directing the attention of our professional readers and the public generally to an undertaking which has recently been established in Duke-street, Adelphi, London, under the above title. The object of this association appears to be that of executing for engineers, architects, and others, their occasional and surplus work, which either from want of room or want of a sufficient staff they are unable at certain times of pressure to execute in their own offices; and what has hitherto been generally put out, and falls into the hands of the lithographers or law stationers, whose want of the *practical* knowledge and professional skill required for this particular and important description of work is continually productive of great and ruinous inconveniences, more especially when such work requires to be done with great rapidity, in a given specified time, such, for instance, as the preparation of plans for Parliament, &c. In this instance alone we consider such an association a most desirable advantage, inasmuch as from all the members of it being practical, civil, and mechanical engineers and architects, who thoroughly understand the various conditions of the work they may be called upon to perform, a guarantee is provided against error, and no small amount of anxiety is removed from the minds of those requiring such work to be done. The association is also calculated to be eminently useful to inventors and professional gentlemen who frequently require designs to be carried out and drawings made, either from sketches or objects. We also notice that drawing and engraving on wood are undertaken, and in this particular instance the correct execution of mechanical engraving can be secured, of the desirability of which a glance at the general run of mechanical blocks will in a moment convince us Photography also comes within the sphere of the operations of the society, as applied to machinery, architecture, and other professional matters, which is highly desirable, as there are no parties in London who have made this branch of the arts a special study. To the foreigner, and persons visiting the metropolis, who are so frequently at a loss how to get their designs carried out, or drawings, &c., made, this association cannot fail to be of great value; and as both designs and working drawings of machinery of every description can be furnished, the establishment only requires to be known to be largely patronised, and where it is frequently the case that contract and other tracings require to be got out correctly and in a short space of time, we think such work cannot fail, if entrusted to the association, which we heartily wish all the success it so justly deserves.—*Builders' Weekly Reporter.*

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(*From our own Correspondent.*)

The Holidays in South Staffordshire—Continued Favourable Reports from Ironmasters: *Expectations relative to Armour Plates: The American War and the Proposed New Tariff*—Pig Iron: *Indian Contract: Coal Machine*—Hardwares: *Progressive Improvement: French Metal Goods for Japan*—Extension of Protection to Copyright of Designs in Metals—Labour Market: *Strike in Nail and Chain Trades*—The Biter Bit—Brown Paper Water Pipes: *Their Doubtful Value.*

Not many orders have been received for finished iron in South Staffordshire this week; but those that have come to hand all indicate a soundness of trade, and were, with rare exceptions, offered at makers' prices. Only very few of the works have resumed since they stopped on Thursday last. Some recommenced last night, but many will remain silent till Monday evening or Tuesday morning next. The attendance of ironmasters and others on Change in Birmingham yesterday (Thursday), and Wolverhampton the day before, indicated that employers as well as employed are availing themselves of the opportunity which the holiday week presents to leave business. On account of the limited attendance very little business was done. Still, the reports communicated were such as to confirm the description of the present state of the trade that we have just given. Certain houses complained of the inconvenience which they are suffering by the week's relaxation. Customers have, in most cases, kept back their orders as long as possible, and when specifications are received the time for the manufacture of the iron is limited to so brief a period that, under the most favourable circumstances, difficulty is experienced in meeting the requirements; and the difficulty is, of course, the greater now that such an interruption takes place as a week's holiday. In its modified form of yesterday's date, as to the extent of the carnage, the important news from America has been received with satisfaction, not so much because of what the *Times* calls the "blood-relationship" which exists between this country and America, but because of the speedier termination of the dispute which would be thereby indicated, do the ironmasters of South Staffordshire desire that, "if they will fight," both North and South should "fight well." But the prostrate condition in which both divisions of the American continent will be left on the cessation of hostilities forced itself with greater prominency than hitherto upon the attention of most of the members of the trade. The American market is, therefore, looked upon as possessing features in regard to the future of a by no means cheering cast. Nevertheless, the news that a resolution, instructing the Committee of Ways and Means to report a new Tariff Bill, was laid on the table of the House of Representatives, by a vote of 85 to 35, should be received with some apprehension, for although the future transatlantic demand may not, for some years, be nearly so large as it at one time was, yet we could not afford to be shut out of that market, and there is reason to fear, arguing from the recent protective tendencies of the commercial legislation of United States Governments, and the influence of the American ironmasters on that legislation, that any change upon the Morrill Tariff may, in respect of British iron, be of a yet more protective character than that bill possesses. At the same time it is cheering to remember that, if the prevailing fears should prove well-founded, such a measure must be considerably modified before any arrangement can be come to which would bring back the Southern States into the former Union. Wistful glances continue to be thrown by the ironmasters of this district towards the iron which Government hereafter requires for the defence of our ships and arsenals, and many are not without hope that it may be, by and by, found that layers of plates, say an inch thick, may be applied to ships' sides with greater success than solid plates of the same combined thickness. In such a case South Staffordshire expresses her readiness to enter the lists and produce iron which shall be of unequalled excellence.

The pig market is inactive. Most of the sales that will be made for a short time to come were effected during the Quarterly Meetings. Upon the orders then received most of the makers of foreign and native iron are tolerably active; and they are therefore firm in their demands of rates, which are decidedly in favour of vendors.

The Director-General of Stores for India is advertising for a supply of pig iron, tenders to be in before two on Monday next.

Coal is inactive; most of the colliers have been "keeping" the Easter week.

The reports from the general hardware manufacturers all indicate a continued improvement. The condition of "depression" seems to be gradually giving place to one of comparatively steady trade, nearly full time being now worked at the houses where goods of the tin-plate and japanned class in demand in the spring season are mostly manufactured. The prospects of the home market are gloomy, but the continental and foreign demand generally is such as to produce a marked beneficial effect. France and Italy continue excellent customers.

We learn from Paris that the Japanese ambassadors are said to have ordered the delivery of manufactured metallic goods of the value of 80,000,000f. in exchange for wool and cotton goods. In the benefits of that order we are hoping to participate in and about Birmingham.

Considerable satisfaction is being expressed by certain manufacturers in Birmingham at the success of their efforts, through the Chamber of Commerce of that town, conjointly with the Sheffield Chamber, to obtain an extension of copyright in ornamental designs in metal work to five years, a period that will compensate for the loss of time variously estimated at from six to twenty-four months in the preliminary arrangements and the preparation of the designs previously to the manufactured article being presented to the market. The majority of the manufacturers, however, in Birmingham and Wolverhampton are of opinion that the period of protection before in force was long enough.

The labour market continues over supplied, with consequent quietness in all the branches but those very restless ones of the nail and chain trades. In these trades there are a vast number of men out, striking against a proposed slight reduction in their wages: and the difficulties are being increased by the encouragement which some of the men receive from certain masters who profess the opinion that the reduction is not called for by the necessities of the trade.

Here is a singular case of "the biter bit." A colliery engineer named Henry Smith summoned his late employer, Mr. S. Mills, of Darlaston, in South Staffordshire, last Monday before the magistrates at Willenhall, for wages which he alleged were due to him. Upon receiving the summons Mr. Mills at once obtained one against Smith for wilfully damaging some winding gearing, of which he had the charge, and for the damaging of which he had discharged him, refusing payment of the wages at that time due. The magistrates dismissed Smith's summons against his employer, and adjudged him to pay between £4 and £5, the amount of the damage, or to be imprisoned a fortnight.

Brown paper water pipes would seem to have been laid down by the Corporation of Bridgenorth, with what success the following extract from the communication of a newspaper correspondent in that town would seem to indicate. He says—"The new waterworks still weeps like the clouds for which this fickle month is remarkable, and there seems to be no prospect that the brown paper pipes, cheaply contracted for, will ever be made to hold water."

Thames Embankment.—The Duke of Northumberland, who holds property along the river side, has petitioned the House against the bill for the Thames embankment, and prays that he may be heard, by himself, council, agents, and witnesses, before the committee appointed to consider the subject, in respect of any provisions contained in prejudicial to his rights and interests. The Metropolitan Board of Works and other bodies have also petitioned to be heard against the bill.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(*From our own Correspondent.*)

Northern Topics: *The Cleveland District: Iron Bridges for Italian Railways: Sunderland Dock: Iron Steamer for Rio Janeiro*—Sheffield: *The Atlas Steel Works: State of Trade*—Liverpool: *Mersey Docks and Harbour Board: Testing Wire Rope: Colonel Clay on Projectiles and Iron-plated Vessels*—The Stock of Cotton—Employment at Manchester: *Machinists and Foundries*—Glasgow: *Monster Forging for the Hector: Steam Shipbuilding*—Institution of Engineers in Scotland.

Trade is considered to have slightly improved in the extreme north. In the Cleveland district the *Newcastle Chronicle* states that all the works are fully employed. A fact deserving of note in connection with the trade of the district is that while in 1860 only 30,000 tons of iron were shipped to France, in 1861 over 90,000 tons were forwarded to that country, illustrating the benefits which the ironmasters and trade of the Cleveland district generally have reaped from the French commercial treaty. Two principal firms are at present engaged in the execution of large orders for railway chairs for lines in the south of France. Mr. Snowdon, late of the firm of Snowdon and Hopkins, Tees Side Ironworks, Middlesbro'; Mr. Leeman, deputy chairman of the North Eastern Railway; and Mr. Muschat, coal-owner, are stated to have purchased a plot of land in the Rosedale district for the purpose of erecting steel works. It is not at present known whether they propose to manufacture steel in all its varied forms, or whether they intend to turn out simply steel plates for ship and boiler purposes. The Cleveland plates have shown themselves quite equal to the tests to which they have been submitted, and will probably find a ready market. The branch line from the North Eastern Railway to the Rosedale Mining Company's Works has now been completed, and will open out the Cleveland ironstone to other districts, running as it does to Stokesley, and on through the very midst of ironstone hills and cliffs. In connection with other northern topics it may be stated that Messrs. Head and Ashby, of Stockton, are executing contracts for twenty-nine wrought iron bridges to be erected in connection with Italian railway lines. The bridges will weigh altogether upwards of 1,000 tons and are to be delivered in the course of the summer. Mr. Abernethy, the engineer called in to confer upon the plans and estimates prepared for the proposed extension of Sunderland Dock, visited the town last week. Mr. Abernethy's official report will not be known for some time, but it is stated he considers there are no engineering difficulties in the way of the proposed extension with an outlet into the present channel. The depth of water is a question that will be decided by the River Wear Commissioners at their meeting, but the prevailing feeling is said to be to lay the new dock sills four feet below the present one, and thus give a depth of 23ft. on the high water of ordinary neap tides, or 26½ft. of ordinary springs. If this is acted upon it will make the port invaluable for vessels of the largest class in neap tides. It is also proposed to use a newly-invented machine for breaking up the rock, in order to deepen the outlet, worked on the principle of a dredger, armed with iron prongs instead of buckets, which has already been employed to loosen soft rock, so that it can afterwards be lifted by an ordinary dredger. An iron steamer, 130ft. keel, 23ft. 6in. beam, and 10ft. 6in. deep, which is being fitted with a pair of engines of 80-horse power nominal, has been launched from the yard of Messrs. Marshall Brothers, Willington Quay. She is intended for the conveyance of passengers and goods, and is the property of Mr. J. T. Thomas, of Rio Janeiro.

The Atlas Steel Works, Sheffield, have just produced a rolled plate 21ft. long, 4ft. wide, and 6½in. thick. The plate is perfectly sound, and Mr. Brown, the proprietor of the works, is ready to have it submitted to the severest possible tests, being convinced that he can produce plates capable of resisting any artillery which can be brought against them. The general state of Sheffield trade is by no means encouraging. In Derbyshire also the demand for iron is generally dull, except as regards a few houses engaged on large contracts for railways and shipbuilding.

At the last weekly meeting of the Mersey Docks and Harbour Board it was agreed to accept the offer of Messrs. W. G. Armstrong and Co., to construct a swing bridge across the north passage of Canada Dock, including the application of hydraulic power to work it, for the sum of £3,265. Some fallen river wall, at Seacome, was ordered to be repaired, at a cost of £1,200. It was agreed to place posts and chains for a length of 5,650 lineal yards, on the margin of the Great Float, Birkenhead, at a cost of 7s. 6d. per yard. A letter, requesting permission to lay down again moorings for the Great Eastern, as the vessel re-commences running on the 6th of May, and on her return from New York will make Liverpool her port of arrival, was referred to the Marine Committee.

The stock of cotton at Liverpool continues slowly to wane, and at the present rate of decline will be entirely exhausted in about twenty weeks. Some such prophecies as these have been often made, the reader will exclaim, and have hitherto been falsified. Nevertheless, the evil has been always steadily coming nearer and nearer, and unless the world's events undergo a speedy change we shall commence next winter with a stock reduced almost, if not quite, to zero.

The state of employment at Manchester does not exhibit much change. Captain Palin, the chief constable, returns the foundries and machinists as follows:—Machinists: Working full time with all hands, 13; working full time with a portion of their hands, 24; working short time, 9; stopped altogether, 1. Foundries: Working full time with all hands, 6; working full time with a portion of their hands, 14; working short time, 4. These figures are not very encouraging, but the state of affairs might be a good deal worse.

Glasgow advices note the completion of a monster forging "licked into shape" at Messrs. Rigby and Beardmore's (Parkhead Forge), and forming the stern post and keel piece of the steam ram Hector, now in course of construction at Messrs. Napier's, Govan. The forging weighed 25 tons, and is 40ft. in length and 32ft. in breadth. Messrs. Rigby and Beardmore constructed the corresponding portion of the Black Prince. Messrs. J. Scott and Co., of Cartsdyke, launched yesterday week an iron screw steamer of 1,000 tons burthen, built for Mr. Alfred Holt, of Liverpool. She is now being fitted at the Greenock Foundry with engines of 300-horse power. Messrs. W. Simons and Co., of the London Works, Renfrew, have launched a fine iron screw steamer of 520 tons burthen, named the Luchana. They are now fitting the vessel with engines of their own construction. Messrs. Simons have three other steamers on hand, and their foundry is also well employed.

The Institution of Engineers in Scotland had an interesting conversazione on the evening of yesterday week.—Among the articles exhibited the Patent Frictional Gearing Company showed a working model of a hoist; Messrs. I. and W. Whitesmith, of Govan-street Foundry, a patent loom and engine; Messrs. Tod and M'Gregor an engine; the Phœnix Iron Company a model of a marine engine; and Messrs. Stewart and Co. a patent moulding frame, for casting iron pipes. There was also exhibited by Mr. Robert Walker, jun., a working model of a new arrangement for propelling ships by reciprocating flexible blades, working somewhat in imitation of a fish's tail. A rifle and seven-shot pocket revolver, and many specimens of the mineral ores of Scotland, England, and Ireland, were also shown. At nine o'clock the visitors adjourned to the large hall, where Mr. W. Johnston, the President of the Society, took the chair, and introduced Sheriff Bell, who addressed the ladies and gentlemen present chiefly on the historical development of engineering science. His lordship touched upon the fact that, when Julius Cæsar invaded Britain, the Britons had no sort of ship save small coracles, and those of Julius Cæsar himself were of very small size. Referring to the battle fought by Suetonius against the Druids, on the very spot where the Britannia Bridge now crosses the Menai Straits, the sheriff passed on to the improvements in roadmaking introduced by Macadam and Telford in recent times, and thence to the time of the development of the canal, steamship, and railway systems. He instanced the Eddystone Lighthouse as an illustration of the conquest made by scientific ingenuity over the rude powers of nature, and concluded by passing a eulogium on the talent and conscientiousness of the members of the engineering profession, and by expressing his satisfaction that in such a city as Glasgow an institution of engineers should exist. The learned sheriff was followed by Professor Rankine, who illustrated, by an apparatus, the direction of motion on the particles of water in the waves of the sea, and the causes and characteristics of the pitching of vessels.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£	s.	d.	Dis. p. ct.
IRON, English Bar and Bolt:—					
in London	pr tn	5	15	0	3
in Wales	„	5	0	0	„
in Liverpool	„	5	10	0	„
Staffordshire Bars	„	7	0	0	1
Sheet, Sngl.	„	8	10	0	„
Dbl.	„	10	0	0	„
Hoop	„	8	0	0	„
Rod, round	„	7	0	0	„
Nail Rod, sq	„	7	5	0	„
SHIPPING IRON, Staffordsh. Bars	„	7	0	0	2
Sheet, Single	„	8	15	0	„
Double	„	10	5	0	„
Hoop	„	8	5	0	„
Rod, Round	„	7	0	0	„
Nail Rod, Square	„	7	5	0	„
IRON, Rails, in Wales, cash	„	5	5	0	nett
„ „ 6 months	„	5	7	6	„
Old, to cut up	„	0	0	0	„
Railway Chairs, in Wales	„	4	0	0	„
„ in Clyde	„	3	15	0	„
Pig No. 1, in Clyde	„	2	11	6	„
3-5ths No. 1 & 2-5ths No. 3		2	12	6	„
No. 1, in Wales	„	3	10	0	„
No. 1, in Tyne and Tees	„	2	12	0	„
Ditto, Forge	„		9	0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	„	3	10	0	„
Welsh Forge Pig (all Mine), at the Port	„	3	5	0	„
Acadian Pig, Charcoal	„	7	10	0	„
Scotch Pig, No. 1, in London	„	0	0	0	„

(Side notes: Staffordshire Bars to Nail Rod, sq — "Deliv. into boats at wrks" and "Nom. rates last qr. day for favourite brands"; Shipping Iron — "Delivered in Liverpool 10s. per ton less.")

		£	s.	d.	Dis. p. ct.
IRON, Swedish, Indian assortments	pr tn	11	5	0	2
Russian C C N D to arrive	„	16	0	0	„
STEEL, Swedish Keg, ham.	„	15	10	0	2½
Ditto, rolled	„	15	0	0	„
Fagot		17	0	0	„
SPELTER, on the spot	„	18	10	0	nett
To arrive	„	18	12	6	„
Hard, remelted	„	17	0	0	„
ZINC, in sheets	„	23	0	0	„
COPPER, Tile, 14 to 28 lb.	„	98	0	0	2
Tough Cake	„	98	0	0	„
Sheathing and Bolts	pr lb.	0	0	11	„
Sheet	„	0	0	11	„
Bottoms	„	0	0	11	„
Old	„	0	0	9	„
Yellow Metal	„	0	0	9	„
Burra	„	100	0	0	„
Russian do.	„	0	0	0	„
LEAD, British Pig	„	20	0	0	„
Spanish	„	19	0	0	„
W. B.	„	21	0	0	„
Sheet	„	20	10	0	„
TIN, English Block, nom.	„	114	0	0	„
Bar „	„	115	0	0	„
Refined „	„	119	0	0	„
Foreign Banca	„	124	0	0	„
Straits	„	114	0	0	„
TIN PLATES, Charcoal, IC	pr bx	1	9	0	„
Ditto IX	„	1	15	0	„
Coke, IC	„	1	2	6	„
Ditto IX	„	1	8	6	„
Do. at Newport, 1s. pr bx less		—			„
Do. at L'pool, 6d.	„	—			
CANADA, Plates	pr tn	12	0	0	2
QUICKSILVER	pr bt		0		

Rails.—But little business has been done this week, and the market remains dull at our last quotations.

Scotch Pig Iron has rallied from the sudden decline noticed in our last report, and the market now closes firm at 52s. 6d. for Warrants cash, f.o.b. in Glasgow; No. 1 Gartsherrie 58s. per ton.

Spelter is rather firmer, and cannot be had on the spot under £18 7s. 6d. to £18 10s. per ton.

Copper without change.

Lead in moderate inquiry.

Tin.—On the 21st inst. the English smelters declared a reduction of £1 per ton on Common and Refined. There has been little animation in the Foreign market this week. Banca nominally called £124, Straits about £114; both very dull.

Tin Plates in fair demand.

April 24th, 1862. Moate and Co., 65, Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861 £	s.	£	s.	1862 £	s.	£	s.
Teak	15	10	17	0	15	0	16	0
Quebec, red pine	3	10	4	10	3	5	4	0
yellow pine	3	0	4	0	3	0	3	15
St. John, N.B., yel.	5	0	5	10	5	0	5	10
Quebec, oak, white	5	0	5	10	5	0	5	10
birch	3	10	4	0	4	10	0	0
Memel	0	0	0	0	0	0	0	0
elm	3	10	4	15	3	10	4	15
Dantzic, oak	3	10	6	0	3	10	6	0
fir	2	15	3	10	3	0	4	0
Memel, fir	3	10	4	0	3	10	4	0
Riga	3	5	3	10	3	10	3	15
Swedish	2	15	3	0	2	15	3	0
Masts, Queb. rd pine	5	0	6	0	5	0	6	0
yl. pine	5	0	6	0	5	0	6	0
rd pine	0	0	0	0	0	0	0	0
Lathwood, Dantz, fm	6	0	6	10	6	0	7	0
St. Peters.	8	0	8	10	8	0	9	10
Deals, per C., 12 ft. by 3 by 9 in.								
Quebec, wht. spruce	13	0	18	0	15	0	19	0
St. John, wht spruce	13	0	16	0	15	0	17	10

Per load—	1861 £	s.	£	s.	1862 £	s.	£	s.
Yel. pine, per reduced C.								
Canada, 1st quality	17	0	18	10	17	10	19	0
2nd do	12	0	12	10	12	0	13	0
Archangel, yellow	13	0	13	10	14	0	15	0
St. Petersbg. yel.	12	0	12	10	12	10	13	10
Finland	9	0	10	0	9	10	10	10
Memel	10	0	15	0	10	0	15	0
Gothenburg, yel.	10	0	11	10	10	0	12	10
white	9	10	10	0	9	10	11	0
Gefle, yellow	10	0	11	0	11	0	12	10
Soderhamn	10	0	10	10	11	0	12	10
Christiania, per C 12 ft. by 3 by 9 in. yellow	22	0	25	0	22	0	24	0
Deck plank, Dnts per 40 ft. 3 in.	0	14	1	4	0	14	1	4
Staves, per standard M								
Quebec, pipe	70	0	75	0	50	0	55	0
puncheon	16	0	18	0	16	0	18	0
Baltic, crown pipe	160	0	170	0	170	0	180	0

SCOTCH PIG IRON REPORT.

	s.	d.	
No. 1 Gartsherrie	57	0	f.o.b Glasgow.
„ 1 Coltness	57	0	do.
„ 1 Calder	53	6	do.
„ 1 G.M.B.	52	0	do.
„ 3 Do.	50	6	do.
M. Nos. Do.	51	3	do.

WARRANTS.

3-5ths No. 1 and 2-5ths „ 3 .. G.M.B.		s.	d.	
	Cash prompt	52	6	per ton.
	1 mo. open	52	9	do.
	2 mos. „	53	0	do.
	3 „ „	53	1½	do.

MANUFACTURED IRON.

	£	s.	d.	
Bars, Govan	7	0	0	
„ Common	6	10	0	
Drumpeller, Common	6	10	0	
Do. Best	7	10	0	
Cramond Scrap Bars Delivered in London	10	5	0	less 5 per cent.
Plates and Sheets	9	0	0	to £9 10s.
Rails	6	5	0	
Pipes	4	17	6	
Chairs	3	15	0	

Glasgow, April 23rd, 1862.

In the pig iron market last week the fluctuations were confined to 1s. per ton, 52s. cash having been accepted on the 16th, and 53s. paid on Monday.

The colliers in certain districts having demanded an advance of 6d. per day had the effect of raising the market. To-day there is a quieter tone, 52s. 6d. sellers, 52s. 3d. buyers.

Exports last week were 12,393 tons, against 17,680 tons in the corresponding week last year.

Shaw, Thomson, and Moore, Metal Brokers.

Artificial Ice.—Ice is a natural product or a manufacture, article. Rich crops of it are gathered every winter in New England in Norway, and in other countries in the same latitudes. In the frigid zone it is common and worthless to the inhabitants; but in warm climates it is in summer either a luxury or a necessary of life. Its value to the millions who inhabit the torrid, and a large portion of the temperate, zone is becoming every year more apparent; in many cases of sickness and disease it is now regarded as indispensable, and it is equally prized by rich and poor. The demand for it is healthy and natural. When the supply afforded by nature or commerce fails, or where it is inaccessible, men frequently go to the expense of making it for themselves. A few years ago it was supposed by many that it could be manufactured in large quantities and at a moderate cost. This opinion, however, does not appear to be well founded. None of the numerous attempts to make it on the Continent, or in this country, or in America, have been successful commercially. Ice may be produced—1, by radiation; 2, by evaporation; 3, by expansion; and, 4, by contact with ice or frigorific mixtures, that is, by liquefaction. . . . . . By none of these different methods, each useful in some places and at certain times, can we procure ice as good and as cheap as it can be obtained from natural sources. We can make it in small quantities and of an inferior quality. Nature is the only manufacturer of it. Ice is so valuable an article to mankind that we need never grudge a good harvest to our ice-gatherers and ice merchants.—*Builder.*

WOOD WORKING MACHINERY IN THE EXHIBITION.

English construction has never been remarkable for a prodigal use of timber, and until within a very few years wood working machinery received comparatively little attention at the hands of English builders and machinists. The block machinery devised by Bentham, and executed by Brunel, was a great example of ingenious construction in that line, and no doubt contained most of the principles which have since been carried out in the best modern machinery for the general conversion of wood. It is true, too, that Bramah's specification of 1802 contained descriptions of many contrivances afterwards patented by others—among these the stationary plane-iron cutters patented in 1827, by Malcolm Muir, of Glasgow, and the rotary cutters patented by the same Mr. Muir in 1831. But, until within less than ten years ago, patent specifications were practically inaccessible, and few could know what secrets the Rolls' Office really contained. It is, however, since the last Exhibition, that wood working machinery has been brought to anything like the comparative perfection of engineers' tools, display in the western annexe will not illustrate half of them. and made applicable to any great variety of purposes. These purposes, indeed, are now so numerous that even the fine We cannot, this week, make more than a cursory reference to the examples of wood working machinery actually exhibited, and must reserve many interesting details for a future occasion.

In sawing large timber such bulky machinery is required that there was no room for its exhibition. In the main building, however, Messrs. Eaden exhibit a circular saw, 7ft. 2½in. in diameter, and Messrs. Worssam and Co. send one made by Wheatman and Smith, 7ft. 1in. in diameter. In Mr. Bessemer's case, also, is a saw 7ft. 1in. in diameter, with teeth of 10in. pitch, and 4in. long, made of Bessemer steel. These great saws would be run at a speed of about 400 revolutions per minute, at which rate they would cut their way through a log as fast as a man could walk. The speed of circular saws must, of course, depend much upon the character of the wood operated upon. Taking the qualities of wood generally dealt with in English saw mills, Messrs. Worssam and Co. assign a speed of 600 revolutions for a 62-in. saw, 700 for a 48-in. saw, 800 for a 42-in. saw, 1,000 for a 33-in. saw, 1,200 for a 24-in. saw, &c. In America where soft woods are generally worked, the speed of saws is much higher than here, a velocity of 2,500 revolutions per minute for a 22-in. saw being nothing uncommon, while the same size of saw (22-in.) has occasionally been driven to make 3,500 revolutions per minute. The American saws are generally thicker than ours, and waste more wood in consequence.

Messrs. Worssam and Co. and Messrs. Powis, James, and Co. both exhibit frames for reciprocating saws; the former house sending a deal frame, and the last-named a combined timber and deal frame. Messrs. Worssam's portable deal frame, which will take in 20 saws and feed 2ft. per minute, is driven from below, and the weight of the swing frame is balanced by an air cylinder, with a wooden piston, over the frame. As the saws descend, a partial vacuum is made in this cylinder, and so quietly does the frame work in consequence that it may be driven at the rate of 250 double strokes of 9in. each per minute with ease. The frame is fitted with Messrs. Worssam's silent feed, which is an application of the principle of Robertson's frictional gearing, modified to meet the wants of a saw frame feed motion. A V groove is turned in the rim of a wheel, and into this an eccentric friction pall and an eccentric "dead pall" are made to take. Not only does the feed go on without the slightest noise, but it can be adjusted with the greatest nicety, instead of, as with the old arrangement, being limited to the space of one tooth on the ratchet wheel. By making also a long deep slot through the connecting rod, so that the feed rack can move directly through it when the rod is in motion, a much longer connecting rod is obtained than could otherwise be had.

Messrs. Powis, James, and Co.'s combined timber and deal frame is driven from above, a heavy cast-iron frame on a cast-iron sole plate being employed to resist any tendency to vibration. A pair of connecting rods take hold of the saw frame at the middle of its height. For timber the logs are supported and carried forward by two iron carriages running on rails, and provided with wrought iron holding-down clips. When required as a deal frame, the pressure roller is easily wound up out of the way, and a fence, which is in a single piece, is readily dropped in place. This frame has a ratchet feed, and will take in 24 saws in a width of 2ft., and work with an 18-in. stroke, at from 160 to 200 double strokes per minute, the feed in hard wood being, say ⅛in. at a stroke, or 2ft. per minute.

To proceed with sawing machinery, we come to the band saw. This elegant application of the principle of the saw had been proposed by various engineers and inventors, among them Mr. George Stephenson, the elder Brunel, J. G. Bodmer, and Mr. Exall, of Reading, before M. Perin, of Paris, brought it into successful use in 1855. It was M. Perin who first succeeded in preventing the constant breaking of the saws, thus rendering the band saw as trustworthy as any other instrument for the same purpose. M. Perin never patented his improvements in this country, one of his machines having been brought from Paris, in 1855, and set up in Woolwich Arsenal before he had time to do so. In France the band saw is extensively used, and M. Perin has made a fortune by it. Some of the French saws are no larger than watch springs, while others are 6in. wide and 30ft. long. In America, a country so famed for its wood working machinery, the band saw is, as yet, almost unknown, the old "jigger" being still used for the same purpose. In this country the band saw frame has been much improved by Messrs. Powis, James, and Co., who have introduced it very extensively. One which they send to the Exhibition is a most creditable example of judicious design and sound construction. Its general appearance is shown in an illustration on page 263. The frame is of great strength, the table is 5ft. long by 4ft. wide, and can be sloped to an angle of 45 deg. The shape of the frame permits of working the saw 3ft. into the object being operated upon. The saw pulleys are each 40in. in diameter, and at their usual speed give the saw a velocity of from 3,000ft. to 3,500ft. per minute. The pulleys are accurately balanced by being turned inside and outside. The bearing of the upper pulley is upwards of 2ft. long, and is held up by Messrs. Powis, James, and Co.'s patent compound spring adjustment, a spiral and an india-rubber spring being held, together, under compression, by means of screws and tightening nuts. It is well known that, as the saw becomes warmed by working, its length increases, and thus, without means of perfect self-adjustment, it would either slip or break. To test the spring arrangement under notice the makers therefore purposely made an upper saw pulley eccentric to the extent of 1in. in its diameter, and having placed it in a frame and attached a ⅝-in. band saw, run it for ten hours at the rate of 3,000 lineal feet per minute. The saw was not injured by this severe ordeal, the pressure upon the springs, perhaps 2 cwt., being ample for keeping it tight without being sufficient to strain it beyond its safe limit of resistance. There is an adjustment also by which the upper saw pulley can be canted slightly to one side if the saw is found to have a tendency to run off. The pulleys are first covered with soleing leather, held on by copper rivets, this being afterwards covered with buff leather like that employed for soldiers' belts. This buff leather is fastened by patent glue. Should the saw break it generally runs down into the pit below, and may be mended by brazing with spelter and borax. The makers do not provide guards to prevent the saw from writhing about in case of breaking, their practice showing that they consider these guards unnecessary. We must say, however, that we have a strong prejudice in favour of guards to band saws, and would not wish to remain long near such a saw if it were unprovided with them. The saw guide is made to rise or lower, to suit the work, and is fitted with a neat boxwood oil box, containing a wick saturated with oil. The whole weight of the machine is 2 tons 6 cwt., the heaviest pattern of this class weighing nearly 3 tons.

Our extended notice of this example of Messrs. Powis, James, and Co.'s band saw is merited by its excellent design and thorough workmanship, as well as by the general interest felt in machines of this class.

Messrs. Greenwood and Batley, of Leeds, exhibit a band saw, illustrated in The Engineer a fortnight ago. The table is not made so as to be tipped for sawing on an angle, but both saw pulleys are so carried as to go over bodily to suit angular work. We fear that this is overingenious, and that the number of parts and one or two other questionable features will prevent this kind of saw frame from coming into extensive use.

Of wood planing machines several are exhibited, but our space limits us to a brief notice of Messrs. Worssam's and Powis, James, and Co.'s. The first-named firm exhibit one of their roller planing machines of extra size, and capable of planing deck plank 14in. by 6in., at the rate of 50ft. run per minute. The machine weighs about 6 tons, and is constructed with all the solidity of a machine for planing iron. It has two fixed cutters in the bed, and close to these, and so placed as to skim the rough surface of the board before being acted upon by the fixed planes is a revolving cutter. This can, however, be removed if desired, and a fixed plane iron substituted in its place. There are, also, revolving side and top cutters for planing all four sides at once. These cutters are placed, four on each revolving cutter head, which revolves about 3,000 times a minute, always, we believe, so as to strike in a direction opposite to that in which the wood is moving. The peculiarity of the machine consists in the use of only two pairs of feed rolls, each 24in. in diameter, and which, therefore, gripe the timber with great force. This arrangement saves something in the length of the machine, and adapts it especially to preparing deck plank or other rough stuff which has been warped or twisted.

Messrs. Powis, James, and Co.'s planing machine is much lighter than the one just noticed, being intended for a different class of work, and sold at a lower price. It will work up to 12in. wide, and work at 40ft. feed per minute on flooring boards, a rate which can be reduced to as low as 7ft. per minute on other kinds of wood. This machine has fixed plane irons in the bed, and a revolving cutter head, with four cutters, making 3,000 turns a minute on the upper surface of the board. It has revolving cutters also to dress the edges of the boards. The bearings are all of hard gun metal, and the ends of the top cutter shafts have each a boxwood step, driven into and revolving with the shaft, and wearing on the surface of a steel block set up by adjusting screws. An illustration of this planing machine will be found on page 263 of our present number.

Messrs. Powis, James, and Co. also exhibit a double tenoning machine, for tenoning the timbers of railway wagons and like heavy work at one operation. A sketch of this machine, to a very small scale, also appears in page 263 of our present number. Two revolving cutter heads, carrying three knives and two lancers each, finish the outer sides of the tenons of four or more timbers at one operation, while a cutter head revolving horizontally behind them finishes the interior part of the tenon. Four complete tenons for heavy railway wagon timbers are thus finished in a minute. This, we believe, is the second machine of the same kind made by the same makers, the first having been set up several months ago at the works of the Railway Wagon Company at Gloucester.

The same makers also send a moulding machine for moulding on two sides, and a small hand mortiseing machine, of which upwards of 3,000 have been sold since 1852. A 6-horse horizontal engine (8-in. cylinder 16-in. stroke) completes their contribution to the Exhibition. A much larger display would have been made by this firm had they not, like many other exhibitors, been required to forego additional space previously allotted to them, the Commissioners having felt it their duty to yield to unexpected and importunate solicitations for space from hundreds of manufacturers and others who had delayed their applications to the eleventh hour. One machine which Messrs. Powis, James, and Co. had prepared for exhibition, but which the last curtailment of their space (originally 1,000 square feet, and now 406) compelled them to withhold, was a crank mortiseing machine, weighing about two tons, and capable of working a 3½-in. chisel 6in. deep into hard oak, at the rate of 35 strokes per minute, and with a feed of ¼in. at each cut.

In addition to their other tools already noticed, Messrs. S. Worssam and Co. exhibit a patent mortiseing machine, a double tenoning machine, a moulding machine, and their "General Joiner." The mortiseing machine is of a kind much used in America, and is made by this firm as the owners of the patent of the American inventor in this country. The mortiseing chisel is a hollow square tool, cutting on all four sides at once, and having within it an auger, driven at about 1,500 revolutions per minute, and going down a little in advance of, and at the same rate as, the chisel. This tool works with very little power, and does excellent work in hard wood. In soft wood it does not perform quite as cleanly. It makes holes up to 2in. square. The double tenoning machine has two revolving cutter heads for the outside portions of the tenons, the intermediate or central portion being completed by a saw with dishing sides, its edge being thick enough (perhaps 1in.) to do the work required. The table which carries the timber runs on small brass wheels. The moulding machine finishes the three sides of the moulding at once, a pair of cutter heads on horizontal spindles being employed for the top and bottom, and another head, revolving on a vertical spindle, for the side. The cutter heads revolve at 3,500 turns a minute, and the machine will finish from 12ft. to 24ft. of moulding per minute.

Messrs. Worssam and Co.'s "General Joiner," as its name imports, is a machine for many purposes. It is a very small affair to look at, consisting, apparently, of a cast iron saw bench, with a circular saw spindle, fence, &c. The frame will take in a 16-in. saw, to run at a speed of from 1,500 to 2,000 turns a minute. The fence can be set at almost any angle for sawing work on the bevel. A very simple tenoning apparatus can be applied so as to cut the tenons completely out with the circular saw, or a grooving saw can be used if preferred. Then, again, a part of the table can be taken out, the saw removed, and a cutter block fitted to the spindle for moulding, grooving, rabbetting, &c. There is also a boring table at the back, and an auger can be set in the outer end of the saw spindle. And, finally, a simple apparatus is provided to be attached to the table for cutting the small wedges used in framing doors, sashes, &c. Altogether the machine is very simple and compact, and is capable of a great variety of applications.

Messrs. Worssam's machines occupy a space of 29ft. by 14ft., and will be exhibited in motion, in which respect they will have an advantage over any other wood working machinery in the building.

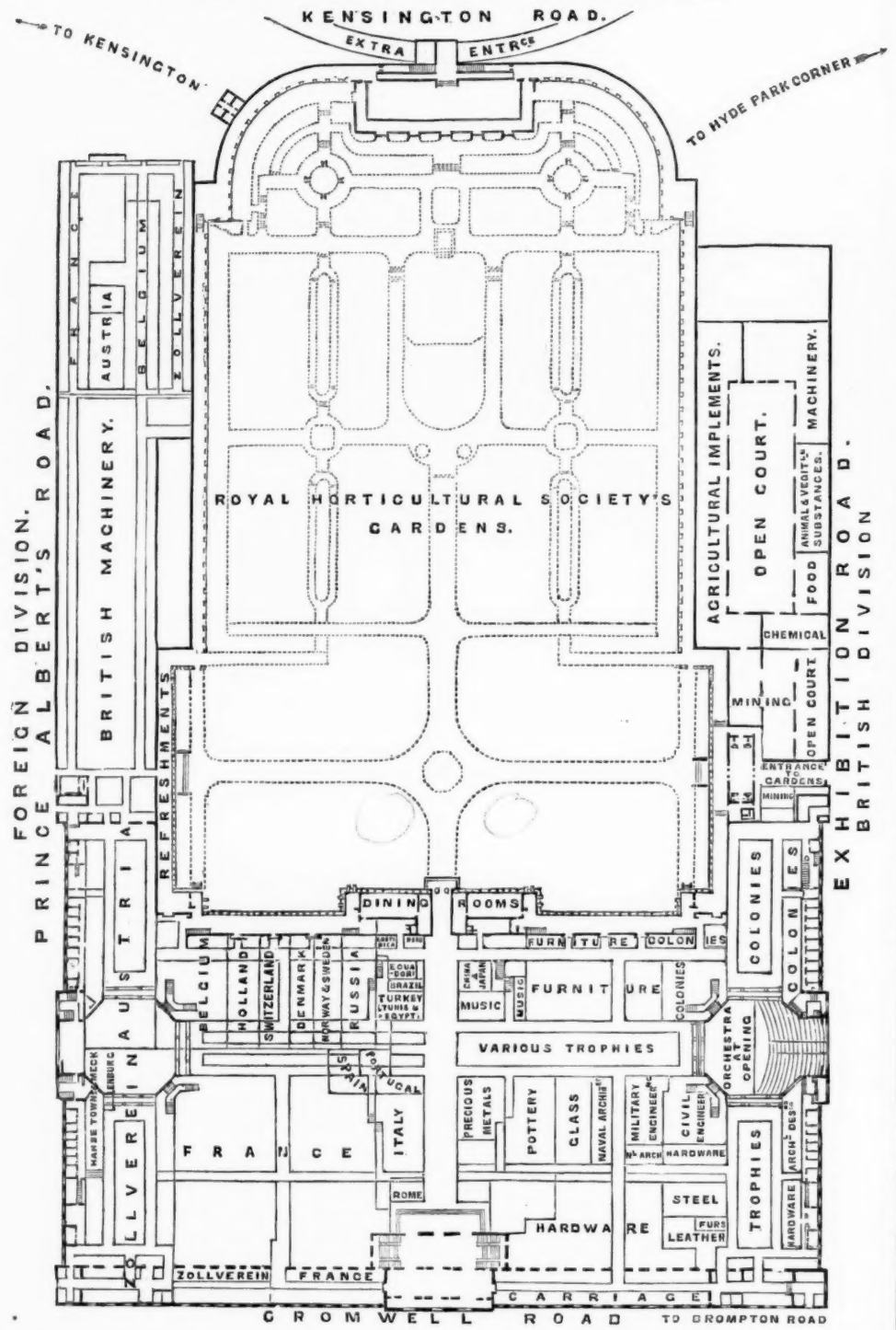
Messrs. Thomas Robinson and Sons, of Rochdale; Messrs. Greenwood and Batley, of Leeds; John McDowall and Son, of Johnstone; and J. and F. Young, of Ayr, exhibit each a number of wood working machines, of which we must defer notice until a future occasion.

The Ocean Mails.—The Government have given a twelvemonth's notice to the Royal Mail Company for the termination of their contract for the conveyance of the mails, and the company are already talking about the sale of their fleet. The Government have also advertised for competing tenders for conveying the mails between Aden and Bombay. The Peninsular and Oriental Company's mail contracts have expired for some time past, and have not yet been renewed by the Government.

The Navy.—The floating battery Trusty is to be immediately refitted with Captain Coles's cupola shield, with a facing of 4½in. plates, and she will then proceed to Shoeburyness, for a series of experiments. The bottom of the large iron floating fire-engine at Portsmouth has been coated, in sections, with the compositions of four different makers to test the comparative value of each in preserving and keeping clean the bottoms of iron vessels. The names of the competing manufacturers are—M. Guibert, of Paris; Messrs. M'Crea, of Liverpool; the Dublin Steam Packet Company; and Mr. Hay, the Admiralty chemist at Portsmouth. The Defence, iron frigate, is having her bows lined externally with ½in. iron plate, in a similar manner to the bows of the Black Prince, to preserve her bow plates proper from chafing by the swing of her anchors from her cat and fish heads. The substitution of the Armstrong 110-pounder gun for the smooth bore has commenced along the most salient points of the sea face of Portsmouth fortifications and the sea approaches to Spithead, many of the works having already received their guns. The relative merits of iron ships and fixed forts is discussed in a letter to one of his constituents by Sir S. M. Peto. He contends that the recent experiments at Shoeburyness afford additional arguments against fixed fortifications and in favour of floating batteries. He doubts, however, the utility of converting wooden ships into such floating batteries, and urges, as the least expensive in the end, the construction of "iron ships of sufficient size to mount large guns in central batteries, protected by shields, and fitted also to act as rams by the aid of powerful machinery."

Foreign and Colonial Jottings.—Some Federal naval officers have been in communication with the Admiralty with a view to the purchase of some sailing men of war. A Charleston paper states that the iron plates of the Merrimac suffered very slightly indeed from her encounter with the Monitor, but her smoke-stack and ventilators were riddled by the enemy's balls, so as to give them the appearance of huge nutmeg-graters. A gun, which throws a 360 lb. shot, has since been put on board the Merrimac.—A French naval officer holding a high command has tendered his resignation, in order to devote himself to the completion of a new fulminating spar which he has invented for iron-cased ships, which will not only drive in the side of any ship, but will lodge in its interior an explosive shell of the most dangerous character.—A letter from Cherbourg says that the Minister of Marine has resolved to submit the iron-cased frigates lately launched to a decisive trial to test their seaworthiness The Couronne, which has arrived from L'Orient at Cherbourg, is selected for the experiments. She is to be sent across the Atlantic. A question which has given rise to a serious controversy among seamen as to the possibility of a completely iron-cased vessel accomplishing the voyage will thus be solved.—A letter from Trieste states that the iron-cased frigate Salamander was launched three days back, and is to be immediately fitted out. She is the first vessel of the kind in the Austrian navy.—Two floating batteries, the Peiho and Palestro, will be launched at Rochefort this month, and experiments are about to be made of a formidable cylindro-conical projectile, of which much has been said. The last report of the mining department of the colony of Victoria states that there were 18,182 persons engaged in mining operations in the colony. They have 773 steam engines at work, the horse power of which is 12,091. The mining plant is valued at £1,386,722. The deeper the miners go the greater is the yield of gold. At 350ft. the yield is upwards of one ounce per ton. In crushing, the yield is oftentimes from four to eight ounces per ton.

PLAN OF THE INTERNATIONAL EXHIBITION.



INSTITUTION OF MECHANICAL ENGINEERS.

THE general meeting of the members of this institution was held on Thursday the 24th ult., at Birmingham, Alexander B. Cochrane, Esq., Vice-President in the chair.

The first paper read was "On the Construction of Lighting Apparatus for Light-houses," by Mr. Armand Masselin, of Birmingham. The old catoptric or reflecting lights, in which a number of silver-plated parabolic reflectors are used, with a lamp in the focus of each, are now being generally superseded by Fresnel's more perfect dioptric or refracting system, in which the rays of light from a single central lamp are refracted in a horizontal direction by a series of glass lenses and annular prisms, undergoing total reflection within the prisms. By this means the whole of the light is made use of in the direction in which it is wanted, and its efficiency is thus greatly increased, the metallic reflectors being much inferior, not only in consequence of their absorbing a large proportion of the light in reflection, but also on account of their wearing out with cleaning, while the dioptric apparatus suffers no perceptible deterioration. The lamp consists of an oil cylinder containing a weighted piston fitted with a cupped-leather packing, the pressure of which forces the oil up to the burner in a quantity several times greater than that consumed, in order to preserve the wicks from becoming charred; the overflow oil is returned into the cylinder, and the piston on reaching the bottom is wound up again by a rack and pinion. By a simple arrangement for regulating the supply of the oil and filtering it in its passage to the wicks, the maintenance of a constant and regular light is thoroughly ensured, with ordinary attention on the part of the keeper, as proved by the completely successful results of many years' working. Above the lamp a ventilating tube extends up into the cowl of the lantern, for producing the requisite draught to support the combustion of the lamp; it is made with inverted funnels at intervals, opening downwards, which prevent the effect of any sudden gust of wind from reaching the lamp. In revolving lights the optical apparatus is carried on a revolving platform driven by clockwork; and the lenses and prisms, instead of distributing a zone of light of equal intensity all round the horizon, as in fixed lights, are arranged in such a manner as to concentrate the light in the centre line of each of the eight faces of the apparatus, producing a succession of brilliant flashes at regular intervals as the apparatus revolves. The lantern containing the light is glazed with panes of thick plate glass, and the standards in which the glass is fixed are inclined alternately right and left, so as not to intercept the light completely in any vertical plane, while the lantern itself is thereby stiffened. A specimen of one face of the apparatus, containing the lenses and prisms of a revolving light, was exhibited from Messrs. Chance's glass works, and also a specimen of the pressure lamp used for the most powerful lights.

The next paper was "On Coal and Iron Mining of South Yorkshire," by Mr. Parkin Jeffcock, of Derby; giving a description of the geological nature of the district, and of the position and extent of the principal seams of coal and beds of ironstone, with a statement of the localities where each is mostly worked. The South Yorkshire coalfield forms the continuation northwards of the Derbyshire coalfield, the principal coal seams being clearly identified with corresponding seams in Derbyshire. The two most important seams are the Barnsley Thick coal of about nine feet thickness, and the Silkstone of about five feet thickness; the former is a fine steam coal, and is the same seam as the Top Hard coal of Derbyshire, worked at Stavely and elsewhere; and the latter is an excellent household coal and the same seam as the Blackshale coal of Derbyshire. The ordinary modes of working the coal in the district were described, all of which are more or less defective, requiring a large amount of the coal, to be left in the mine for supporting the roof during the working; and at some colleries these are now abandoned for the superior "long wall" system, in which the coal is worked in a single face of great length, and the whole of the coal is got out at one operation, the roof being supported immediately behind the working face by timber props or by pillars built up of the rock, and in some cases cast-iron puncheons or props are now used, of which a full-size model was exhibited. The ventilation of the mine is also considerably simplified in the "long wall" system. The quantity of water met with in the district is in general not large, and there are few collieries where large pumping engines are required; but the coal seams are of a very fiery character, evolving great quantities of inflammable gas, and the greatest precautions are necessary to prevent explosions. The most terrible explosions have taken place in the Barnsley Thick coal, the most important seam of the district; this and the Silkstone seam being specially liable to sudden and powerful emissions of gas. In most of the collieries safety lamps are now used exclusively; and the ventilation being produced by a furnace at the bottom of the upcast shaft, the air from the mine is conveyed into the shaft by a separate passage or "dumb drift," so as not to pass through the fire of the furnace, which is supplied with nothing but pure air direct from the downcast shaft. At some of the mines, near Barnsley large fans driven by steam-power are employed, which form a simple and efficient means of mechanical ventilation, and have worked continuously with complete success for several years past.

The last paper was a "Description of a Feed-pipe Connection for Locomotive Engines," by Mr. Alexander Allan, of Perth; consisting of a simple brass or copper tube of elliptical section, bent into a circle of large diameter, for the purpose of allowing the usual amount of play in all directions between the engine and tender, and saving the expense and trouble of the ordinary ball-and-socket couplings, while being more durable than the flexible hose pipes. The new couplings have now been at work for nearly a year on the Scottish Central Railway, and have proved completely satisfactory. A specimen was shown of a tube of circular section, which had been taken off the engine for exhibiting at the meeting, showing not the slightest sign of giving way at any part after nearly a year's work; a new tube of the elliptical section was also shown.

THE MANCHESTER BOILER ASSOCIATION.

AT the last ordinary monthly meeting of the Executive Committee of this association, held at Manchester, on Tuesday, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the last month there have been examined 363 engines and 563 boilers. Of the latter, 10 have been examined specially, 8 internally, 87 thoroughly, and 458 externally; in which the following defects have been found:—Fracture, 14 (3 dangerous); corrosion, 47 (5 dangerous); safety-valves out of order, 18 (1 dangerous); water guages ditto, 8; pressure guages ditto, 8; blow-off cocks ditto, 33; fusible plugs ditto, 4; furnaces out of shape, 6 (3 dangerous); total, 138 (12 dangerous). Boilers without glass water guages, 5; without pressure guages, 22; without blow-off cocks, 15; without back pressure valves, 42.

"I am happy to be able again to report that no explosion has occurred during the last month to any boiler under the inspection of this association. Four explosions, however, which have happened in other quarters have come to my knowledge, from three of which loss of life has resulted; one being of the most disastrously fatal character, no less than twenty-seven persons being killed.

"The latter of these explosions occurred at an ironworks to a vertical boiler, heated by the flames from four iron furnaces. These flames first played upon the lower part of the outside of the boiler, and then passed through four openings in the side into an internal descending flue in the centre, and thence to the chimney. The boiler was cylindrical and egg-ended, and precisely similar in general arrangement to that first described in last month's report, being technically termed an upright furnace boiler. Its height had been about 27ft., and its diameter 10ft., while the thickness of the plates had varied in the original construction from $\frac{7}{16}$in. to $\frac{9}{16}$in. Its age was about nine years, and its working pressure, although stated by the engine attendant to have been 35 lb., was concluded from an examination of the safety valves, &c., on an official inquiry at the instance of the coroner, to have been not less than 50 lb.

"The injury done, however, in the present instance was much greater than that resulting from the explosion of the boiler referred to in the last report. In that case the crown of the internal descending flue was blown down, when the boiler shot upwards like a rocket from unbalanced pressure. In the present case the external shell in the lower part had rent, and an entire circumferential strip or belt ripped off, and scattered in several fragments. The main portion of the boiler, including the internal flue, had flown to a considerable height, being carried, as in the previous case, in the direction of the wind, falling completely beyond the boundary of the works, clearing the Great Western Railway, as well as a tramway, in its flight, and bedding itself so deeply in the ground as to exclude access through the rent at the bottom; the shell, as well as the internal flue, being considerably distorted by the shock on coming to the ground. The fragments rent from the lower part of the shell had been blown laterally, sweeping down several of the columns of the building on which the roof depended for support, so that the whole became one general ruin. The brickwork flue surrounding the boiler, and which stood about 15ft. above the ground, was scattered in every direction, just as the particles of a bomb-shell, and had riddled the roofs and windows of all the surrounding buildings. The percussive force of the steam had also destroyed the adjacent iron furnaces, and unseated, as well as denuded of its surrounding brick-flue, a twin-vertical boiler, which had previously worked in conjunction with the one in question, being connected to it by a common steam-pipe. I note these facts, since, although unimportant in themselves, they show the destructive nature of the percussive action of steam, which should be taken into account, in addition to the force of disruption and effect of unbalanced pressure, when attempting to unravel the complicated effects of explosions.

"There are grave objections to the construction of this boiler, as well as to the mode in which it was set. The intense flames from the furnaces by which it was heated impinged most severely upon the lower part of the external shell, the diameter of which, being not less than 10ft., was of unusual size, while, in addition, the water was sedimentary. The combination of a high tensile strain upon the plate, which a large diameter—such as that in the present instance—involves, with an intense flame locally applied, added to an accumulation of deposit, is always dangerous, on account of liability to injury from overheating of the plates, and more especially of the seams of rivets; and it will be remembered that several explosions from this cause have lately been called attention to in these reports. Added to this, from the fact of the flame operating upon the bottom of a water-space, the circulation of the water was necessarily incomplete; and thus the risk increased of the rapid generation of the steam driving the water away from the plates. Many instances have occurred of plates being seriously overheated from this cause, even when the boiler contained a plentiful supply of water.

"It may be added that the boiler had been found so leaky a few weeks before the explosion that a dose of bran had been resorted to in order to stop it. Bran, while it stops the leaks, thickens the water, and prevents the globules of steam escaping freely, and thus would be most dangerous in a boiler already predisposed, as this one was by its construction and local impingement of the flame, to have the water driven away from the plates.

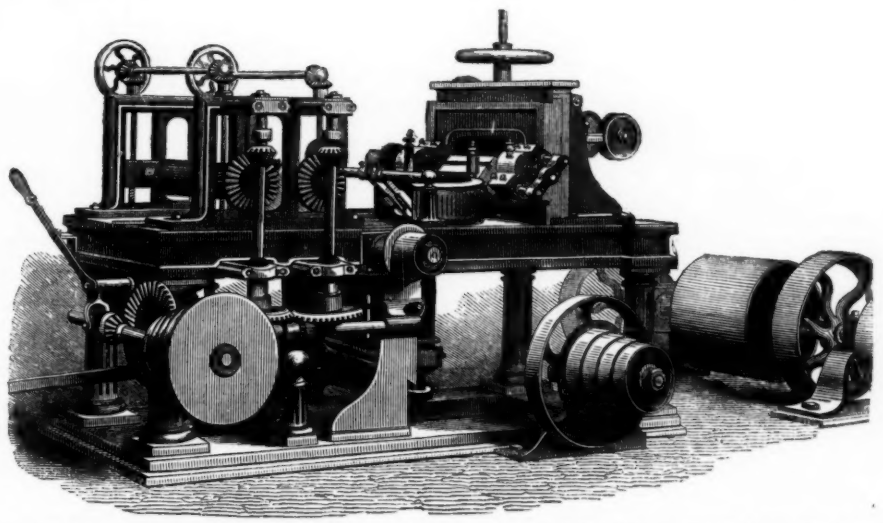
"Examination of the fragments, as well as of the seams of rivets in the twin boiler, confirmed the opinion that the plates had been weakened by overheating, and I consider the dangerous construction and setting of the boiler quite sufficient to account for the explosion. An accidental circumstance, such as a temporary increase of pressure, may have been the actual exciting cause in ultimately inducing explosion, but the conditions under which the boiler was working were such as, I am persuaded, no boiler can safely endure for any length of time, and, since these conditions are not by any means confined to boilers of precisely similar construction, their consideration will be worth the attention of our members generally.

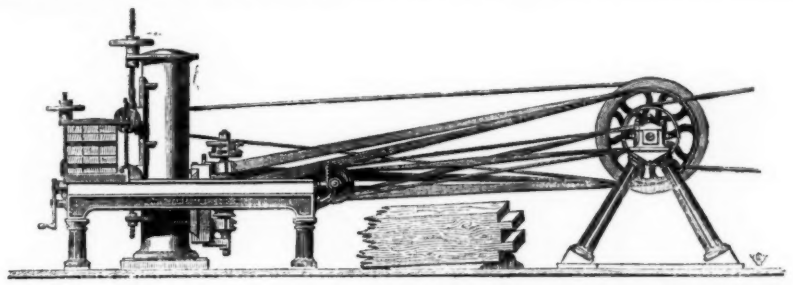
"After the two most serious explosions that have lately occurred, within a few weeks of one another, in the iron districts, to boilers of this description, and each attended with such fatal consequences, it will certainly be most reprehensible if another day is allowed to pass without having all similar boilers carefully examined, and their safety ascertained.

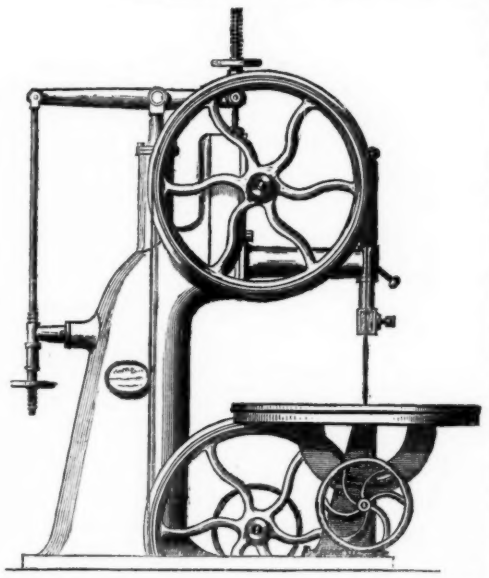
"Another life has been lost during the past month through the rupture of a Cornish boiler, which did not, however, result in explosion. The flattened plate had been allowed to groove at the furnace crown without repair, until it at last penetrated the entire thickness of the plate, when a rupture occurred, from which scalding terminating fatally, ensued. The boiler, however, is reported not to have moved from its seat, which I have found to be the case under similar circumstances.

"The great difference between the result of a rent in a flat plate as above, and when occurring in a cylindrical shell, as in the previous instance, will be at once seen. I have always found that those explosions which have resulted in the most serious consequences have been caused by rupture of the cylindrical portion of the shell, and hence its condition is a matter of the greatest importance, and it appears to me, therefore, desirable that it should be exempted from the injurious action of the fire to which boilers externally fired are exposed."

POWIS, JAMES, AND CO.'S MACHINERY IN THE EXHIBITION.







On page 261 of our present number we have described a number of wood-working machines made by Messrs. Powis, James, and Co., of Watling-street, and exhibited by them in the International Exhibition. The illustrations now given show the planing machine, the double tenoning machine, and the band saw. Besides these are a combined timber and deal saw frame, a hand mortising machine, a steam engine, and other objects. The planing machine, represented in our larger illustration, is of the kind preferred for flooring boards, working up to 12in. wide, and, in soft wood, at the rate of 40ft. per minute. The double tenoning machine, shown in the next woodcut, has three cutter heads, two revolving on horizontal and one on a vertical axis. The heaviest double tenons can thus be cut with the greatest accuracy, and with a rapidity unattainable by no other machine. The remaining illustration, that of a band-saw, needs no description beyond that given on page 261.

The Armstrongs.—The 10½-in. Armstrong gun made at Elswick cost £1,800, and the superintendent of the Royal Gun Factory, at Woolwich, offers to make the same kind of guns for between £700 and £800. The 6-ton guns, of 8in. bore, can be made, it appears, for something under £300 each, and the 95 cwt. Armstrong for £250, or about twice the cost of cast iron guns.

Iron Street Paving.—Yesterday evening the Poultry was re-opened, after having been closed for a week for repaving. The new pavement, which is a modification of Knapp's patent, consists of heavy cast iron sections, hollow and hexagonal in form, locking together at their junctions, and presenting numerous small projections over their upper face. These sections are solidly bedded and filled to the surface level with ballast, well rammed, and next to the kerbs the blocks abut against Redman's cast iron trams. Greatly increased durability, together with sure footing, is expected to be gained by this mode of paving, the granite being found unable to withstand, for any length of time, the immense traffic passing over this short length of street. An adjoining portion has been laid with granite paving, in combination with Carey's cast iron wheel track. In this invention the side towards the centre of the roadway is notched at intervals to admit the ends of the granite sets, the other side abutting upon the iron drawing kerb, and thus is obtained a good track for the near wheels of carriages and a channel for the surface drainage. These works will afford a favourable opportunity for comparing the respective capabilities of iron and granite paving in one of the most crowded streets of the metropolis. The work has been done, under the direction of Mr. William Haywood, the engineer to the Commissioners of Sewers, by Messrs. Crook and Son and Messrs. Ransome, of Ipswich. Knapp's iron paving, put down upwards of three years ago in King-street, Westminster, is still in excellent condition.

THE MANUFACTURE OF LEATHER CLOTH.

(From the Mechanics' Magazine.)

The manufacture of leather cloth as a substitute for Morocco leather was commenced in the year 1849 in the city of Newark, U.S. The first specimen of it seen in this country was exhibited in 1851. The Americans have had the merit of producing many labour-saving machines and articles of domestic convenience, and many of them are becoming increasingly known and extensively adopted in this country. It is certain that this article of leather cloth has superseded the use of leather for many purposes to which the old material has hitherto been applied, besides being put to uses for which leather is wholly unsuitable. Messrs. Crockett, the inventors and patentees, commenced the manufacture of leather cloth in England in 1855, and their factory was an old workhouse situate in one of those dreary, unpicturesque marshes at West Ham, in Essex, a locality somewhat famous for its insalubrious manufactures. The firm was known as the "Crockett International Leather Cloth Company." In 1857 Messrs. Crockett surrendered their business to a company formed under the title of "The Leather Cloth Company, Limited," which purchased the entire European business.

The new company, with a paid-up capital of £90,000, and having Mr. A. Lorsont as their managing director, began the enterprise with great energy. They erected substantial and extensive premises, which cover ten acres of ground, employing upwards of 200 men. They produce daily 1,000 pieces of 12 yards long and 1¼ yards wide, or 15,000 square yards; sufficient, if laid end to end, to reach from their factory to the warehouse in Cannon-street West—a distance of seven miles.

It will be evident that an article intended to resemble leather should be pliant, supple, and not liable to peel off or to crack. These excellencies are to be attained by the peculiar ingredients of the composition with which the cloth is covered, and the method of applying it. On entering the factory our attention was first directed to the boiling room, in which there are twelve furnaces, with a large cauldron over each for boiling linseed oil. This process is attended with considerable danger from the liability of the boiling oil to generate gas and explode; hence, a man is stationed at each cauldron stirring gently the boiling mass and watching a thermometer inserted in it, and which at the time of our visit stood at 580 deg. The oil is supplied to the boiling house by pipes from an adjoining building, where there is a huge tank with nine compartments, containing 3,200 gallons each, or 28,800 altogether, amounting to 122 tons of oil. The boiled oil being allowed to cool is conveyed on a tramway to the mixing house, where, in a puddling machine, it receives several other ingredients, the principal ones being lampblack and turpentine, which being mixed into a composition is ready for use.

The cloth to which this composition is applied is known by the name of "greys," or unbleached cotton. It is of a peculiar manufacture, and made expressly for the company. The store room is a spacious building, and will contain an immense stock; at present it has 25,000 pieces, or 300,000 yards. Here the cloth is calendered, and cut into lengths of twelve yards. The two ends of each length are sewn together to make it endless; two sewing machines are in constant operation at this work. The pieces are then removed to the "milling" rooms, so called because they contain the mills on which the cloth receives the composition. These mills are rough-looking wooden structures, having a drum at one end and a roller at the other, over which the cloth is passed, and then tightened by a crank and wheel at one end. A large frame-knife, or scraper, is then dropped down close to the cloth, a measured quantity of composition being laid on the cloth along the edge of the knife, the mill revolves, and the cloth receives as much of the composition as can pass under the edge of the knife. The piece is then carried to the heating room adjoining, and hung up on the rack to dry till next morning.

There are on the premises six milling rooms, with three mills in each, and having three men attendant upon each mill. The adjoining rooms for drying are heated by three rows of pipes laid along the wall. These pipes, during the day, are at a temperature of about 130 deg. The temperature is increased towards the evening, and during the night to 160 deg., and it is the duty of the watchman to open the doors for ventilation and cooling preparatory to the men resuming their work for the next coating.

Of course, in a building so greatly heated, and having so much inflammable material within it, the danger of fire is imminent, but every precaution has been taken which prudence could dictate. The building is fire-proof, the floors are of metallic lava, and the roof, which is flat, is of the same material. A large pipe runs up the outside wall by the partition which divides the drying-rooms, into each of which runs a branch pipe with a valve, which can be worked from the outside. A deluge of steam can by these means be poured into the rooms in a few minutes by day or night. There are fourteen fire plugs around the buildings, on the main of the East London Waterworks, with hose and turncock at hand, so that ample means of extinguishing fire exist on the premises.

But to return to the manufacture. The coating being thoroughly dry, the cloth is then taken to the "rubbers," whose business it is to remove all inequalities from the surface and make it perfectly smooth. This is done by the "rubbing machine" (an ingenious contrivance of Mr. Eagles, the manager), by which the cloth is made to pass under two rollers revolving in opposite directions. These rollers are covered with pumice stone, and do the work completely and expeditiously, which, till lately, was done by hand at great expense of labour. The "coating" and the "rubbing" being repeated four, and in the case of heavy goods, five times, the cloth is ready for the "painters." The "painting rooms" contain machines similar to the "mills;" but instead of the drum they have a roller at each end, over which the cloth passes slowly, and a man at each side applies the paint, "meeting each other half way." Dependent partly on the colours, and partly on the article to be produced, is the number of coats of paint to be applied. Sometimes two will be sufficient, at other times four are necessary. The last coat receives several applications of a peculiar elastic enamel, composed chiefly of copal varnish, to protect it from the action of the atmosphere.

At this stage of the process the edges of the cloth are rough and have to be trimmed, and the seam by which the ends are sewn together has to be cut. This is done by a machine called the "Guillotine," and we now follow the cloth to the "grainer." This latter, and, to the ordinary leather cloth, finishing process, is done by a remarkably beautiful iron machine, having two rollers, the upper one being of polished iron cut obliquely on the surface, the under one of paper. Between these two rollers the cloth passes twice and receives its external resemblance to morocco leather. There are six machines used for this finishing process, and others for embossing from the small diamond to the large mediæval pattern. The latter consumes much more time in passing through the machines. The cloth is now stamped with the trade mark, labelled, and rolled up ready for transmission to the warehouse in Cannon-street West.

On looking at the pieces when finished, one is struck by the extreme cleanness of the inner side after passing through so many soiling operations; this is owing to the practical skill with which the men handle the cloth, and to the agility with which they remove it from the several machines, and carry it to the drying rooms. While watching the process we thought that, in many respects, it was similar to the tanning with sumach, from the leaves and stalks of the *Rhus coriaria*, by means of which skins are made into morocco leather. As the leather cloth can be made permanently soft and elastic by the oily matter combining with the texture of the cloth, as it does with the fibres of the skin, the imitation is complete and successful.

There is another room in this establishment, specially interesting to the artist, where the cloth is printed in gold and colours, in designs which are really chaste and beautiful, and which, when used for the furniture and hangings, adorn rooms with something of oriental splendour. Here, too, there are table covers with floral borders, rich in colour and choice in grouping, with centre pieces which, as specimens of decorative art, are very effective. Many of these will be displayed at the International Exhibition, and, we doubt not, will excite both surprise and admiration.

The mixing-room is a kind of *sanctum* of the manager's, and we suppose that from the skill with which the colours are prepared arises much of the excellence of the company's manufacture. In a room adjoining there are sixteen colour-grinding mills, constructed on the American principle, and worked by machinery, as indeed almost everything on the premises seems to be. The machine which sets all in motion is a high-pressure double cylinder engine of 50-horse power made by Woods, of Halifax. There are three immense Cornish boilers by Hill, of Heywood, which have been tested to a water pressure of 130 lb. to the square inch, and represent 60-horse power. One of these is sufficient to work the engine by day and heat the drying rooms by night. We observed that, by the generosity of the company, a part of their premises had been given for the use of the Fifth Essex Rifle Volunteers; the drill room and armoury are magnificent apartments, such as are seldom seen devoted to such a purpose.

A writer, in a very useful work on the "Manufactures of Great Britain," asks somewhat triumphantly, "What substitute could be found for leather? a substance at once durable and elastic, affording protection from wet and from cold, capable of being formed into innumerable useful articles, and susceptible of a high degree of ornament, and supplying lining to our carriages and covers to our books." This book was published in 1848, under the direction of the "Committee of general literature and education," and now, in 1862, we have a substitute answering all the requirements here specified.

As to protection from wet and cold, the whole American army is equipped with leather cloth in the shape of capes, leggings, and knapsacks; our upholsterers can vouch for its durability and elasticity. The useful articles into which it can be made, and the degree of ornamentation it can receive, are becoming every day more manifest. We line our railway, our street carriages, and our hats with it; and as to our books, if they are not covered with it they ought to be. Truly our progress in art and science is defying all prediction as to what we may not accomplish, and rendering obsolete many of our familiar proverbs, and none more strikingly so than that "there is nothing like leather."

Railway Travelling.—The number of travellers by railway in the United Kingdom in 1861 was 163,435,678, besides 47,894 holders of season and periodical tickets, who must have made very many journeys; in the whole, there must have been much nearer six than five journeys in the year for every soul in the kingdom. The trains, passenger and goods trains together, travelled 102,243,692 miles, which is further than going 4,000 times round the world; 267,134 horses and 357,474 dogs made railway journeys, little to their liking. The goods traffic comprised 12,083,503 cattle, sheep, and pigs, and 89,857,719 tons of minerals and general merchandise. In these vast piles of property conveyed from place to place the minerals double the general merchandise in quantity, and they are carried at a little more than a quarter of the cost; 60,386,788 tons of minerals produced to the railway companies only £4,951,899; while 29,470,931 tons of general merchandise brought them £9,157,987. The receipts of the railways (10,433 miles in length at the close of the year) from all sources of traffic were £27,766,622, of which £13,085,756 came from passenger traffic and the mails, and the residue from goods. The expenditure was £13,187,368, or 47 per cent., leaver rather more than £14,500,000 net receipts. The compensation paid for accidents and losses amounted to £181,170. The quantity of rolling stock was no less than 5,801 locomotives, 15,076 passenger carriages, and 180,574 wagons for goods traffic; in all 201,451 engines and carriages. The numbers are enormous, and they are enormously increasing. Comparing last year with the year before, notwithstanding the bad weather, the passengers increased by 13,600,000, the minerals by 8,600,000 tons, the receipts by above £2,000,000, the miles travelled by trains nearly 9,000,000. 3,896,960 trains ran in the course of the year 1860; upwards of 10,000 a-day.—*Express.*

LOCOMOTIVE ENGINES IN THE EXHIBITION.

THERE are nineteen railway locomotives in the western annexe, eleven being of English and eight of foreign construction. None are for a gauge wider than 5ft. 6in., this being the gauge of an engine exhibited by Sir W. G. Armstrong and Co. for the East Indian Railway, and of another by Beyer, Peacock, and Co., for the South-Eastern Railway of Portugal. Of the English engines seven have outside cylinders and four have inside cylinders. Of the foreign engines six have outside and two have inside cylinders.

The London and North-Western Railway Company send two express locomotives, one made at Wolverton, the other at Crewe. The Wolverton engine is one of the well-known class of coal burners made upon Mr. McConnell's plans, and previous to his resignation of the post of locomotive superintendent. It has 18-in. inside cylinders, 24-in. stroke, 7ft. 6in. driving wheels, and the usual leading and trailing wheels, the former being 4ft. 3in. in diameter. The boiler is upon Mr. McConnell's patent (although we have never understood wherein it embodied any patentable invention), and has a long combustion chamber, which, for nearly its whole length, is divided by a longitudinal mid-feather, which also runs through the fire-box, dividing it into two separate port ons, each having its own fire-grate, door, &c. The fire-grates are fed alternately with the object of, as far as possible, exposing the freshly distilled gas from one grate to the flame passing through the opposite combustion chamber. In Mr. McConnell's engines generally, however, the mid-feather extends so far into the combustion chamber that little, if any, advantage can be obtained from alternate firing. The weight of this engine, when ready for service, is nearly 33 tons. The room required for the clearance of the cranks is such that the boiler is placed very high, the chimney being very short. The crank and tyres are of Krupp's cast steel, and the boiler is fed with Giffard's Injector, the water being taken in at the side of the fire-box. Were not the tubes very short, and the tube plate at a distance of several feet from the point at which the feed water enters the boil , this position of the boiler-clack would induce leaking. A large six-wheel tender accompanies the engine, the springs of the middle and hind pairs of tender wheels having compensating levers between them.

Mr. Ramsbottom's locomotive, from Crewe, is named the "Lady of the Lake," and is of the class of express engines employed on the northern division of the London and North-Western Railway. It has outside 16in. cylinders, 24in. stroke, 7ft. 6in. driving wheels, and the usual leading and trailing wheels, the former 3ft. 8in. in diameter. This is 7in. smaller than the leading wheels of Mr. McConnell's engine, which has the same size of driving wheel. With outside cylinders, however, even, as in the present case, somewhat inclined, there is not often room for large leading wheels, and these cannot be set as far forward as when inside cylinders are employed. Thus, in the engine from Crewe, the driving axle is 20in. higher than the leading axle, and, at the same time, is at no great distance from it, so that, when running, there is a tendency, to a certain extent, of the mass of the engine to rise on the driving wheels as they are endeavouring to outrun and overrun the leading wheels. With engines similarly proportioned, the sensation of rising at the foot plate is well known to engine men. Until the bogie is brought into use (the Bissell truck, with a single pair of wheels in front of the cylinders, being probably the best arrangement), the somewhat unsatisfactory proportions and position of the leading wheels in outside cylinder engines will be perpetuated. In every other respect, however, outside cylinders, properly clothed, and with the wheels rightly counterweighted, are altogether preferable, in our opinion, to the old arrangement of inside cylinders, with the constant breaking of cranks, against which class of accidents some of the railway companies are now seeking to protect themselves by using steel cranks, at a cost of nearly £200 each. In the case of Mr. Ramsbottom's engine, the boiler is only high enough to clear the driving axle, the centre of gravity being thus kept well down. The weight of the engine, in working trim, is 27 tons, of which 9 tons 8 cwt. are on the leading, 11 tons 10 cwt. on the driving, and 6 tons 2 cwt. on the trailing wheels. The framing is wholly inside the wheels. The boiler is plain and flush throughout. The fire-box is adapted to burn coal, a number of holes being made in the door for the admission of air, while an arch of firebrick is so turned under and in contact with the crown plate as to deflect the air and gases downward, so as to promote their thorough mixture. The internal surface of the tubes has been given to us as 915 square feet, the fire-box surface being 85 square feet, and the area of grate 14½ square feet. The safety valves are upon Mr. Ramsbottom's patent duplex arrangement, and the feed-water enters the boiler through two of Giffard's Injectors, there being no pumps. The pistons are made upon Mr. Ramsbottom's patented plan, the packing consisting only of two or three rings of square steel wire. The cylinders are lubricated by a most simple apparatus, illustrated in THE ENGINEER of May 24th, 1861 (page 317, vol. xi.). It is constructed and worked as follows:—A hollow sphere, containing the liquid lubricating material, is screwed by a long hollow stem into the bottom of the slide valve box, the stem rising high enough inside to clear any water which may collect there. As the steam comes upon the surface of the oil in the top of this stem a slight condensation takes place, and the water, heavier than oil, or melted tallow, settles to the bottom of the spherical vessel. A corresponding quantity of oil is thus displaced and goes over upon the wearing surfaces. This process will continue until all the oil in the hollow sphere has been displaced. This apparatus, we should suppose, would require to be carefully watched to know when it had become empty. Coming to the valve gear, the link is raised, not by a reversing lever on the foot-plate, but by a hand wheel on the left hand side of the engine, and which acts upon the link through a screw and nut. The link can thus be adjusted to any grade of expansion, but the wear of the screw would be inconvenient in the case of an engine which had to be frequently reversed, or upon a line requiring frequent re-adjustment of the link. So, too, the link could not be reversed as quickly as with the ordinary reverse lever. Means whereby the guard can communicate with the engineman are provided. The covering of the cylinders is such that a considerable number of screw heads and flanges project so as to catch dirt, thus presenting a contrast to the finish of the cylinders on other engines near by. The six-wheel tender accompanying Mr. Ramsbottom's engine carries 1,500 gallons of water and 2 tons of coal. It is provided with the scoop, for picking up water while running, illustrated in THE ENGINEER of August 30th, 1861 (page 122, vol. xii.). On the Chester and Holyhead section of the London and North-Western Railway, and near Conway, a level trough a quarter of a mile long, 10in. wide, and holding water to a depth of 5in., is fixed in each line between the rails. The engine is provided with a scoop which can be let down at the right moment so as to dip 2in. under the surface of the water, and at any speed above twenty-two miles an hour, 1,000 gallons are taken up while running the length of the trough. The principle is much the same as that of Appold's pump, the scoop being carried forward in a straight line instead of revolving in a circle. By means of this apparatus, which is easily kept clear of ice in winter, the Irish mail, known as the "Wild Irishman," runs regularly through from Chester to Holyhead, a distance of 84¾ miles, without making a single intermediate stop. On the 7th of January last, when the Europa's mail, containing the answer of the American Government to our demand for the release of Messrs. Mason and Slidell, was brought to London, an engine of the same class as the Lady of the Lake took the express through from Holyhead to Stafford, a distance of 130¼ miles, in 2h. 25min., or at a speed of 54 miles an hour, and without making a single intermediate stop. This was unquestionably the longest continuous run ever made by a locomotive, and could only have been performed with the aid of Mr. Ramsbottom's simple arrangement for taking up water while the engine is in motion.

The Eastern Counties Railway Company exhibit one of their goods engines, No. 327, as built by Messrs. R. Stephenson and Co., of Newcastle-on-Tyne, from the designs of Mr. Robert Sinclair, locomotive superintendent of the Eastern Counties Railway. It is exhibited after having run 44,950 miles upon the Eastern Counties line, with no other repairs than turning the leading wheels and painting. This engine has outside 17-in. cylinders laid horizontally, 24-in. stroke, four coupled wheels, each 6ft. in diameter, and a pair of 3ft. 7in. leading wheels. A 6ft. wheel is undoubtedly large for goods traffic, but Mr. Sinclair finds it to answer his purpose. None of his passenger engines, at the same time, have driving wheels larger than 6½ft. although some new engines are about to be made with 7ft. wheels to work the express train to the east coast. Engine No. 327 has 968⅓ square feet of tube surface (measured externally) and 72·3 square feet of fire-box surface. The weight of the engine in working order is 30 tons 6 cwt., of which 20 tons 15 cwt. are on the four coupled wheels, which are 9ft. from centre to centre, the whole wheel base being 15ft. 1in. The tender weighs 23 tons loaded. The springs of the driving and trailing wheels are below the axles, and are connected by compensating levers under the fire-box. The tyres are of Krupp's steel, and Mr. Sinclair has also sent a pair of 6½ft. wheels with the same make of tyres which have been running since October, 1859, and for a mileage of 67,000 miles, without having been once turned. These tyres are worn equally all round to a depth of about a quarter of an inch, and are still in almost perfect running order. The most that would need to be done to them is to turn down the outer and inner portion of the face and to take a little off the edge of the flange. The pair of wheels under notice is exhibited at Herr Krupp's stand, where also is shown a pair of 6ft. wheels, fitted up by Mr. Sinclair, with new steel tyres and a steel axle only $5\frac{3}{10}$in. in diameter in the middle of the journals; these being 7in. long and turned dishing so as to be $6\frac{3}{10}$in. in diameter at the ends. This axle is intended to carry 10½ tons, and is considered to have a great excess of strength, although the journals are almost too small, one would suppose, to run cool. To return to Mr. Sinclair's engine, it has Injectors and no pumps. The feed water was originally admitted at the side of the fire-box, but the cooling effect produced on the tubes caused them to leak, and the boiler clacks are now placed at the bottom of the barrel, midway of its length. The engine burns coal, a deflecting apparatus, upon the plan of Mr. Frodsham, one of Mr. Sinclair's assistants, being applied in the fire-box for this purpose. The ordinary working pressure is 130 lb., and with this the engine takes thirty-five loaded wagons, weighing with load, 8½ tons each, up the Brentwood incline, the train starting occasionally from a state of rest at the bottom. The incline is 3 miles long, 2 miles rising 1 in 100, ⅜ mile 1 in 114, and ⅝ mile 1 in 90. On the last-named portion, the whole train, including engine and tender, and weighing 350½ tons, has a gravity of 8,723 lb., and taking the friction, &c., at 10 lb. per ton, the whole resistance would be 12,228 lb., equal to a pressure of 127 lb. on the pistons, and to rather more than one-fourth of the weight on the coupled wheels. The design of Mr. Sinclair's engine is simple, and the whole construction is substantial and finished in a most workmanlike manner, Messrs. R. Stephenson and Co., the makers, being entitled to all the credit of the workmanship. The chimney, we may say, is of the inelegant pattern first introduced by Mr. Sinclair on the Caledonian Railway, rather larger at the top than at the bottom, but having no flare at the top. Mr. D. K. Clark's experiments, however, showed that, with this form of chimney, a better draught was produced with a given sized orifice, or a given draught with a larger blast orifice than where the ordinary shape of chimney was used. There is a roof over the foot-plate, and a glazed erection in front of the engineman to protect them from the weather.

Messrs. Beyer, Peacock, and Co., of the Gorton Foundry, near Manchester, exhibit a large passenger engine and tender for the South-Eastern Railway, of Portugal, the gauge being 5ft. 6in. The principal dimensions are as follows:—16in. inside cylinders, 22in. stroke, driving wheels 7ft. in diameter, and leading, trailing, and tender wheels 3ft. 9in. in diameter. The boiler is 4ft. 2in. in diameter, and contains 215 tubes, 2in. in diameter, and 11ft. long, the external tube surface being 1,236 square feet. The copper fire-box is 4ft. 3in. long, and 4ft. 3in. wide inside, and 5ft. 9in. deep, giving 96 square feet of fire-box surface, and 18 square feet of grate. The total heating surface is 1,332 square feet, which is an exceedingly liberal allowance for the cylinders. The six-wheel tender will hold 1,750 gallons of water. This engine, the Dom Luiz, presents no especial peculiarities, but for simplicity and neatness of design, and for excellence of workmanship, it is not likely to suffer in comparison with anything in the annexe. We shall be able, in a week or two, to give drawings of both the engine and tender.

Messrs. Sharp, Stewart, and Co., of Manchester, exhibit a six-wheel coupled goods engine, of which a drawing appears on another page of our present number. The engine is for the London, Chatham, and Dover Railway, and is unaccompanied by a tender. It is the 1,350th locomotive made at the Atlas Works. The principal dimensions are as follows:—17in. inside cylinders, 24in. stroke, six coupled wheels, 5ft. 6in. in diameter, and covering a wheel base of 15ft. 9in. The weight of the engine in working order is 32 tons, of which 12 tons nearly are on the principal pair of driving wheels, the weight on the front and back pairs of wheels being almost exactly equal, and say 10 tons on each. The engine has outside and inside framing, the crank axle having four journals and the others two, stout cranks for the coupling-rods being keyed on outside. The boiler has the kind of fire-box introduced by Mr. Cudworth, of the Ashford shops of the South-Eastern Railway. The grate is much inclined, the fire-bars being upwards of 7ft. long, with a chilled iron clinker-door occupying 18in. of the length of the fire-box at the lower end of the bars towards the tube plate. The back axle is under the inclined ash pan. The fire-box is divided for nearly its whole length by a longitudinal mid-feather, and the fire is fed alternately through a door on each side. The fire doors are at such a height from the foot plate that the firemen will need to lift his coal higher than usual, but on account of the inclination of the grate, the coal will not require to be thrown far in. This arrangement effects a very satisfactory combustion of coal. The external features of the engine are sufficiently apparent in the drawing given on page 270, in which will be seen the "cab," very much in the American style, only that of the Manchester is not glazed at the sides. It has been urged against the introduction of the "cab" over the foot plate that it interferes with the hearing of the men, the reverberation of sound under the roof and within the closed sides being, it has been said, considerable. We doubt, however, that any substantial disadvantage will be made out in this respect, at least in the case of structures like that erected for the protection of the men on Messrs. Sharp, Stewart, and Co.'s engine, and on every other ground it is a much needed addition to a locomotive. Among nearly 9,000 locomotives running on the American railways, hardly any are without a "house" or "cab" for the enginemen. Before dismissing Messrs. Sharp, Stewart, and Co.'s engine we may say that, as might well be expected from the makers, there are no pumps, Injectors only being applied to keep up the supply of water in the boiler. The feed water is let into the boiler, on the sides of the barrel, about midway of its length. The tyres are so set that they will not come off in case of fracture. The regulator is so made as to work in equilibrium, and has a two-armed handle so that it may be moved from either side of the foot-plate. The links are counterweighted with the old clumsy block of iron, instead of the coiled spring which the makers employ in some of their engines.

We may next notice a goods locomotive, made by Sir W. G. Armstrong and Co., of the Elswick Works, near Newcastle, for the East Indian Railway, of 5ft. 6in. gauge. This engine has a 16-in. outside cylinder placed nearly horizontally, 22in. stroke, and four coupled wheels 5ft. 6in. in diameter, and a pair of leading wheels 3ft. 6in. in diameter. The engines of this class were built from drawings prepared by Mr. Marshall, of Birmingham. The extreme wheel base is 15ft. 4in., the coupled wheels being 8ft. 8in. from centre to centre. The inclination of the cylinders is 1 in 32 only. The boiler is 4ft. 1¾in. in diameter outside of the largest ring of plates, and contains 161 tubes, 2¼in diameter and 11ft. long, the front tube plate being flanged over and placed in the barrel of the boiler. The firebox heating surface is about 102 square feet, and the external surface of the tubes 1,043 square feet. There are brass pumps worked from the cross head on each side, and a donkey pump near the firebox, no Injectors being employed. A long, wide awning, or screen, is held by stanchions over the foot-plate and fire-box.

Messrs. Neilson and Co., of the Hyde Park Foundry, Glasgow, send an express passenger engine and tender constructed upon the plans of Mr. Conner for the Caledonian Railway. It is an outside cylinder engine, with outside and inside framing, and driving wheels of the large diameter of 8ft. 2in. As for the general arrangement it is, we believe, much like that of the engines which Mr. Sinclair, now of the Eastern Counties Railway, constructed while locomotive superintendent of the Caledonian Railway. Notwithstanding that the Beattock incline, on this line, is 10 miles long, rising 1 in 84 for 4 miles, and 1 in 75 for 6 miles, Mr. Sinclair's 7-ft. wheel engines were found to perform better than those having 6-ft. wheels. Mr. Conner, the present locomotive superintendent, therefore designed the present class of large wheeled engines in 1859, believing that they would answer even better than those with 7-ft. wheels. The engine in the Exhibition has outside horizontal cylinders, 17½in. in diameter with 24in. stroke. The leading and trailing wheels are 3ft. 8in. in diameter. The weight of the engine with water in the boiler is 30 tons 8 cwt., or 68,096 lb. The barrel of the boiler is 3ft. 10in. in diameter inside, and contains

192 tubes, 1⅞in outside diameter and 11ft. 6in. long, the external tube surface being 1,084 square feet. The firebox is 4ft. long inside, 3ft. 4¼in. wide, and 5ft. 6in. deep. The driving axles of Messrs. Neilson's engines, as also those of the engines made at the Caledonian Railway Company's own shops, are of cast steel. The driving tyres of those at work on the line are of Krupp's steel, but for the engine in the Exhibition these tyres could not be obtained in time. Engines of the same class as that exhibited are employed on the main line of the Caledonian Railway, taking all trains in turn whether fast or local. They have frequently, and without assistance, taken fourteen carriages up the Beattock bank, 10 miles long, and rising nearly 675ft., in 20 minutes, or at the rate of 30 miles an hour. We hope to be able, in the course of a few weeks, to give an illustration of these engines.

Messrs. William Fairbairn and Sons send a goods locomotive for the Midland Railway. It has inside cylinders, six coupled wheels, no Injectors (the common pumps being used), and does not appear to present any noticeable feature, unless we except the fire door, of the well-known Midland pattern, the two halves being separated and made to slide like the scenes in a theatre. Messrs. Beyer, Peacock, and Co. adopt this door in their engine for Portugal.

Messrs. Manning, Wardle, and Co., of the Boyne Engine Works, Leeds, send a handsome little tank engine, their sixtieth, and which has been employed for the last month or so in hauling heavy loads of machinery, &c., into the building. It has outside cylinders and four coupled wheels, the tank being placed on top of the boiler. Without any striking peculiarity it is a most creditable example of design and workmanship, and has won many a good opinion in the busy season of the last few weeks.

Messrs. George England and Co., of the Hatcham Ironworks, at New Cross, exhibit a tank locomotive called the Little England.

The Neath Abbey Company send a diminutive little tank locomotive, the Abbot, which will serve to remind visitors that Wales *does* produce locomotives.

We now approach the foreign locomotive department, and we do so with much hesitation. We desire, of all things, to cherish no prejudice, mechanical or otherwise, and would prefer straining a point or so in order to do abundant justice to foreign skill, yet we may as well "out with it"—we cannot subscribe to the plan and workmanship of some of these continental locomotives, and were we a railway manager and had them on our line we would break one or two of them up for old iron. The faults to which we refer are generally those of design; we have not as yet given especial attention to the workmanship, some of which, however, appears to be particularly good.

Perhaps the most creditable example of foreign locomotives in the building is that called the Berlin, and sent by A. Borsig, of Berlin. It is an outside cylinder engine with four coupled wheels and a pair of smaller leading wheels. All the wheels are placed between the firebox and smoke box, the former overhanging the back pair of coupled wheels. The framing is wholly inside. On each side of the engine, and below the level of the axles of the coupled wheels, is a single spring of great strength. Its concave side is its lower side, as the load presses from above on the middle of the spring. Each end of the spring rests in a long stirrup, the two stirrups being jointed above to a long compensating lever, the ends of which rest respectively on the axle boxes of the two wheels to be coupled. The arrangement is the same as that employed about twenty years ago in American locomotives when coupled wheels had superseded the single pair of driving wheels, and nearly the same plan is still retained in the bogies of the American engines. In Borsig's engine the front ends of the leading wheel springs are also connected transversely across the engine by a compensating lever under the smoke-box. The cylinder is placed horizontally, and both the cylinder and boiler appear to be of large size. The guides for the cross head are double, or of the kind usually adopted for inside cylinder engines. The crank pins are very small, not larger, we should say, than those of Messrs. Manning, Wardle, and Co.'s little tank engine in another part of the annexe, and the coupling rods, which, we must suppose, are of steel, are the smallest we ever saw on any full grown engine. The engine has separate expansion valves. We are unable to discover the strength of the cylinder fastening, but we have always understood that, in most of the engines by the same maker, this fastening was of insufficient strength. The tyres, which are of cast steel, were made at Borsig's own works. The engine is numbered 1,361, and thus, with perhaps one exception, Herr Borsig has made the greatest number of locomotives of any builder anywhere. His works, too, were not started until as late as 1847, notwithstanding which fact he had completed his 1,000th engine in August, 1858. Messrs. Sharp, Stewart, and Co.'s engine in the annexe is numbered 1,350, and we believe Messrs. R. Stephenson and Co. have turned out nearly 1,400. Messrs. R. and W. Hawthorn, too, are not far behind these great firms. In America two establishments, the Norris Locomotive Works, at Philadelphia, and Messrs. M. W. Baldwin and Co.'s factory in the same place, have each completed rather more than 1,000 locomotives, while the Rogers Locomotive Works, at Paterson, U.S., has turned out about 1,000 engines also. None of these builders, however, have delivered anything like the amount of locomotive work, since 1847 which has been produced by Borsig.

We may next notice an engine from Hartmann's machine works, at Chemnitz, in Saxony. Like Borsig's it has four coupled wheels, the firebox overhanging the back pair, and a pair of leading wheels in front, or, rather, a two-wheeled Bissell truck, of which an illustration and description appeared in THE ENGINEER of July 29th, 1859 (page 80, vol. viii.). The cylinders are outside, and placed horizontally, close to the front pair of coupled wheels, the connecting rod taking hold of the outer end of a crank pin in the hind wheels. Long steam and exhaust pipes extend from the cylinders, and on the outside of the boiler, to the dome and smoke box. The shape and fastening of the guide bars for the cross head are extraordinary, and not at all to be commended. The engine, we are told, "will run round in a ring," and so it would, or ought to, if the hind pair of wheels were placed behind the firebox, the cylinder and Bissell truck being, at the same time, carried forward to their proper places. None understand running locomotives round a ring better than the Americans, on whose railways numberless engines with four coupled flanged wheels, and a four-wheeled bogie, run at express speed, around curves of 8 and 9 chains radius, the extreme wheel base of the engines being 21ft. to 22ft., which is nearly double the wheel base of Hartmann's engine.

There is a heavy six-wheel coupled inside cylinder engine from Italy. The boiler is oval, its vertical diameter being several inches greater than that measured horizontally. This is not right, especially when we see no rivet heads on the outside of the barrel (which had not been lagged when we first saw it) indicative of transverse stays within. The middle pair of wheels are without flanges on the tyres, and the hind axle is beneath instead of behind the firebox. The connecting rod is made after the usual Italian fashion, and we may only give our readers a hint to take a look at it.

J. F. Cail, of Paris, sends an outside cylinder, six-wheel coupled locomotive of large size. All the wheels are between the firebox and smoke-box. Owing to want of room the springs of the hind wheels are placed over the rims of the wheels and several inches outside from the proper point of bearing.

La Société Couillet send an inside cylinder, six-wheel coupled goods engine, with 18-in. cylinders, 24-in. stroke, and 5-ft. wheels. The cylinders are cast close together, and the slide valve box, for each cylinder, is placed between it and the framing. The boiler appears to be intended for burning coal, having a firebox of great length and an enormous fire door.

We now come to two locomotives made by Mr. John Haswell, of the Austrian State Railways, at their extensive workshops in Vienna. One is an express, the other a goods engine, and both, in English eyes, are extraordinary productions. The express engine has four outside cylinders, two being cast together for each side. These double cylinders, each 11in. in bore and for a 24½-in. stroke occupy the usual position of single outside cylinders. The driving wheels 6¼ft. in diameter are in front of the firebox, and there are no trailing wheels behind. Between the driving wheels and cylinders are two pairs of large leading wheels (not combined in a bogie), thus giving the engine six wheels in all. The framing is entirely outside of the wheels. The axes of the double cylinders, one being above the other, converge towards the driving axle. The connecting rod corresponding to the uppermost cylinder takes hold of a pin in the end of a crank, keyed upon the outer end of the driving axle, outside of the frame. From this pin a stout bar extends diametrically across the plane of revolution of the crank, and upon the opposite end of this bar is a pin to which the connecting rod corresponding to the lower cylinder on each side is attached. The pistons, therefore, in each pair of double cylinders, work in exactly opposite directions, the admission of steam, however, to the pair of cylinders being managed by a single valve worked by a link in the ordinary manner. Thus one piston and its attached moving parts exactly balances the other on the same side, and the engine can hardly fail to be steady at any speed, excepting of course, the unsteadiness arising from the alternate upward strain on the cross heads on the opposite sides of the engine. We have it, indeed, upon authority which ought to be trustworthy, that this engine has been run, with a load of 50 tons, at a speed of 67 miles an hour, and with nearly perfect steadiness, the engine being run also with the wheels jacked up in the shop, at 100 miles an hour with equal steadiness. This, however, is not enough to enamour us with a four-cylinder locomotive, for, at high speeds, we believe that one cylinder would be even better than two, to say nothing of three or four. The whole weight of the engine, in working trim, is, we are told, 32 tons, exclusive of tender.

The other of Mr. Haswell's engines is a ten-wheel goods locomotive, with 18-in. outside cylinders, 24½-in. stroke, and weighing (the tender being so applied so as to form part of the engine) 42 tons. Three pair of wheels are secured to the frame of the engine, and are worked by coupling rods in the usual manner. Two more pairs of wheels are arranged beneath the tender, which is made to swivel behind the engine, notwithstanding which fact the ten wheels under the engine and tender are all coupled together by an arrangement which we should be unable to describe without a drawing. All the wheels are 40in. (3ft. 4in.) in diameter, and the engine now stands on a curve of 300ft. or 4½ chains' radius.

Having thus noticed at some length the various railway locomotives in the Exhibition, we may now make a few general remarks upon them. Since 1851, a preference for outside cylinders has gained ground, and the proportion of outside cylinder engines exhibited, as compared with those having inside cylinders, is much greater than might have been expected ten years ago. In Prussia and in the United States no inside cylinder engines have been made for many years, and it will not be long, we believe, before English practice will have been similarly qualified. Since 1851, coal burning has become general, and notwithstanding the celebrity, a few years ago, of certain very ingenious contrivances for burning coal, the problem appears to have been solved by arrangements of such simplicity that it is matter for wonder that they were not hit upon before. Among the simplest and best of these is the perforated door and firebrick arch of Mr. Ramsbottom's engine, an arrangement, we believe, first used in America by a Mr. Griggs, of Boston, U.S., and described in Messrs. Colburn and Holley's work entitled *European Railways*. As the locomotives are not included in the "machinery in motion" in the western annexe, visitors, of course, will have no opportunity of observing how far the various coal burning contrivances are effective. We believe, however, that we are able to say that most of them enable the engine man to keep up an abundant supply of steam, and that no notable inconvenience is experienced in respect of burning out the firebox or fire-bars. But most of the coal burners, we believe, fail to "consume" their smoke, as most people persist in calling the *prevention* of smoke.

Counterweighting has generally been resorted to since 1851, and with the best results. It was absurd to suppose, as the old school of locomotive engineers appear to have done, that half a ton of unbalanced machinery could be put in motion at the rate of from 500 to 700 alternations per minute, without destructive consequences somewhere. It is indeed to a better appreciation of the advantages of counterweighting that the appearance of Mr. Haswell's quadruple cylinder express engine in the Exhibition is due. The desired object can be attained, however, as we have every reason to believe, without any such complication. As for the introduction of the Injector, and the probable supercession of pumps (several of our most important lines having already abandoned the use of pumps on locomotives), the improvement is undeniable. So, too, in respect of the materials employed in construction; a certain amount of commercial advantage has been gained, and an incalculable amount of safety secured, by the introduction of cast steel as a material for tyres and axles. We are on the eve, however, of a general application of steel in locomotive practice, this steel being of a kind easily and chiefly producible from cast iron.

The Exhibition contains no example of a locomotive with a bogie, unless we except the Saxon engine, by Hartmann, which is provided with a Bissell truck. Thus far the Americans have had almost an exclusive monopoly of this arrangement, but we believe that its merits are yet likely to attract attention among English locomotive superintendents. Every year new railways are being made with an increased amount of curvature, and on these additional flexibility in the rolling stock is especially desirable. We should have been glad to have seen sand-boxes on some of the engines exhibited, and a better arrangement of the sand delivering apparatus on others. Good clean sand can always be kept dry in a box upon, or at the sides of, or beneath, the boiler, and a small conical plug capable of being lifted and dropped by a handle on the foot-plate will always place the delivery of sand (through ¾-in. or 1-in. pipes coming down nearly to the rails and close to the driving wheels) under complete control.

There are no mammoth locomotives in the Exhibition, and there are very few which illustrate any new and valuable principle. If there be one which contains a feature likely to influence future practice, we should say it was Hartmann's engine from Saxony, this peculiar feature being the Bissell truck. Locomotive engineering, certainly, has made no great strides since 1851, but this truth will not prevent even the most practised engineers from deriving valuable lessons, under this head, from the engines exhibited in the western annexe.

THE LONDON AND NORTH-WESTERN RAILWAY WORKSHOPS AT WOLVERTON.

MR. C. B. KING communicates to the *Mechanics' Magazine* the following description of these works:—

The locomotive, from the time of its first invention to the present moment, has progressed in its development. It has been the subject of improvements from men of genius and skill, to whom society owes considerable gratitude. Need we mention the names of Watt, Murdock, Trevithick, Blenkinsop, Stephenson, Braithwaite, and a host of others. The great outlay attending the continual wear and tear of rolling stock, induced nearly all the railway companies to erect workshops at convenient portions of their line, for the purpose of effecting repairs. The success of such undertaking has been proved so far, that works established for the purpose specified, now build new engines as well as repair old ones. The following description of one of the largest places of this kind will, we trust, prove acceptable to the majority of our readers. Wolverton is situated 52½ miles from London, on the London and North-Western Railway, and was first established in 1836 by the company, as a depôt and repairing shop, when the works covered about four acres of ground. It gave employment to 100 men, the population of the place scarcely exceeding 200. Mr. Edward Bury (who had previously been a locomotive engine builder) was appointed superintendent, but resigned his post in 1847, and he commenced locomotive building at Liverpool. He was succeeded by the late talented superintendent Mr. J. E. McConnell, under whose management the works attained their present gigantic proportions, constructing one new engine weekly, and repairing, on an average, nine old ones. There are now 2,200 men on the books, receiving weekly wages amounting to £2,100. With the works the town has also increased. It now possesses a church of considerable pretensions, with schools and a Mechanics' Institute. The company, some years back, on account of their increasing business, built a large number of cottages, about a mile from Wolverton, for the residence of their men. It has a church, schools, and some dissenting chapels, and is called Stantonbury. The joint population of the two places is between 5,000 and 6,000. Owing to their gradual rise, the works consist of a collection of shops of different and varied construction, some being large and commodious, others inconvenient and cramped. They are erected on both sides of the line, and cover about thirteen acres of ground.

Smiths' Shops.—Of these there are two, one on the east and the other on the west side of the line. That on the west side is an entirely new building and is the finest of its kind we have seen, being 326ft. long by 90ft. wide. It is furnished with 100 forges ranged the whole length on both sides, while in the middle are erected six of Nasmyth's 15 cwt. steam hammers.

The boiler shop runs parallel to the smiths' shop, and is also a new building, with a glass roof. On the day of our visit there were seventeen new boilers and six tenders on hand. A noticeable feature in the former was the introduction of a welt instead of a lap joint for the boiler barrels, giving thereby considerable additional strength. The shop contains twenty-one forges, one steam hammer, two plate-bending rolls with reversing gear, ten drilling machines, a small lathe for cutting dies, a circular saw running at a thousand revolutions per minute for cutting hot angle iron, by which means a great saving is effected both in time and material, 3-in. angle iron can be cut by it in a second. In one corner is one of Haley's steam rivet-making machines, by which one man and two boys are able to turn out seventeen rivets per minute. One of Garforth's steam riveters is also at work, capable of riveting the barrel of a locomotive engine throughout in a day of ten hours, driving about 820 rivets. There are a number of punching and shearing machines, some of great power; one on the lever principle deserves notice as being of Wolverton manufacture. Its framing, which is cast in one piece, is nine tons. Cast iron columns with wrought iron girders support the roof of this building, and form bearings for two large travelling cranes of great power. Some plates were shown us in this shop, one 14ft. 4in. × 4ft. 4in. × ⅜in., another 8ft. 6in. × 6ft. 9in. × ⅜in., also a copper plate 6ft. 8in. × 7ft. 2in. × ⅛in.

Running parallel to this is an erecting shop, the same size and similar in all respects to the boiler shop. One ine locomotive, intended for the forthcoming Exhibition, has just been made here.

Its cylinders are 18in. diameter by 24in. stroke, with a 7½ft. driving wheel. It is intended to work at 150 lb. pressure. Its workmanship is first-class, and will ably sustain the reputation of the works. Thirty-six engines have been turned out of this shop since its erection last year. Twelve are now in preparation. Two travelling cranes, capable of lifting 40 tons, perform the heavy lifting.

The pattern-making and carpenters' shops are also on the west side, furnished with lathes and other machines, and are capacious and admirably adapted to their work.

The fitting and turning shops are very numerous. In one there are 89 men at work, with 31 lathes, &c. One slotting machine has the novel application of elliptical cog wheels, securing a quick return of the tool.*

In the next shop, among various other machinery, we noticed a powerful horizontal shearing machine for cutting old tyres, and in one large lathe two cast steel wheels with corrugated webs are being turned.

In the wheel-turning shops there is one of Whitworth's large slotting machines, worked by screw instead of the crank.

The wheel-yard contains two hydraulic presses for putting wheels on axles, and a shearing machine. The foundry is capable of very extensive operations, being fitted with a large cupola furnace and other plant. A casting weighing 9 tons has been executed. About 11½ tons weekly is the average amount of work. From the brass-foundry, where there are eight furnaces, about 3½ tons of metal are turned out weekly. Among the wonders of the other shops we can only notice a monster steam hammer of 50 cwt., and a large slotting machine 29ft. long.

To describe the stores minutely is impossible, we can consequently only take a cursory glance. There are stacks of brass tubes, all kinds of engine duplicates, bolts and nuts, boiler plates, bar iron, forgings of all descriptions, and, in fact, everything requisite for a large establishment. Noticeable were a number of Giffard's feed-water injectors, which will, doubtless, rapidly supersede feed-pumps. They are applied to the major part of the London and North-Western Railway engines, where their working has given great satisfaction.

There is a large fitting and turning shop on the east side, and near it the repairing shop. This is a large building, capable of accommodating thirty-two engines. A travelling table, driven by a small locomotive, runs the whole length of the shop, by which engines are shunted. They are drawn on the table by chains reefed round the three pulley blocks, and then moved by the engine. Grease from axle-boxes is removed by steam, not burnt off, as in some shops. A great saving is effected by this, for by burning the grease from the bearings they are often burnt out and destroyed.

In the tender shop are several tenders in various stages of progression. And among other shops are some new ones capable of storing thirty-six engines and tenders. Here they are painted and finished. We subjoin a list of the machines in constant uses for locomotive purposes, requiring eleven stationary engines to drive them :—

Lathes	145
Planing machines	20
Slotting and shaping	57
Drilling machines	73
Screwing machines	10
Cylinder boring machines	2
Portable boring machines	2
Rivetting machine	1
Rivet-making machine	1
Shearing machines	15
Bolt-forging machines	3
Circular saws for irons	4
Hydraulic presses	2
Steam hammers	10
Rolling mill	1
Tyre rolling machine	1
Plate-bending machine	2
	349

* Anything but novel, as elliptical gearing has been used for years in Glasgow.—Ed. E.

SUGAR MACHINERY IN THE EXHIBITION.

Since the invention of the vacuum pan the most important improvement in sugar making has been the centrifugal machine for separating sugar from molasses. Strange to say, however, this machine is in use in but two or three London houses, although the Bristol and Greenock refiners have long since adopted it. It has, at all events, found a place in the Exhibition, and will be presently noticed.

Beginning with the first step in obtaining sugar from cane, we are to examine the sugar mill. In the enormous strength of our modern mills, as contrasted with that of the diminutive rollers worked by mules or bullocks on most sugar plantations fifty years ago, we have a not unworthy illustration of the illimitable power and applicability of steam. Cane, as prepared for the mill, contains about 90 per cent. of its weight of juice. Not one-half of this yield, however, was obtained from the old mills, unless so small a quantity of cane was crushed at a time as to render the process unprofitable. The best mills, however, now made, will extract 75 per cent. of the weight of the cane in juice, and 65 per cent. is, perhaps, a fair average of good plantation practice.

In the western annexe there are mills by at least four different makers of repute, the largest, or at any rate, the most powerful, being that of Messrs. Mirrlees and Tait, of Glasgow. Next to Messrs. Maudslay's 800-horse engines this mill is, we believe, the heaviest piece of machinery in the building, weighing, with engine and gearing, and as the whole now stands upon its foundations, 143 tons 9 cwt. Had the boilers been exhibited, the total weight would have been much greater. Beginning with the engine, it is a single cylinder high-pressure beam, with an entablature supported on six columns. The diameter of the cylinder is 22in., the length of stroke 4ft. 6in., the intended working pressure in the boilers 70 lb., the intended speed 34 revolutions per minute, and the indicated power, when in full work, upwards of 200 horses. The fly-wheel is 20ft. in diameter and weighs 14 tons. All the beam centres are of wrought iron. The gearing is in the ratio of 16 to 1, the rolls making 2¼ revolutions per minute, and as their diameter is 33in., their velocity at the periphery will be 18·36ft. or, say, 18ft. per minute. In the intermediate gearing, the second motion wheel is 14ft. in diameter, with teeth of 5in. pitch 15in. wide on the face. The proportions of this gearing are worthy the study of the mechanical engineer. The mill has three rolls, each 33in. in diameter and 7ft. long, cast in loam, and bored for a round shaft 14in. in diameter. The rolls are indented with fine grooves to increase their "bite," but we are unable to say, just now, whether these grooves are distinct from each other, or the result of one coarse continuous cut, so as to form a sort of screw. With some mills we know that screw thread grooves have caused much trouble by reason of the end thrust thereby created upon the bearings of the top and megasse rolls. These rolls work "iron to iron," the megasse roll being often set up at the screws by three or four men on a lever 8ft. long. The cane roll and top roll run ¾in. clear of each other. The bearings of the shafts are generally one and a half diameters in length. The knife for clearing the cane and megasse rolls is of cast iron, bedded for its whole length on greenheart wood, which is nearly as hard as iron. Owing to its great length, the knife is supported at the middle by a pillar rising from the pan. The cheeks of the mill are of a massive pattern, the thrust between the top and lower rolls being taken, in the usual manner, through a stout bolt, with a distance piece at each opening. The brasses are heavy, those for the cane and megasse rolls having each a thick wrought iron plate covering the whole back to receive and distribute the pressure of the screws, which have long brass nuts.

The enormous strength of this mill would enable it to roll out a good sized bar of iron while cold. It is not, however, the largest mill made by the same makers, as, a short time since, they sent one to Cuba with 33-in. rolls, 7ft. 6in. long, and having 15-in. shafts. The engine had a 24-in. cylinder and 4ft. 6in. stroke. The same and other makers have also sent mills to the Mauritius with 36-in. rolls, 5ft. long. The present mill will give off about 80 gallons of juice a minute, or 48,000 gallons, equal to rather more than 20 tons of sugar, in a day of ten hours.

The four and five roll mills, once in some favour, appear to have been pretty generally given up, more and better work being done, with a given power, with three rolls than with a larger number.

Messrs. Fawcett, Preston, and Co., of Liverpool, have an engine and sugar mill close by the one already described, and having 32-in. rolls, 7ft. long. The cheeks are so cast as completely to encircle the journals of the lower rolls, instead of being left open in the usual manner to receive a bolt and distance piece. It would thus be necessary to take the whole mill apart to remove either of the lower rolls, but fortunately this is a task which does not often require to be performed. The screws, for setting up the rolls, bear each upon a small piece of wrought iron, but although many engineers would like to see an iron plate, covering the whole back of the brass, it must be remembered that, after all, only a small portion of such a plate (that portion being just around the point of the screw) is really effective, unless, at least, the plate is of great thickness. We cannot quite commend the proportions of the gearing of this mill, and the journals would be none the worse if they were a trifle longer. We would also prefer round to square shafts. The sole plates and standards do not appear to have been cast from a modern set of patterns, but this may not greatly affect the general character of the engine and mill as a good, serviceable lot of machinery. At the same time we can recommend no builder to imitate it very closely, for as an example of mill-work there are more creditable models on either side.

A very fine piece of work is the engine and mill of Messrs. W. and A. McOnie, of Glasgow. Not as large as its great rivals, it nevertheless will bear a close comparison with the best examples of millwork in the same line, in every respect of proportion and construction. As for general arrangement, it differs in no material respect that we can see from the usual class of three-roll mills, so much in favour in Cuba and in our own sugar-growing colonies. The same makers also send a very diminutive mill, with horizontal rolls.

None can blame our engineers, if there is a sufficient demand for beam engines to go with sugar mills, for making as many of them as possible. Yet we no more believe that a lumbering beam engine is needed for a sugar mill than that a fifth wheel is the best thing for a coach. The Americans, who run very closely upon our sugar mill makers in Cuba, appear to have no difficulty in persuading their customers of the advantages of horizontal engines, of which they sell great numbers. A common American price, we understand, for a 12-in. single cylinder 4ft. stroke engine, with plain cylinder boilers, for driving a 24-in. mill 4½ft. long, is £450. At all events a well-made horizontal engine would be as valuable as any other upon a sugar estate, and, for any other than a wealthy planter, would be much more preferable than a costly beam engine.

In the French department of the Exhibition is a good sized sugar mill by J. F. Cail, the great *constructeur*, of the Quay de Billy, Paris. An engine with a handsomely made locomotive boiler accompanies it.

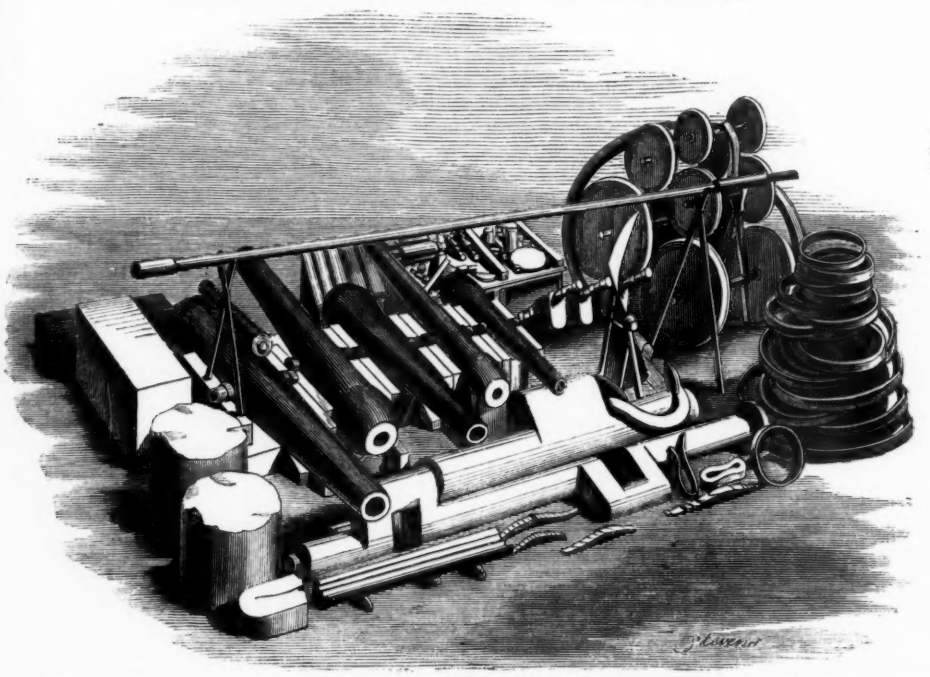
From the mills we come to the vacuum pans, of which Messrs. Forrester and Co., of Liverpool, send a set of three. We must take a future occasion to speak of these, as also of some other contributions in the same line, one especially from the continent being a fine example of workmanship.

The centrifugal sugar purifying machine remains to be noticed under the present head. The first to introduce into this country a contrivance for separating the liquid and solid portions of undrained sugar, by means of centrifugal force, was, we believe, J. G. Seyrig. His plans became known about twenty years ago, and with others embracing modifications of the principle, became the property of Messrs. Manlove, Alliott, and Co., near Nottingham. In 1849, Mr. C. W. Finzel, of Bristol, patented a contrivance for clearing the meshes of the revolving cylinder by means of steam. As now made, a close bottomed cylinder with perforated or meshed sides, and generally 40in. in diameter, is made to revolve around a vertical axis at the rate of from 900 to 1,200 revolutions per minute, the centrifugal force thus imparted throwing out the uncrystallisable portion of the sugar, the granular portion being retained in the case. The operation continues from two or three to eight or ten minutes, according to the quality of the sugar, and the machine is then stopped, the drained sugar removed and a fresh charge applied. In this way from 3½ to 5 tons of sugar are drained in a day of ten hours. By the old process the "titlers" of sugar would be left to stand in moulds for eight or ten days, the tops of the "titlers" being "liquored" three or four times to assist the draining. In many sugar houses a stock of moulds of a value of from £5,000 to £10,000 is kept on hand, the capital represented by the sugar is kept lying idle for nearly a fortnight, and a great deal of room is occupied and considerable labour consumed in the process of draining. As compared with such a treatment that by the centrifugal machine appears like magic, and such are the economy and certainty of the result that it is extraordinary that but two or three London refiners have yet adopted it. The large refinery in course of erection near the Victoria Docks will be provided with the centrifugal machines; and with their extensive and successful use in Bristol and Greenock, it cannot be long before they will have superseded the system of draining in moulds.

It would be desirable to make the centrifugal machine self-feeding and self-discharging, so that its action might be continuous. Messrs. D. Napier and Co. have endeavoured to effect this object in a 48-in. machine which they exhibit in the annexe, but we are unable to speak of its practical operation. Thus far in seeking to make the centrifugal machine automatic, great difficulties have been experienced with the numerous valves and cylinders which almost any arrangement for that purpose would appear to require.

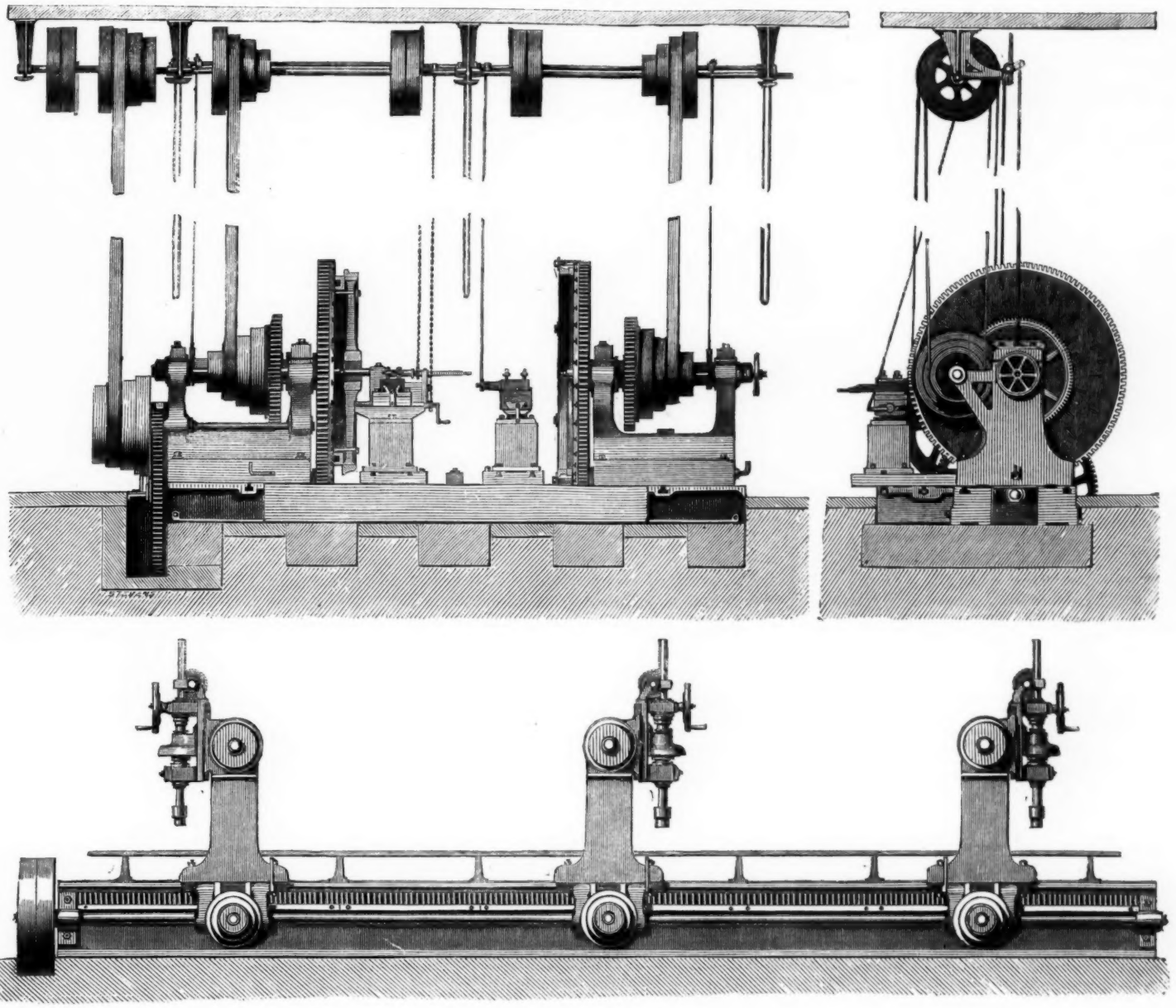
We may note also that J. F. Cail, of Paris, also exhibits a centrifugal purifier, upon the plan covered by Messrs. Manlove, Alliott, and Co.'s patents, and, furthermore, that the last-named firm have applied the same principle in machines for cleansing yarns and drying clothes. At Messrs. Strutt's works, at Belper, twenty-eight of these machines are at work in a single room for the former purpose, and at many large public institutions they are extensively employed in the laundry department.

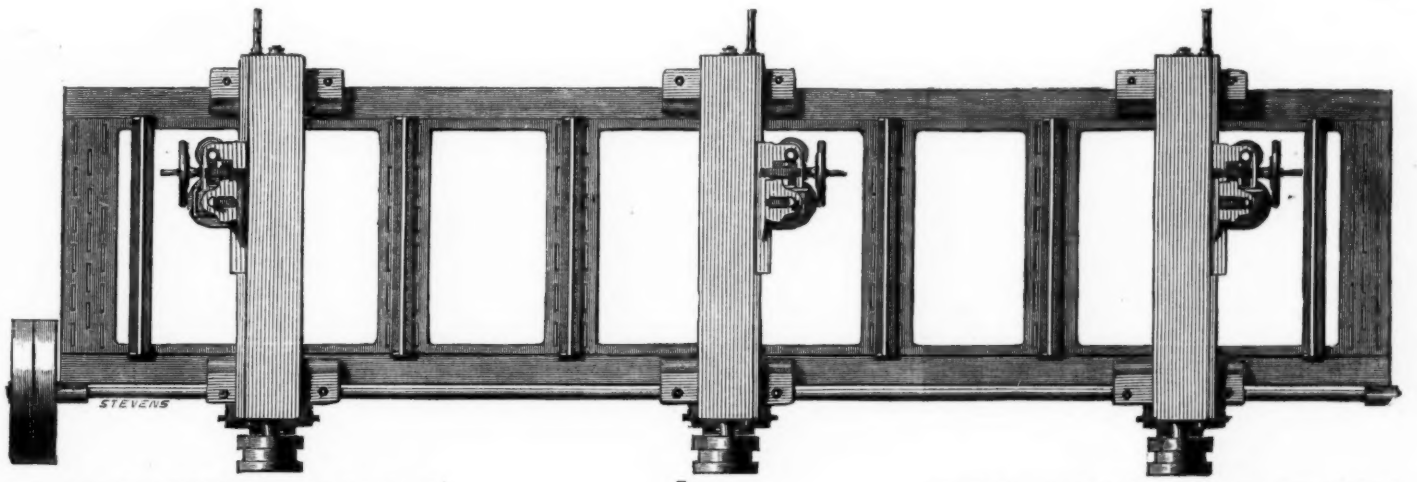
KRUPP'S CAST STEEL IN THE EXHIBITION.



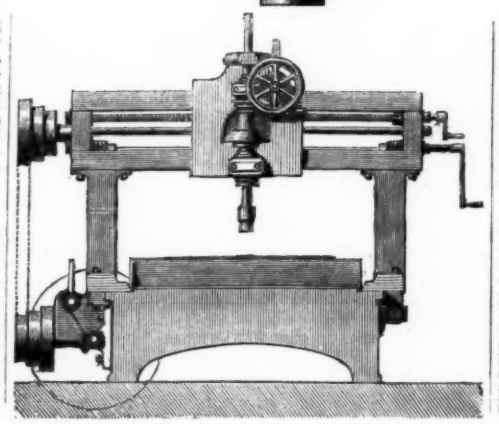
We give an illustration of the collection in the Exhibition of objects in cast steel by Herr Krupp, of Essen, in Rhenish Prussia, and described in page 272 of our present number. The reader will comprehend the scale of the figures when we say that the platform upon which these wonders of steel casting and forging are exhibited is 40ft long and 17ft. wide. The great circular ingot, shown broken in two, is 44in. in diameter, and weighs, together, about 21 tons.

BEYER, PEACOCK, AND CO.'S TOOLS IN THE EXHIBITION.





On another page we have alluded to Messrs. Beyer, Peacock, and Co.'s 7ft. lathe, and drill in the Exhibition. The former is sufficiently explained by the illustration at the top of this page. The latter is a special tool for drilling the holes, three at a time, in a pair of locomotive frames. The work once properly placed the drills can work only in right lines, the only two directions in which the drills can be moved bodily being exactly at right angles to each other. The feed screws are all of either ¼in. or ⅛in. pitch, so that the pitch of the holes being drilled can easily be regulated as required. A practical locomotive maker will readily comprehend the great assistance to be derived from the use of such a tool.



Notes from British America.—Recent reports with reference to the railways of New Brunswick and Novia Scotia show that the former colony has 108 miles, and the latter 100 miles of line in operation. In New Brunswick the working expenses were in the ratio of 72·12 per cent. to the revenue receipts, and in Novia Scotia they were still higher, 78·30 per cent. The net income per cent. on the cost of the New Brunswick system was thus 0·8 per cent., and on the Nova Scotia line 0·6 per cent. It must be confessed that there is room for much further improvement. However, the lines cannot fail to effect great public good, although they do not at present yield a fair return upon the capital expended. Since the American blockade has shut out Southern turpentine, a sort of coal oil called turpentoleum has been used for some purposes in Canada. Some discussion has a risen as to the propriety of opening up a road through the Western Canadian possessions to the Pacific. The project is generally viewed in a favourable light and now forces itself prominently on public attention in consequence of the exceeding richness of the gold-fields in British Columbia. A general geological examination of the province of Nova Scotia is contemplated. Arrangements are in progress by which a semi-monthly line of steamers will be established between San Francisco and Victoria, Vancouver's Island. The Government has issued notices for tenders for the construction of roads to all parts of the Cariboo county from the main line from Lillooet to the Forks of Quesnelle, reserving to itself specially the construction and improvement of a main trunk wagon road between those points. To meet the expense of constructing trunk lines of roads through the interior a sum of £100,000 is to be borrowed on debentures. Mr. Nicholas Sparks, the founder of the city of Ottawa, died there on the 27th of February. Mr. Sparks purchased the ground on which the rising city is built for £95 in 1821, and lived to see it occupied by a large population, and of course immensely increased in value. An elevator, worked by a steam engine, has been erected at Portland, and is now in operation loading vessels with grain worked by the Grand Trunk Railway of Canada. Other elevators have, we believe, been erected at various parts of the system with the view of facilitating the development and conduct of the traffic.

MANCHESTER GEOLOGICAL SOCIETY.

March 25th, 1862.

Joseph Dickinson, Esq., F.G.S., President, in the Chair.

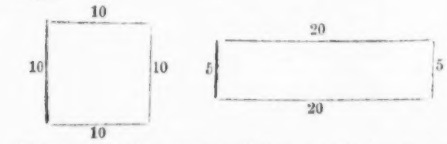
The chair having been taken by Mr. Peter Higson, the President read the following paper, by John J. Atkinson, Esq., her Majesty's Inspector of Mines for the South Durham district.

On the Friction of Air in Mines.

The amount of friction is reckoned or estimated by the amount of the pressure or force required to overcome it. Numerous experiments have been made to find out the laws that govern the friction of air and gases, both in pipes having an uniform section, and, to a less extent, in the irregular air-ways of mines. By these experiments the following laws have been found to hold good in practice.

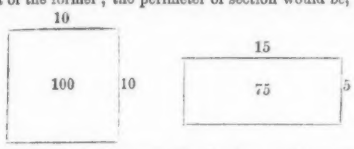
The pressure required to overcome the friction of air increases and decreases in exactly the same proportion that the area or extent of the rubbing surface exposed to the air increases or decreases; so that when the velocity of the air, and the sectional area of the air-way, remain the same, the pressure required to overcome the friction is proportional to the area and extent of the rubbing surface exposed to it; and hence, if we double or treble the extent of the rubbing surface, we also double or treble the friction, or, what is the same, the force or pressure required to overcome it. The rubbing surface, of course, depends upon the circumference or perimeter of the air-way, and upon its length; the rubbing surface is found by multiplying the perimeter by the length of the air-way, where it has an uniform section. A circular pipe or air-way offers less rubbing surface, for same length, than any other form or shape of air-way of equal sectional area; because the circumference of a circle is less, in proportion to its area, than the perimeter of any other figure is to its area. A circle whose area is 1 has a circumference of 3·1416, or rather less than 3½; the perimeter of a square is 4, when its area is 1; so that 22 yards of square pipe would offer nearly the same resistance as 28 yards of round pipe having an equal size or area of section, when the same quantity of air passes through them in a given time.

It is true that the friction of air or gas, in passing through the same pipe or air-way, varies in just the same degree that the density of the air or gas may vary; but in air-ways in coal-mines the air has always nearly one and the same density, and it is only in particular calculations that it becomes requisite to notice its changes of density—in reference, at least, to this part of the general subject—they are so small in amount. This is the case as regards friction, but the effects of variations in the density of the air circulating in mines are more sensible in producing pressure, operating either in favour of or against the ventilating pressure, in rise or dip workings; but the effects belong more especially to another part of the subject. In an air-way 5ft. square the perimeter of the section is $4 \times 5 = 20$ft.; and, if it is 1,000ft. long, the rubbing surface is $20 \times 1{,}000 = 20{,}000$ square feet. In an air-way 10ft. square, the perimeter of the section is $4 \times 10 = 40$ft.; and, if it was a 1,000ft. long, the rubbing surface would be $40 \times 1{,}000 = 40{,}000$ft.; so that on comparing the two cases, it will be apparent that for four times the area there is only two times the extent of rubbing surface. If such an air-way as that last mentioned (10ft. square, and having a rubbing surface of 40,000 square feet for every 1,000ft. in length) were divided into four equal sized square air-ways, the rubbing surface exposed to the moving air would be exactly doubled by the division; and there would be 20ft. of perimeter for each of the four air-ways, or 80ft. on the whole; so that for a length of 1,000ft. the rubbing surface for the four small air-ways would be 80,000 square feet, or, exactly twice as great as that for the one large air-way; although the united areas of the smaller air-ways would be exactly equal to that of the single large one. In one case there would be a single air-way, 100ft. in area; and in the other four smaller air-ways each 25ft. area; but the rubbing surface, and therefore the friction, and the pressure required to overcome it, for the same gross quantity of air, would be twice as great in the four small as in the one large air-way having the same area. And from this fact we learn that one large air-way is preferable to a number of smaller ones, even if they together make up the same sectional area or size. In practice it often happens, however, that a number of small air-ways can be made and maintained at less cost than one large air-way presenting an equal sectional area; and, in such cases, a few extra air-ways, of small area, may more than compensate in utility, and make up in cost, for the absence of one extra-sized air-way; and hence the futility of insisting upon the sectional area of air-ways in mines being of any particular amount, without specifying their number, beyond requiring that one at least in each split be large enough to admit of persons travelling in it. The same principle may be illustrated by taking two air-ways of equal size or sectional area, but having different forms or shapes of section; supposing one of them to be 10ft. high and 10ft. wide, its size or area of section would be $10 \times 10 = 100$ ft.; and supposing the other air-way to be 20ft. wide, but only 5ft. high, the area would be the same (or 5×20) —100ft.



The air-way 10ft. square would have a perimeter of section $4 \times 10 = 40$ft.; while the other would have a perimeter of $(28 + 20 + 5 + 5)$ 50ft., compared with only 40 in the former; so that for equal lengths the friction of the air would only be 40 in the square air-way, compared with 50 in the oblong one; and the friction in 50 yards of length, in the square-shaped air-way, would be no more than that for 40 yards of length in the oblong one for the same quantity of air. Since the air in a mine presses with nearly the same force upon every square foot, it is quite natural that the frictional resistance should be greater or less in amount to the same extent that the rubbing surface or number of square feet exposed to the air is greater or less; and this is the general law or principle that has just been stated and illustrated by examples.

The pressures employed to ventilate mines are commonly reckoned at so much per square foot of area, and not by the entire pressure employed, which is equal to the number of square feet, multiplied by the pressure on each square foot of sectional area, in the shaft or air-way. For instance, a ventilating pressure of 10 lb. to the square foot on an air-way 100ft. in area is equal, on the whole, to $10 \times 100 = 1{,}000$ lb. If the same pressure of 10 lb. per foot is applied to an air-way of only 50ft. area the total pressure is only $10 \times 50 = 500$ lb.; owing to the area being one-half, the total or gross pressure is also only one-half. In order to get the same total pressure we must make the pressure per foot greater in the same proportion that the area is less, when the rubbing surface and velocity of the air are to be the same in two cases. If we reckoned ventilating pressure by its total amount we would not require to notice this law, it is so self-evident; and it is only because we speak and treat of it as so much pressure per square foot that we require to consider the number of square feet to which it is applied. If there were two air-ways, one just twice the area of the other, the velocity of the air and the extent of rubbing surface being the same in each, then we must apply twice the pressure to each square foot of the small one that is required by the larger one to overcome the equal amount of friction in the two air-ways, the quantity of air passing in the smaller one being just one-half of that in the larger. As an example, if we had an air-way 10ft. by 10ft., the area would be 100ft. and the perimeter of section 40ft.; and another air-way, 5ft. high by 15ft. wide, the area would be 75 square feet, or just three-fourths of the area of the former; the perimeter of section would be, however



exactly 40ft. in both air-ways. In the larger air-way we would only require to employ three-fourths of the pressure on each foot of surface, that is to say, three-fourths of the water gauge) that we would require to employ on each foot of the smaller area, so as to make up the same total ventilating pressure—the rubbing surface, for an equal length of air-way being the same in the two cases; because the perimeter of their sections are equal, the velocity of the air being taken as the same in the two cases—the quantities of air per minute would be simply proportional to their respective areas, under these circumstances.

This second law relating to the friction of air in mines need not have been noticed at all if we had reckoned ventilating pressure as a whole; but, as we generally speak of it as so many pounds per foot, we must also take into account, as has previously been remarked, the number of square feet to which it is applied, that is, the area of the section of the air-way; in the same manner that the area in inches of the cylinder or piston of a steam engine, multiplied by the pressure on each square inch, gives the total force applied to the piston. An inch of water-column, as shown by a water-gauge, represents a pressure of about 5·2 lb. per square foot.

The third general law relating to the friction of air in mines is that the pressure required to overcome the friction in the same air-ways varies (that is to say, increases or decreases) in the same proportion that the square of the velocity of the air increases or decreases; so that a double velocity of air, in the same air-way, meets with a double double, or fourfold resistance; a treble velocity meets with a treble treble, or ninefold resistance; and a velocity of four times as great, gives rise to a resistance four times four, or sixteen times as great. In the same way, a half velocity meets with one half of a half, or one fourth of the resistance; one third of the velocity encounters only a third part of a third, or one ninth of the friction, and so on.

The third law of friction, at first sight, looks rather complex. Consideration, however, shows it to be quite natural; because if we double the velocity of the air in the same air-way we, in the first place, cause twice the quantity of air to meet the resistances in a given time; and, in addition to this, every part of this double quantity meets every resistance with a double velocity or momentum; the double quantity air, and the double velocity taken together, may well be supposed to give rise to a double double or four-fold resistance; and this is the true law.

The laws of ventilation would be very simple—quite as simple, indeed, as they are natural—were it not that, in lieu of the mere quantity of air circulating, in a given time, or the mere velocity of the air, we must make use of the square of the quantity, or, what is the same, the square of the velocity, in our calculations; and, as a matter of course, in calculations for comparative results, if we employ the squares of the quantities or velocities we must expect as results, not the quantities or the velocities simply, but their squares; and therefore it will be necessary to extract the square roots of the results so obtained, in order to get at the simple quantities themselves.

It has already been stated that there is one other principle bearing on the friction of air passing through mines; to the effect that it is greater or less in the same proportion that the density or weight of each cubic foot of air is greater or less; so that, if each cubic foot of air had a double weight, it would have a double amount of friction; or, if it had only half the weight, it would have only half the amount of friction, in the same air-way, when the velocity or the number of cubic feet per minute is the same. But the variations in the density of the air in mines are so very small, compared with the whole density, that the effects of this law on the amount of ventilation are very small; so small, indeed, as to be practically unfelt, at any rate, as an increase or reduction of friction in the moving air; even in an upright or vertical shaft the density of the air would only be altered, on the average, by about $\frac{1}{30}$th part of its amount, compared with a level air-way, supposing the shaft to be 150 fathoms deep, so far as the pressure of the atmosphere is concerned. The changes of density arising from the heat of upcast shafts, in expanding the air, has a greater effect, so far as such shafts alone are concerned, under furnace ventilation; but this does not affect the friction of the air in the workings of the mine; and, even in these shafts, the lessened density, arising from expansion by heat, has its effects on reducing the shaft friction, greatly modified by the greater velocity due to the increase in the volume of the air. This increased velocity does more than make up, by the accompanying increase of friction, for any reduction in such friction that is due to the lessened density of the air in every case; the friction, in fact, increases or decreases in just the same proportion that the volume of a given weight of air increases or decreases, whether the change of density arises from change of temperature or from change of pressure. Supposing the temperature of the air in a mine to be 60 deg. in winter and 65 deg. in summer, on the average, such a change would only alter the friction in such mine by about $\frac{1}{104}$th of its amount; in summer the friction would be $\frac{1}{104}$th greater than in winter for the same weight of air; but it would, at the same time, be about $\frac{1}{104}$th part less for the same volume of air—an alteration hardly worth notice for the present purpose. The total friction, or the total pressure due to the friction, of air rubbing against the top, bottom, and sides of the air-ways of mines is not very well ascertained; all the experiments—at least all that have come under my notice, as having been made for the purpose—have been in some respects of a rude character, the necessary particulars not being given in the accounts published to fix with rigid accuracy its amount.

From the best accounts of such trials it seems probable that for every foot of rubbing surface, and for a velocity in the air of 1,000ft. per minute, the friction is equal to 0·26881ft. of air column of the same density as the flowing air, which is equal to a pressure, with air at 32 deg., of 0·0217 lb. per square foot of area of section. Calling this the co-efficient of friction, we have the following rules with respect to the friction of air in mines:—

Where p = pressure per sq. foot.
a = sq. foot of sectional area.
s = the area of rubbing surface exposed to the air.
v = the velocity of the air in thousands of feet per minute—1,000ft. per minute being taken as the unit of velocity.
k = the co-efficient of friction in the same terms or unit as p is taken in.

Total pressure	$pa = ksv^2$	(1)
Rubbing surface	$s = \frac{pa}{kv^2}$	(2)
Velocity squared	$v^2 = \frac{pa}{ks}$	(3)
Co-efficient of friction	$k = \frac{pa}{sv^2}$	(4)
Pressure per foot	$p = \frac{ksv^2}{a}$	(5)
Area of section	$a = \frac{ksv^2}{p}$	(6)

Putting these formulæ into words we have the following set of rules:—

(1) *To find the total pressure* due to friction.*—Multiply the co-efficient of friction by the extent of the rubbing surface, and the product by the square of the velocity in thousands of feet per minute, that is to say, by the square of the quotient resulting from dividing the velocity in feet per minute by 1,000.

(2) *To find the rubbing surface.*—Divide the total pressure by the product of the co-efficient of friction, and the square of the velocity in thousands of feet per minute.

(3) *To find the velocity.*—Divide the total pressure by the product of the co-efficient of friction, and the rubbing surface—this gives the square of the velocity—the square root of which is the velocity itself, in thousands of feet per minute; this multiplied by 1,000 will give the velocity in feet per minute.

(4) *To find the co-efficient of friction from experiments.*—Divide the total pressure by the rubbing surface, and the square of the velocity (in thousands of feet per minute) multiplied together.

(5) *To find the pressure on each foot of section.*—Multiply the co-efficient of friction, the rubbing surface, and the square of the velocity (in thousands of feet per minute) all into each other, and divide the product by the area of the section.

(6) *To find the area of the section.*—Multiply the co-efficient of friction, the rubbing surface, and the square of the velocity (in thousands of feet per minute) all into each other, and divide by the pressure on each foot of sectional area.†

The foregoing rules embrace only the pressure due to friction, and not that due to the creation of velocity; so that they may be regarded as being true of long pipes and air-ways, as they are given; but, as requiring an allowance for the pressure due to velocity in short pipes and air-ways, this allowance renders the rules much less simple.

Now these rules, which are found out by practical trials, or experiments, lead us to many very important conclusions in reference to the best mode of conducting the ventilation of mines; in proof of which, it would be easy to multiply examples.

The laws of friction may be illustrated by the following example—

In an air-way 10ft. square = 100ft. area, and 25,000ft., or nearly 5 miles long—if the velocity of the air were 1ft. per second, or 60ft. per minute, the quantity of air would be 6,000ft. per minute—the pressure due to friction (taking the pressure at 14·7 lb. per square inch, and the temperature at 32 deg.) would be ·7812 lb. per square foot of sectional area of the air-way; the horse-power being ·142.

In another air-way of equal length, but, instead of being 10ft. square, only 5ft. square, giving only 25ft. or one-fourth of the area of the larger air-way, we have the following results:—The rubbing surface in the small air-way would only be one-half of that in the large one; but, on the other hand, the area to which the ventilating pressure would apply would only be one-fourth; and, at the same time, the velocity of an equal volume of air would be increased fourfold in the lesser air-way, this increase of velocity alone making sixteen times the friction, so that on the whole it would be thirty-two times as great; making the pressure on each square foot 24·998 lb., being thirty-two times as great as in the large air-way. And, therefore, on the whole the power expended would be also thirty-two times as great—in the small as in the large air-way, for the same amount of ventilation per minute—the coals consumed would also be thirty-two times as great. If furnace ventilation were used, and the heat of the upcast shaft and pressure per foot were the same, instead of 6,000 cubic feet per minute, as in the large air-way, we should only have 1,061 feet in the smaller one; but, in this case the coals burnt would only be $\frac{1}{\sqrt{32}}$, or between $\frac{1}{5}$th and $\frac{1}{6}$th of the former quantity, and the power would be less in the same proportion for the lesser quantity of air. This shows in a striking manner the great advantage of large air-ways.

The calculations relative to the two cases compared with each other for the example just given stand thus:—

For The Large Air-way.

The length is 25,000ft., and the perimeter of section is $4 \times 10 = 40$ft.; so that the rubbing surface

$$s = 40 \times 25{,}000 = 1{,}000{,}000 \text{ square feet,}$$

the area $a = 10 \times 10 = 100$ square feet,

the velocity $v = \frac{60}{1{,}000} = \cdot06$, in thousands of feet per minute,

and $k = \cdot268{,}81$, being the co-efficient of resistance, in feet of air-column of the same density as the flowing air.

Now by formula (5) we have

$$p = \frac{k\,s\,v^2}{a}$$

giving in this case

$$p = \frac{\cdot268{,}81 \times 1{,}000{,}000 \times (\cdot06 \times \cdot06)}{100} = 9\cdot67716$$

feet of air-column as the pressure required.

Taking the flowing air to have had the density due to a temperature of 32 deg., and to a pressure of 14·7 lb. per square inch, a cubic foot of it would weigh ·080728 lb., and therefore such a column would represent a pressure of

$$9\cdot67716 \times \cdot080728 = \cdot7812 \text{ lb. per square foot;}$$

and hence the horses' power due to the friction of 6,000 cubit feet of air per minute, in passing through such an air-way, would be

$$\frac{6{,}000 \times \cdot7812}{33{,}000} = \cdot142, \text{ or about } \tfrac{1}{7} \text{ of a horse power.}$$

For the Small Air-way.

Proceeding as in the former case, we have

$$\frac{\cdot26881 \times (20 \times 25{,}000) \times (\cdot24 \times \cdot24)}{25} = \cdot309{\cdot}66912$$

feet of air-column, as the pressure required for putting the same quantity of air, 6,000 cubic feet per minute into circulation, being equal to a pressure of

$$309\cdot66912 \times \cdot080728 = 24\cdot9989 \text{ lb. per square foot; giving}$$

$$\frac{6{,}000 \times 24\cdot9989}{33{,}000} = 4.545 \text{ horses power.}$$

If the pressure per square foot was the same in the small as in the large air-way, or ·7812 lb. per square foot, the air-column would be $\frac{\cdot7812}{\cdot080728} = 9\cdot67716$ft. high; and the square of the velocity (in thousands of feet per minute) would by formula (3) be

$$v^2 = \frac{9\cdot67716 \times 25}{\cdot268{,}81 \times (20 \times 25000)} = \cdot0018$$

and hence the simple velocity, in thousands of feet per minute, would be

$$v^2 = \sqrt{\cdot0018} = \cdot042426$$

and the velocity in feet per minute would therefore be

$$\cdot042426 \times 1{,}000 = 42\cdot426:$$

and this gives for the quantity of air that would be put into circulation in the small air-way, by the same pressure per foot that is required to circulate 6,000 cubic feet per minute in the large one,

$$42\cdot426 \times 25 = 1{,}061 \text{ cubic feet per minute, as has been stated.}$$

* The total pressure in these rules is found by multiplying the sectional area of the air-way in feet by the pressure per square foot.

† If it is preferred to employ in these rules the velocity in feet per minute, in lieu of in *thousands* of feet per minute, the co-efficient of friction, in lieu of ·268,81, would become ·000,000,268,81; and if the velocity is taken in feet per second it would become ·000,267,716.

To circulate 1,061 cubic feet of air per minute in the small air-way would, however, only involve the application of

$$\frac{1{,}061 \times \cdot 7812}{33{,}000} = \cdot 0251 \text{ horse power,}$$

which, under the conditions of the small air-way, and the assumed pressure, represents the entire power due to the friction of the quantity of air that would circulate in it.

Air, in being heated under a constant pressure, expands 1-459th part of its volume at the temperature of zero of Fahrenheit's thermometer for each degree of temperature imparted to it; 459 cubic feet of air at 0 deg. become 469 at 10 deg., 479 at 20 deg., 489 at 30 deg., and so on. 1,000 cubic feet of air at 32 deg., the temperature of melting ice, expand to 1,366½ cubic feet at 212 deg., the temperature of boiling water. To find the relative volumes occupied by equal weights of air under equal pressures, but at different temperatures, we have simply to add the constant number 459 to the temperatures, and the sums give the relative volumes. The ordinary pressure of the atmosphere is equal to that of a column of water, about 34ft. or 400in. in height. We, however, seldom employ a difference of pressure of more than 2in. or 3in. of water column as ventilating pressure in mines. The pressure of the air is about 2,116 lb. per square foot, but we seldom employ more than 10 lb. to 17 lb. extra as ventilating pressure. Owing to the ventilating pressures being so small, the changes of density in the air of mines (as it circulates) arising from changes of temperature, the mixture of watery vapour or steam, the gases given off, and one or two other causes, give rise to small local pressures in the various splits of air in a mine. In rise splits these local pressures usually operate against the general ventilating pressure, and lessen the quantity of air that would otherwise circulate. In dip splits these small local pressures commonly act in the same direction as the general ventilating pressures, and so add to the amount of their ventilation. This arises from the return air of any split being generally less dense than the intake air.

The laws of ventilation lead us to conclude that if we increase or decrease the total ventilating pressure and total quantity of air circulating in a given time, where the seam of coal is perfectly level, each way or split will get a fixed share of the whole of the air entering the mine, no matter how long or short may be the different splits, and no matter how great or small may be the quantity of air. This is contrary to an old notion that a short split gets an increasing and a long one a decreasing share of any lessened amount of ventilation, apart from considerations as to the rise or dip of the seam. Not long ago this point was severely tested by numerous experiments at several collieries. The results showed that the old idea was a mistaken one, and that the only changes that took place in the proportion or share of air going to different splits, with a reduced ventilation, arose from their relative rise or dip, together with the relative densities of the intakes and returns, and had no connection with the mere lengths of the splits. In ordinary cases, where the air of the returns is less dense than that of the intakes, if we have a short level split regulated so that, with the full ventilating pressure, it gets the same amount of air as a long dip split, and, if we then halve the total quantity of air circulating, we find that the short level split no longer gets its share, but only a quantity less than that which goes into the long dip split. The very reverse of this is the case where the long split is a rise one, and these results are perfectly agreeable to the laws of ventilation that have been stated. In practice, and with the ordinary splits of air used in mines, except in extreme conditions as to the amount of rise and dip, and changes of density in the air, and in the amount of ventilation, the share or proportion of air going into the different splits of a mine are nearly maintained, whether we increase or lessen the total amount of ventilation, and any deviation from this depends upon the rise or dip of the splits, and not at all upon their relative lengths. In practice, then, when any reduction of ventilation has been brought about, we should generally find that the rise splits have been more affected than dip ones, if even the rise splits are shorter than the dip ones, and should therefore expect to find accumulations of gas in the short rise splits rather than in the long dip splits of the mine. The greater the rise the greater is the danger of this, quite apart from the mere length of the splits, supposing them to be equally well ventilated to begin with.

So far as experiments have gone, they show that if we had a series of equal-sized and similarly-shaped air-ways, made of different substances, the friction of air in passing through them would differ according to the nature of the substances.

Taking the friction in earthenware pipes at	100
In the air-ways of mines it would also be	100
In sheet-iron pipes, new and clean	39
In do. rusty inside	10
In cast-iron pipes, sooty inside	20
In do. tarred inside	18
In tin pipes the friction would only be	10

So that $\frac{1}{10}$th of the pressure would send the same quantity of air through a tin pipe that would be required to force it through an earthenware pipe of the same size in the same time.

Table showing the values of the co-efficient of friction, represented by the letter k, in the formulæ already given; being the heigh in feet of air column, of the same density as the flowing air, required to overcome the frictional resistance encountered by 1,000 cubic feet of air per minute, in passing through a passage having 1ft. of sectional area, and presenting 1 square foot of rubbing surface to the air in motion.

Nature of the material composing the pipe or air-way.	State of the internal or rubbing surface exposed to the wind.	Observers' names.	General temperature of the air or gas.	Head of column of the same density as the moving air or gas required to overcome the friction, being the co-efficient of friction = k.	Remarks.
Burnt earth.	Clean.	Péclet.	Hot.	0·263,81	In applying these values of k to the formulæ as given, since they are calculated for velocities of which the unit is 1,000ft. per minute, the real velocities in feet per minute must be divided by 1,000, to give the value of v in the formulæ; and v in the formulæ must be multiplied by 1,000 to give the velocity in feet per minute.
Galleries of a coal-mine.	Ordinary state.	G. C. Greenwell.	Cool.	0·254,36	
Sheet iron.	New and clean.	Péclet.	Hot. From to	0·105,83 0·067.73	
Cast iron?	Ordinary?	Mons. Rudler.	Hot.	0·084,66	
Cast iron.	Sooty.	Péclet.	Hot.	0·052,92	
Cast iron.	Old Tarred.	Girard.	Cool.	0·048,44	
Gas in pipes. } cast iron.	Ordinary.	Mr. Hawkesley.	Cool.	0·030,14	
Water in pipes. }	Ordinary.	Eytelwein.	Cool.	0·030,28	
Sheet iron.	Old and rusty.	Girard.	Cool.	0·02 ,52	
Tinned Iron.	?	D Aubuisson.	Cool.	0·025,40	

From these laws we learn that the quantity of air that will pass through any mine is greater or less as the ventilating pressure is greater or less—but not in the same proportion. When the air-ways are the same the quantity of air only alters in the proportion of the square root of the pressure; so that a fourfold pressure only gives a double quantity of air; and a ninefold pressure only gives a treble quantity of air. But, on the other hand, one-fourth of the pressure still gives one-half of the air; and one-ninth of the pressure gives one-third of the air. The changes in the quantity of air, then, are sluggish as compared with the changes in the ventilating pressure; only varying as its square root. The quantity of air, however, is more sluggish still in reference to the power employed to cause it to circulate. The quantity of air only varies as the cube root of the power, and of the quantity of coals burnt to produce it; so that eight times the coals only double, and twenty-seven times the coals only treble the quantity of air circulating in a mine; whether the ventilation is produced by furnace-action, ventilating machines, or otherwise, so long as the air-ways remain in the same unaltered state. From this we learn that we must not expect any great general improvement in the ventilation of mines from a mere increase of power; any increase in the quantity of air in the same air-ways is slow, small, and costly, compared with the necessary increase of power required to produce it.

In the same manner these general laws show us that the quantity of air increases as we decrease or lessen the extent of the frictional rubbing surface; but, again, not in the same proportion, but only as the square root of the extent of the rubbing surface. If we could do away with three parts out of four of the rubbing surface, so as to reduce it to one-fourth, other things being the same, we should only double the quantity of air in the mine; if the rubbing surface were reduced to even one-ninth the quantity of air circulating per minute would only be increased to three times its previous amount. On the other hand, if the extent of workings and rubbing surface were increased to four times, or nine times their previous amount, while the area of the air-ways and the ventilating pressure remained unaltered, the air would only be lessened to one-half or one-third of its previous amounts, respectively, by such extensions, if we suppose the size of the air-ways and the number of splits of air to remain the same—as well as the ventilating pressure—in each case.

From these laws, then, we learn that either to increase the ventilating pressure, or to lessen the extent of rubbing surface exposed to the air circulating in mines, are very slow and very costly modes of proceeding to increase the amount of ventilation, as the quantity of air circulating in a given time alters so slowly, with any alteration that may be made in the ventilating power or pressure, or in the mere extent of rubbing surfaces that may be presented to it.

The same general laws of resistances show us that if we could reduce the velocity of the air, consistently with increasing the quantity circulating in a minute, we should greatly lessen the friction in comparison with the quantity of air circulating, and so obtain an increased quantity for the same amount of friction, or by the same ventilating pressure. This object is accomplished by splitting the air, so that, instead of allowing the whole of the air to traverse the whole of the workings, a separate portion is taken into each different district of workings, and also brought out in a separate channel, to near the upcast shaft, after it has done its work. The air, as a whole, thus has as many ways to go in, and as many to come out by, as there are separate splits in the mine; the extent of the rubbing surface is not lessened by this, on the whole, but the area offered to the air is greatly multiplied; and, although the velocity of each current may be reduced, still, on the whole, the quantity of air in all the splits is very much greater than if there were only one single current in the mine, even when the ventilating pressure is the same. Splitting the air does not necessarily enlarge the area offered to the air in the shafts, and the increased resistance arising from the increased quantity and velocity of air in them sets a limit to the benefits resulting from splitting the air in a mine. Owing to the resistance offered by the shafts we dare not have more than a limited number of splits in a mine, because although every split adds to the total quantity of air circulating, still, in each separate split the quantity ultimately becomes less and less; and, if the number be too great, the current of each becomes too feeble and slow to sweep into the holes, corners, and places driven in advance of the actual current; and, besides this, powder smoke is a long time in being carried away from the workmen. Still it is a fact that an additional quantity of air is obtained from every new split that is made.

The following general rules should be observed in splitting the air in mines:—

Every principal split of air should commence as near as possible to the bottom of the downcast shaft, and should have a distinct air-way to return in, as nearly as may be, to the furnace or the bottom of the upcast shaft, except in cases where it is necessary to mix different currents lest some one or more of them may be dangerously charged with gas. Splits of air only commencing far into the workings of a mine have comparatively little effect in increasing the quantity of air.

Where the air-ways are nearly of the same area in all parts of a mine, and the gases given off, and the workmen employed, are pretty evenly distributed, the length of the runs of the different splits should be as nearly equal to each other as circumstances may permit; the observance of this rule has a tendency to render regulators and other obstructions comparatively needless, and so to increase the amount of ventilation.

If we have a lot of splits of air in a mine, each with an equal amount of air, then it is necessary so to obstruct each of the shorter splits as to cause their frictional resistances, when they have their proper share of air, to be as great as that of the very longest split, when it also has its due share; otherwise they would get too much air, and the longer ones too little.

The increased quantity of air obtained by splitting depends greatly upon the relative depths and areas of the shafts, as compared with the lengths and areas of the air-ways forming the workings of the mine. Supposing a mine to have such shafts and air-ways that when there are five equal splits of air, the shaft resistances amount to one half of the resistances offered by the mine—and this is no uncommon case—then, if before splitting the air at all, we had a ventilation of 10,000 cubic feet of air per minute, the following are the quantities of air that would circulate, by increasing the number of equal splits, while the entire extent of the workings, and the heat of the upcast shaft, and the ventilating pressure, all remained the same.

No. of currents.	Quantities of air on the whole.	Quantities in each split.
1	10,000	10,000
2	27,891	13,946
3	49,449	16,480
4	71,527	17,882
5	90,789	18,158
6	107,800	17,966
10	141,710	14,171

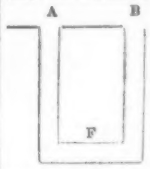
In this case the coals burnt, whether in a furnace or by an engine driving a ventilating machine, would increase in the same proportion that the quantity of air increased; because the power would increase in that ratio. If the coals burnt and the power remained unaltered, the results would only be as below:—

No. of currents.	Total quantities of air per minute.	Quantities of air per min. in each split.
1	10,000	10,000
2	19,013	9,506
3	29,022	9,674
4	37,121	9,280
5	43,736	8,747
6	48,797	8,133
10	58,556	5,856

Enlarging the sectional area or size of air-ways has a great effect in increasing the ventilation, but it is attended with great cost, and in general terms, may be said to be much less effectual than judiciously splitting the air into a series of different currents. The beneficial effects of splitting air are, I believe, more fully appreciated, and the practice more extensively followed, in the Newcastle coal-field than in any other mining district; but even there it too often happens that the splits are made too far from the bottom of the downcast shaft, and are again brought into the same return, too soon after they leave the face of the workings. This often arises from pillars being worked away near the shafts, without proper places being left to make additional air-ways leading to and from the more distant parts of the mine. This is a very common oversight, and often entails either danger or a serious outlay, which might be avoided by care and forethought.

ON THE MEANS OF APPLYING POWER OR PRESSURE TO PRODUCE VENTILATION.

We have seen that pressure is required to put air into motion, and, more particularly, to overcome the friction it meets with in rubbing against the top, bottom, and sides of the galleries in mines. We have next to consider the means employed to give rise to this ventilating pressure. There is constantly a pressure of nearly a ton to the square foot, in every direction in the air near the surface of the earth, owing to the weight of the air above it; and we must either increase or lessen the amount of this pressure in order to put the air into motion; and it is only the amount of this increase or decrease, and not the entire pressure, that puts the air into motion and overcomes the friction in mines.



Take the case of two pits or shafts, of equal depth, and having their tops and bottoms on the same level, and filled with stagnant air, which likewise occupies an opening, extending from the bottom of one shaft to the bottom of the other; and suppose that, in the first place, the weight of air in each shaft is the same as that in the other—the temperature and other conditions being the same in each—and that the shafts are of the same sectional area or size. In this state the two columns of air exactly counterbalance and support each other, so that there is no motion in the air, and therefore no ventilation is produced; nay, further, if one shaft be ever so much larger than the other the air it contains can only press upon that in the smaller one, over the area of the smaller section; the air contained in the extra size of the larger shaft, resting or pressing upon the sides of the shaft or air-way at the place where the area is lessened, and not upon the air in the smaller shaft; so that, whatever may be the relative sizes of the shafts, the air in the one will balance that in the other if the density of the air is the same in each; this may be termed pneumatic paradox. If, however, by means of a furnace, at F in the diagram, the air in one shaft is heated and expanded, it becomes lighter, bulk for bulk, than the cool air in the other, and no longer balances it; the pressure of the heavier air then overcomes that of the lighter air, and pushes it up the shaft before it, while the cool air from the cool shaft takes its place—not in a cool state—as it gets heated in its turn, in passing over the furnace; so that there is a continual current of cool air going down one shaft, which pushes before it a constant current of hot air up the other shaft.

In mines, the air instead of being allowed to go direct from the bottom of one shaft to the furnace, and up the other, is guided by means of stoppings and doors, into and along the various passages forming the workings of the mine, before it is brought upon the furnace or into the upcast shaft; and by this means a continual stream of air is made to sweep through the workings, and mix with and carry off the gases, as they are given off; and this is called the ventilation of the mine.

In some cases men, boys, and horses require to travel in all directions that the air is not wanted to go, and in such cases we cannot build up the way, by stopping; but have to place doors to stop the passage of the air; in many cases the opening of a door to allow a person or horse to pass, would have a bad effect by allowing the air to pass through it even for a short time, and to avoid this evil two doors are employed, so that one may always be closed when the other is open. The use of doors in the principal roads of mines is objectionable where it can be avoided, and is much less common, at least in some districts, than formerly; in other districts of the kingdom the number of ventilating doors is very great, notwithstanding the danger and cost attending their use. The neglect of keeping doors shut has, no doubt, often led to serious explosions of gas in mines. In some cases it is necessary that the route of one split or current of air should intersect and cross that of another, and, in such cases, one current is carried over or under the other by means of drifts or masonry, to prevent their coming into contact with each other; this arrangement is called an air-crossing or bridge. When an explosion occurs the force of the concussion often destroys air-crossings, and thereby interrupts the ventilation; so that they should be avoided, as far as possible, and made very strong where they are used in fiery mines.

It has already been stated that, where there are several splits of air in a mine, of different lengths, and offering different resistances, we sometimes find that too little air goes into the longer splits, compared with the quantity going into the shorter ones; and, in order to correct this evil, we put regulators or contractors into the shorter ones, so as to increase the natural resistance they offer, and cause more air to go into the long splits. Regulators, although useful where they are unavoidable, are not desirable, as they contract the air-ways, and so lessen the total quantity of air circulating in the mine in a given time. As far as may be, the routes of the air should be so proportioned that each split may obtain its proper share of air, without using any artificial regulators. Doors, air-crossings, and regulators should be avoided in all cases where the circumstances of the mine admit of it.

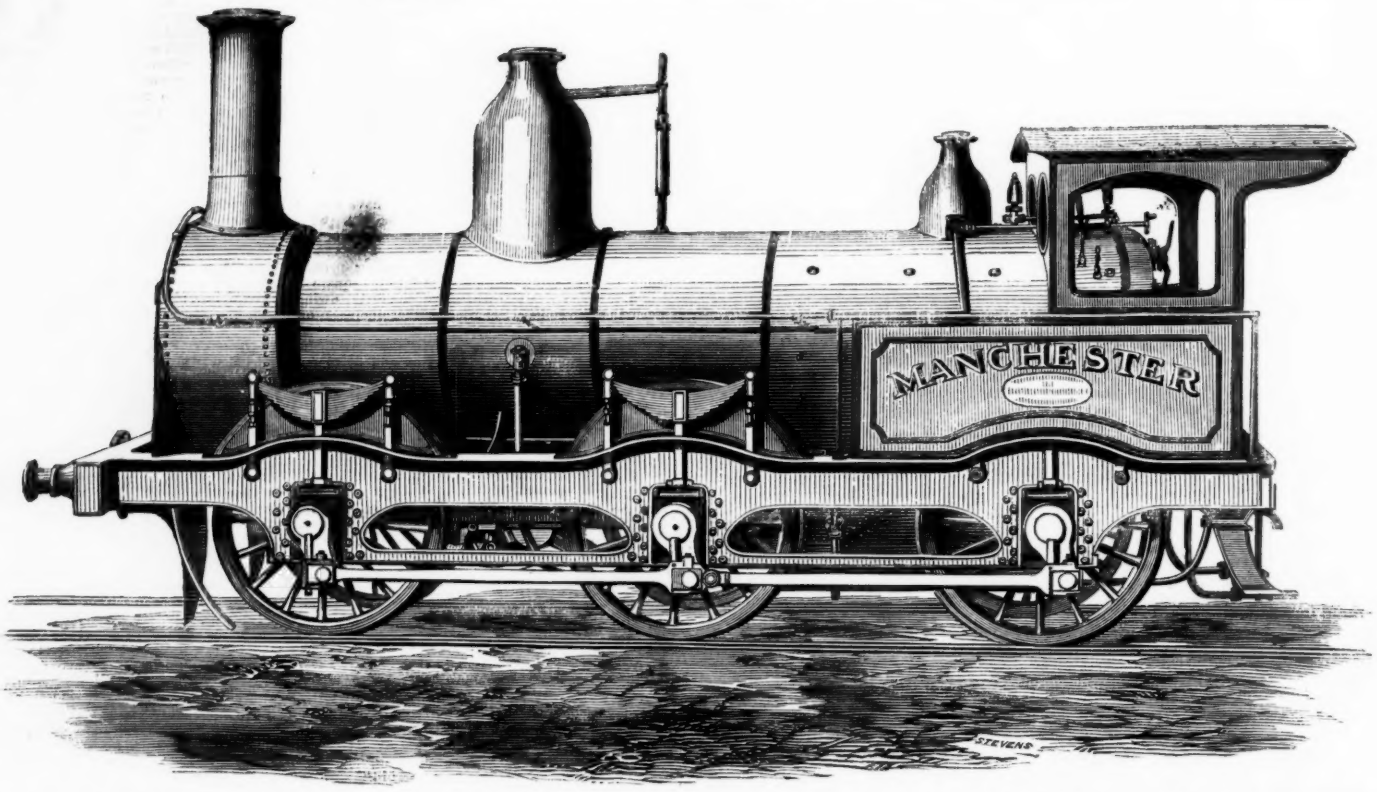
In order to find the amount of ventilating pressure, and the power arising from the use of a ventilating furnace, we require to know the weight of a cubic foot of air at different temperatures and under different pressures. Careful experiments show that 459 cubic feet of air at 0 deg., or zero of Fahrenheit, the common thermometer, weigh 39·76 lb., when the pressure is 30in. of mercury of the density due to 32 deg.—a pressure equal to nearly 14¾ lb. per square inch, which is the ordinary pressure of the atmosphere; but it only weighs 1-30th of this, or 1·3253 lb., when the pressure is only 1in. of mercury; and, since 459ft. of air at 0 deg. expand exactly a cubic foot for each degree of heat added, we get the following rule to find the weight of a cubic foot of air, at any temperature, and under any pressure—

$$W = \frac{1{\cdot}3253 \times I}{459 + t}$$

where I = the height in inches indicated by the barometer, and t = the temperature by Fahrenheit's thermometer. At 88 deg., under a pressure of 30in. of mercury, 100 cubic feet of air weigh just 8 lb.; a box 5ft. every way would just contain 10 lb. of such air.

On one occasion, at Hetton Colliery, when 225.176 cubic feet of air per minute were circulating, the average temperature of the air in the downcast shaft was 43½ deg., and that of the air in the upcast shaft was 211 deg. Now, by the rule given (if we take the barometer half way down the shaft to have shown a pressure of 30·4in. of mercury), the weight of a cubic foot of air, taking the average in the downcast shaft, would be ·08044 lb.; and, the pit being 900ft. deep, this air would produce a pressure of ·08044 × 900 = 72·396 lb. on each square foot by its mere weight. The air in the upcast shaft, owing to its being hotter, would be lighter, and only produce a pressure on each foot = 54·297 lb.; and hence the difference of pressure on each square foot of area, between the two columns of air, would be = 18·099 lb. Now, in order to find the horses' power producing ventilation, we require to multiply this difference of pressure of 18·099 lb. on the square foot, by the number of cubic feet of air circulating per minute, and then to divide the result by 33,000, the

SHARP, STEWART, AND CO.'S LOCOMOTIVE IN THE EXHIBITION.



number of pounds raised 1ft. high per minute by a horse power. In this case then we find the ventilating power at Hetton Colliery must have been—

$$\frac{\text{lb.} \quad \text{c. ft. pr. min.}}{18{\cdot}099 \times 225{,}176} = 123\tfrac{1}{2}\text{-horse power;}$$
$$33{,}000$$

225,176 cubic feet of air per minute being in circulation at the time. Some part of the extra heat of the air in the upcast over that in the downcast shaft would have arisen from the heat of the mine, and would have caused what is called a natural ventilation, even if furnaces had not been used. But natural ventilation is generally very small in amount, and cannot be depended upon, as, in hot weather, the downcast column of air is little or no cooler or denser than in the upcast, and, by making the weight or pressure of the two air columns equal, is liable to stop all ventilation.

Where furnaces are used to produce ventilation the deeper the upcast shaft the better, because this gives rise to a longer upright column of hot air, and so causes a greater ventilating pressure, and consequently a brisker ventilation. Furnaces are not well suited for causing ventilation in shallow pits owing to this, and sometimes machines are fixed at the top of the pit to pump the air through the mine. These machines, for the most part, exhaust air out of the upcast shaft; and the pressure of the denser air in the other, or downcast shaft, causes the current. Such a ventilating machine, like a furnace, acts by rendering the upcast column of air lighter, bulk for bulk, than the air in the downcast shaft. The same effect is sometimes produced by large fans, the machines mostly being worked by steam engines. A few of these ventilating machines are used in the south of England and in Wales, and a great number are used on the Continent. Ventilating machines of the best construction consume less coals, to produce the same quantity of ventilation, than furnaces, except in very deep and dry shafts. But coals are plentiful at collieries, and the liability of ventilation being suspended by the breakage of the machinery, and the inconveniences attending stopping the ventilating machine for repairs to itself or the engine, together with the difficulty of applying ventilating machines to working shaft, render them, in the opinion of many persons, less to be depended upon than furnaces in general. Taking the average of eleven different collieries in the Newcastle district, each pound of coal puts 13,000ft. of air into circulation by the action of furnaces. In some collieries two or three times as much air is circulated by each pound of coal as in others, depending on the depth of shaft and its state as to dryness or wetness, and on the friction of the air in the shafts and in the mine itself. There are, in Wales, some seven or eight ventilating machines at work, producing ventilations varying from 16,000 to 75,000 cubic feet of air per minute, the largest machine being one recently erected at Deep Duffryn Colliery, which, with air-ways of sufficient area, would be capable of producing a ventilation of double the latter quantity.

Jets of steam were proposed to produce the circulation of air in mines a few years ago, but, by an elaborate series of experiments, their effects were found to be far below that of furnaces, and the cost to be very great, and the idea of their utility for ventilating mines was therefore abandoned. The useful work contained in a jet of steam probably varies as the cube of the velocity of the steam; so that, if the same quantity of water was converted into steam in a given time, the power contained in it would depend upon the smallness of the jet orifice it had to escape through. By halving the area of the jets we should obtain eight times the power, and should therefore get a double quantity of air through the same mine. By reducing the area of the jets to one third we should obtain a treble quantity of air, by the same quantity of steam, in a given time. At least these are the results given by calculations made upon the principles of mechanics, which are found to be true for streams of water and air. I have not taken pains to compare them with the results of the experiments on steam jets as applied to ventilation, because the results seem to hold out no hope of steam jets ever being made available for ordinary ventilation. There are, no doubt, temporary and peculiar circumstances under which steam jets may be useful in the production of ventilation, such as cases where it is either unsafe or impracticable to use ordinary furnace action.

Falls of water are sometimes employed in downcast shafts to cause a current of air to descend; but as the water has, for the most part, to be raised again from the mine, and as the effects they produce are small, in proportion to the power employed, this mode of ventilation is seldom used, except where furnace action or other means are necessarily excluded.

On the Instruments used in connection with the Ventilation of Mines.

Barometer.—The pressure of the atmosphere, in different states of the weather, varies from 28½ to 31in. of mercurial column, being from 2,016 to 2,192 lb. per square foot; and it is found that the natural discharge of gas in mines becomes greater as this pressure becomes less; so that the reduced atmospheric pressure, as shown by a barometer, is a warning that an increased quantity of gas may be expected to be given off in mines, and therefore calls for increased care and vigilance to keep the ventilation at its greatest point, and for taking precautions against the enemy. The air pent up in goaves and abandoned excavations also expands in volume from the reduction of pressure which causes the fall of the barometer; the increase of volume being given out into the air-ways, and often being mixed with gases, should be carefully watched, as the barometrical pressure of the atmosphere is lessened; the more suddenly the pressure falls the more observable are these results. A very sudden fall of the mercury is accompanied by a worse effect on mines than a greater fall, provided it takes place less rapidly. An increase or decrease of the pressure of the atmosphere has little or no effect in altering the volume of air passing through a mine in a given time, although it alters the density and weight of such air, often to a considerable extent.

A good portable barometer may be used to ascertain the friction of air in passing along air-ways; because the loss of pressure by friction, as the air circulates, is always taken off the pressure of the air itself; so that in level air-ways the air is less and less compressed as we proceed in the direction followed by the air; and the reduction of pressure is an exact measure, in such air-ways, of the pressure spent on friction. When the air-way rises or dips allowances for this have to be made in finding the amount of friction from the pressure of air in this manner. Aneroid barometers appear to be better suited for use in mines than the common barometer or weather glass, as they are more portable, less liable to derangements, and almost equally reliable, at least for comparative indications, which are just as useful as absolute ones in mines.

Thermometer.—The thermometer is used to measure the heat of air in mines. When the fresh air going down a downcast shaft is heated it expands and becomes lighter, and is, therefore, less able to force the air before it through the mine; in other words, by being heated the weight of the column of air in the downcast shaft is reduced, till it is more nearly equal to that in the upcast shaft, and consequently the ventilating pressure is lessened; and, therefore, the quantity of air circulating is also reduced in amount. By the use of this instrument we find the difference of temperature between the air in the downcast and that in the upcast shaft, and so are able to calculate the ventilating pressure due to the action of a furnace.

Water Gauge.—The water gauge is merely a glass tube bent into the form of the letter U, with a scale of inches and parts, by which we can measure the difference between the height of the water in one tube and that in the other. It has already been stated that the air loses the pressure that is spent on the friction as it progresses along an air-way. Now, when an air-way happens to turn so as to come nearly parallel to itself, there is often a door or stopping separating the two adjacent parts of the same air-way, and this instrument enables us, in a direct way, to measure the amount of pressure that is spent on friction between the two adjoining parts of the air-way so situated. The air has less pressure on the outcome or return side of the separation than the air on the intake side, which has not yet met with the friction of the intervening distance of air-way. If the water in one leg of the tube is exposed to the pressure of the intake air, while that in the other is exposed to the less pressure of the return air, the greater pressure on the intake leg of the water gauge sinks or depresses the surface of the water in that leg, and raises it in the other leg; the difference of level, which represents the ventilating pressure spent on the air-ways lying beyond the place where it is taken, is seldom so much as three inches, and often only one inch, in well ventilated mines. The amount of water gauge can be increased, either by increasing the ventilating pressure, and, consequently, also the quantity of air circulating in a given time, while the air-ways are in the same state; or, it can be increased by falls of material, or other obstructions in the air-ways, even while they lessen the quantity of air circulating, because such obstructions increase the frictional resistance of the air, and the gauge is a measurer of that resistance. A water gauge does not show the shaft resistances when used in a mine. The pressure shown by the water gauge is equal to the general shaft ventilating pressure, *less* or *minus* the friction due to the air in the shafts, and in the air-ways extending from the shafts to where the gauge is tried. It is also a measure of the resistances the air meets with in the workings lying beyond it, *less* or *minus* any local force, arising from the air in the returns being lighter than that in the intakes in dip-ways; or it is equal to such friction added to any such pressure, that may operate against ventilation from the same cause, in the rise-ways or splits of air in the mine; and in cases where the air of the returns is more dense than that of the intakes, the effects arising from the dip or rise of the workings will, of course, operate in the reverse manner, upon the indications of the gauge. When the air-ways remain in the same state the amount of water gauge increases as the ventilation increases, and falls as it decreases; but the proportion of variation of the gauge pressure is much greater than that of the quantity of air circulating; the square of the quantity of air, except in so far as local pressures may interfere, is proportional to the pressure indicated by the gauge, because the friction varies as the square of the quantity of air.

The Anemometer is an instrument used to measure the rate at which the air flies in mines. That invented by the late Mr. Biram is the one mostly used in English mines; it is not a very easy matter to find how much each of these instruments require to be allowed for their own working friction—no perfect rule has yet been established for this purpose, although one is much needed. An approximate rule requires that a constant quantity should be added to the number of revolutions in a minute, no matter what may be the speed of the wind or of the instrument; and that the sum so obtained should be multiplied by another constant quantity, to give the velocity of the air in any terms in which we wish to find it. Coombes' anemometer can be put into or out of gear by pulling strings attached to it; this instrument is said to give very correct results, and is greatly used on the Continent. It is, however, more troublesome to use than Biram's anemometer, and is seldom seen in our mines. There are a few other kinds of anemometers; but a good and simple instrument, or mode for finding the velocity of air in motion, has probably yet to be contrived.

The Hygrometer.—In fine experiments, the hygrometer is used to ascertain the proportion of moisture in the atmosphere of mines, from whence its density and also its capacity for heat are found. Mason's wet and dry bulb hygrometer is better adapted for use in mines than the more delicate one of Daniel. The return air in nearly all mines is found to be saturated with vapour of water; that is to say, it contains the greatest quantity of vapour that can exist in it, at its temperature; and a portion of vapour is condensed by the least degree of cooling that takes place in the air. An atmosphere saturated with vapour is lighter, bulk for bulk, than another at the same pressure and temperature, but containing less vapour.

Naval Engineers.—The following appointments have been made since our last:—George Simpson, of the Coquette, confirmed first-class assistant-engineer; Adam Young, of the Banshee, promoted to first-class assistant-engineer; William Fraser, of the Imperieuse, confirmed as second-class assistant-engineer; T. W. Dearden, of the Cumberland, in the Medusa, confirmed as second-class assistant engineer; and J. W. Owen, of the Dasher, in the Speedy, confirmed as second-class assistant-engineer; John Simpson, acting first-class assistant-engineer, to the Royal Adelaide, for the Princess Alice; Stephen V. Bull, in the Chanticleer, confirmed as second-class assistant-engineer; and A. J. Tout, second-class assistant-engineer, to the Asia, as supernumerary.

Precautions against Fire at the Exhibition.—Captain Bent is the officer who has the superintendence-in-Chief of the fire-arrangements, and under him are one engineer, four sub-engineers, and nine firemen, of which number at least eight will always be on duty in different parts of the building, while close at hand a company of sappers is stationed, from whom considerable assistance and support would, of course, be received. There are 6 engines, 10 standpipes, 24 dozen of fire-buckets, 24 hand-pumps with pails, 120 lengths of hose, and 3 hose-reels, with an adequate proportion of tools. The water supply consists of a 9in. main, which runs east and west throughout the entire length of the building, and which is again intersected at right angles with 4in. service pipes. The eastern and western annexes are similarly supplied, and the galleries and roof with smaller service pipes. There are a large number of stopcocks, and no less than 107 hydrants or fire-cocks. As during 16 hours out of the 24 in summer the pressure of water is very low the firemen have been warned that their dependence must be placed solely on the pumping of their engines, as in case of accident the pressure from the main alone is insufficient to carry the water into the high parts of the building during these periods. The duties of the firemen are to watch carefully all places where fires are allowed—the boiler houses and line of steam-pipes in the western annexe; to accompany the lamplighters when lighting the gas every night—one fireman to be present in each kitchen and one in each cellar or vault at all times during which the gas is alight; to constantly ascend and walk over all parts of the roof, which they will keep cool in summer by scattering water on it from the nearest hydrants; to endeavour to discover any infraction of the rules against smoking, and above all, to impress upon exhibitors "that the best possible safeguards against fire are perfect ventilation, scrupulous cleanliness, complete preparation, and, above all, careful and constant watching." If exhibitors can only be induced to follow the latter advice the duties of the firemen will be very light indeed.

TO CORRESPONDENTS.

**** *Covers for binding the volume can be had from the publisher price 2s. 6d. each.*

We must beg the indulgence of several of our correspondents until next week, the pressure upon our space, this week, having compelled us to withhold their communications.

MEETINGS NEXT WEEK.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, May 6, at 8 p.m., continuation of the paper "On the Sea Dykes of Slesvig and Holstein, and Reclamation of Land from the Sea." By John Paton, M. Inst. C.E.;—"On Reclaiming Lands from Seas and Estuaries." By James Oldham, M. Inst. C.E.; and, "On the Reclamation of Land from Seas and Estuaries." By J. H. Muller.

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THE ENGINEER.

FRIDAY, MAY 2, 1862.

THE INTERNATIONAL EXHIBITION.

THE successful opening of the International Exhibition is a subject for gratulation. An undertaking which has aroused so much interest and no little anxiety deserves success, and nothing could be more auspicious than the opening ceremony yesterday. Whatever may be the comparisons made between the present Exhibition and that of 1851, the public are manifestly preparing to come in millions, and they will certainly not be disappointed in the materials for valuable observation, whatever they may think of the general effect of the whole.

We think every engineer who has examined the structure of the building must now feel that one critical test of its strength is well over. The building is not over and above strong. It was planned by a gentleman who has exhibited the most intrepid defiance of some of the first principles of construction, his neglect to provide, in his original plans, for the outward thrust of the arches, being one example in point. Before the contractors, acting upon the ready suggestion of Mr. R. M. Ordish, had supplied extra diagonal tension rods, the main columns of the nave had gone out of plumb, and in the western annexe the visitor can still see the results of the same contempt of abutments, the wooden posts being from 12in. to 16in. out of plumb in a height of 28ft., the whole being held up by props in the Prince Albert-road. So, too, the breaking weight of the gallery girders is given as only 88 tons, while it is possible to accumulate upwards of 35 tons of moving load upon them. The assigned breaking weight is, we take it for granted, the distributed breaking weight, which is twice that required as a central breaking weight. We have less fear of a failure by actual overloading, however, than by buckling, or the settling of one or more of the detached brickwork piers, or the fracture of one or more of the weak lugs to which the diagonal tension rods are secured. For those who care to go through the details of the construction of the Exhibition building, we may refer to THE ENGINEER, vol. xii., page 354, or to still more complete information in the current number of the *Practical Mechanics' Journal*. Few, however, we apprehend, care to spend much time in studying a notoriously imperfect model, as the building in question is—imperfect in construction as well as in architectural design. We allude to its defects chiefly for the purpose of expressing the hope that those having charge of the building will exercise every care to guard against a catastrophe, by frequently testing the truth of the columns, and watching the deflection of the gallery girders. With this we may dismiss the building, merely remarking that no curiosity on the part of a stranger to see it on the spot is likely to be rewarded by a single emotion when he arrives at South Kensington. But the contents of the building will quite atone for other defects, and to many objects the visitor will feel he can hardly return too often. In engineering and mechanical interest, especially, the display far surpasses anything of the kind ever attempted before. The machinery department, too, is the most advanced of any in the Exhibition, and this fact, all who have looked into the annexe will say, reflects great credit upon Mr. D. K. Clark, the untiring superintendent of classes 5, 7, 8, and 10. Mr. Clark first assumed the duties of this post in June last, and since October he has given his whole time to it, with a success to which every visitor will bear testimony.

The western annexe is likely to be intolerably hot. With nearly two acres of glass roof, at a low elevation, and more especially with upwards of a mile in length of steam and exhaust pipes ranging from 8in. to 18in. in diameter, and lying but a short distance beneath the floor, the temperature after St. Swithin's may be conjectured. Almost the only danger from fire, in this portion of the Exhibition, would be, one would suppose, from spontaneous combustion, and we do not doubt that ample precautions will be taken to prevent any outbreak from this cause. The value of all the goods in the whole Exhibition has been roughly estimated at £4,000,000, of which a large portion must be included in the annexes, almost too fragile to hold themselves upright. There must be, at least, £100,000 worth of marine engines in the building, and hardly less than £50,000 worth of locomotives. Mr. Clark has, in all, about 700 exhibitors in the classes under his superintendence, and we should suppose the average value exhibited by each was quite £1,000.

We have, in other portions of our present number, noticed at some length a few of the objects exhibited in the classes under Mr. Clark's superintendence, but we have hardly gone farther than enumeration, the field of practical comparison and mechanical analysis lying almost untouched before us. We feel that, in the general interest of our profession, it is incumbent upon us to collect and present the greatest possible amount of information as to the engineering objects and machinery represented. It is often the case that the visitor can only take a general glance at the whole, or at most spend an hour or so in going over the points of a particular example. Even here, however, the most important portions of the construction or adjustment are often out of sight, and unless a purchaser is to be had, the exhibitor may naturally feel disinclined to enter upon a very full description. At the same time, he is seldom disposed to object to placing the general peculiarities, and the leading dimensions, weights, &c., of his work before the public through the columns of a respectable professional journal. It is thus our peculiar privilege to obtain and supply such information to those most in need of it, and who, otherwise, might experience considerable difficulties in obtaining it. This task almost appears to grow with its own performance, and we may look forward to leaving much of it uncompleted, even when the doors of the International Exhibition of 1862 are closed for the last time.

MARINE ENGINES IN THE EXHIBITION.

JUDGING from the examples of marine engines, as the visitor to the Exhibition enters the western annexe, the triumph of the screw over the paddle is at last complete. All the engines are direct acting, with no longer stroke, we believe, than 4ft. and that for a 112in. cylinder. In these revolutionary times, eleven years is a long period in mechanical engineering. Yet, from what can be seen in the annexe, it has not given us very much in marine engines, beyond their adaptation to screw propulsion. We have hardly the conscience to claim the trunk engine, the double piston rod plan, or the inverted cylinder engine, as new since 1851. The trunk engine was designed by Watt, and represented in the specification of his steam-hammer patent of 1784. The double piston rod engine is the steeple engine of David Napier, laid horizontally. The inverted cylinder engine is a Nasmyth steam hammer with a connecting rod and crank attached to the piston rod, and with the head and anvil block omitted.

It is true that marine engines are now commonly worked with superheated steam, but there is nothing in the Exhibition to indicate this fact, for there is neither marine boiler nor superheater in the building, at least we have seen none. The practical use of superheating steam dates since 1851, although Dr. Haycraft and Mr. Thomas Howard, of Rotherhithe, pointed out some of its advantages thirty-five years ago.

There is at least one marine engine in the Exhibition fitted with a surface condenser, a condenser, too, upon a plan which has been practically adopted in some of the finest steamships afloat. Surface condensers, *per se*, are by no means new, and it was the discovery and practical use of india-rubber alone which enabled our engine builders to adopt them in regular use. But for Davison's perforated sheet of india-rubber packing, and Spencer's and Rowan's india-rubber rings, surface condensers would now be almost exactly where Samuel Hall left them nearly a quarter of a century ago.

A great step, however, *has* been made in marine steam engineering since 1851, but by some mischance, not a hint of its direction can be obtained from anything in the western annexe. High pressure superheated steam worked expansively in either one or two cylinders, and condensed in a surface condenser, has been adopted in extensive use in marine engines, but notwithstanding that some of the exhibitors this year are makers of such engines, they have kept them back, preferring to send examples of the good old orthodox practice, of which it has been said that it required an iron mine to make a steam engine and a coal mine to work it. The reformed practice, however, is still regarded in the light of an experiment, just as Watt's engines and Stephenson's locomotives first were, and naturally, nobody cares to send experimental machinery to an exhibition intended to represent the grandest practical successes of all nations. We may content ourselves, therefore, with a glance at the massive marine machinery which meets the visitor to the Exhibition at the entrance to the western annexe.

In the south-western corner of the annexe Messrs. Maudslay, Sons, and Field exhibit the 800-horse screw engines of the Valiant, one of the new iron-plated frigates. These are a pair of horizontal, double piston rod screw engines, with 82in. cylinders and 4ft. stroke. The pistons are not in, as the engines cannot be worked, and the pistons could not be seen unless the cylinder covers were removed. The cylinders are steam jacketted for nearly their whole length, and both cylinder covers are made double to admit steam to keep them hot. The cylinder cover next the crank shaft is cast in, the core being set so as to make one continuous steam jacket upon the cover and around the cylinder. A hole has, of course, to be made through this cover for the boring bar, in boring out the cylinder, and this hole is made to serve as a man-hole, a plate cover being bolted upon it. Another man-hole is made in the opposite cylinder-cover, and through those man-holes (a few bolts only requiring removal) a man can enter the cylinder to set up the piston packing, which operation can thus be performed as well as if the whole cylinder cover were taken off. The piston rods, being of great length, are of proportionate strength. The cross head, finished from a massive forging, is of a very simple but appropriate design. The guides are of ample surface, the guide-blocks having brass plates, lined with white metal, on their lower sides. The air pumps are worked by long rods directly from the pistons. The crank shaft, 17in. in diameter, is supported on three large bearings, the brasses being lined with white metal. No counterweight is shown on the shaft, but when fitted on board ship, the cranks and reciprocating parts (we take the latter for granted) will be counterweighted. The eccentrics are fixed to the shaft outside the framing, and work a link motion for each cylinder, the block of the link being attached to the lower arm of a rock-shaft, the slide valves being placed on the top instead of to one side of each cylinder. There are two slide valves working simultaneously together, for each cylinder, the two valve faces forming an obtuse angle with each other, both being inclined outward from an horizontal plane. Each valve, moreover, is double ported, so that steam is taken simultaneously through four openings at each end of each cylinder. By a well-known arrangement, long since adopted in all Messrs. Maudslay's engines, nearly the whole of the pressure is taken off the back of the slide valves. A revolving expansion valve is fitted in a separate case in immediate connection with the slide valve chests.

The iron work of these engines, where not brightly finished, is painted a lead colour, the best of all for bringing out the points of well-finished machinery of all descriptions. The whole weight of the machinery exhibited is about 170 tons, and had the pistons and counterweights been included the weight would have been about 188 tons. The value of the whole, as exhibited, cannot be far from £40,000, the value of such a pair of engines, including boilers, being nearly £50,000. Messrs. Maudslay, Sons, and Field are now engaged in constructing a pair of double-piston rod engines of 1,350-horse power for one of the largest plated frigates. The cylinders are 101in. bore, and the stroke 4ft. 6in. These engines were but lately commenced. Had they been ready it is not improbable that they might have been exhibited in place of those intended for the Valiant. Messrs. Maudslay's collection of working models of marine engine is one of great interest, and cannot fail to attract crowds of visitors.

The next largest engines are a pair of 400 collective horse power, constructed by Messrs. Humphrys and Tennant for the screw vessel of war, North Star. They have horizontal cylinders of 64½in. diameter and 32in. stroke. A pair of engines from the same patterns have been worked up to 1,838 indicated horse power, or to more than 4½ times their nominal power.* These engines, as all others by the same builders, connect directly, by a short connecting rod, from a single piston rod to the crank. The valves are worked by a link motion, the link being a solid curved bar. The valves are double-ported and are placed on the sides of the cylinders. The crank shaft, although not counterweighted, is intended, we are told, to be put in proper balance on ship board. There are some good points in these engines, the framing being particularly simple and strong, the caps of the main brasses, too, being made to tighten up in the direction of the principal strain, which is not the case in some other large engines exhibited. If Messrs. Humphrys and Tennant's engines have faults of construction, we might be disposed to regard the lightness of the bonnets of the slide valve chests, and the small diameter and wide pitch of the bolts by which they are held in place, as not quite in keeping with the generally massive character of the rest of the work. In a trial, we have heard, on board a ship fitted with much the same kind of engines, the bonnets of the slide valve chests were blown to pieces under the Government test pressure of 40lb. per square inch. The link, too, is supported at the lower joint by a very short holder, and as the eccentrics have a large throw, the slip of the link in the valve spindle block must be considerable. The short connecting rod, in screw engines at least, is inseparable from the arrangement adopted, but we doubt if it causes more friction than, if as much as, the "trunk," adopted by certain other builders to get over the same difficulty. On the whole, it will not be denied that Messrs. Humphrys and Tennant's engines do them much credit, when they are regarded as examples of workmanship only. Had they thought fit to send a pair of the compound engines which they are now making for the Peninsular and Oriental Company, the low pressure cylinders being 102in. in diameter, it cannot be doubted that they would have been regarded with greater interest than those already exhibited. It is to be hoped that, if another great International Exhibition is held in

* The North Star's Engines are like those of the Albion, which were made by the same makers, and supplied with steam from boilers of exactly the same size and construction. We may, therefore, give the following particulars and result of trial of the Albion, on the 22nd March, 1862:—This vessel (formerly a sailing ship) was built about 15 years ago from the designs of Sir William Symonds, and has been altered to admit of the application of the screw propeller, and is now rated in the *Navy List* as an 86-gun ship of 3,117 tons. During the trials of her machinery she immersed 700ft. of midship section and displaced 3,000 tons of water. She was tried without her masts, with the following results:—

No. of runs.	Revolutions of engines per minute.	Observed time.	Speed due to time.	1st mean speeds.	2nd mean speeds.
1	68½	5·36	10·714	10·947	10·955
2	69½	5·22	11·180	10·963	11·057
3	69	5·35	10·764	11·051	10·996
4	69	5·17	11·356	10·941	10·968
5	69	5·42	10·526	10·996	
6	69	5·12	11·465		

giving with her full power a mean speed of 11 knots per hour. When tried with half her boilers the average speed of the ship was 8·887 knots per hour, the average revolutions of the engines 54 per minute, and the average vacuum 27½in. The cylinders of these engines are 64½in. diameter, the stroke 32in., and are nominally 400-horse power. The propeller is 17ft. in diameter, and 18ft. pitch. The fire-bar surface is 280ft., and the heating surface 7,600ft. The mean pressure on the pistons during the full power trial, as ascertained by the inspecting officers named below, was 25·42 lb, the boilers being loaded to 24 lb., and the vacuum in the condensers equal to support a column of mercury 27in. high, the weather barometer 29½in., the mean revolution being 69 per minute, it follows that the actual power exerted by the engines was 1,838 horses or 4·595 times the nominal.

These trials were conducted by Captain Astley C. Key, of her Majesty's ship Indus, John Ward, Esq., Assistant-Engineer of the Royal Steam Factory, Keyham, and James Steel, Esq., Inspector of Machinery Afloat, all officers of the Admiralty station at Devonport.

London in 1872, our marine engine practice will have been so far reformed by that time that not a low pressure engine nor a single injection condenser will there be seen.

Messrs. John Penn and Son exhibit a pair of 600-horse trunk engines made for the Spanish Government. They also send one cylinder of the engines of 1,250-horse power for the new iron-plated frigate Achilles, this cylinder being 112in. diameter (for a 41in. trunk), and for a 4ft. stroke. The weight is about 18 tons. The same firm send a finished crank shaft for the same engines, also weighing about 18 tons. There is also a finished connecting rod to go with the great cylinder; a 20-horse oscillating cylinder casting, as taken in the rough from the mould; examples of planing, turning, &c.

A very fine piece of work is a pair of 60-horse power inverted cylinder engines, by Messrs. Tod and MacGregor, and placed close against the southern end wall of the annexe. Those engines are from patterns from which the same makers have turned out two pairs of engines for a couple of Spanish steamers, and they are the only marine engines in the Exhibition provided with surface condensers. The cylinders are 30in. in diameter with 22in. stroke. The condenser is of the kind introduced into this country by Mr. Davison, of Glasgow, about the only peculiarity, indeed, being the packing of the tubes. These pass closely but not tightly through tube plates at each end, and over the ends of all the tubes is placed a sheet of india-rubber with holes corresponding to the tubes, but of so much smaller diameter that the latter can pass through the rubber only by stretching it to a considerable extent. The rubber thus tightly grasping each tube, and forming a sort of projecting elastic collar around it, another plate, drilled like the tube plate, is bolted down to the latter, compressing the rubber tightly around the tubes, and at the same time leaving a free passage for the condensing water. In the engines under notice the cast iron casing of the condenser has been made to serve as a part of the framing. The crank shaft has four bearings in the width of the engine, not so much, we suppose, because three would not have supported the shaft equally well, but for convenience in getting in the eccentrics. Of these there are six, there being a link motion, employed only as a reversing gear, for each cylinder, and expansion gear besides. The levers for working the engine are most conveniently placed in front, and the whole combination is characterised by compactness and propriety of design.

In the French department we have a pair of 400-horse engines from La Compagnie des Forges et Chantiers de la Méditerranée. Their general arrangement is much like that of Messrs. Maudslay, Sons, and Field's. At all events they are double piston rod engines. The most notable peculiarity is that the eccentrics, instead of being fixed on the main shaft, are worked on another shaft placed above, and geared to the crank shaft by spur gearing. The slide valves are on the top of the cylinders, and we must suppose that the weight is taken off their backs by Messrs. Maudslay's well-known arrangement; for not only are the eccentrics and valve spindles light, but the supplementary shaft which gives motion to the eccentrics has no intermediate support in a distance of upwards of 7ft. The cylinders are tied to the main plummer blocks by great bolts, perhaps 5in. in diameter, these going through and fastening the caps of the boxes so that they may be tightened in the direction of the principal strain. The white metal in the main brasses comes through to the outer edges, and, unless it is harder than usual, it would, when heated, run like butter. There is much good work about these engines, notwithstanding that a multitude of parts and resplendent copper work and brass work are the first to take the eye of the visitor. The cylinders are not steam jacketted, however; there are no visible man-holes through which a man might enter the cylinders to adjust the piston packing, and there is nothing to be seen of a counterweight for the crank shaft. This is extended by a screw shaft, which has a thrust bearing, and a four-bladed screw with the leading corners as sharp as those of a lady's fan. Our French neighbours have something yet to learn about the form of a screw propeller, for the one exhibited is of a description of which few are now to be found in British waters. By means of a small steam engine, with an endless worm on the shaft working into a worm wheel on the screw shaft of the large engines, the quadruple fanned propeller will be rotated during the Exhibition, imparting, no doubt, a grateful coolness all around.

IRON AND STEEL IN THE EXHIBITION.

Upwards of 4,000 tons of castings, supplied by Mr. Barrow, of the Staveley Ironworks, in Derbyshire, besides 1,200 tons of wrought iron, supplied by the Thames Ironworks, were employed in the construction of the building of the International Exhibition. Without noting these quantities as part of the exhibition of iron and steel, we will confine ourselves to the display made in the various classes.

Messrs. Schneider, Hannay, and Co., the eminent ironmasters, of Barrow, in North Lancashire, send a model of their extensive hematite ironworks, with which representation might be commenced the examination of the whole process of converting the crude ore into iron and steel. We can hardly do more, however, than note a portion of the objects actually exhibited under these heads.

Perhaps the largest contribution from an English ironmaster, or firm of iron-masters, is that by the Butterley Company, near Alfreton, in Derbyshire. They exhibit, in Class 1, Section 1, the following specimens:—A solid wrought iron deck beam, 16in. deep, flanges, 6½in. wide, thickness, ½in., and having solid knees formed whole with the beam. This is one of a lot for the new iron-plated frigate Achilles. A rafter bar, rolled with four flanges, and made to the order of Messrs. Cubitt and Co., for the roofs of the new buildings in Kew Gardens. A solid wrought iron engine beam, a single slab 31ft. 6in. long, 7ft. deep in the centre, 2¾in. thick, containing 163 superficial feet on each side, and weighing 7 tons. An armour plate, cut to size, viz., 14ft. long, 5ft. wide, 4½in. thick, and weighing 6 tons. A wrought iron boiler-plate, 12ft. 9in. long, 7ft. 6in. wide, and 1¼in. thick. A sample, 9ft. 3in. long, of a patent solid wrought iron main girder, 3ft. deep, with flanges 12in. wide. Girders of the same section can be made 60ft. long, if required, the upper and lower halves of the girder being rolled separately, and afterwards welded by Mr. W. Bertram's process. A sample, 4ft. long, is also given of a solid wrought iron girder, 2ft. 6in. deep, and having flanges 12in. wide; also of a like girder, 21in. deep, with 6½in. flanges, and ½in. thick. Also of like girders, 9in. deep with 6½in. flanges, and ½in. thick, cut down to length permitted by Commissioners of the Exhibition, viz., 14ft. Also rolled girders, 14ft. long, 10in. deep, and 4½in. flanges; also a patent solid wrought iron girder, 14ft. long, 12in. deep, and 6½in. flanges. The exhibitors were limited by the Commissioners to a length of 14ft., although many of the sections could be produced of any length, and the armour plate originally intended for exhibition was 24ft. long, 6ft. wide, and 5½in. thick. The Butterley Company succeeded in obtaining space for a railway bar 117ft. long and 5½in. deep, equal in length, therefore, to more than six ordinary rails. A tension bar for a wrought iron girder is also exhibited, 83ft. long, 12in. wide, and 1in. thick. A railway carriage axle, bent cold, and a railway tank pumping engine, are also exhibited, besides a lot of sections of T and angle iron, deck beams, &c., and specimens of the coal and iron stone from which the whole were manufactured. In Class 5 the Butterley Company also exhibit a patent solid wrought iron girder, 60ft. long, 14in. deep, and having 6½in. flanges.

It will be borne in mind that, until within a few years, it was practically impossible to roll beams, &c., of the proportions now exhibited, while large armour plates and wrought iron engine beams were unheard of.

The Lowmoor Iron Company exhibit bowl-shaped vessels, drawn out by the hammer from circular iron plates, from 3ft. to 3ft. 10in. in diameter, and perhaps ⅞in. thick. These are placed upon a table, the top of which is a large plate of iron, supported by legs of round iron bars, each tied in a knot.

The Bowling Iron Company, the Monkbridge, the Shelton Bar Iron Company, and others, exhibit samples of their productions, the Shelton Company sending a plate of 112 square feet area and $\frac{9}{16}$in. thick.

The Weardale Iron Company, of Tow Low, Durham, send a variety of engine axles, tyres, &c., of Bessemer steel.

Messrs. Taylor Brothers, of Leeds, send cranks, tyres, &c.

The Mersey Iron and Steel Company, of Liverpool, exhibit a double-throw wrought iron crank shaft, weighing between 24 and 25 tons, and made for Messrs. Penn and Sons, for the engines of one of the new iron-plated frigates of 1,350-horse power. The forging is a very smooth one, and a notification appears on one of the cranks that it has neither been smithed nor tooled.

The greatest display of steel in the Exhibition, and no doubt the greatest ever made, is that of Herr Krupp's, in the western annexe. The whole quantity of cast steel exhibited by this maker must be about 100 tons, covering a platform 40ft. long and 17ft. wide. On another page we have given a view of the collection as it stands. There are two halves of an ingot, which, before breaking in two, weighed 21 tons. The ingot is 3ft. 8in. in diameter, and each half is nearly 5ft. long. After it was cast it was cut around in the middle and broken under Krupp's famous hammer, the head of which weighs 40 tons, and falls 10ft. The fracture shows perfectly sound metal, although the ingot has never been hammered. Another ingot, 8ft. long, and weighing about 8 tons, is shown, rough at one end and hammered down at the other. An ingot, originally weighing nearly 15 tons, and 30in. by 17in. in section, is shown broken into four pieces, so as to disclose the internal character of the metal. A cast steel intermediate shaft, of the kind supplied to the Holyhead and Kingston boats, is also shown. It is about 15ft. long and 2ft. in diameter, with a large air pump crank-throw in the middle. The weight of this specimen is 15½ tons. A cast steel breech-loading gun, weighing 9 tons, and having a bore of 9in., is exhibited bored and partly turned. Also guns of the like description, and in like condition, rating, respectively, as 100, 68, 40, 25, and 12-pounders; also a rifled muzzle-loading 4-pounder. Six small steel cylinders are also shown to illustrate different systems of rifling. A cast steel double crank screw shaft, 24ft. long, and 16in. in diameter, made for the 700-horse engines of the North German Lloyd's steamers, running from Bremen *viâ* Southampton, to New York, is shown, and also a finished steel shaft for one of the Danube steamboats. A steel pump rod, 30ft. long and 5in. in diameter, is shown, and but for limited space a rod 60ft. long would have been shown, up to which length they have actually been made. A cast steel two-bladed screw propeller, 9ft. in diameter, and weighing 800 lb., is shown; also the head and flukes of an anchor on Trotman's principle. A number of cast steel engine tyres are exhibited, among them a pair on the wheels, as taken from the Eastern Counties Railway, after running 67,000 miles without once turning, the wear being very uniform and about ¼in. in depth all round. A number of cast steel axles, one having been run 66,179 miles, and another which has run 73,494 miles, are also shown. There is also a collection of steel rifle barrels, specimens of tool steel, rolls, &c. But for the limits of the space allotted to him, Herr Krupp would have exhibited some large steel plates. He is now erecting a rolling mill with 2,000-horse power, and rolls 15ft. in clear length between the standards, for rolling armour and other plates of cast steel. By this mill he will be enabled, also, to turn out plates each sufficiently large for the whole barrel of the largest locomotive boiler ever made. The Peninsular and Oriental Steam Navigation Company, we may add, have commenced the use of Krupp's steel shafts in their steamers. We should observe, while we are upon this subject, that in the most important cases the examples of Krupp's steel in the Exhibition have been purposely broken to show the quality of the metal. The fractures show sound steel over their whole surface, and afford far better evidence of quality than any mere forging, however large, or however handsomely finished.

The Bochum Company, whose works are also in Rhenish Prussia, and but a few miles from Krupp's, exhibit a cast steel bell, weighing between 8 and 9 tons, as also a pair of cast steel engine tyres of the great diameter of 9ft. 6in., besides cast steel wheels and axles for railway carriages, &c.

The mode of casting steel into bells, wheels, and other objects, originally practised at Bochum, has for some time been adopted in Sheffield, and Messrs. Naylor, Vickers, and Co., exhibit a number of such castings. Considering the difficulties in casting steel, these examples, although showing numerous small surface cavities, are, nevertheless, very creditable to the makers.

Messrs. Charles Cammell, of the Cyclops Steel Works, Sheffield, send numerous examples of their productions, and also a large and handsomely finished machine, made by Messrs. Greenwood and Batley, of Leeds, for testing Messrs. Cammell's steel daily, at their works, by tension, compression, and torsion. We expect to be able shortly to give an illustration of this machine, and shall defer till then a notice of the manufactures accompanying it.

Messrs. Shortridge, Howell, and Co., contribute an interesting collection of "homogeneous metal," and other steel or steely iron plates, tubes, ingots, &c. A cast steel ingot, 10in. square, presents a splendid fracture, and is accompanied by a case of numerous smaller samples of steel, showing fractures also. A plate of "homogeneous metal," 6ft. 6in. long, 6ft. wide, and $\frac{9}{16}$in. thick, is exhibited, along with one 16ft. 6in. long, 3ft. wide, and ¼in. thick. There is also a length of lap welded tube of the same material, 3ft. in diameter and $\frac{3}{16}$in. thick. Homogeneous metal, so called, has only been produced, to any extent, since 1856. Wrought iron, as is well known, is almost, if not entirely, infusible, but when cut into scrap and put in a crucible along with 5 oz. or 6 oz. of charcoal to every 40 lb. of metal, it will melt under a high heat, and become exceedingly tough and strong. The ordeal is a severe one, however, for the melting pots, and "homogeneous metal" thus produced is never likely to be cheap. Its strength is undoubtedly great, and its quality excellent. Sir John Burgoyne, we understand, in reporting upon some rifle experiments conducted at Chatham, stated that a $\frac{3}{16}$in. plate of this metal was proof against a Minié ball at 100 yards' range, whereas a ½in. plate of Lowmoor iron was not so. The force required to perforate a plate by a rifle bullet must be the same as that required to make a like hole by a punching machine, and, as the resistance to punching is exactly as the tensile strength, we should say the alleged results of the Chatham experiments were perfectly probable, Messrs. Napier's experiments having shown the greatest cohesive strength of small bars of Lowmoor iron to be 67,876 lb. per square inch, while that of Messrs. Shortridge, Howell, and Co.'s homogeneous metal was 99,570 lb., the lowest breaking strain being 82,218 lb. Mr. Howell also exhibits some cast steel shells, cast without a core, the metal having been poured into a mould made to revolve rapidly in two directions at the same time. Shells can be thus cast of any thickness, and when afterwards filled, in action, with molten iron, the heat, instead of melting them, will only increase their toughness. On this account Mr. Howell hopes to be able to fire these shells red hot through thick armour plates.

We must close for the present with a notice of the objects, in Bessemer steel, exhibited in the case of Messrs. Bessemer and Co., of Sheffield. This case, apart from its contents, we may observe, is one of the handsomest objects in the building, occupying a space 35ft. square in the southern portion of the eastern transept near the dome. The simple discovery which has given to the world the cheap and ready means of making this steel direct from pig iron is, perhaps, the most remarkable addition to modern scientific knowledge since the invention of the steam engine itself. The wide interest attaching to the process justifies us in describing it, with proper illustrations, on another page (see page 274).

Messrs. Bessemer and Co. exhibit the following objects in Bessemer steel:—1st. Cast steel octagon ingot, 14in. diameter, broken to show that it is perfectly solid; the fracture is preserved at one end, while the other is turned up in the lathe, and its perfect surface can only be detected from forged steel by the unturned portion still exhibiting the marks of the mould. As an ingot it is a most perfect example, and is the best answer to the statements of "W. S. P." in a letter which appeared in our last number. 2nd. A cast steel ingot, 18in. square, weighing 28 cwt.; this ingot is the 6,410th "direct steel" ingot made by Messrs. Bessemer and Co., of Sheffield. 3rd. A 24-pounder steel gun, in the rough, with the trunnions formed upon it, out of an ingot of the same size as the above. This gun is the ninety-second made by Messrs. Bessemer and Co. 4th. A 24-pounder steel gun, bored and finished by Messrs. Fawcett, Preston, and Co., of Liverpool, for whom a dozen of the same size are in course of being forged. 5th. A 32-pounder spherical shot in steel; also a 43-pounder spherical shot, with a flat zone, fitting accurately the bore of a 32-pounder, and an elongated 80-pounder for the same gun. The latter, being on the turbine principle, is suitable for discharging from a "smooth bore," and will receive rotatory motion during its passage along the chase of the gun, thus rendering rifling unnecessary, and giving a higher velocity to the projectile. 6th. There are also half-a-dozen swords, a shield, a dozen bayonets, cuirass, helmet, Enfield rifle, and rifle barrels and revolver, all made of Bessemer steel, by Mr. Reeves, of Birmingham. In the engineering department will be found a 50-horse power crank-shaft, made by Messrs. Galloway, of Manchester; a marine engine cross-head, by Fawcett, Preston, and Co., of Liverpool; an immense screw nut, and screw and box for a rolling mill, by Messrs. Hawkes and Smith, of Birmingham; a steel piston rod, 7in. diameter and 14ft. long, two smaller ones, and the piston rod of a locomotive engine, finished bright, and then folded backward and forward into a short length by the steam hammer, the severe blows of which are shown on its surface. There is also a hydraulic press cylinder and 7-in. ram fitted into it. The extreme lightness of this press renders it particularly applicable for cotton pressing in India. This thin cylinder is capable of sustaining a pressure of 12 tons on every square inch. In railway matters we have—first, a rail, 40ft. in length, rolled at Crewe. It is a beautiful sample of its kind. Some hundred tons of the rails are now laid. Next is a rail twisted cold into a spiral like a ribbon, and it does not

show a single flaw after this severe treatment. All idea of the "brittleness of steel" vanishes with the inspection of this example. There are also some close bends of rails, one of which is deserving special notice. Mr. Ramsbottom, the able engineer of the railway works at Crewe, had this piece taken up while covered with sharp frost, and placed under the large steam hammer, where it stood the blows necessary to double both ends together, without showing the smallest indication of fracture. This is an important fact in relation to the action of frost on steel, which is not affected thereby like iron. Under a glass shade is also exhibited several crop ends, or waste pieces, cut from rails now in use on the London and North-Western Railway. They show beautiful fractures. Some of the pieces have been polished at the ends to show how perfectly free they are from flaws; one specimen being polished all over gives an excellent idea of the very beautiful material which lies below the dark scale of these homogeneous rails. There are also a pair of locomotive engine tyres and a passenger carriage tyre, one left black from the rolls, and the other two finished bright. These tyres are especially interesting from the fact that the first solid form that the metal assumed was that of a hoop with a raised flange; the metal was never even in the form of pig iron, having been run direct from the blast furnace into one of Bessemer's converters, and, after nine minutes' blowing, was run into the mould, and formed into a *cast steel tyre*. In these beautiful tyres we have an example of the complete and precise working out of Mr. Bessemer's first plans, as laid down in 1856 in his paper at Cheltenham. The metal was run at once from the blast furnace into an upright fixed cylindrical vessel, with horizontal tuyeres fixed radially around the lower part, the quality or temper of the steel being ascertained by the appearance of the flame and sparks, and the metal was tapped by a bar, as practised in iron-founding, and as indicated in Mr. Bessemer's patent. There is no alloy of metal, no "spiegel eisen," *and no manganese* in any form whatever, nor was any metal employed to recarbonise, the entire process being precisely the same in all its details as that described to the meeting at Cheltenham, and patented by Mr. Bessemer. There are also some extraordinary examples of the toughness of the Bessemer steel, made from British coke pig iron, among which may be enumerated two deep vessels of 1ft. in diameter, with flattened bottoms and vertical sides. At the top edge one of them is $\frac{5}{8}$in., and the other $\frac{7}{8}$in. in thickness. These were forced up in a press from flat circular discs of steel. They can now be drawn into long tubes, either of their present diameter, or they may be reduced to locomotive boiler tubes of 2in. diameter. There is also shown an attempt to raise a piece of the best quality of Staffordshire iron plate by the same tools; this only went about as deep in proportion as a dinner plate before it fractured all around the punch, and almost fell in two pieces. It may be remarked that Mr. Parkes, who invented this beautiful system of making unwelded tubes, has been obliged to use the very highest quality of copper for that purpose, as the ordinary copper of commerce generally cracks; but the Bessemer steel, as seen by these examples, stands this fearful ordeal with perfect safety. There is also a 5-in. square bar folded up quite close (red-hot), as an example of the powers of stretching hot without a symptom of crack or flaw. Another 5-in. bar is half cut through, and then doubled close up, without any sign of fracture; a mass of 4-in. in thickness is cut into nine cubes, not quite separated, and showing great tenacity as well as facility in working the metal. A 4-in. square bar has been so twisted while hot that its angles have approached within less than half an inch of each other, so that what was originally 1ft. length of surface has now become 26ft., while the central portion of the bar still preserves its original length of 1ft. Mr. Bessemer also exhibits beautiful samples of steel wire, by Fox, of Deepcar, near Sheffield; wire cards for cotton and wool, by Messrs. Fairbairn Brothers; and some of these sharp elastic cards may be seen in the western annexe on the carding machines of Messrs. Platt Brothers. There are also samples of plates of 4½in. to $\frac{1}{64}$in. thick; also round and square bars from 4in. diameter to ¼in.; also flat and octagon tool steel. Among the tools exhibited are some beautiful taps, from ¼in. to 3in. diameter, by Chatwin, of Birmingham; files, saws, and a variety of other tools, by Ibbotson, of Sheffield; steel pens and split rings, by Mason, of Birmingham; and some beautiful cutlery by Mr. Rotherham, of Sheffield. There are also exhibited on boards two piles of "scrap"—one is boiler-plate scrap, and the other "ladle skulls," that is, the thin shell of steel which sets in the ladle during the casting process. It is, consequently, neither hammered or rolled. These piles have placed before each of them a bar of steel, made by treating a similar pile precisely the same as scrap iron would be treated, and forging them into a solid bloom. A part of each bar, or bloom, has been turned in the lathe to show how sound the welding of some hundreds of pieces may be made.

Whatever may be the contrasts between the former and the present International Exhibitions, there is none in which the superiority of the present is more manifest than in the examples of iron and steel already noticed in this article. In 1851, the Butterley Company could have sent no such beams and plates, the success of the great Mersey forging would have been to some extent doubtful, while as for Krupp's great steel forgings they would have been looked upon as impossible, and Bessemer's steel, the Bochum steel castings, and Messrs. Shortridge and Howell's "homogeneous metal" were unknown. With such progress in so brief a period what may we not look for in the future?

ENGINEERS' TOOLS IN THE EXHIBITION.

ALMOST all that can be said of engineers' tools now was known at least ten years ago. No great improvements are consummating or dawning in this class of machinery. Yet it always must command a large share of engineering interest, as being the parent of almost all other classes of finished machinery. As for the principles of engineers' tools, there is but one—that of a cutting point, or a cutting edge, acting upon a metallic object—the cutter fixed and the object in motion, or *vice versâ*. In the turning lathe and the planing machine the tool is stationary, and the metal surface is brought up for operation, while, in the slotting, shaping, drilling, screw-cutting, punching and shearing, and other machines, the work lies stationary while the tool is fed up to the surface to be excoriated or the section to be amputated. Incision, excision, and circumcision, are the only functions dischargeable by engineers' tools. In these respects, indeed, the operative tasks of the mechanical engineer and the surgeon may be regarded as identical, and those who have the nerve to examine the ghastly machinery of a "regulation army case," or that of a great Sawbones in extensive practice, may be left doubting whether the apparatus for the vivisection of human beings or that for the dissection of inert metal is the more ingeniously devised and skilfully put together. We make this comparison in the belief that, by this time, engineers' tools have, popularly, been over-admired, and a certain degree of intelligence ascribed to them which is explicable upon the most elementary principles of motion.

The tools of the carpenters of bygone days contained the germs of all the inventions in machine tools of a Maudslay, a Roberts, or a Whitworth. In turning, the old "rest," with its long, straight guiding edge, contained the idea of the slide rest, an invention variously ascribed to Henry Maudslay, and to Mr. Sherriff, who turned rolls for Maudslay. The hand plane moved over the plank, guided by the eye and the sense of touch of the workman. It was not so great a step, in principle at least, to move the work, whether wood or iron, over the plane, the latter fixed and the former guided aright. Indeed, there have been many modern planing machines, brought out as improvements, in which the work was strapped down while the tool went to and fro over its surface. As for the drill, it is no more in principle than the old auger, while the punch, shears, screw-cutting, slotting, and other like contrivances have their ante-types in tools which have been used for centuries, although upon somewhat more yielding materials than iron and steel. Now we are not seeking to depreciate the merit, such as it is, displayed in our modern workshop tools; we only protest against their being unduly worshipped (of which we have reason to know there is danger), as the embodiment of recent genius exclusively.

We have not gone far into the archæology of engineers' tools, but the slide lathe was as early as the time of Henry Maudslay, and the first planing machine appears to have been made in 1794, at Harrocks, Miller, and Co.'s works, at Preston, where it was used for planing mule tracks. This Ancient Briton was 5ft. long, had a cross beam with a tool head sliding upon it, and was worked by hand through a drum and chain. In 1817 Mr. Richard Roberts brought out his planing machine, much like Horrocks', but contrived, we do not doubt, without the slightest knowledge of that original. We have been told that Mr. Roberts' planing machine, 45 years old, may still be seen at the works of Mr. Chidlaw, Great Bridgwater-street, Manchester. A claim is put in for Mr. Fox, of Derby, whose grandsons exhibit a planer in the Exhibition—one which, for anything that we know, may have been the one upon which Mr. Fox's claim, as the inventor, was originally founded.

To go through the several phases of mechanical adaptation which have invested the primitive contrivances of the pre-planing period with the dignified accuracy and unfaltering incisive energy of our modern tools, would be a task beyond our present space and inclination. That these tools present comparatively little that is new in principle is a proposition which, we think, will not want for proof, after a little reflection. It is not for the peculiar application of known principles, nor for the discovery of new starting points in mechanism, that our modern tool-builders have gained fame. Their success, whatever it may have been, will generally be found to have grown out of the proportions of their patterns, and more especially the quality of their workmanship. These are matters which almost defy generalisation, and in no case could they be successfully imparted in manuscript or print.

"By line and rule
Works many a fool,"

once said a lady, jestingly, to Dr. Johnson, when she found him, for the nonce, applying a measure to the buttresses of Henry VII.'s chapel. And, indeed, no lines or rules would elevate the slop-shop work of the mere copyist into the rank of true mechanism.

The visitor to the western annexe is confronted, almost at the entrance, with a very extensive display of engineers' tools. Reading, in unmistakable and durable letters on the framing of each the name of the maker, one might profess to assign the merit of these tools according to the several reputations under which they appear. But remove the names, and, if possible, disguise the external form, and who shall say which are the best? Not until the geometrical accuracy of each had been proved could any valuable opinion be pronounced. The practical machinist would wish to test them by a few hours' hard work upon objects requiring great precision in finish. Almost all the tools look strong—some, of course, looking stronger than others, and the weak points could only be found out by imposing, as a test, the hardest work to which the tool could "stand up." In all that part of their construction capable of verbal description there is, indeed, a common likeness in the tools, for any given purpose, by nearly all makers.

Inasmuch, then, as all the engineers' tools in the western annexe will remain at rest during the Exhibition, we shall not profess to criticise them closely, nor assign to them qualities dependent on the mere *prestige* of a name. In respect of proportion and outward finish, a purchaser might open his check-book and the gates of his premises in confidence to nearly all of this class of work on exhibition. Further than this, however, he need go; but we shall not undertake to impart, in these columns, that kind of information which is always regarded in "the trade" as confidential.

Messrs. Joseph Whitworth and Co. exhibit several tools, which have but just been got into place. There is a large gap lathe, a forging machine, a large screw planer, &c. The screw in the planing machine must have been retained, we suspect, simply because no one else will use it.

Messrs. P. Fairbairn and Co., of Leeds, send a large planing machine for armour plates, a very large gap lathe, a radial drill, and, among other tools, a smaller planing machine, with bevel driving gearing, so that the machine may range alongside instead of athwart the lathes in a workshop. The planing machines have a rack under the table with a single breadth of tooth.

Messrs. Sharp, Stewart, and Co., of Manchester, send a fine lot of tools. They comprise a large shaping machine, driven by a crank working in a slotted vibrating arm, so as to give a quick return to the tool; a 1½-in. punch and shears, weighing about 13 tons; a 21-in. drill and a 17-in. drill; a 6-in. shaping machine; a large railway wheel lathe, weighing 24 tons, to turn 6½ft., and having double face plates, and four tool posts and tools, two on each side of the bed, according to Mr. Whitworth's duplex arrangement; a 9in. slotting machine; a large and a small slotting drill, each with a single head, also a slotting drill with double head for connecting rods; a "marine slotting drill" (illustrated on page 275 of our present number); three of Sellers' bolt-cutting machines, as made by Messrs. Sharp, Stewart, and Co. (and illustrated on page 275 of our present number); and finally, a radial drill, in which the spindle may describe a complete circle, 12ft. in diameter. Not capable of inclusion with "tools," but fixed to a show board in the midst of them, are eleven of Giffard's Injectors, from a very small to a very large size, that is to say, from No. 2 to No. 23, the latter capable of feeding 6,000 gallons of water an hour, under 50 lb. pressure, equal to the supply of twelve boilers of 50-horse each.

Messrs. William Muir and Co., of Manchester, exhibit a number of tools, including a large radial drill, which moves through rather more than half a circle. Also a pair of double grindstones, with patent adjusting apparatus. The principle of employing one stone to true up another is a very useful one, and was first applied at least thirty years ago. It was described in Holtzapffel's work, in 1844, and, as taken up by Messrs. Muir, who have added improvements of their own, has met with much success.

Messrs. Smith, Beacock, and Tannett, of Leeds, send several examples of their celebrated tools, among others a lathe with a central headstock and end tail-stocks.

Messrs. Shepherd, Hill, and Co., also of Leeds, send a gap lathe, 15ft. long, and capable of turning an object 5½ft. in diameter; also a smaller lathe, a small planing machine, a large slotting machine, and two shaping machines.

Messrs. Maclea and March, also of Leeds, send a large double head lathe for turning up to 6ft., or thereabouts; a shaping machine, &c.

Messrs. J. Buckton and Co., of Leeds, exhibit a large shearing and punching machine.

Messrs. Beyer, Peacock and Co., of Manchester, have put in an appearance as tool builders, exhibiting a 7-ft. railway lathe, illustrated on page 267 of our present number, and a drilling machine for setting out locomotive frames, also illustrated on page 267. The last-named is a novel tool, for a special purpose, and both are good examples of workmanship.

Messrs. J. Hetherington and Sons, of Manchester, contribute a large radial drill, and a lathe of moderate dimensions.

Messrs. J. S. Hulse and Co., of Manchester, send a planing machine with rack and pinion motion, the rack being in four sections, each set a quarter of a tooth ahead of the next. The same makers also send a radial drill, portable shears, &c.

Messrs. Fox Brothers, of Derby, exhibit an antiquated pattern of planing machine, a drill, and, we believe, a few other tools.

Messrs. Smith and Coventry, of Manchester, send a screw-cutting machine, in which three chasers are employed, the whole three being brought simultaneously up to their work, and forming their own stay to the screw. The same makers also send a radial drill of 6ft. radius, a shaping machine with 10-in. stroke, a 40-in. vertical drill, a bench drill, with change wheel castings, specimens of screws, &c.

Messrs. Crawhall and Campbell, of Glasgow, also exhibit a few tools.

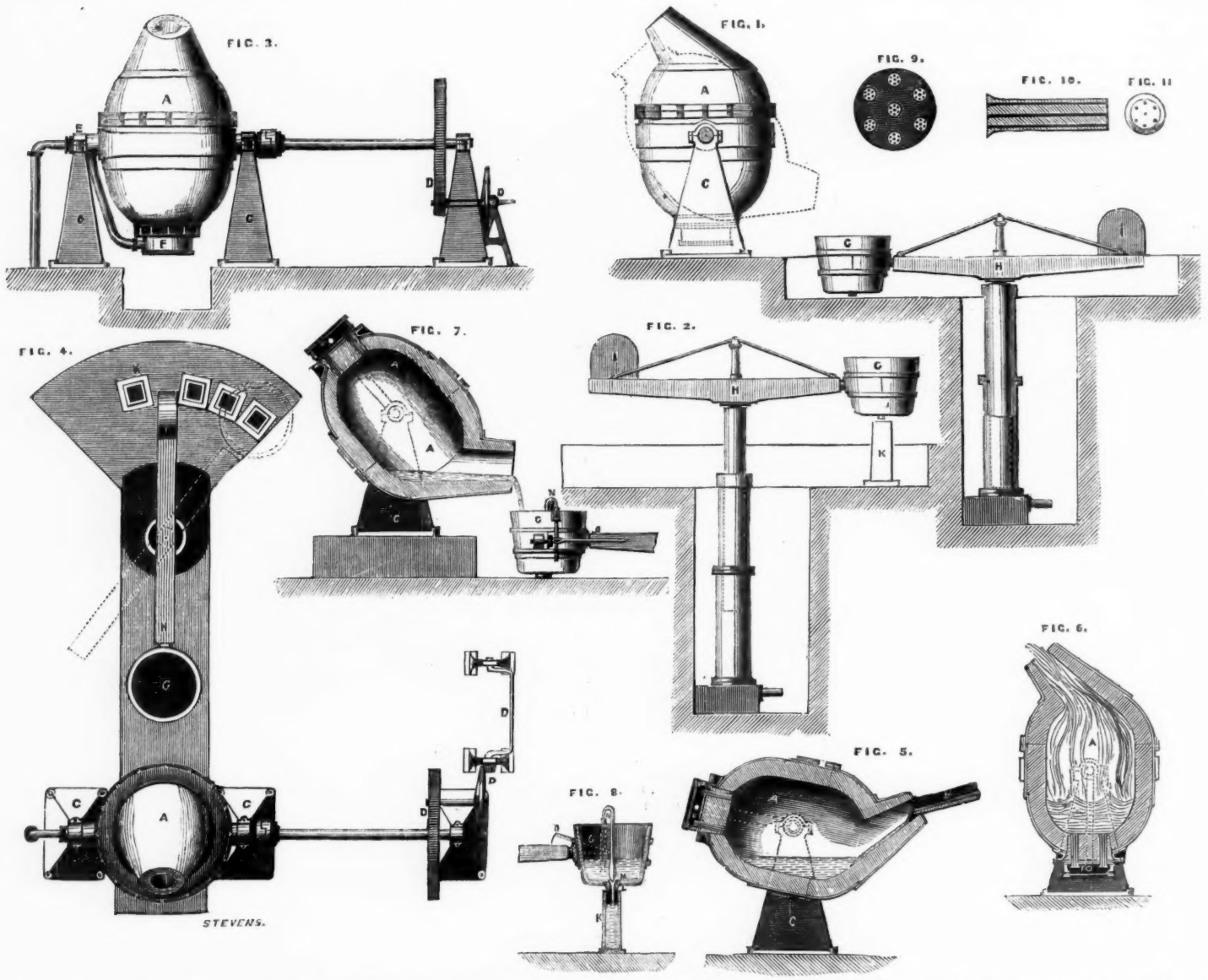
Messrs. Shanks and Co., of London, exhibit some of their well-known tools, besides a couple of novelties in the way of drills. The latter are the multiple drill and the turnstile drill, both recently illustrated in THE ENGINEER. Their well-known double slotting drill, with two tools working towards each other, is represented by a large-sized example, capable of making a slot 18in. long, and embodying such improvements in construction as have suggested themselves to the makers since their first production of this tool in 1856. The bolt-cutting machine is one in which the dies are fixed while the bolt revolves.

In the foreign department Herr Hartmann and Herr Zimmermann, of Chemnitz, in Saxony, have sent an extensive lot of tools. Zimmermann has sent a very large planing machine, apparently closely copied from a well-known Manchester pattern, even to the unnecessary division of the rack into four sections, each set a quarter of a tooth ahead of the next. The work is good, however; as is that generally from Chemnitz, and, with the maker's name cut away, it might be some time before a good English machinist would become aware that these tools were made abroad.

Like almost every other department of machinery in the Exhibition, that of engineers' tools is so fully represented that we can only do it justice in a series of articles.

THE LOCOMOTIVE IN INDIA.—The opening of the railway from Umritsir to Lahore at the beginning of last month seems to have excited interest among the Punjabees even more intense than that felt by the Bengalees in 1854. Day after day thousands congregate, from the most distant places, to see the "Lawrence" locomotive come into Umritsir. Its fame has spread to the Peshawur and Mooltan frontiers. Some daring spirits insist on a ride on the "fire-horse," just as the Bengalees used to crowd round to examine the new "car of Indra," and would not be convinced of the danger they incurred till a cow was killed straying on the line. A Brahmin, looking on the locomotive at Umritsir, remarked, "All the incarnations of all the gods in India never produced such a thing as that." By this time the news has been carried by the trading caravans into Cabul and Central Asia, and so our prestige increases.

THE BESSEMER PROCESS.



Mr. Henry Bessemer's process of converting crude pig iron into cast steel at a single operation has now been in daily operation in Sheffield for nearly three years. The apparatus by which it is effected is shown in the illustrations which represent the arrangement at Messrs. John Brown and Co.'s, Atlas Steel Works, Sheffield. Fig. 1 is a side elevation, and Figs. 3 and 4 a front elevation and plan.

The crude pig iron chiefly used in this process has been the hot-blast hæmatite pig smelted with coke, which is melted in a reverberatory furnace adjoining, and is then run into the converting vessels A, Figs. 1 and 3, in which its conversion into steel is to be effected. The converting vessel is shown enlarged in section in Fig. 5, which represents its position in filling, the melted pig iron being run into it by the spout B direct from the furnace. It is made of stout boiler plate, and lined with a powdered silicious stone found in the neighbourhood of Sheffield below the coal, and known as "ganister." The rapid destruction of the lining of the converting vessel was one of the great difficulties met with in the early stages of the invention: the excessive temperature generated in the vessel, together with the solvent action of the fluid slags, was found to dissolve the best firebrick so rapidly that sometimes as much as 2in. thickness would be lost from the lining of the vessel during the thirty minutes required to convert a single charge of iron into steel. The ganister now used, however, is not only much cheaper than fire-bricks, costing only about 11s. per ton in the powdered state, but it is also very durable: a portion of the lining of the vessel is shown which has stood ninety-six consecutive conversions before its removal. The converting vessel A is mounted on bearings which rest on stout iron standards CC, Figs. 3 and 4, and by means of the gearing and handle D it may be turned into any required position. There is an opening at the top for filling and pouring out the metal; and at the bottom of the vessel are inserted seven fireclay tuyeres, Fig. 9, each having seven holes, as shown enlarged in the longitudinal section and plan, Figs. 10 and 11. The blast from the engine is conveyed through one of the bearings E of the vessel, Fig 3, into the tuyere box F, and enters the tuyeres at a pressure of about 14 lb. per square inch, which is more than sufficient to prevent the fluid metal from entering the tuyeres.

Before commencing with the first charge of metal, the interior of the converting vessel is thoroughly heated by coke, with a blast through the tuyeres to urge the fire; when sufficiently heated it is turned upside down and all the unburnt coke falls out. The vessel is then turned into the position shown in Fig. 5, and the melted pig iron is run in from the furnace by the spout B, the vessel being kept in such a position during the time it is being filled that the holes of the tuyeres are above the surface of the metal. When the proper charge of iron has been run in, the blast is turned on and the vessel quickly moved up into the position shown in Fig. 6. The blast now rushes upwards into the fluid metal from each of the forty-nine holes of the tuyeres, producing a most violent agitation of the whole mass. The silicium always present in greater or less quantities in pig iron is first attacked, and unites readily with the oxygen of the air, producing silicic acid: at the same time a small portion of the iron undergoes oxidation, and hence a fluid silicate of the oxide of iron is formed, a little carbon being simultaneously burnt off. The heat is thus gradually increased until nearly the whole of the silicium is oxidised, which generally takes place in about twelve minutes from the commencement of the process. The carbon of the pig iron now begins to unite more freely with the oxygen of the air, producing at first a small flame, which rapidly increases, and in about three minutes from its first appearance a most intense combustion is going on: the metal rises higher and higher in the vessel, sometimes occupying more than double its former space, and in this frothy fluid state it presents an enormous surface to the action of the air, which unites rapidly with the carbon contained in the crude iron and produces a most intense combustion, the whole mass being in fact a perfect mixture of metal and fire. The carbon is now burnt off so rapidly as to produce a series of harmless explosions, throwing out the fluid slag in great quantities; while the combustion of the gases is so perfect that a voluminous white flame rushes from the mouth of the vessel, illuminating the whole building and indicating to the practised eye the precise condition of the metal inside. The blowing may thus be left off whenever the number of minutes from the commencement and the appearance of the flame indicate the required quality of metal. This is the mode preferred in working the process in Sweden. But at the works in Sheffield it is preferred to continue blowing the metal beyond this stage, until the flame suddenly drops, which it does just on the approach of the metal to the condition of malleable iron: a small measured quantity of charcoal pig iron containing a known proportion of carbon is then added, and thus steel is produced of any desired degree of carburation, the process having occupied about 28 minutes altogether from the commencement. The converting vessel is tipped forwards and the blast shut off for adding this small charge of pig iron, after which the blast is turned on again for a few seconds.

The vessel is then turned into the position shown in Fig. 7, and the fluid steel run into the casting ladle G, which is carried by the hydraulic crane H, being counterbalanced by the weight I on the opposite end of the jib. When all the metal is poured out of the converting vessel, the crane is raised by water pressure and turned round, as shown in Fig. 2, for the purpose of running the steel into the ingot moulds K. Instead of tilting the casting ladle for pouring into the moulds, it is made with a hole in the bottom fitted with a fireclay seating L, Fig. 8, and closed by a conical plug of fireclay M, forming a conical valve. The valve rod N is coated with loam and bent over at the top, and works in guides on the outside of the ladle, as shown in Fig. 7, with a handle O for opening and closing the valve. By thus tapping the metal from below, no scoria or other floating impurities are allowed to run into the mould, and the stream of fluid steel is dropped straight down the centre of the mould right to the bottom, without coming in contact with the sides of the mould. The moulds are made of a slightly tapered form, as shown in Fig. 8, so that as the ingot contracts in cooling it liberates itself from the mould completely on all sides; and the mould is removed by being lifted off the ingot when sufficiently set. The moulds are arranged in the moulding pit in an arc of the circle described by the casting ladle, as shown in the plan, Fig 4.

By this process from 1 to 10 tons of crude iron may be converted into cast steel in 30 minutes, without employing any fuel except that required for melting the pig iron and for the preliminary heating of the converting vessel, the process being effected entirely without manipulation. The loss on the weight of crude iron is from 14 to 18 per cent. with English iron worked in small quantities; but the result of working with a purer iron in Sweden has been carefully noted for two consecutive weeks, and the loss on the weight of fluid iron tapped from the blast furnace was ascertained to be only 8¾ per cent. The largest sized apparatus at present erected is that in use at the Atlas Steel Works, Sheffield, as shown in the illustrations already described, the converting vessel being capable of converting 4 tons at a time, which it converts into cast steel in 28 minutes. In consequence of the increased size of the converting vessel in this case no metal is thrown out during conversion; and the loss of weight has fallen as low as 10 per cent., including the loss in melting the pig iron in the reverberatory furnace.

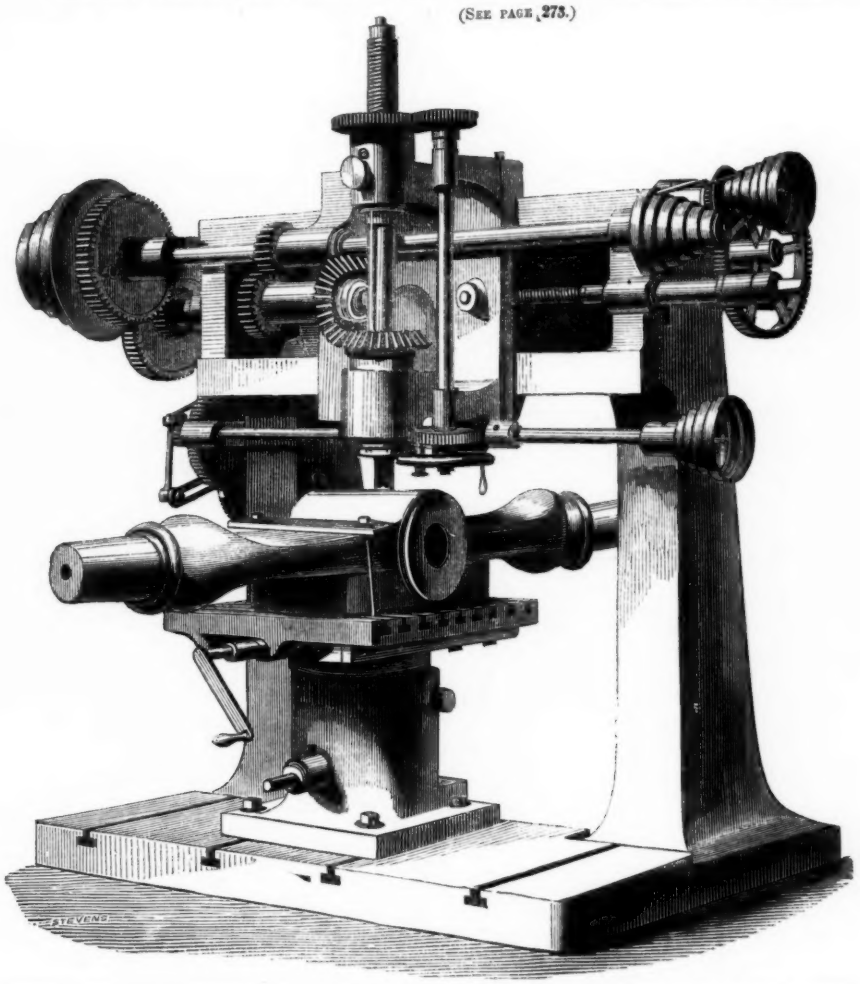
The Patent Laws.—In the House of Commons, on Tuesday evening, Lord J. Manners gave notice (for Sir F. Kelly) that on Tuesday, the 27th of May, he would move an address for a commission to inquire into the working of the law relating to patents.

Heights of French Public Buildings.—A lengthy list appears in the *Builder* of the heights of churches and other public buildings in France, giving also the elevation of both the base and highest point of each building above the sea. Strasburgh spire is 466·2ft. high, the pavement of the church being 472·8ft. above the sea. The summit of the lantern of the Pantheon, at Paris, is 273·3ft. above the pavement, which is 198·8ft. above the sea. The pinnacle of the Invalides is 334½ft. above the pavement, the balustrades of the towers of Notre Dame, 216½ft.; and the column of the Place Vendôme 141·1ft. The foot of the cross of Amiens spire is 327·1ft. high from the pavement. The summit of the new steeple of Chartres Cathedral is 361·1ft. high from the ground.

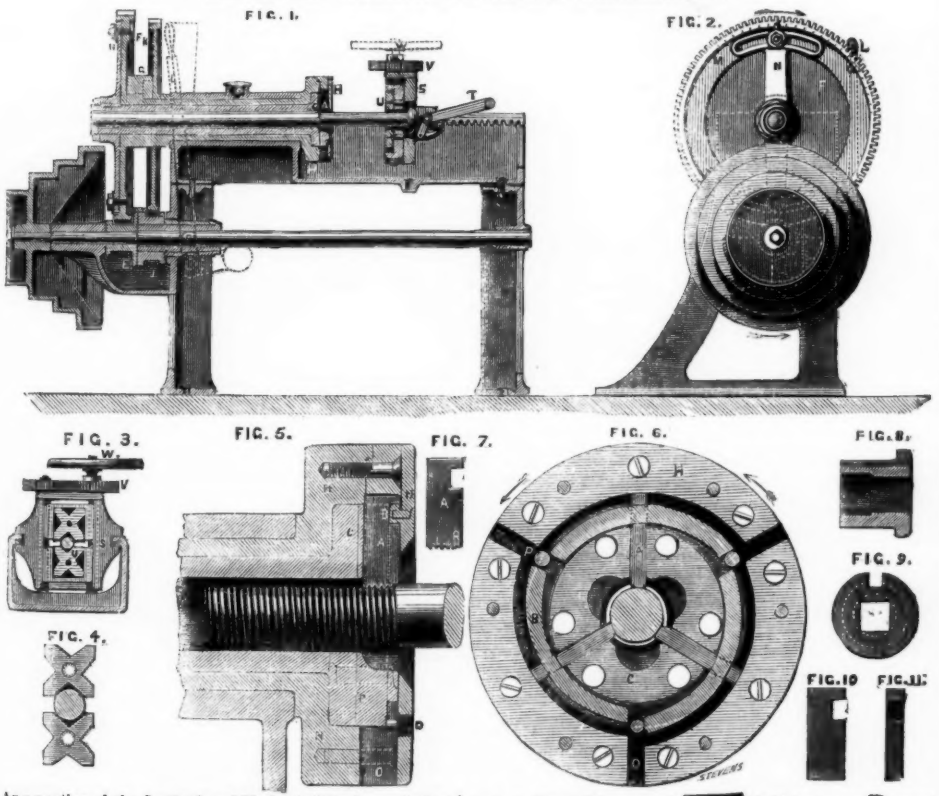
Traffic Receipts.—The traffic receipts of railways in the United Kingdom amounted for the week ending the 19th of April on 10,145 miles, to £518,484, and for the corresponding week of last year, on 9,911 miles, to £520,985, showing an increase of 234 miles and a decrease of £2,501. The gross receipts on the following fourteen railways amounted in the aggregate, on 6,618 miles, to £402,234; and for the corresponding week of 1861, on 6,458 miles, to £402,489, showing an increase of 160 miles and a decrease of £255. The decrease on the Caledonian Railway amounted to £288; on the Great Northern to £645; on the Great Southern and Western to £178; on the Lancashire and Yorkshire to £2,595; on the London and North-Western to £1,909; on the Manchester, Sheffield, and Lincolnshire to £1,633; on the Midland to £840; on the North British to £453; and on the North-Eastern to £2,335—total, £10,876. But from this must be deducted £203, the increase on the Eastern Counties; £847 on the Great Western and West Midland; £4,837 on the London, Brighton, and South Coast; £2,560 on the London and South-Western; and £2,174 on the South-Eastern—together £10,621; leaving the decrease, as above, £255. The goods and mineral traffic on those lines amounted to £200,566, and for the corresponding week of 1861 to £220,207, showing a decrease of £19,640. The receipts for passengers, parcels, &c., amounted to £201,667, against £182,282, showing an increase of £19,385. The traffic receipts on sixty-six other lines amounted, on £3,527 miles, to £116,250, and for the corresponding week of last year, on 3,453 miles, to £118,496, showing an increase of 74 miles and a decrease of £2,246. The falling off in the traffic of the past week as compared with the corresponding period of 1861 is considerable in the goods traffic of the great lines, chiefly in consequence of the depression of trade in the manufacturing districts, but this falling off has been nearly counterbalanced by the great increase in the passenger traffic, in consequence of it being Easter week. The traffic receipts of the past week show an increase of £23,789 as compared with those of the preceding week ending the 12th inst.

SHARP, STEWART, AND CO'S MARINE SLOTTING DRILL.

(SEE PAGE 273.)



SELLERS' SCREW-CUTTING MACHINES.



AT a meeting of the Institution of Mechanical Engineers, held at Birmingham on the 7th of November, 1861, Mr. Charles P. Stewart, of the Atlas Works, Manchester, read the following paper:—

The screwing machine* described in the present paper was designed by Mr. William Sellers, of Philadelphia, United States, to combine accuracy of cut and greater perfection of thread than is obtained in ordinary screwing machines, with rapidity of action and simplicity of working, and with increased facility for keeping the cutting dies in good order. The screw thread is cut in a single operation, and the finished bolt is released by the withdrawal of the dies, the machine being driven continuously in one direction without reversing or stopping.

The machine is shown in the illustrations; Fig. 1 is a longitudinal section through all the working parts of the machine, and Fig. 2 an end elevation. Fig. 5 is a longitudinal section of the die box, enlarged to one-third full size; and Fig. 6 is a front elevation of it, with the cover-plate removed in order to show the dies.

The dies for cutting the screw-thread are in three separate pieces, A, A, A. Fig. 6; these are advanced and held in the required position for screwing the bolt by means of eccentric ribs or cams fixed upon the cover-plate, as shown in section at B, B, B, which work in a notch in the edge of each die, as shown in Figs. 5 and 7. In working, the die box C revolves in the direction of the arrow, being driven from the driving shaft D, Fig. 1, by the pinion E and spur wheel F; and the projecting clutch G, on the back of the wheel F carries round with it the cam plate H, which thus revolves at the same speed as the die box C, so that the relative position of the cams and dies remains unaltered in revolving, and the dies are held up to the proper position for cutting the thread without alteration during working.

When the screwing is completed the bolt is released by the dies being all simultaneously withdrawn by means of the cams. This is effected by the second pinion J, Fig. 1, gearing into the spur wheel K fixed on the shaft of the cam plate H. This pinion J is a little larger in diameter than the driving pinion E, and runs loose on the driving shaft D during the time that the dies are in operation cutting a screw; but when that is completed, the conical friction clutch between the two pinions is caused to engage by pressing forward the handle L, shown dotted in Fig. 1, whereby the spur wheel K, being of a little smaller diameter than the wheel F, is made to revolve faster than the latter, and causes the cam plate H to over-run the die box C; the dies A, Fig. 6, are thus made relatively to move back along the cams, so that they are withdrawn from the finished bolt, which, being released, is drawn out by hand, while the machine is still driven continuously in the same direction without stopping or reversing. The handle L on being released is immediately brought back to its original position by means of the counterbalance weight attached to it, thereby disengaging the pinions E and J, and pressing the loose pinion J against a leather collar on the end frame of the machine, the friction of which checks the motion of the pinion J and the spur wheel K of the cam plate, allowing the die box C to overtake the cam plate again; the dies are thus moved forward along the cams till they are again in their original working position ready for cutting a fresh thread.

The adjustment of the dies to the exact position required for the size of bolt to be cut is accomplished by means of a graduated index, M, Fig. 2, on the spur wheel F which drives the die box C. The wheel F is loose on the shaft of the die box, and in working is clamped by set screws to the arm N, Figs. 1 and 2, which is keyed on the shaft. For advancing the dies, the arm N is turned forward in the direction of the rotation, as shown by the arrow in Fig. 2, carrying the dies forward along the cams, the latter being held stationary at the time by holding the spur wheel K that is fixed on the cam-plate shaft. The dies are thus advanced to the position for cutting, and the spur wheel F is then clamped securely to the arm N by the set screws, having previously been turned so that the projecting clutch G on the back of the wheel F is engaged with the wheel K of the cam-plate. The machine is then ready for starting to work. The total length of the graduated index corresponds with the total length of the cams; and two holes in the wheel F for each of the set screws are sufficient to admit of adjustment throughout the entire range of the index, by means of the slotted arc at each extremity of the arm N.

For changing the dies in the die box the spur wheel K is turned forward by hand as far as it will move; this brings the dies opposite the openings O in the cam plate H, Figs. 5 and 6. The three fixing screws P are then slacked back till their inner ends are flush with the inside of the cover plate, when the dies can be pushed out through the holes O. In putting in the fresh dies each die is inserted in turn and pushed down until the notch in its edge comes opposite the fixing screw P, which is known by a shoulder on the screw driver; and the cam plate is worked backward and forward by hand, by means of the wheel K, to make sure of the die being properly placed with the notch fitting on the cam; the fixing screw is then set up, which secures the die from falling out.

In order to cut a full screw thread on the bolt in once running up, the dies are cut with a perfectly full thread throughout, and of such size as to fit the bolt when it has the thread cut complete upon it. The tops of the die threads are then eased off on the side where the bolt enters, as shown at R in Fig. 7, commencing at the base of the thread and terminating at the top of the third or fourth thread from the point of entering. The thread on the bolt is thus formed by a succession of cuts, each one deeper than the preceding, until the full depth is attained.

When the machine is used for tapping nuts the cutting dies are removed, and the tap holder, shown in Figs. 8 and 9, is inserted in the hollow spindle of the die box, and secured from turning by a blank die, Figs. 10 and 11, which serves as a key fitting into the notch in the tap holder.

The bolt or nut to be screwed is fixed in the sliding holder S Figs. 1 and 3, sliding freely on the top edge of the framing; the handle T is made with a finger on it to fit in a rack on the framing, which gives sufficient leverage for the momentary pressure that has to be put upon the bolt on its first contact with the cutting dies to ensure its entrance. The clamps U for gripping the bolt or nut, shown separate in Fig. 4, are opened or closed simultaneously, one up and the other down, by two right-and-left-handed screws geared together by the pinions V and worked by the hand wheel W. It is essential that the bolt or nut to be screwed should be truly in the axis of the die box, which is ensured by boring the clamp in their places in the machine, and they are afterwards slotted to the required shape.

In cutting new dies or re-cutting old ones a set of master taps is used; the leading end of the master tap is supported in a circular thimble which slides inside the hollow spindle of the die box. The dies are then pressed close upon the master tap by means of the arm N on the spindle of the die box, Fig. 1, and the machine is run forward and backward; the dies are again closed upon the tap, and the process repeated until a full thread is obtained. A small stop is first inserted in the clutch G between the spur wheels F and K, so as to make them immovable with respect to each other during the process of cutting the dies.

In this machine the necessity of setting up the dies by hand between successive cuts is obviated, as they are set up at the first by the graduated index of the cam plate to the exact diameter required for the finished bolt, and the screwing is completed in once running the bolt up. With each machine a table is prepared showing the position on the index to which the pointer has to be set for cutting bolts of the various diameters within its range; and a slight change in the position of the pointer will make the bolts slightly larger or smaller, as the case may require. When the dies have become worn and have been re-cut a readjustment of the index readily gives the means of bring them up to exactly the same diameter as previously, so that the size of bolt is not altered by re-cutting the dies. The original adjustment of the index is made by actual trial of the different diameters of bolts in the machine, the results being tabulated; and this is done again when the dies are re-cut.

This screwing machine has the advantage of rapidity of action, producing a perfect screw thread in once running up, while the time usually required for running back is saved by the plan of withdrawing the dies and releasing the bolt. The machine is never required to be stopped except for changing or repairing the cutting dies, and does not need the application of a crossed belt or reversing apparatus for driving it, since it runs continuously in one direction only. It is of small size in proportion to the work it accomplishes, and is on a plan very convenient for the workman using it. As the dies can be readily adjusted to any diameter of bolt for which the machine is adapted, they can be worn down for a long time before requiring renewal.

* Three of these machines are comprised in Messrs. Sharp, Stewart, and Co.'s collection of engineers' tools in the International Exhibition.

INDIAN RAILWAYS.—At the last meeting of the Great Indian Peninsula it was stated that the section of eighty-seven miles from Nassick to Chales-gaum, on the north-eastern division of the railway, was opened last October, making the number of miles worked 437¾. The traffic continues to increase steadily. During the last half-year the number of passengers using the line was 1,217,595, against 831,864 in the corresponding period of the preceding half-year, and the goods carried have been 116,263 tons, against 85,103 tons. The great improvements now in progress in India are expected to prove very advantageous to the undertaking. The report of the East Indian announces that, during the last six months, an additional length of 72½ miles was opened in Bengal, and 120½ miles in the North-West Provinces. The total distance now completed is 603¼ miles, and the remainder of the main line is expected to be finished by the end of the current year. The gross traffic receipts have increased from £90,424 in 1860, to £143,008 in 1861. The whole amount of capital estimated to be necessary for completing the line to Delhi, £19,700,000, has now been issued. The directors of the Great Southern of India state that the first portion of the railway from Negapatam to Trivalore was opened in July last, and the second, to Tanjore, in December. The remaining part of the first section to Trichinopoly was completed last month. The total number of passengers carried in the five months and a half during which the line was partially opened was 66,898, of whom 64,614 were third-class. Since the commencement of the working petitions have been received from native merchants for three additional stations, one of which has been agreed to, and the others are under consideration.

SOCIETY OF ARTS.

April 23rd, 1862.

Henry Cole, Esq., C.B., in the Chair.

ON THE EFFECT OF PRIZES ON MANUFACTURES.

By Samuel Sidney.

In a week from the present evening the Great International Exhibition of 1862 will be opened, under two essentially different conditions from those which regulated the Exhibition of 1851. Prizes will only be given for absolute merit, and not for gradations of merit, as on the former occasion. Sales (by sample) will be authorised. The question to be examined and discussed this evening is, whether this decision is founded on sound commercial and economical principles. Whether under any and what circumstances the improvement of manufactures can be promoted, or manufacturing inventions stimulated, by invitations to compete for substantial or honorary rewards?

Neither prize poems, nor prize bulls, nor Derby winners, nor the latest example of prize competitions, the candidates for civil and military service, are within the scope of this paper, which will be strictly confined to considering the influence of competitive prizes on staple articles of trade and manufactures—articles produced in quantity or numbers, to be sold at a profit—articles whose value consists in utility or beauty of design, durability or cheapness, or a combination of some or all these qualities.

It is a question that ought not, and need not, be discussed on theoretical grounds; we have the experience of centuries of trade to refer to, and, within a convenient compass, the records of more than one society, including that under whose auspices this discussion will take place.

The views contained in this paper have not been suddenly adopted. Ten years have elapsed since the attention of the author was first drawn to the prize system as applied to manufactures, and as he has carefully studied its effects ever since, in the course of pursuits which particularly occupy his attention, he hopes to lay his conclusions before you in the spirit of candour and impartiality befitting the character of papers read before this society.

There can be little doubt that if the question were asked of any half-dozen members of the wealthy and educated classes who had not been concerned in competitive exhibitions, the majority would unhesitatingly answer, "Undoubtedly prizes have been of the greatest possible benefit to manufactures."

The prize system is the very salt of our public schools and universities—on a system of prizes, the racing ring, the most universal democratic amusement and business of this country, revolves; almost every landed squire takes part in distributing rewards amongst the breeders and feeders of prize cattle, and, not unfrequently, amongst prize labourers. But if we were to ask any one, not being of the manufacturing class, why he believed that the system which produces great scholars, and wonderful short-horns, and swift racehorses, has produced, and will produce, material improvements in manufactures, he would be surprised to find how few and far between are the facts in support of this pet and attractive theory—mere drops in the ocean of our manufacturing system.

A vague impression no doubt prevails that prizes have produced extraordinary improvement in certain trades; but when we proceed from generalities to particulars, and seek for direct evidence in support of this opinion, either amongst the successful competitors for the prizes distributed amongst manufacturers of all nations, as on the occasion of Great International Exhibitions, like those of London in 1851, and Paris in 1855 and 1856, or at the annual distributions of those British Societies which include prizes amongst other means of encouraging commercial and manufacturing enterprise, we are strangely disappointed. We turn over page after page, year after year, of awards, without finding an instance of remarkable inventions brought to light, or of obscure merit discovered and rewarded.

It will be found on close inquiry that the faith which many intelligent persons have in the advantage of the universal application of the prize system generally rests on what may be called the "Post hoc, propter hoc," or, to paraphrase freely, the "why and because" fallacy.

As thus: Prizes have been awarded in a particular trade—there has been a great improvement in that trade—therefore it is the result of the medals or the ten pound notes offered and distributed by this and that government, society, or commission. In this order of reasoning it is altogether forgotten that in every manufacture for which there is a daily increasing demand there is also daily competition between the manufacturers and vendors, and a prize offered by every one who deals in it, in the shape of profits.

Wherever there has been an improvement there has also been a demand. The improvement is invariably the result of the competition of manufacturers desirous of supplying the demand.

Nay, more, it can be shown that rewards of a very munificent character have failed to develope mechanical inventions which at a later date, when a national demand required them, were made and adopted without the stimulus or honour of medal or prize money.

Let us consider what are the objects for which prizes are supposed to be distributed amongst manufacturers who are invited to compete in public exhibitions and the trials arising out of those exhibitions. The presumed objects of such prizes are either to procure the invention or improvement of something which the ordinary demands of trade are not sufficient to produce, or to assist customers by the intervention of judges more competent than the customers to decide on the comparative merit of rival manufacture.

There is a third object not so generally known or avowed—to amuse and interest an uninstructed public by the excitement incident to the competition of a race. And when the public is really interested a great, although indirect, benefit may be conferred, for often—to paraphrase Goldsmith—

"Those who come to stare remain to buy."

The first object or pretext—"the improvement or invention of something not produced by the ordinary demands of trade"—may be dismissed very summarily. It is something like Charles the Second's question to the Royal Society, "Why two or three small fish added to one of two buckets of water of equal weight have no effect on the balance?" The most important manufactures of this country have been carried to their present perfection by the ordinary demands of trade competition. No prizes or honorary rewards of an official or unofficial character have ever been bestowed on, or offered to, the authors of the steps by which the iron manufacture, or the manifold hardware trades of Birmingham and Sheffield, or the woollen manufacture, including that of alpaca wool, which has created a new material, a new town, and provided for a district—or the cotton manufacture, or the linen manufacture of Ireland and Scotland, have become famous throughout the world. The manufacture of marine steam engines, in which such wonders have been effected during the last ten years—the locomotive engine, in which 300-horse power is packed up with the accuracy of a watch—have both found sufficient stimulus for daily improvement in commercial enterprise and commercial demand. It is true that on the first passenger railway, the Liverpool and Manchester, there was a locomotive race for five hundred guineas, won by George Stephenson's engine, which has been in its most essential principles the type of every engine since made, but the experiment of racing locomotives has never been thought worth repeating.

It is possible that in a country where manufactures were of artificial growth, where success of every kind is expected to be rewarded by the state, where a strictly protective system has accustomed manufacturers to look for official assistance and official reward, a medal or a riband may have a more powerful effect than on our matter-of-fact manufacturers, who concentrate their hopes and exertions in obtaining a reputation and customers. But it is quite certain that in any country where the spirit of commercial enterprise is widely diffused, the profits of useful inventions and successful manufactures far exceed in value any prizes that can be offered by a non-commercial society, or even a government.

Instances of the soundness of this conclusion are easily found. The Royal Agricultural Society, better placed for obtaining competent judges and practical trials than most societies of the kind, has, for twenty-two years, distributed prizes amongst a select band of implement makers. During that period inventions and improvements, of extraordinary value to farmers, have been made under the influence of exhibitions and competition, without reward, while toys and contrivances of a worthless character have been raised by prizes into injurious notoriety. But the society can only lay claim to developing one important invention by a prize—the conversion of a perpendicular into a horizontal drain-tile making machine.

One of the most prominent and energetic members of the Society of Arts often says that the only inventive result of the long list of prizes given by the society during more than 100 years, which he has been able to discover, is "The Shilling Colour Box!"

Centuries of experience prove that mechanical invention of a high order is a vocation not to be raised by a forcing process, like early peas or strawberries. Prizes have never produced a great poem, a great prose essay, a great picture, a great musical composition; but they have stimulated the growth of a mushroom brood of useless novelties, the result of the misdirected efforts of common-place people. Admirably is this prize-giving mistake sketched by Balzac, one of the greatest French novelists, in the first chapter of his painfully exact picture of *Le Cousin Pons*:—"The old musician was one specimen of the many victims of the fatal and degrading system called 'competition' (*concours*), which still reigns in France, after a hundred years barren of results. This hot-bed for breeding genius was invented, in 1746, by the brother of Madame de Pompadour, who was then President of the Academy of Fine Arts. Try to count on your fingers the men of genius—sculptors, painters, musicians—who have been prize-winners during all these years. The artists raised under this hot-house process are forgotten as soon as crowned, and the public of taste turns to the great men who, indifferent to prizes, have arisen and flourished in the free air, under the influence of that invisible sun—vocation!"

But perhaps the advocates for distributing prizes amongst the manufacturers of the staple objects of trade—and these advocates are generally found amongst amateurs with more zeal than exact knowledge—will argue that prizes promote solid improvements, if they fail in producing great inventions. Let us examine this theory, on which the distribution of the Council Medals of the Great Exhibition of 1851 was founded.

The offer of prizes for standard articles of trade, such, for example, as cloth, clocks, musical instruments, steam engines, cutlery, and agricultural machines, assumes:—

1st. That customers are not competent to select what they require.

2nd. That there are tests or trials by which the marketable value of the articles in competition can be ascertained.

3rd. That judges can be found competent to direct and appreciate the comparative tests, and sufficiently free from local or natural prejudices to be impartial.

4th. That there is some security that the articles rewarded are average specimens of the goods the successful manufacturer has sold or intends to sell.

On one or all of these points it will be found, on examining the records of prize-giving exhibitions, that the prize system has invariably broken down.

Who is there who would be willing to leave to a third person, however clever, the choice of his clothes, or his furniture, the house he was to live in, and least of all the implements or machines he was to use in his trade. Under such a dispensation there would be a great many people hobbling about in prize boots and shoes; and dress coats, like Sir Edwin Landseer's, in which a man could not dine, would be a common grievance.

The difficulty of finding competent judges is familiar to every one who has had anything to do with prize-awarding societies. To find one man who combines, with accurate technical knowledge, the industry, the close observation, and the power of reasoning requisite in the judge of closely competing claims, is sufficiently difficult, but then he must also be impartial—he ought to have no leaning toward the person or the locality where he acquired his knowledge—he is not to feel as an Englishman or a Scotchman, as a Suffolk man or as a Kent man—he is simply to be a judge, without any laws, precedents, or customs to guide him; and, having found this phœnix, you have to find a dozen like him. If any one thinks competent judges of manufactures are to be found, even on the greatest occasions, let him turn to the array which decided on the prizes of the International Exhibition of 1851.

The difficulty is increased immeasurably where the judges differ not only in their ideas and standards of perfection, but in their nationality, and have to converse and discuss in a foreign language.

But suppose these rarest of all living animals, competent and impartial judges of manufactures, found, how few are the instances in which it is possible to test, in a satisfactory practical manner, the comparative merits of manufactured articles, even if they appear to be of the same kind, material, and quality. First, a standard of comparison must be established, and then the needful tests must be applied. What standard of comparison, or what tests can be applied to textile goods, cottons, silks, woollens, carpets? Beauty of design is a matter of national taste; the wearing qualities can rarely be ascertained by the touch; whether the price is cheap or dear can only be decided by a knowledge of the quality of the article and the wants of the customer; this man desires a coat to wear for years—that man, something at a low price for a short season, or until he can spare more money: both must be served, and are served by the trade, and only the dealer and the customer can usefully settle such points.

Plated wares, hardware, cutlery, and furniture, present difficulties as great as textiles. Are razors to be tried by a course of shaving? What is to settle the merits of rival broughams and competing armchairs? What trials can be carried out for placing in due order printing presses, pianos, or marine steam engines? The list of difficulties is, at least, as long as the classes of an International Exhibition, and the moment the undertaking is gravely considered it becomes evident that an award of prizes can only be made by hap-hazard, or by a system of compromises, or by following a groove of precedents, and invariably bestowing the first prizes on established trade reputations. The last will be found to be the expedient which resolved the difficulties of jurors, puzzled by competing claims and overwhelmed by work, in London and Paris.

But, supposing the prize-awarding labour ended, another difficulty presents itself, which involves the utility of the whole proceeding. What security is there that the prize-winning article has not been got up, regardless of expense, to win the prize—as an advertisement in fact? The very effect of a prize for a manufactured article is to remove the responsibility of personal reputation from the prize winner and throw it on the judges.

That such is the result is notorious. Machines and goods are prepared, like Peter Pindar razors, expressly to win. We have racing steam engines, which, when successful, are sent home to be reduced to working order before being delivered to a purchasing customer; cases of cutlery, which no shopkeeper could afford to buy if he meant to make a profit by selling them again; and a long list of machines which, for practical purposes, are no better than toys, fitted to work for a few hours under the management of a skilled mechanic. In addition, in every exhibition of machinery there are a number of colourable alterations and improvements, devised to satisfy the passion for "something new," which is the peculiar failing of amateur judges.

Of course it cannot be denied that prizes are very useful advertisements to those who win them, and for this reason that wherever there is any competition which involves expense they fall to wealthy firms. The theory that prizes encourage humble merit is only a theory, for experience shows that in a series of yearly contests wealth wins, as it must when hundreds of pounds must be expended to win ten. The truth is that admirers of the prize system confound the advantage of public exhibitions and the public competition of trade with prize competition. The most complete system of annual competition for prizes in this country is that organised by the Royal Agricultural Society, and there it is sustained by unrestricted sales—in fact, by a great agricultural fair, which commences when the races for implement prizes have concluded. The fair is crowded, the business done is an index of the prosperity of British agriculture, while for years the trials of implements have been, save in such important novelties as steam cultivation, performed in deserted fields, without other than official witnesses.

But before examining the results of the well-meant labours of the judges of the Royal Agricultural Society, it may be as well to take a glance at the prizes of the Exhibition of 1851; a list which exhibits prominent examples of all the illogical incongruities which it has been the object of this paper to make plain. The prizes of 1851 were of two classes—the council medal being intended to designate superior and original excellence. 170 council medals were distributed, but I have only been able to discover two instances in which extraordinary novelty or utility were thus rewarded, that is to say, Sir Joseph Paxton for the design of the building, which certainly required no medal to stamp its fitness for its great purpose, and Mr. M'Cormick for his American reaper, the latter being, in my humble opinion, one of the most useful results of the Exhibition.

After Paxton and M'Cormick, I find a list of names favoured with the council medal whose reputation was not enhanced by the success, or whose success in competition with other names of equal reputation was, in many instances, only due to some fortunate accident in the composition of juries. For instance, it cannot be argued that the public gained any information, or that the firms themselves derived any honour from council medals bestowed on the great Belgian firm of Cockerill, or on Messrs. Penn, of Greenwich, or Messrs. Maudslay and Field, or Messrs. Fairbairn, or Mr. Nasmyth for his steam hammer, or Mr. Joseph Whitworth, and on other names equally distinguished in their respective manufactures. It certainly does not seem worth while to organise an intricate Court of Arts and Science to tell the world that Mr. Whitworth is a clever mechanic, and the steam hammer a capital invention. It is rather puzzling not to find the name of Broadwood placed in the place of high honour in the musical class, and not at all surprising that, in the class for horological instruments, the late Mr. Dent's name occupies a first place. Agriculturists laugh when they see Busby with a council medal, and such firms as Ransome and May, Clayton and Shuttleworth, and Howard on the lower list. In a word, the more closely we examine the awards of council medals the more are we at a loss to discover the principle on which they were awarded, or the public object which was promoted by such prizes being offered. This list of council medals is of itself a complete and conclusive defence for the resolution not to award competitive medals, adopted by the Commissioners of 1862. A judgment should be founded on evidence. There is very rarely available reliable evidence to guide judges in deciding on the relative merits of manufactures and machinery, therefore such trials and such verdicts had better be avoided. They unfairly raise and unfairly depress manufacturers, while they only mystify the public.

But the transactions of the Royal Agricultural Society regularly recorded, and extending over a period of twenty-two years, supply the most complete contradiction of the assumed useful effect of prizes for manufactures—a theory which is much in favour with a large and increasing class in modern society, composed of gentlemen of wealth and position, with a slight knowledge of divers practical pursuits, some enthusiasm, a great love of patronage, and nothing to do.

The Royal Agricultural Society is more competent than most societies or commissions to test the competitive value of the machinery and implements in which its members are interested—for it has a wide choice of judges amongst persons who have, at least, some qualification for the office as agriculturists and mechanics; its operations are conducted in public; its council is composed of men connected more or less directly with agriculture, and sincerely anxious to promote agricultural improvement—yet there are to be found, in the management of its prizes, illustrations of all the errors inherent in a system which proposes to reward the merit of mechanical inventions which cannot be created and which cannot be tested. Thus the Royal Agricultural Society has failed to reward improvements of the highest importance in agriculture. It has bestowed prizes on perfectly useless inventions. It has distributed a prize for each of several implements constructed on different principles, in such a contradictory manner that after ten years of trials it is impossible to learn anything useful from the awards of the judges. It has year after year awarded prizes to some firm or person, or two or three persons in turn, long after the machines or implements rewarded had became standard, universally used, and capable of only colourable improvement.

The sincere desire of the council to be useful has been baffled by the impossibility of testing in experiments, at the wrong season, in a few hours or days, the actual merits of agricultural implements. At least half the trials are in defiance of the vulgar proverb, "Teaching your grandmother," &c.

The society has distributed in twenty-two years £6,000 in money, two gold medals, five council medals (at the time of the Great Exhibition), and 256 silver medals, for every kind of miscellaneous article, from a field-gate to a sausage-machine. Amongst its omissions, for eleven years, no prize was offered for a reaping-machine. Mr. M'Cormick's arrived by accident at the Great Exhibition of 1851, and received a council medal. It was then discovered that the Rev. Mr. Bell had, many years previously, received a gold medal from the Highland Society for a reaping machine, which, not being needed by the public, had been forgotten. Since that date three varieties of reaping machines have been brought into competition. "First (I quote from a letter to the *Mark-lane Express*), those on the 'Hussey' principle, which only cut the corn, and require a man to deliver it in bundles left behind the machine; second, 'M'Cormick's' reapers, which carry a reel or fan to gather the crop, and, since 1854, have had the addition of a self-delivering apparatus to lay the cut corn in swathe; third, 'Bell's' machine, differing from the others in going in front of the horses, and which can therefore enter any part of the standing crop, and is capable of delivering the cut corn in swathe on either side. The awards of the Royal Society have been made to these three classes of machines in the rotation shown by the following table; so impartial has been the division, that the advocates of neither sort can boast of the slightest advantage over the other, and the successive decisions are so uniform that any one knowing nothing of either the machines or crop for the next trial may, with perfect safety, bet two to one against the prize being taken by Bell again, and it is about even betting on the other two, the call being slightly in favour of Hussey, as it was behind M'Cormick in the last rotation.

Year.	Place of trial.	First-prize reaper.
1851	At the Great Exhibition	M'Cormick
1852	At Lewes	Hussey.
1853	At Gloucester and Pusey	Bell.
1854	At Lincoln	Hussey.
1855	At Carlisle and Bristol	M'Cormick.
1856	At Chelmsford and Boxted	Bell.
1857	At Salisbury	M'Cormick.
1860	At Canterbury	Hussey.
1861	At Leeds and Garforth	Bell.

"The result to the agricultural public is that every farmer requiring a machine must form his own opinion as to what reaper is most suitable to his land and crops; it is entirely hopeless for him to expect to derive any reliable assistance from decisions, to obtain which all the care and trouble of our most wealthy and influential agricultural society have been devoted."

Mowing machines, also of American invention, followed corn-cutting machines to this country, and the awards of prizes have been equally contradictory and puzzling. In 1857, at Salisbury, a first prize was given (very properly according to the prize system) to a machine which did its work admirably on about an acre of ground, under the management of a very clever man, and that was all it could do. It has never come into use. It was a toy got up to win a prize and find a purchaser.

Steam cultivation is another of the great facts of the agricultural age, for which prizes have done as little as possible. The Highland

Society offered a prize every year, from 1836 to 1843, for the first successful application of steam power to the cultivation of the soil, without result, but when the time came, and the public wanted steam in the fields, Smith, of Woolston, with his steam cultivator, manufactured by Howard, made the system popular in many counties, without receiving a prize at all, and Fowler had spent £20,000 before the tardily offered prize of the society was awarded to him.

(To be continued.)

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

MR. MALLET'S MONSTER MORTAR.

SIR,—THE ENGINEER has always shown fair play. I trust you will, therefore, permit me thus to set right an error as to fact which occurs in your leader of the 18th inst., and which repeats a similar error, remarked by me in some other past articles on the subject of artillery. You say, "Mr. Mallet's mortar fired a shell of 2,481 lb. weight with 80 lb. of powder, but the strain was too great, and the mortar gave out in almost the same manner as a number of the 110 lb. Armstrongs have done."

The facts as to the weight of shell and charge are correct, the shell having been thrown nearly two miles; but what follows is not so, if it be meant (as I assume it is) by the words "the mortar gave out," that it burst or showed symptoms of bursting. Of the two mortars, that one which alone was fired never showed the slightest indication of weakness as respects bursting, and both chase and chamber are as sound and uninjured as before it was first fired. Upon the last occasion on which practice was carried on from this 36-in. mortar, a longitudinal bolt, one of the six connecting the muzzle-ring and base, which was proved to have been cottered up tighter than any of the others, was broken in two. So fully was the chance of such an accident foreseen by me, that, by the original contract, I had a spare bolt provided, and it now lies beside the mortar.

I requested that this bolt should be put in place of the damaged one, and that the experiment with the mortar should be continued, increasing the charge 10 lb. at a time, until, at length, if possible, the maximum range of the shells should be ascertained, and, finally, the ultimate strength of the mortar itself proved "*a l'outrance.*"

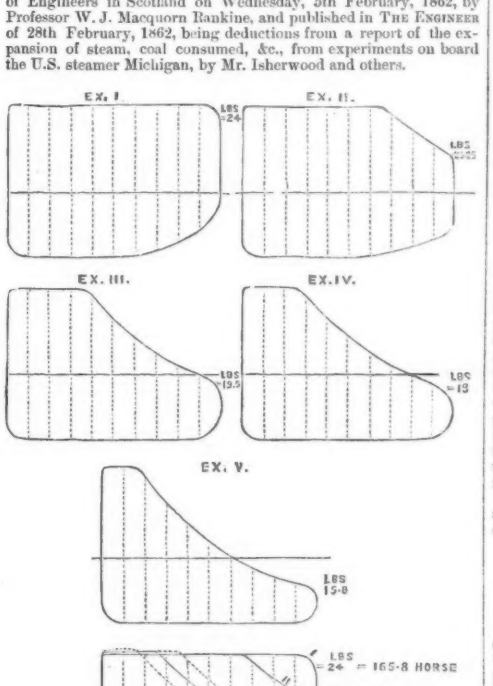
The cost of replacing the broken bolt was, by arsenal estimate, £30! It formed, however, sufficient excuse to shelve the matter, the "Select Committee" reporting, without assigning any reason, that "they did not think it advisable to continue further experiments with Mr. Mallet's mortar," *i.e.*, they *did* think it advisable to have expended £14,000, and, rather than spend £30 more, to halt short of getting almost any important and precise experimental results from the money and labour already gone, and so the matter stands to this moment. I felt I could employ my time better than by entangling myself in red tape in a prolonged attempt to obtain a reversal of wisdom so obvious and infallible as the above. I, however, purpose, for my own reputation's sake, placing all the facts regarding these 36-in. mortars on record by a paper at the Institution of Civil Engineers; and had I (as I hoped) been able to do so this session I should not now have trespassed on your columns.

Save as to this one bolt, the mortar now in the Woolwich Marshes is absolutely uninjured, and is competent to throw a yard shell, of a ton and a quarter weight, and containing 480 lb. of powder, I believe, fully four miles.

ROBERT MALLET.

EXPANSION OF STEAM.

SIR,—I beg to refer to one part of a paper read at the Institution of Engineers in Scotland on Wednesday, 5th February, 1862, by Professor W. J. Macquorn Rankine, and published in THE ENGINEER of 28th February, 1862, being deductions from a report of the expansion of steam, coal consumed, &c., from experiments on board the U.S. steamer Michigan, by Mr. Isherwood and others.



The part of Table I. I consider worthy revisal is that where the average pressure is taken, and consequently the indicated horse power, which, if found wrong, will so far alter the case with the coal consumed per indicated horse power per hour.

Extract from Table I.

Number of Experiments.	1st.	2nd.	3rd.	4th.	5th.
Point of suppression of steam—stroke..	·93	·67	·4	·354	·25
Number of engines worked	One	One	Two	One	Two
lb. pressure in boiler	20	20	20·7	20·7	21
lb. average pressure	30	28·4	20	20·5	15·8
Indicated horse power	207·5	200	379	111	240
lb. coal per I.H.P. per hour	5·666	4·89	5·4	5·855	5·95

In the first experiment, where the steam is cut off at ·93 stroke, my opinion is that an effective pressure of 30 lb. throughout the stroke could not possibly be got with only 20 lb. in the boiler. The effective vacuum would not be more than 11 lb. so to make up the 30 lb. The steam would have been wanted in the cylinder at the same pressure as in the boiler, or even higher. Now the steam would not enter the cylinder, at best, say 4 lb. below the pressure in the boiler.

In the experiment No. 5, where the steam is cut off at ·25 stroke, the average pressure seems something like ordinary marine work, with 21 lb. pressure in the boiler.

The other experiments graduate between the two, namely, 1st and 5th. In going over them as a whole, I, for one, cannot accept them at all for the plain reasons above stated. Far be it from me to suppose that Mr. Isherwood falsified his figures to favour his theory; still, it does seem strange that the apparent fault is favourable to his side of the argument.

The condensation or liquefaction of steam on entering the cylinder proportionate to the reduction of temperature on account of the exhaust cannot be denied; neither do I mean at present to question the deductions of Mr. Rankine as to the extent of that liquefaction; but I cannot understand why he, who is possessed of such attainments and research, should pass over such a glaring part as shown above in the simple effective pressure, before he made his tables; perhaps he is more alive to theory than practice.

I beg to enclose a set of diagrams for these experiments, theoretically constructed, but with due allowances made for clearance of piston, ports, &c., as found in ordinary diagrams of the kind. In these I have taken experiment No. 5 as correct, constructed the others upon it as a basis. I also enclose a combined diagram of the whole, showing, at a glance, the different grades of expansion. Supposing these about correct, the part of Table I., extracted above, would stand thus:—

Number of Experiments.	1st.	2nd.	3rd.	4th.	5th.
Point of suppression of steam—stroke..	·93	·67	·4	·354	·25
Number of engines worked	One	One	Two	One	Two
lbs. pressure in boiler	20	20	20·7	20·7	21
lbs. average pressure	24	23·25	19·5	18	15·8
Indicated horse power	165·8	164·1	353·27	98	241·72
lbs. coal per I.H.P. per hour	7·08	6·03	5·82	6·67	5·95

which considerably influences the amount of coal consumed per indicated horse power per hour. The first experiment does look like consuming 7 lb. or 7½ lb. of coal per horse per hour at least; the fifth like consuming 4¾ lb. or 5 lb.

Had it been possible during these experiments to have regulated the pressure in the boiler so that the engines could have ran at about a uniform speed, driving a steady amount of power, the account, I am convinced, would have been more satisfactory. There is really so little to be made out of 20 lb. pressure in the boiler. Another thing: Supposing the engine to have been working with a good load in experiment No. 1, in the experiment No. 5 it would be like a horse doing a donkey's work.

From every-day experience in indicating ordinary engines, and noting the consumption of fuel, where steady power is used, where a higher pressure of steam is to be attained, and a greater amount of expansion resorted to, we can—making allowances for extra radiation, from the higher pressure in boiler pipes, &c.—confidently depend on the reality being within a few per cents. of the theory.

I beg your kind attention to these, and ask pardon for intruding so far on your time and space.

A. C.

Liverpool, April 24th, 1862.

ROTATORY ENGINES.

SIR,—"LAW" was so kind as to take notice of Andrews' rotatory engine in a former number of THE ENGINEER, and "J. S.," in No. 324, has solicited some practical information respecting rotatory engines.

I beg to state the result of three different trials until we are favoured with "V.P.'s" description.

The first engine was made for a clinker-built yacht, 30ft keel, 5ft. beam, and has run on the Clyde for two seasons. The design of the engine was new, and had defects which have since been improved on. With all its faults it beat any other steam yacht upon the Clyde, and run from Helensburgh Quay to Greenock Quay in 27½ min., a distance of about six miles.

The second engine made was likewise for a yacht, to test a screw placed at the bow to drag the boat, the invention of Mr. Honeyman. The result of the trial did not come up to Mr. Honeyman's anticipations, and both designs being new, it was agreed to test the engine. Mr. Honeyman and other friends brought with them from Glasgow a practical engineer, of long standing, to test the engine with the lever, or dynamometer, to see if it would give out 8-horse power. The cylinder is 9in. diameter; length of stroke, 12in.; pressure of steam upon the boiler, 50lb.; length of the lever from the centre of the shaft, 27in. The engine made 150 revolutions, and suspended a weight of 124 lb. at the end of the lever.

The next trial was to test a propeller something like a paddle-wheel, with feathering floats, but placed horizontal, the invention of Colonel Kyle. There were two engines, and the two cylinders formed one casting, and placed at right angles to each other. The colonel thought they did not give the power wanted, and he got a pair of direct-acting engines put in, made by one of the principal engineering establishments here; stroke of the direct-acting engines, 9in.; cylinders, 7in. diameter; stroke of the rotatory engines, 6in., cylinders, 7½in. diameter. The direct-acting engines are connected to the propeller with a pair of bevel-wheels 3 to 1; the pinion is upon the engine-shafts. The rotatory engine was connected to the propeller with a pair of mitre wheels 18in. diameter. The propeller made twenty-seven revolutions with the direct-acting engines, and twenty-five revolutions with the rotatory engines. The relation of the floats to each other was as 8 is to 6; direct-acting engines 8in., rotatory engines 6in.

With pleasure I submit the above tests for "J. S.'s" inspection; and, judging from the article that appeared in your paper, I have no doubt but he will take an interest in them.

D. A.

Greenock, 26th March, 1862.

THE AUSTRIAN LOCOMOTIVE ENGINE AT THE INTERNATIONAL EXHIBITION.

SIR,—In the last number of THE ENGINEER you conclude a very concise and correct description of Mr. Haswell's locomotive engine with four cylinders with the remark—"The object of all this appears to be to obtain an application of the power at four points in the circle of revolution instead of two."

As this could, perhaps, convey an incorrect notion to some of your readers I beg to offer a few remarks explaining the principle of this peculiar construction.

The two cylinders on each side of the engine having one slide valve only, and their pistons moving in exactly opposite directions, it follows that the four points in the circle of revolution are not equidistant; the two crank pins on one wheel being exactly opposite each other, both cranks would arrive at their dead points at the same instant were it not that the inclination of the cylinders, to some extent, modifies this, and avoids the exact coincidence of two dead points on one side of the engine.

Yet this advantage is only trifling compared with the one principally aimed at in this construction, viz., the greater perfection in balancing the working parts of the engine while in motion. In the locomotive engine, as usually constructed, the whole mass of each piston, piston rod, cross-head, &c., moves forward and backward at a speed of sometimes nearly 1,000ft. per minute through a space of about 2ft. for every stroke, and the unbalanced reaction of this rapid motion causes a succession of jerks, the main cause of all vibration in quick running engines.

Now by using two pistons instead of one, the whole mass in motion is divided into two equal parts moving always in exactly opposite directions, and the position of their common centre of gravity remains always mathematically at the same point. The moving parts being balanced in all their successive positions, all reaction is avoided, and the vibrations at high speeds must be very materially lessened.

Another great advantage is the diminished strain and friction in the driving axles and axleboxes, the strain or pressure caused by one crank being very nearly balanced by an equal and opposite force o the other.

These conclusions are arrived at from theoretical reasons only; but no doubt you will take an early opportunity of making yourself and your readers acquainted with the practical results obtained by the working of this engine.

F. K.

STEAM CULTURE.

SIR,—There can be little doubt that the definition of steam culture, as given by your correspondent Mr. R. Blackburn, has caused a smile on the face of many who are assiduously labouring in its cause. Unfortunately, the definition given is more difficult to explain than the term itself. All practically engaged on the subject could, in a few minutes, unanimously adopt a meaning for the term "steam culture," but it may be doubted whether any amount of discussion, even if aided by the opinions of the most practical and intelligent agriculturists of the day, would enable them to agree on the meaning of a "thorough and honest cultivation in the true sense of the word." Could your correspondent hear a discussion on that sentence by practical farmers who have used or observed the results of using the steam cultivator, as well as the steam plough, prudence would never permit him to re-assert, as the opinion of every agriculturist, that "the plough is a necessity for good farming, without which a good and rich seed bed cannot be produced," at least, one is led to believe such would be the case from the general tone of the discussions on steam culture during the last eighteen months. I do not venture an opinion on the subject, but merely point out that the value of the use of the "plough," in contradistinction to that of the "cultivator," is at present a moot point among our first-class agriculturists.

He must be a bold man indeed who will venture a positive assertion as to another's reasons for pursuing a certain course in business. Having devoted considerable attention to the subject generally of steam culture, and the rope traction system in particular, and being personally unacquainted with any member of the firm of Messrs. Howard, I may perhaps be excused for expressing an opinion that the reason assigned by your correspondent, for Messrs. Howard's turning out more implements for "cultivating" than "ploughing" by steam, is not the correct one. Can Mr. R. B. be aware that Messrs. Howard make and supply both? I have not yet found any inherent defects in the rope traction system, though it must be owned that in scheming a set of tackle on that principle every detail requires to be most attentively considered. It may fairly be anticipated that the experience, which is being gained by carefully studying the working of the numerous sets of tackle by various patentees and different makers now in use, will soon cause the few little practical difficulties that still present themselves to be surmounted. As it is, if your correspondent will provide a six furrow plough free from any radical defect (there is the difficulty) I will undertake, with tackle that has been made some time, to "plough" a 20-acre field at the rate of upwards of 12 acres per diem, and that, too, at a depth requiring four horses in the ordinary plough, and with a consumption of less than a fifth of the whole power in overcoming the friction of rope and other presumed disadvantages of the system. You will not object to be reminded that in my letter the cultivator was the implement referred to and not the plough. The remarks contained therein would not apply with so much force to the one as the other; indeed, the last sentence would not be in accordance with my opinions on "ploughing" by steam.

It is disheartening to be so bluntly told that "the rope traction system is useless except as a secondary agent;" but, fortunately, that statement is at the latter part of the letter, and one feels relieved immediately on reading the last paragraph by the conviction that the writer cannot have studied the history or details of either steam cultivation or the motive powers used on railways.

Were he but moderately upon the subject of his letter it would not be necessary to inform him that all he promises his "snorting horse" shall do "at some not distant day" (a rather vague expression) has already been accomplished, and is being daily turned out by several sets of tackle on the rope traction system. It is not for me to explain the reason rope traction was adopted on the Blackwall line in the first instance, but a perusal of the original Act of Parliament will enlighten your correspondent on that subject, and perhaps cause him to regret having used the expression "engineering imbecility" in reference to one of the works of deceased engineers (father and son) who have so greatly benefited the world by the exercise of their brilliant talents, mechanical ingenuity, and untiring energy. Whatever may now be thought of the atmospheric tube, in connection with propulsion on railways, I have no fear of contradiction when I state it was the offspring of another deceased engineer, who was anything but an engineering imbecile.

1A, Adelphi-terrace, London, 28th April, 1862.

WM. COLLETT HOMERSHAM.

DURABILITY OF IRON BRIDGES.—Mr. Fairbairn applied a load of one-fourth of the calculated breaking weight to a model wrought iron girder, and removed the same, and continued to apply and remove it for one million times, and the beam was apparently uninjured. Loaded and relieved alternately with one-half the calculated breaking weight, 5,175 times the beam broke down. Repaired and tested with 25,900 applications of two-fifths the breaking load, it broke again. Again repaired and tested with three million changes by one-third of the breaking weight, it was not broken. Now it is rather an important and interesting question to have settled, whether there is any number of applications of one-fourth or fifth or sixth of the breaking weight, which will eventually destroy a bridge made of wrought iron: for if there is, it behooves our railway companies to calculate carefully the precise time when the failure of each bridge may be expected, so that the structure may be replaced the day before the failure. According to Mr. Fink's experiments upon the wrought iron rods, taken after about eight years' active service from some of the Baltimore and Ohio railway truss bridges, the iron was not injured. If a bridge passes twenty trains per day, of ten eight-wheeled cars each, supposing each truck to cause a strain upon the several parts, we shall have, say, 20 trains by 24 trucks (calling the engine and tender as equivalent to four trucks), or 480 shocks per day, or about 150,000 shocks per annum: so that we might have the following:—A bridge proportioned so as to be strained to two-fifths of the breaking weight, will break down in 150,000 divided by 25,000, or about two months, at twenty trains per day. If 5,000,000 shocks will break a bridge down, of which the iron is strained to one-third or one-fourth of the breaking weight each time a load is applied, the life of the bridge would be about 33 years, at 20 trains, as above assumed, per day. But we have another thing to consider. The often quoted anchor which had laid for nearly a hundred years in the Woolwich dockyard, England, broke short off when moved. Railway bridges remain in one magnetic position always (so long as they stand): may they not tumble down without being strained at all some fine day: who shall say? Possibly every time the sun rises on one side of the Britannia Bridge, the molecules of iron turn like the sun flower to meet "The rising orb," and turning thus about from day to day, at last arrange themselves in those so called "crystals," often seen when what was once good fibrous iron breaks short off without warning, and shows us a material quite different from that of which the bridge was built. Dr. Joule has given us the mechanical equivalent of heat: heat and work are transferable; work will change the nature and destroy the fibre of the best iron: heat will restore the fibre by annealing. The atoms of iron have magnetic poles; magnetism is around loose in the world, and has free access to our bridges. So, then, finally—here we are. Our iron bridges are stationary, and are submitted to heat, magnetism, and mechanical action, or force: all of these physical elements are transferable: some of them tend to dissolve our bridges, some when properly applied restore the lost strength: possibly the very force exerted by the passing locomotive would, if converted into heat, repairs the damage caused by its passage.—*American Railway Times.*

THE PRIESTFIELD BOILER EXPLOSION.

Mr. Wright, the engineer appointed to examine the boiler which lately exploded near Bilston, has made the following report:—

In conformity with instructions received from the coroner I have carefully examined the wreck and the site of the steam boiler blown up at the Millfields Ironworks on the 15th inst., and have also made diligent inquiry into the circumstances connected with the explosion in order, if possible, to ascertain its cause. The result of my labours I now report. The boiler was one known to those persons familiar with ironworks by the name of an "upright furnace boiler." It was of cylindrical form, with hemispherical ends; its length about 27ft., and its diameter 10ft., and it stood end upwards. Nearly half way up its sides were pierced by four short horizontal flues, each about 2½ft. diameter, converging in a central descending flue of about 4½ft. diameter. The flame and heated products of the puddling furnaces would ascend the outside of the boiler, enter the short horizontal flues, descend through the central flue into a culvert under the mill floor, and thence pass away to the chimney stack. It was seated on a cast iron ring, and surrounded to the height of about 14ft. by a brick wall, in which was formed the outside flues, and which was strongly bolted with wrought iron. Around the boiler stood the four puddling furnaces which were connected with it. The proper water level, owing to the unusual height of the boiler, was from 6ft. to 7ft. above the crown of the central flue—a depth of water considerably more than is customary in such boilers. The plates were generally from three-eighths to seven-sixteenths thick, but in some places no more than five-sixteenths, whilst in places where the plates have suffered much from oxidation the thickness does not exceed a quarter of an inch. The general quality of the plates is fair, but in some places very inferior. The boiler was not in a good state of repair, for although it may not have leaked much at the time it had suffered much from old leakages and old strains, and was much weakened at the rivetted joints in its lower part. That portion of the boiler bottom which rested on the cast-iron ring had suffered more than any other from oxidation. Many of the rivets were nearly cankered away, and the plates greatly reduced in thickness; nor could this be detected by any ordinary inspection so long as the boiler remained seated on the cast-iron ring. I would advise that these rings of iron be never used in these cases. It is better to let the boiler rest on fire-bricks, which can be easily removed for the purpose of inspection or repair. But the boiler did not first give way in this particular place, because the strain would not be so great upon this part as upon that a little higher up the side, and it should be known that the difference in strength arising from position is very great. It is a very common but serious mistake to suppose that the strain is equal upon all parts of a boiler. There appears to have been no lack of appliances for showing the level of the water. There was a self-acting steam whistle, a common water buoy, and a gauge cock. The supply of water was regulated by a feed valve adjusted by handle and screw. A 7in. pump attached to the engine supplied this and other three boilers in connection with it. There was a steam clack or safety valve, 5½in chain on the boiler, also a steam box on the top containing a 9in. valve, with plain stalk and bow handle, through which the steam passed to the engine. This valve could not prevent the steam escaping from the boiler, even if it had been shut down. It is only designed to prevent the steam from entering the boiler while undergoing repairs or cleaning. All the fittings are so much damaged that it is impossible to determine, by an inspection of such parts of them as can be found, whether they were in good working order or not. I find nothing to show that they were out of order, nor do I find any reliable evidence of deficiency of water. On the contrary, I am led to conclude that the boiler was well filled at the time of the explosion. As regards the pressure under which the boiler was working, no evidence is to be obtained from its own safety valve, inasmuch as the weight is missing; but as three other boilers worked into the same range of steam pipes to supply one engine, with free passage to each, they must all have worked under the same pressure; and the weight carried by the remaining safety valves will be fair evidence of the pressure under which the exploded boiler worked. It is stated by the engineers and others, that the engine usually worked at 35 lb. pressure of steam, as shown by Smith's patent gauge in the engine house, and that this pressure was never materially increased. This gauge is fixed upon the steam pipes in the engine house, and now that the engine is not at work reveals nothing. The engine is of the non-condensing or high-pressure kind, and its cylinder is 32in. diameter. It is supplied with steam by two common firing boilers, and two "upright furnace boilers," one of the latter being 9ft. diameter and 22ft long, with three puddling furnaces attached, and the other, the exploded boiler, 10ft. diameter and 27ft. long, with four puddling furnaces. On the first firing boiler is one safety valve 4in. diameter, loaded to 50 lb. per square inch. On the second firing boiler are two 4in. safety valves. One of them has a Salter's spring balance attached, which, being now broken, it is impossible to ascertain the weight that was upon it. The other valve is loaded to upwards of 60 lb. per square inch. On the remaining and smaller furnace boiler, thrown down by the explosion, is a 4in. safety valve, and this appears to have been loaded to 50 lb. per square inch. There is also a 4in. safety valve on the steam pipe, and that is loaded to 45 lb. per square inch, and I believe its load is a little increased when the engine is at work. It is true that these valves might begin to blow at a little under the load stated, but I have no hesitation in saying that, with safety valves loaded as these, the pressure would be liable to get up to 45 lb. or 50 lb. per square inch. It was difficult to reconcile the statement of the engineers that the steam was never above 35 lb. per square inch with the actual state of the safety valves. I was, therefore, led to suspect that the steam gauge in the engine house did not give the true pressure, and, in consequence, had it removed and tested by comparison with a new gauge, upon which I could rely, when it was at once shown to be seriously out of repair, the new and reliable gauge registering 37 lb., when the Millfields gauge registered only 30 lb. I had not the means at hand of testing it at a higher pressure, but think it probable that it would be 8 lb. or 10 lb. in error when showing 35 lb. This steam gauge is stated to have been at work several years, and to have been repaired several times. At present it is quite unfit for use, and appears to have led the engineers astray with respect to the real pressure upon the boilers. This shows the importance of not trusting too implicitly to these gauges. They should be tested from time to time by comparison with the actual load on the safety-valves, or with a new and reliable gauge, or both. The explosion was very violent in its character and destructive in its effects, scattering ruin and death all around. The boiler itself was torn into several pieces, one of which—a single plate—has not yet been found. The largest portion, consisting of the upper half of the shell and all the flues, weighing about six tons, was blown up to a height of 100 yards or more, as I am informed by credible witnesses who saw it from more than a mile distant, and describe it as like a balloon in the air, far above the top of the lofty chimney stack; and it fell at a distance of about 200 yards from its seat, crushing the flues and imbedding itself in the earth. The lower portion of the shell was rent into six pieces, which, with the exception of the missing piece, fell within 20 yards of its seat. These lower portions appear to have been projected horizontally, and intercepted by the surrounding objects. The brick walls which enclosed the boiler and contained its external flues was entirely swept away, together with portions of the adjoining puddling furnaces, and nearly the whole of the enclosing brickwork of the smaller furnace boiler. This smaller boiler was knocked down, the roofing over the puddling furnaces was swept away, the principal portion of the large roof over the forge machinery was demolished, and everything around shared the destructive effects of the explosion. No fewer than 20,000 bricks—some of them red-hot—and large quantities of ironwork were hurled around with terrific force and frightful results. A minute examination of the parts of the boiler convinces me that it gave way first in the lower portion of its shell—not at the bottom, where it was most cankered, but a little higher up, where a longitudinal rivetted seam was much weakened by the joint effects of oxidation and old cracks running from one rivet pole to another. I have prepared a model of the boiler, and have marked upon it all the rents occasioned by the explosion. A glance at this will, I think, confirm my views respecting the place which first gave way. Such a boiler, well made, and in perfect repair, with good plates seven-sixteenths thick would not give way under a pressure of 180 lb. to 200 lb. per square inch; but would not be safe to work at 45 lb. The ultimate strength of a safe steam boiler should not be less than six times its working pressure; but, in my opinion, boilers of this class are quite unsuitable for working non-condensing engines. An attentive consideration of the circumstances of the case, so far as I have been able to make them out, convinces me that the pressure in the boiler, at the time of the explosion, was about 50 lb. per square inch, and that the boiler was not in a condition to sustain such a pressure.

E. T. Wright.

Wolverhamton, April 24th, 1862.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

107. Samuel Wilmer Marsh, Washington, Columbia, U.S., "Improvements in breech-loading fire-arms."—*Petition recorded 14th January*, 1862.

782. Daniel Edwards Sikes, Mason-street, Lambeth, Surrey, "Improvements in machinery or apparatus for refrigerating or producing cold, part of which improvements are applicable also to other purposes."

784. William Joseph Curtis, Tufnell Park-road, Holloway, London, "An apparatus to ascertain and point out the fares and earnings or receipts of public vehicles and their conductors."—*Petitions recorded 21st March*, 1862.

899. Leonce Bernard Schmolle, Upper John-street, Golden-square, London, "Improvements in the construction of crinolines or steel skirts."—*Petition recorded 31st March*, 1862.

923. George Holcroft, Manchester, "Improvements in the construction of blast furnaces."

935. William Leopard, Hurstpierpoint, Sussex, "Improvements in railway brake apparatus."—*Petitions recorded 2nd April*, 1862.

937. Gustave Rebour, Passage des Petites Ecuries, Paris, "A permanent autographic log serving to measure, and if needed to retrace graphically the swiftness and sailing of a ship, the rapidity of streams, and the propelling of rising and ebbing tides."

941. John Newton, Montpellier-road, Rye-lane, Peckham, Surrey, "Improvements in the construction of breakwaters, piers, and sea walls."

943. Robert Moore Toogood and John Laybourne, Newport, Monmouthshire, "An improvement in railway crossings."

945. Mark Amos, Westbury-on-Trym, Gloucestershire, "Improvements in harrows."

949. William Antil Richards, Chester-cottage, Cornwall-place, Holloway, London, "Improvements in the manufacture of bags, and in fastenings and locks for bags, parts of the invention being also applicable to purses, cigar-cases, reticules, and other similar articles."—*Petitions recorded 3rd April*, 1862.

951. John Francis Woodall, Orchard-street, Portman-square, London, "Improvements in ventilating carriages for common roads."

953. Francis Spencer, Pendleton, Lancashire, "Certain improvements in looms for weaving."

954. William Ryder, Bolton-le-Moors, Lancashire, "Improvements in the construction of machines for forging metals."

955. Frederick Collier Bakewell, Haverstock-terrace, Hampstead, Middlesex, "Improvements in letter printing machines."—A communication from William Bullock, Pittsburg, Pennsylvania, U.S.

957. Leonard Lindley and Frederick Taylor, Melbourne-street, Mansfield-road, Nottingham, "Improvements in sewing and embroidering machines."

959. George Moulton, Manchester, "Improvements in pentagraph machines used for tracing or engraving rollers or cylinders employed in printing calicoes and other surfaces."

961. Alfred Joseph Hale, William-street, Margaret-street, Clerkenwell, London, "Improvements in instruments for drawing ovals."

963. Samuel Fielding, Samuel Fielding, jun., Robert Fielding, and Thomas Fielding, Smallbridge, near Rochdale, Lancashire, "Improvements in valves, and in apparatus for lubricating the same and other parts of steam engines."

965. Jaffray Sceales, Lloyd's, London, "Improvements in steering ships."

966. William Edward Newton, Chancery-lane, London, "Improvements in the manufacture of iron and steel."—A communication from Aristide Balthazar Berard, Rue St. Sébastien, Paris.

967. William Edward Newton, Chancery-lane, London, "Improvements in pumps for ships' use and other purposes."—A communication from Thomas Hansbrow, Sacramento, California, U.S.

969. John Nock and William Kirby Price, Birmingham, "An improvement or improvements in gas cooking ranges."—*Petitions recorded 4th April*, 1862.

973. Henry Joseph Simlick, Baker's Arms-gardens, Wellington-row, Bethnal-green, London, "Improvements in the manufacture of vesuvians or cigar lights."

975. Alexander Clark, Gate-street, Lincoln's-inn-fields, London, "Improvements in the manufacture of revolving window shutters and blinds, in window sash bars and plates, also in apparatus used in such manufactures."

976. Leopold Faconnet, Rue du Transit Vaugirard, Paris, "A new kind of tiles."

977. Richard Alexander Kobitzsch, Bucharest, Wallachia, "Improvements in diving apparatus, and apparatus to be used for working in deep water."—*Petitions recorded 5th April*, 1862.

981. Titus Smith, Salford, Lancashire, "Improvements in machinery for cutting and shaping screw bolts and other articles."

983. Alfred Harris, Birmingham, "An improvement or improvements in the manufacture of gun barrels."

986. William Newzam Nicholson, Newark, Nottingham, "Improvements in ranges and stoves."

987. Thomas Jackson, Orchard-street, Portman-square, London, "Improvements in pianofortes."—*Petitions recorded 7th April*, 1862.

991 James Brown, Aldgate, London, "Improvements in protecting the bottoms and sides of ships and other entirely or partially submerged surfaces."

995. Hon. William Edward Fitz Maurice, Hyde Park-gate, London, "An improved construction of plating for ships, batteries, and other structures used for war or other purposes."

997. Frederick William Brearey, Cornhill, London, "Improvements in medicated cups or vessels for drinking purposes."

1003. John Lawson, Hope Foundry, Leeds, Yorkshire, "Improvements in balling cotton and thread."—A communication from Adolphe Alphonse Poullier, Lille, France.

1005. Thomas Corley and James Wright, Bridge-street, Blackfriars, London, "Improvements in the method of, and the apparatus for, treating auriferous and argentiferous minerals and ores for the purpose of extracting and separating the gold and silver from the other metals, minerals, and substances combined therewith, also in the method of treating the various residues resulting therefrom, and in the utilisation, application, and use of the said residues when so treated."—*Petitions recorded 8th April*, 1862.

1007. James Edward Hyde Andrew, Audenshaw, Lancashire, "Improvements in looms for weaving."

1009 George Hollinshed, Salford, Lancashire, "Improvements in sandwich cases and similar articles."

1011. William Taylor, Oldham, Lancashire, "Certain improvements in machinery or apparatus for preparing and spinning cotton or other fibrous materials."

1015. Colin Mather, Willow Bank, Brompton, near Manchester, "Improvements in spittoons."

1017. William Edward Newton, Chancery-lane, London, "An improved apparatus for raising and forcing water and other liquids."—A communication from Abel Brear, Sangatuck, Fairfield, Connecticut, U.S.

1019. Robert Thetson, Hanover, "Improvements in cork-cutting machinery."—*Petitions recorded 9th April*, 1862.

1020. Edward Funnell, East-street, Brighton, Sussex, "An improved self-acting indicator signal for railways."

1025. Alexander Black, Banbridge, County Down, Ireland, "Improvements in swing bridges adapted for crossing lines of railways and other ways."

1027. Cowper Phipps Coles, Southsea, Hampshire, "Improvements in masts for ships."

1029. Louis Christoph and Gustavus Palmer Harding, Paris, and William Hawksworth, Linlithgow, N.B., "Improvements in drawing metals, and in the machinery or apparatus employed therein."

1031. John Platt and William Richardson, Oldham, and William Holland, Salford, Lancashire, "Improvements in carding engines."

1033. George Burge, Albert-road, Regent's Park, London, "An improved means of protecting forts, ships, and other structures and places against projectiles and other striking bodies."

1035. Osborne Reynolds, Debach, near Woodbridge, Suffolk, "Improvements in building ships and other vessels."

1037. William Fox, Amiens, France, "Improvements in the manufacture of brooms and brushes."—*Petitions recorded 10th April*, 1862.

1039. Henry Holland, Birmingham, "Improvements in manufacturin the stretcher joints of umbrellas and parasols."

1040. James Thomas Price, Birmingham, "Improvements in the manufacture of twisted metallic tubes."

1042. John Garnett, Windermere, Westmoreland, "Improvements in apparatus for washing photographic pictures."

1044. Jules Francois Mathias, Rue de Chalons, Paris, "An apparatus for pressing and ironing straw hats of any shape or form."

1045. Francois Rigollot, Passage des Petites Ecuries, Paris, "Improvements in machinery or apparatus for manufacturing rivetting pegs for boots and shoes and other pins or pegs."

1046. Jean Marie Landmann, St. Croix, Algiers, "Improvements hydraulic engines."

1047. Thomas Knowles, James Houghton, William Knowles, and William Houghton, Gomersal, Yorkshire, "Improvements in looms for weaving."

1048. Ellis Butterworth, Calder-cottage, near Rochdale, Lancashire, "Improvements in machinery for applying adhesive substances to preserve the form of cops of yarn."

1049. William Clark, Chancery-lane, London, "Improvements in the manufacture of leathern accoutrements."—A communication from Messrs. Adolphe Blanc and Jean Frédéric Auguste Marty, Boulevart St. Martin, Paris."

1050. William Bush, Tower-hill, London, "Improvements in the construction of ships and shields."

1053. Isaac Whitesmith, Glasgow, Lanarkshire, N.B., "Improvements in power looms and in pirn winding apparatus."—*Petitions recorded 11th April*, 1862.

1055. Nicholas Nussey, Holbeck, near Leeds, Yorkshire, "Improvements in machinery or apparatus for preparing and combing wool, flax, hair, cotton, silk, and other fibrous materials."

1056. Ernest Bollee, Le Mans, La Sarthe, France, "A new hydraulic ram."

1057. Andrew Sweet, Hampstead-road, Middlesex, "Certain improvements in locks and latches."

1058. Edgar Drewett, Blackheath, Kent, "Improvements in bottles and other vessels whereby to separate and retain sediment from their contents."

1059. Archibald Samuels Campbell, Hampstead, Middlesex, "Improvements in surface condensers."

1060. Archibald Samuels Campbell, Hampstead, Middlesex, "Improvements in the refrigeration of liquids."—*Petitions recorded 12th April*, 1862.

1061. James Park, Bury, Lancashire, "Certain improvements in or applicable to steam engines."

1062. Edward Peyton and William Fothergill Baths, Birmingham, "Improvements in angle iron applicable to metallic bedsteads, roofs, bridges, and other similar purposes."

1063. John Frederick Spencer, Newcastle-on-Tyne, "Improvements in steam engines."

1064. Henry Clay Lee, Lawrence Pountney-lane, London, "Improvements in knitting machines."

1066. John Beard, Leonard Stanley, Gloucestershire, "An improvement or improvements in sofa beds or sofa bedsteads."

1067. James Martin French, Birmingham, "Improvements in upright pianofortes."

1068. John Darlington, Gresham-street, London, "Improvements in the arrangement of marine telegraph wires and cables."

1069. Joseph Kaye Hampshire, Whittington, Derbyshire, "A safety-cage with disconnecting catch to prevent accidents in the working of coal or other mines arising from the over winding or breaking of the ropes or other parts used for hoisting purposes."

1071. Charles Harratt, Hornsey-lane, Highgate, Middlesex, "Improvements in the manufacture of masts, yards, and booms."

1073. Richard Archibald Brooman, Fleet-street, London, "Improvements in reaping and mowing machines."—A communication from Ernest Clement, Boulevart de Strasbourg, Paris.

1075. Richard Archibald Brooman, Fleet-street, London, "Improvements in pumps."—A communication from Jean Marie Henri Paul Metivier, Rue Keller, Paris.

1076. Richard Archibald Brooman, Fleet-street, London, "An improved hobby horse."—A communication from Amedée Constant Pouceau, Rue des Vieux Augustins, Paris.—*Petitions recorded 14th April*, 1862.

Invention Protected for Six Months by the Deposit of a Complete Specification.

1124. George Tomlinson Bousfield, Loughborough Park, Brixton, Surrey, "Improvements in sewing machines."—A communication.—*Deposited and recorded 17th April*, 1862.

Erratum.

17. For "John Jacob, of Gutknecht," read "John Jacob Gutknecht."

Notices to Proceed.

3163. John Dale, Manchester, "Improvements in the manufacture of glue or size."

3165. John Platt and William Richardson, Oldham, Lancashire, "Improvements in machinery or apparatus commonly called 'gins,' for cleaning cotton from seeds."—*Petitions recorded 17th December*, 1861.

3166. Robert Scott, Great Portland-street, London, "An improved method of rifling or grooving the barrels of fire-arms and ordnance."

3173. John Piddington, Gracechurch-street, London, "Improved condensing apparatus for steam engines."—A communication from Wilhelm Winter, Charlottenburg, near Berlin.

3175. Charles Edward Symonds, Stone's End, Southwark, Surrey, "Improvements in the treatment and application to various useful purposes of light spirituous liquids."

3179. Charles Pontifex, St. Paul's-road, Islington, London, "Improvements in refrigerators for cooling worts or other liquors."—*Petitions recorded 18th December*, 1861.

3183. Eli Scott, Ashton-under-Lyne, Lancashire, "Improvements in apparatus used for collecting and removing of waste and dirt which occurs in the process of spinning cotton and other fibfous materials."—*Petition recorded 19th December*, 1861.

3187. James Standfield, Aylsford, Kent, and John Standfield, Stratford, Essex, "Improvements in machinery or apparatus for giving motion to ships and machinery, and for raising water."

3193. George Walkland, St. Pierre-les-Calais, France, "An improved machine for winding lace or other similar fabrics or tissues on cards or other materials."

3194. William Tipple, Clarence-place, Gravesend, Kent, "Improvements in paddle-wheels for the propulsion of ships and other navigable vessels."

3195. Vasco D'Almeida, Nottingham-street, Marylebone, London, "An improved mode of obtaining colouring matter applicable for dyeing skins, silk, wool, and other fibrous materials."—A communication from Edward Smith, Place Cruzquebrada, Lisbon.

3202. Robert Wailes, Brighton, Sussex, "An improved tool or apparatus for cleaning windows and glasses."—*Petitions recorded 20th December*, 1861.

3207. Filippo Grimaldi, Manchester-buildings, Parliament-street, Westminster, "Improvements in rotatory steam boilers."

3211. Fraser Selby, Surbiton, Surrey, "Improvements in boilers for the generation of steam in engines, for applying steam for motive power purposes, and in wheels and ways for steam carriages to run on."—*Petitions recorded 21st December*, 1861.

3216. Charlotte Smith, Bedford, "Improvements in stays."

3218. Charlotte Smith, Bedford, "Improvements in stays."

3223. Edward Barnard Sampson, Ham Mills, Stroud, Gloucestershire, "Improvements in apparatus for drying wool and other fibres and substances."

3226. John Cochrane, Woodside Ironworks, Dudley, "Improvements in apparatus employed in sinking cylinders and open coffers for forming foundations under water."—*Petitions recorded 24th December*, 1861.

3230. Thomas Standing, Preston, Lancashire, "Improvements in cinder-sifters and ash receptacles applicable to domestic fire-grates."

3234. James Shepherd, Manchester, "Improvements in apparatus for for cleansing steam boilers."—*Petitions recorded 26th December*, 1861.

3240. William Turner and John William Gibson, Hammersmith, County Dublin, "Improvements in rolling bridges."

3242. Thomas Bright, Old Foundry, Carmarthen, "Improvements in machinery for cutting hay, straw, and other vegetable substances."

3245. James McIntyre, New York, U.S., "Improvements in bomb-shells and similar projectiles."—*Petitions recorded 27th December*, 1861.

3255. James Gordon, Park House, and Bartholomew Henderson, South Shore, Gateshead, Durham, "Improvements in the manufacture of ropes."—*Petition recorded 30th December*, 1861.

13. William Barker Patrick, Highgate, Middlesex, "Improvements in the manufacture of sugar, and in the apparatus employed therein."—*Petition recorded 1st January*, 1862.

18. William Edward Gedge, Wellington-street, Strand, London, "Improved apparatus for roasting coffee."—A communication from Jean Louis Rivret-Justin, Passage des Petites Ecuries, Paris.

20. William Atkinson Fell, Troutbeck Bridge, Windermere, Westmoreland, "Improvements in the manufacture of bobbins, and in the means or apparatus employed therein."—*Petitions recorded 2nd January*, 1862.

53. Charles Pilkington and Thomas Pilkington, Sheffield, Yorkshire, "Improvements in skates."—*Petition recorded 8th January*, 1862.

71. John Carter, Tipton, Staffordshire, "A new or improved draining plough."

77. Montague Wigzell, Strand, Topsham, Devonshire, "An improved double-acting ventilator for railway carriages and other carriages and compartments."—*Petitions recorded 10th January*, 1862.

90. FERDINAND CHARLES WARLICH, Alma-terrace, New-cross, Kent, "Improvements in the manufacture of artificial fuel."—*Petition recorded 13th January*, 1862.
106. WILLIAM GORSE, Minworth, Warwickshire, "An improvement or improvements in machinery for manufacturing the cut nails called brads."
107. SAMUEL WILMER MARSH, Washington, Columbia, U.S., "Improvements in breech-loading fire-arms."—*Petitions recorded 14th January*, 1862.
174. WILLIAM HOOPER ROPER, Crown-court, Old Broad-street, London, "Improvements in machinery or apparatus for cleaning coffee, rice, or any seed or grain having outer hull and inner pellicle."—A communication from William Maxwell Greene, Tongoi, Chili, South America.—*Petition recorded 23rd April*, 1862.
188. TIMOTHY MORRIS and ROBERT WEARE, Birmingham, and EDWARD HENRY CRADOCK MONCKTON, Fineshade, Northamptonshire, "Improvements in submarine and other telegraphic communication, and in apparatus connected therewith."—*Petition recorded 24th January*, 1862.
293. JAMES LEE NORTON, Belle Sauvage-yard, Ludgate-hill, London, "Improvements in beating, stretching, and drying fabrics, and in the apparatus employed therein, part of which apparatus is also applicable for thrashing linseed." — Partly a communication from William Aldon, Boulevart Bonne Nouvelle, Paris.—*Petition recorded 4th February*, 1862.
309. ALFRED VINCENT NEWTON, Chancery-lane, London, "An improvement in fire-arms."—A communication from Caleb Hannum Bradley and Gideon Miles, West Chester, Pennsylvania, U.S.—*Petition recorded 5th February*, 1862.
368. THOMAS COLTMAN, Leicester, "Improvements in sewing machines."—*Petition recorded 12th February*, 1862.
388. WILLIAM DANIEL ALLEN, Laithfield House, Norfolk-road, Sheffield, Yorkshire, "Improvements in the manufacture of stamp heads and beds employed in crushing ores and other mineral substances."
389. GEORGE CRISP BURROWS, Stoke Holy-cross, Norfolk, "Improvements in lounges, seats, or other apparatus for sitting or reclining on, which improvements are also applicable to rocking horses."—*Petitions recorded 13th February*, 1862.
468. SPENCER SMITH, High Holborn, London, "Improvements in electro-magnetic engines for obtaining and applying motive power."—*Petition recorded 21st February*, 1862.
494. THOMAS PARTRIDGE, sen., Tenby-street, Birmingham, "Improvements in apparatus for printing railway and other tickets or cards."—*Petition recorded 24th February*, 1862.
503. JOHN PIDDINGTON, Gracechurch-street, London, "Improved condensing apparatus adapted for high pressure steam engines, especially locomotive engines."—A communication from William Winter, Charlottenburg, near Berlin.—*Petition recorded 25th February*, 1862.
635. FRANCIS ROBERT NEWTON and HIRAM CODD, Esher-street, Westminster, Middlesex, "An appararus for indicating and measuring the flow of liquids."—*Petition recorded 8th March*, 1862.
647. JEAN BAPTISTE GABRIEL MARIE FREDERIC PIRET, Boulevart St. Martin, Paris, "Improvements in lubricating apparatus."—*Petition recorded 10th March*, 1862.
841. WILLIAM LOUIS WINANS, Brighton, Sussex, "A new or improved mode of mounting, and apparatus for manœuvring, ordnance in land fortifications."—*Petition recorded 27th March*, 1862.
929. GEORGE COLLIER and JOHN COLLIER, Halifax, Yorkshire, "Improvements in looms for weaving carpets and other pile fabrics."—*Petition recorded 2nd April*, 1862.
994. JOHN WHITEHOUSE, Birmingham, "Improvements in the manufacture of metallic door and other knobs, and the ornaments of the pillars of metallic bedsteads and other articles of like manufacture, and in attaching metallic mounts to china or earthenware knobs and ornaments, and roses for knobs."—*Petition recorded 8th April*, 1862.
1124. GEORGE TOMLINSON BOUSFIELD, Loughborough Park, Brixton, Surrey, "Improvements in sewing machines."—A communication from William Grover, Boston, Massachusetts, U.S.—*Petition recorded 17th April*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

1025. JOHN MARSHALL, jun., Selby, Yorkshire.—Dated 23rd April, 1859.
1040. WILLIAM WARNE, JOHN AMERICUS FANSHAWE, JAMES ARCHIBALD JAQUES, and THOMAS GALPIN, Tottenham, Middlesex.—Dated 25th April, 1859.
1091. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London.—A communication.—Dated 26th April, 1859.
1065. CHARLES RANDOLPH and JOHN ELDER, Glasgow, Lanarkshire, N.B.—Dated 28th April, 1859.
1062. Sir THOMAS TASSELL GRANT, Chester-terrace, Regent's Park, London.—Dated 27th April, 1859.
1074. ARTHUR BOYLE, Birmingham.—Dated 28th April, 1859.
1082. WILLIAM WINSTANLEY and JOSEPH KELLY, Liverpool.—Dated 30th April, 1859.
1120. JACOB GEOGHEGAN WILLANS, Clarence-place, Belfast. — Dated 4th May, 1859.

Patents on which the Stamp Duty of £100 has been paid.

921. LOUIS ALEXANDRE AVISSE, Paris.—Dated 25th April, 1855.
979. WILLIAM BANKS, HENRY HAMPSON, and JOHN BANKS, Bolton-le-Moors, Lancashire.—Dated 1st May, 1855.

And notice is hereby further given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days next after the date of the Gazette (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending April 26th, 1862.

2237, 1s. ; 2267, 2s. 2d. ; 2268, 1s. 5d. ; 2269, 1s. 11d. ; 2270, 3d. ; 2271 3d. ; 2272, 10d. ; 2273, 5d. ; 2274, 7d ; 2275, 5d. ; 2276, 6d. ; 2277, 7d. ; 2278, 3d. ; 2279, 9d. ; 2280, 3d. ; 2281, 1s. 4d. ; 2282, 8d. ; 2283, 10d. ; 2284, 1s. 1d. ; 2285, 6d. ; 2286, 10d ; 2287, 3d. ; 2288, 6d. ; 2289, 2s. 6d. ; 2290, 3d. ; 2291, 6d. ; 2292, 8d. ; 2293, 3d. ; 2294, 7d. ; 2295, 4d. ; 2296, 3d. ; 2297, 3d. ; 2298, 4d. ; 2299, 3d. ; 2300, 7d. ; 2301, 6d. ; 2302, 6d. ; 2303, 10d. ; 2304, 8d. ; 2305, 5d. ; 2306, 3d. ; 2307, 3d. ; 2308, 6d. ; 2309, 3d. ; 2310, 1s. 1d. ; 2311, 8d. ; 2312, 6d. ; 2313, 11d. ; 2314, 9d. ; 2315, 9d. ; 2316, 7d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

558. W. MACNAB, *Greenock*, "*Marine steam engines and boilers.*"—*Dated 14th October*, 1861.
This invention cannot be described without reference to the drawings.

2569. W. E. NEWTON, *Chancery-lane, London*, "*Condensers, &c.*"—*A communication.—Dated 15th October*, 1861.
The patentee claims, First, constructing condensers or coolers for steam engines of a series of parallel rectangular passages, through which the steam to be condensed or water to be cooled passes, whilst the current of the cooling water is made to pass through the passages on the reverse side of the surface, and in a current at right angles to the current of the steam to be condensed or water to be cooled. And he claims forming these passages by means of rectangular metallic plates cast separately and bolted together or cast together. He also claims combining two or more of these condensers into one apparatus, by attaching or connecting them together, as set forth. Secondly, reversing the current of the water to be cooled by means of the cap pieces, so that it may be made to flow successively through two or more of the rectangular passages. Thirdly, the use of guiding plates for the purpose of guiding the water into the rectangular apertures, so that it may be equally distributed. Fourthly, the use of bow pieces for the purpose of deflecting the cooling water into the rectangular apertures. Fifthly, making two or more apertures through the side of the vessel or ship, for the purpose of conducting the water from the outside of the vessel to the condenser or cooler, in combination with two or more similar apertures for conducting the water from the cooler or condenser back again in a closed circuit to the outside of the vessel, and arranged as set forth, so that the strength of the vessel shall not be unduly impaired. He also claims sloping the recesses by which the water is conducted from the outside of the vessel to these apertures, and to the pipe or pipes leading to the cooler or condenser, for the purpose of easily deflecting the water into the pipe. Sixthly, turning upwards the pipe that conducts the cooling water from the outside of the vessel to the condenser or cooler, and again from the condenser or cooler to the outside of the vessel, both as it enters and leaves the vessel, so that a portion of this pipe may be above the water line on both sides of the condenser or cooler, so that the condenser or cooler may be at all times accessible without the intervention of a valve or cock to shut off the water from the outside of the vessel. He also claims the use of the small pipe and cock connecting the pipe at or near the summit of the turn with the interior of the condenser, to start the current of the cooling water. He further claims the use of a centrifugal or rotary pump, geared to the shaft of a screw propeller, in combination with a surfaced condenser, or with a cooler, and also forming the outlet for the cooling water below any of the acting portions of the surface of a surface condenser or cooler.

2588. T. WILD *and* T. HODSON, *Heywood*, "*Apparatus for heating the feed-water for steam boilers.*"—*Dated 17th October*, 1861.
This invention consists in the novel use of a tube or supplementary boiler placed in the return flue, or in the space between the two ordinary boilers, and in passing the feed-water through the said tube or boiler, the products of combustion from the furnaces of the ordinary boilers being caused to circulate around or pass over the outer surface of the additional tube or boiler before passing to the chimney, by which means the feed-water is heated, and a portion of the impurities deposited therefrom, before entering the ordinary boilers. The additional tube or boiler is connected, by means of pipes, with a steam reservoir or holder fitted with a safety valve or valves, and communicating with the steam spaces of the ordinary boilers, or with the main steam pipes in connection therewith, through a valve or any other suitable apparatus, by means of which arrangement the steam generated in the tube or boiler constituting the "heater" may be employed for any purpose for which it may be required.

2589. T. E. MERRITT, *Rochester, Kent* "*Motive power.*"—*Dated 17th October*, 1861.
This invention relates to a peculiar construction and arrangement of apparatus for obtaining motive power, intended to be worked either by the action of steam, gases, compressed air, rarefied air, water, vacuum, or atmospheric pressure, whereby, when worked by steam, for example, a considerable economy of steam, and, consequently, of fuel, is effected. According to this invention it is proposed to employ a cylinder and piston, the latter fitting accurately into the former, but, in lieu of working them as in ordinary steam engines, the piston is stationary, whilst the cylinder itself receives the reciprocating motion due to the steam or other pressure therein. The bore of the cylinder may be only one-half the size of an ordinary cylinder for the same power, but its two ends, upon which the steam operates alternately, are enlarged or expanded, so as to obtain the desired area for the steam to exert its pressure upon. For example, a 6-in. cylinder, of the improved construction, having its end expanded to a diameter of twelve inches, will be as effective, other things being the same, as a cylinder of twelve inches bore on the old system. The piston rod is provided with two steam passages running longitudinally within it, and opening respectively on opposite sides of the stationary piston. The outer ends of these passages communicate with an ordinary slide box and valve, or any other convenient valvular arrangement for governing the inlet and outlet of the steam or other medium employed to and from the cylinder. The cylinder works between suitable guides, placed either vertically, horizontally, or in an oblique direction, and in order to still further economise steam, the space intervening between the piston and each cylinder cover may be partially filled in by causing the covers to protrude inside the cylinder, or by making an enlargement or bulge on each side of the piston, which will enter such space, and so reduce the steam room therein.

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2476. E. T. HUGHES, *Chancery-lane, London*, "*Permanent way of railways.*" —*A communication.—Dated 4th October*, 1861.
This invention consists in forming each chair with a large bed plate having inclined edges on the outside to prevent the accumulation of water or sand. One of the cheeks of the chair is movable, and so formed that the rail rests upon it between the cheeks. The lower part of the said movable cheek fits a groove in the bed plate, and is pressed up by a key or wedge, so as to force the movable cheek against the rail and hold it fast. Under the lid plate there are strong ribs for the purpose of obtaining strength, and to prevent the chair from shifting in the ground. Connected to each chair there is a bar extending across the line, in order to hold the two opposite chairs firmly at the proper distance apart, and some of the chairs are provided with long cheeks acting as splints to allow of the junction of the rails.

2539. A. ENGLISH, *Hatfield, Hertfordshire*, "*Reins or apparatus for preventing harness horses falling.*"—*Dated 10th October*, 1861.
The patentee attaches a strap, by means of a suitable loop, to the girths or straps of saddle and lug in harness horses, and from this point, under the belly, he leads it forward between the horse's fore legs; at the horse's chest it separates into two parts, having a suitable surface or plate of leather to bear against the horse. The two straps forming the combination are attached by rings or other suitable attachments to give the necessary freedom of motion: they pass thence and are led upwards through eyes situate one on either side near the lower ends of the hames, then through similar loops or guides near the upper part of the hames, and thence through the terrets of the saddle. From this point the reins or straps are carried along the back of the horse, and through openings in or over the top of the dash-board, and are continued somewhat in a straight line towards the seat of the vehicle, and thence to the flooring or bottom of the carriage (in two wheeled vehicles) where they are suitably secured in a position a little behind the axle tree. To strengthen the bottom of the carriage he attaches a short chain from the point where the reins are fixed to the axle.

2492. J. S. COLLINS, *Liverpool*, "*Apparatus for reefing and furling sails.*"—*Dated 5th October* 1861.
This invention rel ates to the reefing, furling, unreefing, and unfurling, of all sails, square or fore and aft, but especially to top sails, wherever yards, looms, spars, or such like mechanical contrivances are placed at or near the top and bottom of and connected to the sails, and consists in placing on or near the ends of the lower yard, boom, spar, or other apparatus, framing to carry chain wheels movable on an axis attached to and stretched between the said wheels. The patentee employs a chain parcelled with hair or other fibre to give it stiffness (a spar, rope, or any other article), to which the foot of the sail can be lashed or otherwise fastened, the other parts of the sail being left as at present. Over the chain wheels above referred to, as placed on the ends of the lower yards, chains are passed, and varied or continued thence round or over cheek sheaves, blocks, or other guiding arrangements near the chain wheels, and also about the middle of the yard, near the mast down to the deck, where the halyards are operated upon at the same time as the top halyard, thus causing the chain wheels to revolve and wind, on the parcelled chain or other parallel rod or rope, or unwound from the same, as much of the sail as may be desired, keeping the whole taut and secure from the wind, and enabling the operation of taking in one or more reefs, furling and unfurling, to be performed from the deck, and obviating the necessity of sending men aloft. The leading feature of the said improved apparatus is entirely different from all other revolving systems of reefing, furling, unreefing, unfurling the sails of ships and other vessels. In the apparatuses at present in use the principal revolving parts are placed near to the upper yard, boom, or spar, and form part of the same, or are attached about the middle of the sail itself, and communicate by ropes or otherwise with the said upper yard, boom, or spar; but in this system each sail is wound on or from its own "foot," and none of the new parts employed are directly connected to, or work immediately with, the said upper yard, boom, or spar.

2517. E. HASLEWOOD, *Lothbury, London*, "*Apparatus for preventing or lessening the lip of the driving wheels of locomotive engines.*"—*A communication.—Dated 9th October*, 1861.
This invention has reference to that class or description of apparatus by the use of which it has been sought to effect a more perfect bite or adhesion of the wheels upon the rails, by the application of an electric helix or coil, applied at or near to the lower portion of the periphery of the wheel, so that the wheel may rotate within, but without touching, the helix or coil, and become converted into an electro-magnet. And the said invention comprises the following improvements, viz., the constructing such apparatus with the helix or coil covered, in respect of the appearance it would present in elevation or side view when applied to a wheel, so that the lower portion of the curve might be disposed at or in proximity to the lowest portion of the wheel, that is to say, where the wheel and rail are in contact, whereby it is intended to obtain a maximum or an increased magnetic effect. Also it comprises means of adjustment for varying the position of the helix or coil. Also means of insulation of the helix or coil. Also the "laying up" or constructing the helix or coil, by a continuous coil of copper or other wire from the bottom to the top and from the top to the bottom.—*Not proceeded with.*

2568. J. GILBERT, *Church-street, Old Kent-road, London*, "*Endless railways.*" —*Dated 15th October*, 1861.
This invention consists of an improved endless railway so constructed that it can be worked at a high speed without noise, be applied to all common road vehicles, whether such vehicles are drawn by horses or propelled by steam or other power, and can be made available not only for heavy goods and passengers, but likewise for ploughing or cultivating land. It consists in so constructing an endless railway that each short piece of rail shall be moved in regular succession, so that at least one length is at rest on the road for the wheel to roll upon, and, when the wheel has passed over, it is then taken up and carried over the top of the wheel, and again placed in position under the running wheel. The rails, chains, and sleepers are so connected together that no depression can take place at the joints of the rails when the wheel is passing over them, but form one continuous and unyielding rail.

2570. R. A. BROOMAN, *Fleet-street, London*, "*Improvements in the method of and apparatus for propelling vessels.*"—*A communication.—Dated 15th October*, 1861.
This invention relates to feathering propellers, and continuous propulsive effect is obtained by means of two sets of propellers on each side of the vessel. The floats are always submerged, and nearly vertical; when propelling they act successively upon fresh bodies of water; after performing their stroke they are returned in a horizontal position or feathered; and when about to repeat their stroke they are made to assume a vertical position. When two floats are used instead of one they are set one below the other. To go astern, the inventor adopts arrangements whereby the propellers may be made to drive the vessel backward without altering the stroke of the piston in the steam cylinder. The propellers may be applied at the stern of vessels, particularly those used on canals. The invention cannot be described in detail without reference to the drawings.—*Not proceeded with.*

2571. J. D. *and* R. CLAYTON, *Bradford*, "*Railway wheels.*"—*Dated 16th October*, 1861.
In performing this invention the patentees make a dovetailed recess at one side of the tyre on a V shaped projection on one side of the felloe, as heretofore practised. At the other side of the tyre is a groove, and another groove is made in the felloe; an annular clip or cramp slightly fits into these two grooves, and when in its place the tyre and felloe are hammered up so as to retain the clip or cramp. Or, instead of an annular clip or cramp segmental clips or cramps, of any convenient length, may be employed, and in this case the grooves in the tyre and felloe may be square in those parts into which the clips or cramps enter, and dovetailed in the immediate parts which are hammered up to retain them in their places. Or the segmental clips or cramps may fit into square grooves in the tyre and felloe, and be secured therein by hammering up on to the dovetailed parts. Or the clip or cramp may fit in the groove in the tyre and under the rim of the felloe.

2584. W. WELCH, *Southsea*, "*Screw-propellers.*"—*Dated 17th October*, 1861.
This invention relates to the position and form of the spiral curvature and cylindrical surface of the blade or blades, which, instead of varying in their width of surface, shall be of uniform dimensions throughout their entire length, and the outer or entering ends of the blades, instead of maintaining the pitch or passing the axis at an angle, are made the neutral or vanishing points of the screw, and rotating in a disc form in a line at a right angle with the axis, or parallel with the midship section of the vessel, while the conjunction of the blades with the propeller shaft is placed at a right angle with the opposing end, or parallel with the water line, each blade thus forming a curved cylindrical surface, the ends crossing at an angle of 45 deg., or both blades combined producing a true screw, the ends crossing at an angle of 90 deg. The greater pitch of the screw is thus placed at a point on each blade, about one half the radius of the blade from the propeller shaft; the entire driving pitch is thus passed over, and the angle best suited to the vessel realised with the aid of shifting blades, and an additional impulse given to the water backward or forward by the combined centripetal and centrifugal tendency obtained by the neutral points at the ends of the blades as also destroying the vibrating influence consequent with curved surfaces, whose vanishing points are at a distance from the end of the blades, and which also produce a centrifugal tendency to the outer current beyond the diameter of the screw, detrimental to the progress of the vessel.

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2528. T. P. BENNETT *and* J. COLLIER, *Bolton-le-moors*, "*Certain improvements in or applicable to self-acting mules for spinning.*"—*Dated 10th October*, 1861.
This invention consists in certain improved arrangements of parts for regulating the rise of the faller when released from the sector or other apparatus by which it is held during the running in of the carriage, the object being to wind the slack yarn on to the spindles when the carriage is near the roller beam, and thus to prevent snarls. The invention cannot be described without reference to the drawings.

2530. W. MOULD *and* J. HALL, *Belmont, near Bolton, and* S. COOK *and* W. H. HACKING, *Bury, Lancaster*, "*Machinery for manufacturing healds or harness used in looms for weaving.*"—*Dated 10th October* 1861.
This invention cannot be described without reference to the drawings.

2542. T. B. COLLINGWOOD *and* A. BUTTERWORTH, *Rochdale, Lancaster*, "*Throstle and doubling frames.*"—*Dated 11th October*, 1861.
This invention cannot be described without reference to the drawings.

2547. R. EDGE, *Dean Mills, near Bolton-le-Moors*, "*Machinery for preparing, spinning, and doubling cotton, &c.*"—*Dated 12th October*, 1861.
This consists in an improved mode of driving spindles of machinery employed in preparing, spinning, and doubling, without the aid of bands or belts. In performing this part of the invention the inventor employs a shaft extending the length of the row of spindles to be driven; on this shaft are placed worm wheels which gear into worms which are fastened to or made on the spindles; the longitudinal shaft above mentioned is driven in any convenient manner. To effect the stopping of any individual spindle, for the purpose of piecing up, he allows the worm wheels to run loose on the shaft, and inserts a spiral spring between the face of the wheels and a collar which is made fast to the shaft. The object of the second part of the invention is to diminish the waste usually made in spinning and doubling cotton and other fibrous materials.—*Not proceeded with.*

2549. J. C. RAMSDEN, *Bradford*, "*Healds or healdes for weaving.*"—*Dated 12th October*, 1861.
These improvements consist in having three continuous threads, one of which, to form the loop, is lapped by suitable mechanism round the other two, then drawn up to the rigband or selvage of the heald, and there fastened, hence the patentee obtains a perfect loop without knots. The mechanism by which he proposes to accomplish this is as follows:—On the face of a common mail-heald machine, somewhere about where the mail trap is now placed, he fixes a hollow stud; this stud bears a flyer containing a bobbin which is caused to revolve at stated times by suitable mechanism, and through this hollow stud he passes a rod which may be of different thicknesses, according to the size of loop required; likewise through this hollow stud he passes two threads, one on each side of the rod which come from bobbins placed on spindles at some convenient part of the machine; when, therefore, the flyer on the stud is caused to revolve, the thread on the bobbin fixed thereon will lap round the two threads, and the rod, which pass through the stud, and when this is done the threads are drawn up to their respective rigbands or selvages by a system of hooks similar in construction to those now in common use in the mail-heald machines, and so on until the heald or heddle is completed.

2557. V. DE LA JOUSSELANDIERE, *Nantes*, "*Machinery for weaving cords and ropes.*"—*Dated 14th October*, 1861.
This invention consists of a hollow sphere with sloping apertures in which conical pieces will turn, and, by means of channels (say four) on their surface, carry with them contiguous spindles and bobbins; thus each of the spindles, moving on a cone and within a sphere, will always tend to one point, namely, the centre of the sphere, and, consequently, the thread or strand will always be stretched, and the twisting or weaving point move in proximity to a mathematical point. Each of the cones is set in motion by a gearing placed on the same axle, and the motor is placed indifferently on one or other of the axles, working all the gearings which command each other, forming a hexagon around the sphere. By means of return pieces or cramps the spindles pass successively from one cone to the other, and thus, alternately rising and falling, and making the entire circuit, effect the twisting of the threads or strands. To prevent the spindles turning on their own axes during their translation, and thereby either twist or wind off the thread or strand, the inventor applies to their hind part a pin or stud, which acts as a buffer against a similar piece behind each channel in the cones.—*Not proceeded with.*

2552. H. NELSON, *Manchester*, "*Apparatus for punching washers of throstles, &c.*"—*Dated 12th October*, 1861.
This invention consists of two rollers or cylinders revolving in suitable bearings, between which the cloth or material to be punched passes. On one of the said rollers or cylinders are one or more projecting cutters, so that, as the material to be perforated comes in contact with each cutter, the requisite hole is punched; and, to cause the material to pass through or between the rollers regularly without slipping, one or both of them are grooved or fluted, and at the front of the apparatus any suitable guides may be fixed to keep the material in a straight direction. The required distance of the perforations is regulated by the diameter of the roller, and, consequently, the distance of the punches asunder. Motion may be given to the rollers either by hand or power.

2566. W. BLAND, *Baildon, near Leeds*, "*Pickers used in looms for weaving.*"—*Dated 15th October*, 1861.
This invention relates to the construction and shape of pickers used in looms for weaving, and has for its object the strengthening of those parts which have principally to sustain the shock in striking against the shuttle, and consists in so arranging the material of which the pickers are composed as to render it less liable to destruction by that shock. To effect this the inventor makes the pickers of pieces of buffalo or bullock hide, a material commonly called "sizing," leather, caoutchouc, or any other suitable material which has hitherto been used for the manufacture of pickers; but to strengthen the striking part he lays the outer fold of the material composing the picker over the side of the picker to the back end of the same, and secures it there with one or more staples and rivets, thus changing the T shape of the picker into ⅂, or any other suitable shape, and turning in the outer fold of the material edgeway to the work, or parallel to the spindles on which the picker slides. The picking band or strap being fastened as usual, he provides the necessary space for it to pass the outer fold where it laps over the side.—*Not proceeded with.*

2573. F. B Baker, *Nottingham*, "*Dressing or stiffening lace or other fabrics.*"—*Dated 16th October*, 1861.

According to this invention the patentee causes the fabric to be dressed or stiffened, to pass in contact only with a roller which is kept coated with a film of dressing material. This dressing roller revolves constantly, and receives its film of dressing from another roller against which it rests by its own weight, and which latter roller dips into a trough containing the stiffening material. It is the back of the fabric which comes in contact with the dressing roller, and it bears but lightly upon it, so that the dressing is not pressed through to the face of the fabric, and the quantity of dressing on the dressing roller is so adjusted as not to be sufficient to soak through it without pressure. After the fabric leaves the dressing roller it passes over another roller covered with soft material, which removes from the interstices of the fabric any dressing which may have entered and filled them. But the filling of the interstices of the fabric is for the most part avoided by the proper regulation of the quantity of dressing on the dressing roller.

2585. R. Smith, *Chorlton-upon-Medlock, and* J. B. Rowcliffe, *Manchester*. "*Apparatus for winding yarn or threads upon the pin-bobbins or spools used in smallware and ribbon looms.*"—*Dated 17th October*, 1861.

This invention consists in so constructing pin-winding machines that any required number of threads may be wound together, and with an even tension on each pin-bobbin; also, when either or any of the pin-bobbins is or are full, that the same will be disconnected from the driving power, and cease to take up any more thread or threads, without affecting the remaining pin-bobbins that are not sufficiently filled. In connection with each pin-bobbin is a stopping apparatus, which disconnects the pin-bobbin power when either or any of the threads thereon break or run out, thus preventing its further action till the breakage is made good or more thread supplied. The length of traverse given to the guides which direct the threads on to the pin bobbins is gradually shortened as the pin-bobbin fills, that the ends of the same may be tapered, which not only prevents the threads overlapping, but also enables the patentee to dispense with flanges to the pin-bobbin.

2587. J. Tattersall, *Preston*, "*Carding engines.*"—*Dated 17th October*, 1861.

This invention consists, First, of an extra roller placed above the ordinary "licker in," and in contact with it, and with the main cylinder. This extra roller is covered with wire-card teeth, and is caused to revolve at a suitable velocity by any convenient means, in such a manner that its surface, where it is in contact with the main cylinder, travels in the opposite direction to that of the main carding cylinder. The Second part of the invention consists of a screen or cover formed of metal, wood, or other suitable material, which encloses or covers in the upper part of the "licker in," the extra card roller above named, that part of the main cylinder between the extra roller and the first roller clearer, and also the lower part of the first roller clearer. The screen is curved to follow the form of the cylinder and rollers, and is placed nearly in contact with their surfaces. The screen is so constructed as to regulate the quantity of air to be admitted to the rollers and cylinders, and thus prevent or lessen the draughts incident to ordinary carding engines.—*Not proceeded with.*

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

Trade Since the Holidays: *Slight Improvements: Demand for America—Present and Prospective: Plates for the Admiralty: South Staffordshire Iron in the Exhibition*—Local Failure—Boiler Inspection Society for South Staffordshire—*The Late Calamity: Funds for the Bereaved*—Coal Trade—General Hardware Trades: *Improvement*—The Labour Market.

The week after the holidays has opened with quite as cheerful a feeling as that which signalised the close of the period at which relaxation commenced. Most of the iron that is being made for the home market is going to London, to be used by the London engineers, shipped from the London Docks, or be ultimately used in the Government dockyards. Plates of the heaviest class that this district can conveniently produce are now being forwarded to the naval yards. In the foreign trade most is now being done for Russia, Canada, India, and France; and China is sending some orders, not for nail rods only, but also for general descriptions that are of tolerable value, say, from 400 to 500 tons each. A by no means insignificant quantity of iron is also going to Spain. The American inquiry is again subsiding; and for samples, the makers of which require remunerative rates, Liverpool supplies no orders. The demand must, however, soon again spring up and be more perceptible than has been the case for same time past, inasmuch as in the States, scarcely any iron can be produced in June and July.

The houses that are the best off for orders are those who are paying great attention to the quality of their product; and a vigilance in this direction is being now displayed that augurs most favourably for the future of South Staffordshire. We have been assured that plates have just been tested by an engineering firm of considerable standing in London, which more than confirm the assertions of ironmasters here, and reported in a previous letter, namely, that plates are being produced in South Staffordshire equal in quality to Low Moor iron, and upwards from £5 to £8 a ton below the Yorkshire list plates, evidencing the severity of the test to which they have been submitted, are now being exhibited we are told in the Wolverhampton Court in the Exhibition.

The failure is announced of Mr. John Kimberley, of the Eagle Works, Oldbury. Mr. Kimberley has been for some time in the finished iron trade, and his stoppage is doubtless traceable to the recent depression. The liabilities have been mentioned at as high a figure as £20,000; but the correct amount has not yet transpired.

A step has been taken by the leading ironmasters of this district which has been, doubtless, hastened by the fearful boiler explosion at the Millfield Works, from which as many as twenty-eight deaths have now occurred. At a meeting held in Wolverhampton, on Monday last, called by Mr. Philip Williams, the chairman of the Ironmasters' Association, it was resolved that a committee should be appointed to take the necessary steps preliminary to the formation of a Boiler Inspection Association for South Staffordshire, somewhat—if not entirely—on the principle of the Manchester Association. Indeed, it is not yet decided that the proposed concern shall not be in connection with the Manchester society. The shape which the movement will ultimately take, will depend upon the extent to which it is likely that the firms will avail themselves of the advantages that such an association presents. That there is great need for such a combination for self-defence and mutual protection in South Staffordshire the most self-satisfied cannot doubt after the report of Mr. E. T. Wright upon the explosion referred to. Not only was the boiler most unfit in itself, but the steam gauge was seriously out of repair, so much so as to show only an assumed safe-pressure of 35 lb., when the real pressure was a dangerous one of 45 lb. Had this boiler been under inspection it is not too much to say that the terrible calamity which, after destroying life to the extent named, has left nearly seventy persons destitute, would not have happened. We trust that every readiness will be evinced by all the iron and coal masters of South Staffordshire to become members of the association. The subscriptions for the bereaved amounted, up to Tuesday evening, to over £900.

Coal of the best quality is in good demand.

In the general hardware trades there is rather more doing than at the time of our last report. In Birmingham business has decidedly improved in the leading branches, such, for instance, as the tube, edge tool, and military store trades. The electro-platers have begun to work nearly full time. Further, the demand for fancy goods is increasing; but it is in fancy, and some of the less conspicuous of the general trades, that the want of orders are now most felt.

For tin-plate wares, both in Birmingham and Wolverhampton, there is a demand which would require only a few more orders in some directions to make the demand equal to the average of the last year or two. Japanned goods are not so healthy. But hollow ware trades keep slowly improving.

The lock, bolt, and curry-comb-makers of Willenhall are maintaining the improved position which they took up about a month or six weeks ago; but the time worked is, on the whole, very short. At Darlaston and Wednesbury a very decided improvement has sprung up during the week in the gun-lock filing for the military trade. All hands are now employed upon export orders for rifles for immediate shipment.

There is yet much unemployed labour in most parts of the West Midlands.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

Liverpool: *The Observatory: Steamers between Lisbon and Liverpool: Surat Cotton: Mersey Dock Board: Proposed Town Improvements*—State of Trade: *Sheffield: Derbyshire*—Northern Matters: *Border Counties Railway: Newcastle and Carlisle and North Eastern Railway Amalgamation: The Cleveland Iron District*—State of Employment at Manchester: *Machinists and Foundries*—Miscellaneous Items: *The Manager of the Metropolitan Railway: Steam Travelling Crane: A Reservoir giving Way*—Scottish Topics: *Clyde Shipbuilding: Forth and Clyde Canal.*

We commence with Liverpool. The annual report by Mr. Hartnup to the marine committee of the Mersey Docks and Harbour Board on the operations of the Liverpool Observatory has just been published, and contains, as usual, a good deal of information, showing that, both in respect to the testing of chronometers and the astronomical observations made, the Observatory is usefully and busily engaged. Messrs. Bibby and Co. are about to establish two steamers between Lisbon and Liverpool, with efficient accommodation for passengers. It is expected, however, that in June next the Peninsular and Oriental Company will run only one steamer to London at the reduced subsidy of £5,000 per annum. An important fact is noted at Liverpool, in connection with the hitherto neglected and despised Surat cotton. That description is coming more and more into favour with spinners; and, although it is "Hobson's choice" that it should be so at present, it is anticipated that alterations made in machinery will lead to an extended use of the products of India, even when American industry is permitted to resume its normal activity. If this should turn out to be the case the long-required stimulus will be given to our eastern possessions, and great results may be anticipated to flow from it. At the last meeting of the Mersey Docks and Harbour Board it was agreed to let 2,860 square yards of land at the Canal-bank, Lightbody-street, for five or seven years, to certain parties engaged in the carrying trade between Liverpool and the Staffordshire potteries. It was also agreed, on the application of Mr. C. E. Dixon, agent for the Great Ship Company, that permission should be given to lay down moorings for the Great Eastern on the same terms as before. Accommodation for the various branches of the steam trade of the port in connection with the Huskisson branch dock was carefully apportioned among the leading steam shipping firms. With reference to improvements in the approaches to the landing stages, it was stated that Mr. Lister, the engineer of the board, was preparing a model, which will shortly be submitted for consideration. The question as to who is to bear the cost of the improvements is, however, not yet decided, some members of the dock board very fairly contending that the outlay ought not to be borne by that body, already burthened as it is with heavy responsibilities. The Town Council has been again discussing a great scheme of street improvements, involving an outlay of £480,000, but the project has been shelved for the present. The fact is, this is an exceedingly inopportune time for either the Town Council or the Dock Board to embark in further expenditure—everything must stand over till the troubles in America are adjusted, and even then some caution must be exercised.

The large steel houses of Sheffield—where trade generally continues in a languid state—have pretty good orders on hand, both for home and Continental markets, and also for the Federal States. The few wire works of the town are busily occupied in the manufacture of wire rope used principally in collieries. A tolerable demand is experienced for tools required for agricultural purposes, and also for materials used in the construction of agricultural machinery. The demand for steel from France continues good. In the Derbyshire district there is not much change, and in the hardware trade there is a general dullness. An increased demand is experienced for plates for shipbuilding purposes, and Messrs. Brown and Co., of Sheffield, have received an order for the cupola plates recently adopted by the Government. There is some increase in the demand for rails.

From the north several interesting items of information reach us. The Border Counties Railway is now completed throughout, and the section from Keilder to Riccarton is about to be examined by the Government inspector. The amalgamation of the Newcastle and Carlisle and North-Eastern Railways is expected to be carried through Parliament this year. The scheme is still stoutly opposed by the London and North-Western, but the North British Company has withdrawn all opposition, an arrangement having been made by which, when the line from Hexham to Hawick is completed, the North British will have the liberty of running its engines direct into Newcastle, while the North-Eastern has the privilege of running its rolling stock direct into Edinburgh.—The *Newcastle Chronicle* observes with reference to the Cleveland iron trade:—"Now that the weather is more settled, and the winds favourable, the exports of iron from Middlesbro' are on the increase. No less than 4,000 tons have been shipped this last fortnight to foreign ports, but principally to France. Should this state of things continue we may predict a busy season in the Cleveland district; indeed there is every sign that such will be the case, both in pig iron as well as in manufactured articles of both wrought and cast iron. Towering up above their other furnaces at the Middlesbro' Ironworks Messrs. Bolckow and Vaughan are erecting a blast furnace on a large scale. This furnace, we understand, is much larger in diameter, and about 20ft. higher than the ordinary or present furnaces. The object of erecting such a large furnace is said to be to improve the quality of the iron. We believe these high furnaces have been tried at the works of the same firm at Witton Park, and found to answer, and as their old furnaces burn out they will, no doubt, in re-building them increase them in height. This same firm is seemingly doing a good business in the pipe trade. Large quantities of pipes are leaving their works every day for the Hull Corporation new waterworks. These pipes are 25in. bore, weighing about 22 cwt. each. The delivery is at the rate of twenty-five per day, the order extending over three months. Besides those pipes, we understand they have also extensive pipe orders from the Continent. The facilities for pipe-making in this establishment are very great. Gilkes, Wilson, and Co., too, are going extensively into the pipe trade. They have lately built a very large foundry entirely for the manufacture of pipes, and have lately obtained an order from the London Central Gas Company for 1,000 tons of 36-in. pipes, which they are now preparing to make. This firm have just completed a large order of bowl chairs or sleepers for the Madras Railway, and we hear that there are about 13,000 or 14,000 tons of the same kind of chairs for the same railway to be let this week. A large quantity of those sleepers have been manufactured at Middlesbro' within the last twelve months, Bolckow and Vaughan having made about 3,000 tons last year, and Gilkes, Wilson, and Co., have had upwards of six months' work at the same order. The Middlesbro' firms, therefore, should be in a better position than most firms to compete for these goods, as they have all their patterns and other materials ready for the manufacture of so large an order on hand. We are sorry to see that the extensive iron shipbuilding yard of Messrs. Richardson and Duck is to be closed. This company launched the last vessel they intend to build at Middlesbro' about a week ago, and are now removing to their other shipyard at South Stockton, where they intend to concentrate all their work into one establishment.

The last official return prepared in illustration of the state of employment at Manchester states that, of 47 machinists, 12 were working full time with all hands, 25 were working full time with a portion of their hands, 9 were on short time, and 1 had stopped altogether. Of 24 foundries, 7 were on full time with all hands, 13 were on full time with a portion of their hands, and 4 were on short time.

We may group together one or two miscellaneous fragments of intelligence. Mr. Myles Fenton, assistant traffic manager of the Lancashire and Yorkshire Company, and formerly secretary of the East Lancashire, has been appointed manager of the Metropolitan Railway.—Messrs. H. and J. Ellis, of Stanley-street, Salford, have just completed a steam travelling crane for the new battery works of the Government at Portsmouth. The crane, which is their own invention, is capable of lifting twenty tons with a pressure of 40 lb. It is worked by two small cylinders with a perpendicular tubular boiler, and has three motions—longitudinal, horizontal, and perpendicular, with a span of 54ft. The engineer, who stands in front of the crane, has all its motion perfectly under his command, and can double its power with the utmost facility. A water tank and pump for supplying the boiler are also connected. The steam crane is calculated to do double the work of an ordinary ten-ton crane worked by six or eight men, and in half the time.—The Picthorn new reservoir of the Oldham Waterworks has given way, the loss involved being estimated at £8,000.

From the Glasgow district we learn that Messrs. W. Denny and Brothers, of Dumbarton, have laid down two first-class screw steamers, of 600 tons each, for Mr. Walter M'Farlane and others. Each vessel is intended for the China trade, and is to be supplied with engines of 100-horse power nominal, by Messrs. Denny and Co. The dividend of the Forth and Clyde Canal appears, by the proceedings at the annual meeting, to be still maintained at the satisfactory rate of 6½ per cent. per annum. From the ship yard of Messrs. J. and G. Thomson, at Govan, has been launched a screw steamer, named the Clydesdale, belonging to Messrs. David Hutcheson and Co., and intended for their West Highland trade. The Clydesdale is 500 tons B. M., and her engines are of 110-horse power, of inverted cylinder construction, with surface condensers and all recent improvements. On Friday the screw steamer Lotus, which was lately launched from the yard of Messrs. Henderson, Coulburn, and Co., and which is intended for the China trade, made a trial trip. The vessel started from Bowling and ran from the Cloch Lighthouse to the Cumbraes and back, at an average speed, going and returning, of 13¼ miles per hour. This speed was attained under very disadvantageous circumstances, as the vessel was somewhat out of trim, in consequence of the non-delivery of some coal which was to be taken on board. She had at the same time 200 tons of dead weight with her, but the speed attained surpassed expectations. Her dimensions are 210ft. length of keel and forerake; 27ft. breadth of beam; 16ft. depth of hold. She will carry 700 tons with 10ft. fore and aft of water, and she is propelled by a pair of inverted diagonal oscillating engines, which worked during the trip with smoothness and economy.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Teak	15 10	17 0	15 0	16 0
Quebec, red pine	3 10	4 10	3 5	4 0
yellow pine	3 0	4 0	3 0	3 15
St. John, N.B., yel.	5 0	5 10	5 0	5 10
Quebec, oak, white	5 0	5 10	5 0	5 10
birch	3 10	4 0	4 0	4 0
Memel	0 0	0 0	0 0	0 0
elm	3 10	4 15	3 10	4 15
Dantzic, oak	3 10	6 0	3 10	6 0
fir	2 15	3 10	3 0	4 0
Memel, fir	3 10	4 0	3 10	4 0
Riga	3 5	3 10	3 10	3 15
Swedish	2 15	3 0	2 15	3 0
Mass, Queb. rd pine	5 0	6 0	5 0	6 0
yl. pine	5 0	6 0	5 0	6 0
rd pine	0 0	0 0	0 0	0 6
Lathwood, Dants, fm	6 0	6 10	6 0	7 0
St. Peters.	8 0	8 10	9 0	9 10
Deals, per C., 12 ft. by 3 by 9 in.				
Quebec, wht. spruce	13 0	18 0	15 0	19 0
St. John, wht. spruce	13 0	16 0	15 0	17 10

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Yel. pine, per reduced C.				
Canada, 1st quality	17 0	18 10	17 10	19 0
2nd do	12 0	12 10	12 0	13 0
Archangel, yellow	13 0	13 10	14 0	15 0
St. Petersbg. yel.	12 0	12 10	13 10	13 10
Finland	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	15 0
Gothenburg, yel.	10 0	11 10	10 0	12 10
white	9 10	10 0	9 10	11 0
Gefle, yellow	10 0	11 0	11 0	12 10
Soderhamn	10 0	10 10	11 0	12 10
Christiania, per C.				
12 ft by 3 by 9 in. yellow	22 0	25 0	22 0	24 0
Deck plank, Dnts per 40 ft. 3 in.	0 11	1 4	0 14	1 4
Staves, per standard M				
Quebec, pipe	70 0	75 0	80 0	85 0
puncheon	16 0	18 0	16 0	18 0
Baltic, crown pipe	160 0	170 0	170 0	180 0

SCOTCH PIG IRON REPORT.

		s.	d.	
No. 1	Gartsherrie	58	0	f.o.b Glasgow.
,, 1	Coltness	57	6	do.
,, 1	Calder	53	9	do.
,, 1	G.M.B.	53	3	do.
,, 3	Do.	51	9	do.
M. Nos.	Do.	52	6	do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths ,, 3 G.M.B.	Cash prompt	53	9	per ton.
	1 mo. open	54	0	do.
	2 mos. ,,	54	3	do.
	3 ,, ,,	54	6	do.

MANUFACTURED IRON.

	£	s.	d.	
Bars, Govan	7	0	0	
,, Common	6	10	0	
Drumpeller, Common	6	10	0	
Do. Best	7	10	0	
Cramond Scrap Bars Delivered in London	10	5	0	less 5 per cent.
Plates and Sheets	9	0	0	to £9 10s.
Rails	6	5	0	
Pipes	4	17	6	
Chairs	3	15	0	

Glasgow, April 30th, 1862.

The market has been remarkably firm again, and a very large business has been done at from 52s. 6d. to 53s. 10½d. cash. Investors and speculators for a rise are eager to get in and take advantage of every trifling reaction in the price.

To-day the market is firm at 53s. 9d. cash sellers.

The demand for export and consumption is good.

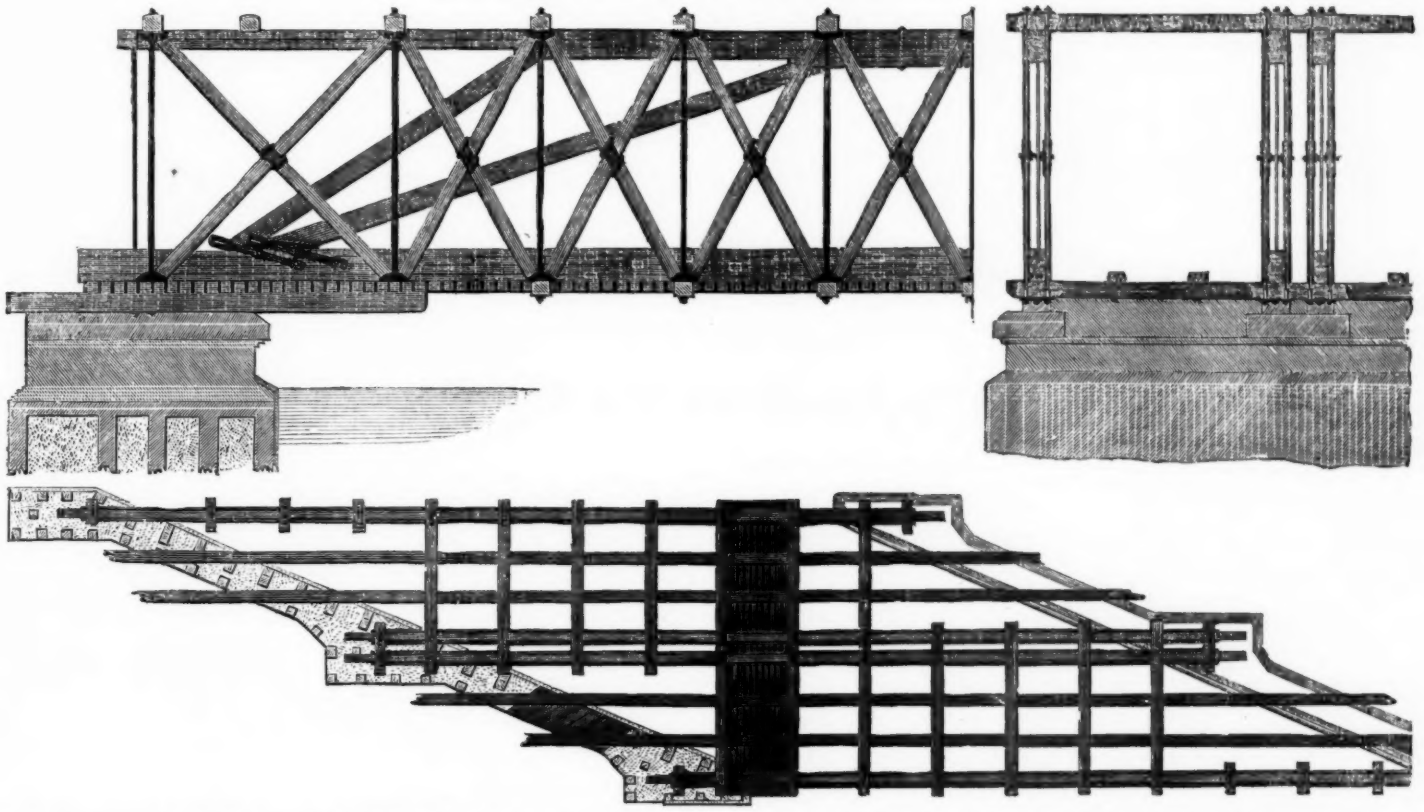
Exports last week were 11,654 tons, against 15,522 tons in the corresponding week last year.

Shaw, Thomson, and Moore, Metal Brokers.

The Terrible Boiler Explosion.—Yesterday afternoon the inquest was resumed upon the bodies of the unfortunate deceased killed by the boiler explosion at Millfields, near Bilston (who now number twenty-eight), before Mr. P. M. Phillips, at Bilston. Mr. Rose, the employer of the deceased, was present, and also his counsel and solicitor, with Mr. E. T. Wright, the engineer who made the official examination; and Mr. A. Bourne, the travelling agent of the Steam Boiler Assurance Company, of Manchester, who produced, for the assistance of the jury, some photographs of the riven boiler. The coroner, in summing up the case, said that the jury could not return a verdict of manslaughter against the engineer, because of the ruling of Baron Channel at the last assizes at Stafford, to the effect that an engineer who had left his engine could not be found guilty of that offence, unless it could be shown that he knew that his boiler which exploded was short of water. The jury, after a lengthened deliberation, returned the following verdict:—"That the boiler exploded from an over-pressure of steam, but how caused there is no evidence to show. The jurors express a strong opinion that boilers of this size and description should not be made or used for high-pressure steam."

A Wonderful Projectile.—The *Patrie* announced, a few days ago, that the French artillery had invented a new projectile, capable of piercing plated ships, and of producing effects hitherto unknown; and it added—"The principle of this invention will remain a secret; but we are assured that the fact of its existence is now placed beyond all doubt." M. Mathieu (de la Drome), once a representative of the people, lost no time in claiming the invention as his own. He states that he communicated the fact to the Minister of Marine on the 8th, and again on the 11th of the present month, together with all the necessary details; and, so far back as the 26th of December, that he submitted, under cover, to the Academy of Sciences, the drawings and descriptions as mentioned in the *Patrie*. I believe that his communications were not acknowledged either by the Minister or the Academy. M. Mathieu's claim is well-founded. In February last the English Admiralty were informed of his invention, but did know the nature of the means he employed. I believe that at the present moment they do know these means, and that the "secret" of the *Patrie* is no longer a secret. The "*boulet mine*" (for so this new infernal machine is called) is described as capable of destroying six iron-plated ships at a distance of more than 3,000 yards. If it really possesses this wonderful power, Great Britain, Gibraltar, Malta, &c., will be less accessible than ever, and the superiority of iron ships will not have been of long duration.—*Paris Correspondence of the "Times."*

EASTERN COUNTIES' RAILWAY BRIDGE.



In the western annexe of the Exhibition is a model of a timber bridge for railway purposes, as planned and executed by Mr. Sinclair, of the Eastern Counties Railway. We give an illustration of one-half of one of the same class of bridges erected over the Middle Level Drain, on the Peterborough branch of the above line. It is a skew of 90ft. span, that, however, at right angles to the waterway being about 35ft. The trusses are 111ft. long. Each bottom chord is formed of timbers each 6in. by 12½in., the top chord being framed of the same sized scantling, in numbers according to the strain. The diagonals are generally 9in. by 4in., increased to 10in. by 4in. at the abutments, with abutment braces, also 12½in. square. The whole height of the truss, from lower side of bottom chord to top of top chord, is 15ft. 7in., the camber of the top chord being 5in.

Mr. Sinclair's model is described as "on the American principle," and so it is, but there are very few American bridges so substantially framed, or of which the workmanship is so accurately performed. With cheap timber bridges of the same span and for a double line in the States would not cost above £10 per foot run, whereas here the cost must be far greater.

SOCIETY OF ARTS.

April 23rd, 1862.

Henry Cole, Esq., C.B., in the Chair.

ON THE EFFECT OF PRIZES ON MANUFACTURES.

By Samuel Sidney.

(*Continued from page* 277.)

Turning from arable cultivation to the dairy, Keevil's machine, which almost entirely supersedes women's labour in cheesemaking, and enables one man to make nine tons, has been invented and widely introduced in Wiltshire and Gloucestershire, without receiving any prize at all from the society. A churn of no value, except in a farm-dairy of two cows, has been thrice rewarded.

Again, prizes varying from £3 to £10 have been awarded, to the extent of £35, for a gorse bruiser, a machine which had its origin in a crotchet and never found a farmer-purchaser. Five prizes, of £10 each, have been given for drop drills, a perfectly useless implement, made by one of the first drill makers in the kingdom expressly to win the prize, but which he always refused to sell, knowing their worthlessness. Chaff-cutters, cake-breakers, and turnip-slicers simple machines, which have not been usefully improved for the last fifteen years, have been rewarded with small prizes, amounting altogether to about £200.

As to agricultural steam engines, the reports of the stewards and judges contain repeated complaints that "racers," differing materially from useful farm engines, are constructed at a great cost for the express purpose of carrying off the society's blue riband, and this is by far the most favourable example of the prize system.

To pursue the analysis further would exhaust the patience of my hearers. Prizes may be useful to amuse and excite the public in the infancy of an art. In that point of view, perhaps, prizes for steam cultivation may, for the next few years, be useful. The distribution of prizes is a pleasant occupation for amateurs. Money may sometimes be usefully spent in assisting inventors to pursue or complete promising experiments, but looking at the difficulty of finding competent judges, the impossibility of carrying on efficient tests and trials, and the insignificant value of prizes as compared with a commercial demand for really useful articles, it is impossible to come to any other conclusion than that attempts to ascertain the comparative merits of manufactured articles by a contest for graduated prizes is certain to be delusive, and will often encourage fraud. It is the interest of the public that the reputation of a manufacturer should not rest on winning this or that prize at an unknown sacrifice of time, thought, and money, abstracted from his regular business, but on the average quality and steady improvement of all the goods he makes. As to exceptional efforts of exceptional inventive genius, they may properly be the subject of exceptional rewards.

DISCUSSION.

The chairman said, after the very gallant attack which had just been made upon prizes he hoped there would be some champion who would stand up on their behalf. The question to be considered was, whether they were prepared to reject all prizes for manufactures, and to cast them aside as they had done fiscal protection to trade? He thought, perhaps, even if they were prepared to resolve at once that trade could take care of itself, and that every man knew best what he wanted, and was the best judge of it, still there might be some cases where prizes were useful; and therefore it might be desirable to try and find out, in any resolution they might form in their own minds for getting rid of prizes generally, how far they should be prepared to maintain them in particular cases. It seemed to him that they might discriminate between prizes for manufactures and prizes for certain things where, in fact, the public assembled to judge of the result, could see at once that that result was fairly accomplished. He saw no objection to prizes for horse racing. Everybody could tell whether a horse won or not. Nor did he see any objection to prizes in flower shows; any one could judge for himself whether one tulip was better than another. He was not sure that at archery meetings prizes were not a little stimulus to skill, and perhaps rifle shooting was encouraged by them. These were all cases where the result was patent, and where everybody was as good a judge as another. He did not know whether the author of the paper concurred in that limitation for prizes, but to his (the chairman's) mind there was just that distinction to be drawn. He agreed with Mr. Sidney in almost all he had said in his paper, but he hoped there would be some discussion upon the subject, so as to elicit the distinction between those cases where prizes were useful and where they were not so. Mr. Sidney had alluded to the Society of Arts' colour-box. He thought at the time that prize was offered by the society it was very useful. It had the effect of enabling the world generally to obtain an infinitely better shilling colour-box than it had before. All trades were known to be more or less conservative, and likely to go on in the old way; and if an innovation were proposed they often looked upon the projectors as mere enthusiasts. In the case of the colour-box he recollected there was a sort of round-robin issued by the respectable colour-dealers, representing that, in their opinion, the Society of Arts was trenching too much upon the provinces of trade; but the practical result had been that almost all the persons who did not approve of that action of the society were now producing shilling colour-boxes in competition with each other. That was but a trifling instance in which prizes had been useful. There was another class of prizes which the society had given up, which might be put in the same category—that was prizes to artists. Many years ago the council of the society were accustomed to give prizes to students of the Royal Academy, and they found the names of Mulready, Landseer, and Millais amongst the recipients of those prizes, who, nevertheless, might, perhaps, have been equally eminent in this art without those prizes. On the other hand, those young men might have been stimulated by those prizes to work the harder so as to distinguish themselves; and, as far as education was concerned, they had a great number of precedents in which prizes were invariably offered, and he thought they, too, ought not to be confounded with prizes given for excellence in manufactures.

Mr. G. F. Wilson, F.R.S., did not rise as an advocate for prizes, for he thought every one who saw anything of the prizes of the Exhibitions of 1851 in London, and of 1855 in Paris, must have felt the very great difficulty of the subject. But he thought in many cases prizes and exhibitions were a good deal associated together, and he believed it would be difficult to get a sufficient number of exhibitors together without offering some form of inducement in the shape of prizes; but that the effect would be much less amongst English exhibitors, who might be said to be as yet not thoroughly inoculated with the exhibition disease — if it were a disease; and he believed there was a much stronger feeling abroad on this subject than in England. In England there appeared to be a growing feeling, judging from those manufacturers with whom he had come in contact since 1851, in favour of exhibitions, and he believed there was an anxious looking forward to future exhibitions. He thought the question was not so much one of prizes in the abstract, but as a means of collecting together the best possible representation of the different manufactures of all parts of the world. Perhaps at the close of the discussion Mr. Sidney would favour them with his opinion upon that particular view of the subject.

Mr. Wm. Hawes thought this paper was written with a very narrow view of the subject of prizes. It was confined chiefly to the smaller pecuniary rewards, and did not touch the larger branch of the question. The greatest prize they had in this country for the encouragement of manufactures, and one which he believed a large proportion of those he addressed still supported and maintained with very strong feeling, was the system of patents. If they were prepared to discard prizes to manufacturers for inventions they must come to the conclusion that granting patents—giving for a term of years a monopoly to inventors, was unnecessary and mischievous. He was one who had, for a long time, advocated that opinion, and agreeing as he did with Mr. Sidney's conclusions as applied to prizes given at international exhibitions, at the same time he did not agree with the grounds on which he arrived at these conclusions, because he believed in a great number of cases, although many foolish prizes might have been given by the Agricultural and other societies, yet, on the whole, the prizes given by such societies had done great service. He thought the principle of granting prizes as applied to international exhibitions was entirely distinct from that which governed those given by Agricultural Societies and other institutions as rewards for new inventions. For instance, in an international exhibition, the object of those who sent their productions was not so much to obtain a prize as to exhibit their manufactures; and the great benefit the public derived from them was the opportunity afforded to young manufacturers to bring their works prominently before the public, in a manner and under auspices which they could not accomplish by any other means, and that was a benefit greater than could be derived from the possession of a medal awarded by any jury or body of commissioners. Therefore, reasoning upon the question generally, they must not forget the conclusion they were led to, that, if they stated the principle broadly, and maintained that prizes did not encourage improvements, and that therefore they were useless—that the public were the best judges of the value of every invention, and of the benefits they would derive from using it—if they broadly maintained that principle, they must be led to the conclusion that the system of granting a monopoly to any invention or manufacture was also useless and injurious. To that conclusion they must all come, and they were coming to it rapidly. The first blow given to the old-fashioned patent system was by making patents cheap. Discussing this question with the late Mr. Brunel when public opinion was more strongly in favour of retaining them than it now was, Mr. Brunel said, "If you cannot abolish patents altogether, make them so cheap that patents may be taken out for everything, and then they will become comparatively worthless." That was the point to which they were now tending. They had patents by thousands, and nobody knew or cared what patents were taken out for. If any really good thing were discovered, the best thing for the discoverer was to lay it before some large manufacturer, by which means more profit would be made than by protecting his invention in the form of a patent. He agreed with Mr. Sidney, that the public were the best judges of what best answered their purpose, and that, therefore, there was no need to call in the law in the shape of patents, or prizes from the commissioners of an international exhibition to stimulate invention or production, or to induce people to buy the cheapest and best commodities of the kind they required.

Mr. Philip Palmer thought the fault was rather in the application of the system than in the system itself. When he joined this society, thirty-three years ago, it was in the habit of issuing year after year a long list of prizes to be awarded for certain objects. The effect was not seen at the time, but many present would remember that it was the habit of gentlemen who read papers here to allude to the encouragement this society had afforded to their early efforts. He believed they were the means of stimulating to further efforts which in after life had been satisfactory to them and beneficial to the public. He would ask Mr. Sidney in what way the merits of inventors could be recognised by the society to which he had more particularly alluded except by a system of prizes. If the judges were prejudiced beforehand, the fault must be in the selection of the judges; but if they were to have agricultural and horticultural societies for the encouragement of different objects, in what way were their decisions to be recorded and brought before the public except by the award of prizes? If they admitted the beneficial effects of rewards for agricultural or horticultural productions, in what way were the merits of manufacturing inventions and productions to be publicly recognised? It appeared to him to be a bold stroke, in this age of testimonials, to abolish the prize system altogether, as Mr. Sidney appeared to advocate in his paper. It seemed that Mr. Sidney regarded the success of an invention as the best prize that could be awarded, but how was that success to be arrived at, unless some help up the ladder was given, by means of some public recognition or testimonial of merit, by a body qualified to pass an opinion upon the invention or production? Although he could not go to the full extent of Mr. Sidney's views, he nevertheless thought that many of the prizes of the Exhibition of 1851 had been bestowed without sufficient discrimination and judgment; and without being an advocate of the whole system, he was of opinion that prizes, under certain circumstances, should be continued, but he should like to see more judgment exercised in the distribution of them, as well as in selecting the persons by whom they were to be distributed.

Mr. Newton Wilson dissented from many of the views expressed that evening, both by the author of the paper and by the succeeding speakers. He was one of those who thought manufactures were not the only things in the world to be excepted from administration of prizes. If they were to exclude manufactures from prizes they ought to exclude everything else. To begin with their school days, few would deny that prizes were a great stimulus to exertion, and it would be so as long as the world lasted, whatever they might think of the propriety of awarding prizes to manufacturers. It appeared to him that the argument on which Mr. Sidney proceeded was this, that because judges were not infallible, and sometimes

awarded prizes to improper things, and passed over deserving things—because one set of judges awarded a prize to a thing on one occasion, and another set of judges awarded a prize to another thing of the same kind at another time, therefore the system of prizes should be altogether abandoned. He (Mr. Wilson) did not admit the force of that argument. If it had been found that the public invariably followed the decision of the judges, there might be some force in the objection. But who did that? Everybody exercised the right of choice and judgment for himself, and was but little influenced by the opinion expressed by the judges. The judges having pronounced favourably on an article, the public were led to examine it, and by that means the young aspirant to fame and position in the world had a greater chance of achieving his object. He thought a more comprehensive view of the subject might have been taken than had been adopted by Mr. Sidney. He had referred to the anomalies which were to be discovered in going through the prize lists of the Royal Agricultural Society, and no doubt similar anomalies might be found in the lists of any other society; but he thought if Mr. Sidney had extended his views a little further, and had regarded the effect of prizes in stimulating manufactures on the other side of the Atlantic, another conclusion might have been arrived at. From his knowledge of what had taken place in America he was much mistaken if the effect of prizes to manufactures had not been largely to stimulate their production. The prize system there had undoubtedly had the effect in many cases of bringing persons into notice, who, from the obscurity of their position, might, but for the adjudication of those prizes, have fought their lives through without obtaining notice or position. It might be said that many difficulties must attend the adjudication of prizes for manufactures. He was himself an exhibitor in the coming Exhibition, and he looked forward to some distinction. He had tried hard to obtain it. He had gone to a large expenditure of time, money, and labour, to effect what might be a success or not. If he succeeded in producing effects in advance of what had been produced before he did it to obtain distinction. He believed foreign exhibitors were actuated by the same feelings and motives, and he also believed that the distribution of rewards for superior skill was the great incentive which led them to take part in the approaching great World's Show. He thought if it had been known that no prizes were to be given, it would have had an unfavourable effect upon the Exhibition. He would ask whether he had rightly understood that there were to be no competitive prizes?

The chairman replied, the distinction between the prizes on the present occasion and those in 1851 was this: In 1851 there were prize medals and council medals, and the latter might be regarded as competitive. In addition to that there was "honourable mention" of articles, so that in 1851 there were three grades. On the present occasion the commissioners intended to issue only one medal for, he believed, merit of all kinds. They had not declared the limitations. Therefore, if Mr. Newton obtained a medal, and another manufacturer did not, to that extent there would be competition, but no further.

Mr. A. Salomons confessed his surprise at hearing the avowal of the chairman, that he agreed for the most part with the views contained in the paper. The remark was made, in the early part of the paper, that it was difficult to find out the merits of various articles for which prizes were given. Textile fabrics were quoted as an instance of this—that they could not be judged until they were used. They were, therefore, to suppose that the gentlemen who were appointed judges did not understand the manufacture of textile fabrics on which they were called upon to give an opinion. He flattered himself that they had manufacturers who could tell whether a chair was well made without trying it by continued use, and the same with a piano or other musical instrument. If not he thought exhibitions, instead of doing good, had done harm. There was, perhaps, a difficulty in getting the best men to act as jurors, particularly in a large exhibition like the coming one; and he thought if Dr. Playfair were asked how many had refused that office, because they were themselves competitors, it would be found that there was a very large number, which was in itself a proof that those gentlemen did not regard prizes as not worth having. He knew from good authority that instead of having 4,000 exhibitors from France, if prizes had been withheld, there would not have been 1,000; therefore it was evident that prizes were an incentive, and had brought a large number of exhibitors on the present occasion. He held in his hand a list of the number of exhibitors, and prizes awarded from the time of the first Exhibition in France, in the year 1798, down to the last Paris Exhibition, and it might interest the meeting to hear the results. In the year 1798 the first Exhibition took place in France. There were then 110 exhibitors only, and 23 prizes were distributed. In 1801 there were 229 exhibitors, and 80 prizes were given. In 1802 there were 540 exhibitors, and 250 prizes, consisting of 34 gold medals, 53 silver medals, 60 bronze medals, and 103 honourable mentions. In 1806 there were 1,422 exhibitors, and 610 prizes, of which 54 were gold medals, 97 silver, and 80 bronze, and 379 honourable mentions. In 1819 (thirteen years after), there were 1,662 exhibitors, 869 prizes, and the medals still increased to 80 gold, 120 silver, the number of bronze not being given. In 1823 there were 1,642 exhibitors, and 1,091 prizes. In 1827 there were 1,695 exhibitors, and 1,245 prizes. In 1834 there were 2,447 exhibitors, and 1,785 prizes. In 1839 there were 3,281 exhibitors, and 2,300 prizes. In 1844 there were 3,960 exhibitors, and 3,253 prizes. In 1849 there were 3,738 prizes distributed, and in the principal exhibition of 1855 there were 20,788 exhibitors, of whom 10,691 were French, and 10,097 foreign, including English. The prizes distributed to English exhibitors alone amounted to 1,378, of which 130 were awarded to foremen—not masters themselves, but at the head of manufactories. He thought this was pretty clear evidence of the estimation which manufacturers placed upon prizes. To pursue the subject a little further, take the Exhibition of 1851; of the 19 gold medals then awarded, seven of the holders of them had obtained honourable mention at the previous Exhibition, and the same was the case with regard to 28 holders of silver medals in no less than eight instances. He could also mention a few remarks with regard to the Exhibitions at the Franklin Institute, Philadelphia. In 1850 there were 746 exhibitors, and 470 prizes; in 1851, 753 exhibitors, and 473 prizes; in 1852, 700 exhibitors, and 436 prizes. These statistics were sufficiently conclusive that prizes were desirable. He was almost inclined to think that Mr. Sidney was in this paper expressing the feelings of a disappointed man. He hoped it was not so, but from listening to the paper that impression had forced itself upon his mind, especially with regard to the proceedings of the Royal Agricultural Society. No doubt there was room for some alteration in the selection of the prizes and in the mode of distributing them, but with regard to abandoning the prize system altogether he was decidedly averse to it.

Mr. Corbett had not had the advantage of hearing the whole of the paper, but as far as he gathered it seemed to be somewhat of an attack upon the system of the Royal Agricultural Society. He maintained that to be one of the most useful societies in England, and the best thing they had was their prize system. The Royal Agricultural Society would not have existed three years without the prizes, and the best implements now in use were those for which the prizes of that society had been awarded; the best ploughs, harrows, drills, and, above all, the best steam-plough, had been selected for distinction by the Royal Agricultural Society. The chairman had remarked that this country would not have the best race horses without prizes; and he was sure the same remark would apply to the breeds of agricultural stock. He had attended nearly every meeting of the Royal Agricultural Society, and had acted as a judge in some of the departments. Judges might be right or wrong in their decisions, but as Englishmen he believed these were given in strict honour and integrity. Mr. Sidney had instanced the case of the reaper—one man getting the prize one year and another the next. That was the virtue of the prize system. A man found he was beaten on one occasion, and he then set to work to improve his own invention, and at the end of six or seven years the farmer got an implement which he never would have had but for the competitive prize system.

Mr. Eamonson thought they were indebted to Mr. Sidney for drawing attention to this subject. He had been connected with manufactures all his life, and had taken great interest in the various exhibitions that had been held. He did not think it desirable to do away entirely with rewards for merit, or that they should not in some way mark their approbation of improvements or novelties. Some kind of stimulus must be afforded. No doubt great mistakes were made in the awards of the Exhibition of 1851. There were too many prizes given, and, as far as his own opinion went, many were unworthily bestowed. It certainly seemed that in many cases the prizes were awarded from the public prestige of the parties, rather than from any particular merit of their productions. He thought in too many cases the heads of departments who assisted the manufacturers in bringing novelties before the public were lost sight of. He was of opinion that an order of merit, or a system of prizes, was the only way of bringing a rising man prominently before the world. As had been very properly observed, the public were not bound by the decision of the judges in their choice as to style, price, or novelty. They could judge for themselves, and would always exercise that right. The great advantage he saw in giving prizes was that they were the means of bringing before the public dormant and rising talent. In the same way that children were stimulated by prizes at school, children of larger growth were stimulated by honourable distinction with regard to their productions and inventions; and merit was entitled to distinction as much as bad actions and bad work were deserving of censure. He thought it very possible that the method of giving prizes might be improved. It might not be right to give a medal to be used as a sort of advertisement. Rewards might be given in some other form; but that was a question to be considered apart from that which was now under discussion. The next question would be whom they were to have for judges; he thought gentlemen who were themselves exhibitors ought not to be judges of the productions of other exhibitors. He did not say that an honest man would not lay aside all considerations of friendship; but still, an exhibitor, knowing that others in the same class had personal friends amongst the jurors, might have some fear that a strictly impartial judgment might not be passed. He would have persons for judges who were not themselves exhibitors. Then came the question upon what principle were they to judge? Was it for novelty, or style, or cheapness? The merit did not consist in the mere invention alone, but in producing the greatest amount of usefulness to the public at the least possible cost. He thought they were indebted to Mr. Sydney for bringing so important a question under their consideration. He was of opinion that they should maintain an order of merit or prizes, but that these should be given in less numbers, so as to make them more valuable to their possessors.

(To be concluded next week.)

Foreign and Colonial Jottings.—A daily direct train service commenced, on Tuesday, between Berlin and St. Petersburg. A through train is also about to be established daily between Paris and St. Petersburg! The first section of the line from Moscow to Saratov, which has cost some £1,600,000, will be opened in August. When this line is completed railway communication will be established between the Neva and the Lower Volga; or from the north-east to the south-east of the vast Russian empire.—The Belgian iron trade continues active. English and Belgian pig is coming into greatly increased consumption in France, the imports in the first three months of this year having amounted to 45,786 tons, as compared with 16,425 tons in the corresponding quarter of 1861.—A third section of forty-seven miles has just been opened on the Northern of Spain Railway, from Miranda to Alsasua; and a fourth, comprising forty-five miles more, from Miranda to Quintanapalla, will be ready by the 1st of June. Towards the end of the year the small section from San Chridian to Avela will be completed.

Certificated Engineers for Steamships.—The Merchant Shipping Acts and Amendment Bill, as amended in Committee, has just been published. The fourth section enacts that every steamship required to have a master possessing a certificate from the Board of Trade shall also have an engineer or engineers possessing a certificate from the Board of Trade. There are to be first-class and second-class engineers' certificates. Every foreign-going steamship of 100-horse power, or upwards, is to have two certificated engineers, one having a first-class, the other a second-class certificate. Foreign-going steamers of less than 100-horse power are to have an engineer having a second-class certificate, a regulation which applies also to every sea-going home-trade passenger ship. Every person having engaged to serve as engineer, without being at the time possessed of such certificate as is required, and every person who employs any one in such capacity, without ascertaining that he is entitled to and possessed of a certificate, will incur for each offence a penalty not exceeding £50. The Board of Trade will under this Act cause examinations to be held from time to time of persons desirous of obtaining certificates of competency as engineers; the board to lay down rules as to the qualifications of applicants as they may deem fit. To every applicant who is reported to have passed the examination satisfactorily, and given evidence of his sobriety, experience, ability, and general good conduct on board ship, the Board of Trade will deliver a certificate of competency as chief-engineer, or assistant-engineer, as the case may be. Certificates of service as engineers, differing in form from the above, will likewise be granted, and every person who before 1st April, 1862, has served as first engineer in any foreign-going steamship of 100 horses' power, or who has attained the rank of engineer in the service of her Majesty, or of the East India Company, shall be entitled to a first-class certificate; also, every person, who before the date mentioned has served as second engineer in a foreign-going steamer of 100 horses' power, or as first or only engineer in any other steamship, shall be entitled to a second-class certificate. The fees to be charged on examination of engineers, under the authority of the Board of Trade, are for a first-class certificate, £2; for a second-class certificate, £1.

Merryweather and Son's Patent Steam Fire Engines.—Mention was made in our pages, a short time since, that Messrs. Merryweather and Son, of Long-acre, were building a steam fire engine of great promise, for which they had obtained letters patent. This machine is now completed for the International Exhibition, and the preliminary trials that have taken place are highly satisfactory, the results being such as will fully sustain the reputation of this, the oldest fire engine manufactory in the kingdom. The carriage, which is of a novel form, combining as much lightness as is compatible with the required strength; the wheels are large, to facilitate rapid transit; the springs are of the very best description, and the framework of the carriage is pivoted on the fore carriage, to avoid all possibility of straining from unevenness of the road. Between the hinder wheels is placed the boiler, made of steel,* with copper tubes arranged upon the circulating principle, and so perfectly has this principle been carried out that steam of 40 lb. pressure has been generated from cold water in nine minutes. The steam cylinder, which is direct-acting, is 9in. in diameter, with 15in. stroke, working a patent double-acting pump, 6½in. in diameter. The piston carries an oil chamber, which lubricates the pump barrel at every stroke, and, passing beyond the ends of the cylinder, completely empty it, so that any grit or other foreign substances that may be drawn up with the water are at once ejected; the suction and delivery valves are all placed in easily accessible valve chambers beneath the pump barrel. The mode of working the slide valve is novel and ingenious, permitting any required speed, from 1 to 150 double strokes per minute to be obtained at pleasure without the use of any fly-wheel. The prevalence of wind has of late been very unfavourable for trials of fire engines; however, with single jet of 1¼in., 1⅜in., and 1½in., most satisfactory results have been obtained. The latter jet, held at an angle of about 35° was projected over an intervening building, to a horizontal distance of 216ft.; the engine lifting by suction 14ft. perpendicular, and half a gale of wind blowing dead against the jet. Such a performance has never before been achieved in this or any other country.—*Mechanics' Magazine.*

* Bessemer Steel.—Ed. E.

Harbours of Refuge.—The annual return showing the progress of works and harbours of refuge has been issued. At Dover, where £500,000 has been laid out, and a vote of £50,000 is to be taken this year, to be followed by £100,000 more in future years, the length of the pier founded is now 1,573ft., and 1,390ft. have been completed to the quay level. The South-Eastern Railway is now carried on to the pier. At Alderney, 1,220 yards of sea wall and 1,226 of harbour wall of the western breakwater are complete except the coping, and the promenade wall is ready for the coping for a length of 1,217 yards from the shore; the base of the breakwater extends 1,636 yards from the shore. From 500 to 700 men are kept employed at this work, for which there has been voted £937,000, the total estimate being £1,300,000. Of the breakwater at Portland which is to shelter 2,130 acres of the bay, the centre of the north head is 8,512ft. from the shore, and the depth of water 9½ fathoms at low water of spring tides. During the heavy gales of February and March many vessels took refuge within this harbour, some from 600 to 1,200 tons burden, and from 110 to 120 vessels remained in harbour for some days. The votes already passed for the works at Portland amount to £973,000; the total estimate exceeds £1,000,000. Upwards of £5,000,000 tons of rough stone have been deposited since the commencement of the work.

This Year's Export Trade.—In the first quarter of the current year the shipments of pig iron increased from 62,400 tons last year to 87,667; bar, bolt, and rod iron from 53,063 to 59,579 tons; cast iron from 10,556 to 11,638 tons; hoop, sheet, and boiler-plate iron from 15,385 to 16,800 tons; wrought-iron of all sorts from 19,097 to 21,786 tons; and unwrought steel from 5,251 to 5,284 tons; but railway iron of all sorts has fallen off from 605,782 to 482,530 tons, and iron wire (except telegraphic wire) from 3,625 to 1,629 tons. France has been our best customer this year, for pig and bar iron; Spain for railroad iron; Australia for cast and wrought iron; and the United States for hoop, sheet, and boiler-plate iron, and unwrought steel. The exports of lead increased from 3,967 to 4,716 as compared with last year, but seed oils have fallen off from 2,114,676 to 1,538,945 gallons; painter's colours from £101,120 to £92,307. Of machinery (other than steam engines) the value exported this year has been £431,826 against £540,978 in 1861, and £489,988 in 1860, but in steam engines the increase has been considerable. Telegraphic wire and apparatus show an extraordinary increase, viz., from £24,362 in 1860, and £3,408 in 1861, to £95,884 this year. The total value of our exports during the first quarter of the year was in round numbers, in 1860, thirty millions, in 1861 twenty-seven millions, and in 1862 twenty-six millions.

A Banquet in a Sewer.—On Monday afternoon, at the invitation of Mr. W. Webster, the contractor for carrying out that portion of the metropolitan main drainage from Deptford to the outfall at Erith, the members of the Greenwich District Board of Works, and about 500 inhabitants of the locality, proceeded to inspect the line of sewer previous to its being handed over to the Metropolitan Board. About twelve o'clock the company assembled in front of St. Alphage Church, Greenwich, the band of the Volunteer Rifles being in attendance; and the descent, which occupied some time, having been accomplished by means of a long ladder, a novel scene was presented. The immense archway of brickwork, the radius of which is struck from a centre of 5ft. 9in., giving 11ft. 6in. in the clear, or diameter, and of circular form, had been provided with a temporary floor for a distance of about one mile, and was lighted on both sides with lamps. The refreshment tables were abundantly supplied. The most interesting portion of the proceedings was the presentation of a testimonial from the inhabitants of Greenwich to Mr. Webster. The chair was occupied by Mr. Bristow, M.P., who presented the address to Mr. Webster, and observed that the sewer in which the large number before him were then assembled was, in his opinion, one of the greatest engineering works of modern times. A similar testimonial was presented to Mr. Jennings, agent to the contractor, who acknowledged the same in suitable terms. Several toasts were duly honoured and addresses delivered, and after remaining underground about two hours the company ascended.—*Express.*

Gigantic Canals in India.—From Calcutta we learn that, in anticipation of the future extensive cultivation of cotton in British India, it is intended to form a number of canals for the irrigation of the districts adapted to the growth of the plant. The general scheme, proposed by Colonel Dickens, under the sanction of the Government, consists in the construction of two main canals leading from a dam, to be fed by the river Soane. These will extend in opposite directions to a distance of ten or twelve miles, when they will branch off into two fan-like systems of irrigation channels, extending on one side to the Kurumnassa and Ganges, and on the other to the Poon Poon and Ganges. There will also be navigation channels for facilitating the transmission of the crops to Benares, to the mouth of the Kuramnassa, to Arrah, and to Patna. The aggregate dimensions will be 681 miles of irrigation, and 145 of navigation channels, or in all 826 miles. Through these water will flow at a speed of two miles per hour, whilst the supply will yield 3,124 cubic feet per second. The dam is proposed to be formed on the plan of the Madras Delta Works. The chief difference consisting in the depth of the undersunk foundations, which Colonel Dickens in his plan suggests, namely, two rows of blocks, 20ft. each in depth, whereas the wells at Madras range from 7ft. to 9ft. only. The principal impediment to the carrying out of the works is their enormous probable cost. The colonel, however, has entered into lengthy calculations to prove that the outlay would be amply compensated for by the enhanced productiveness of the land to be irrigated, and it is likely that a portion, at least, of the scheme will soon be commenced. As to its complete fulfilment we apprehend that that will depend much upon the future phases which the civil war in America may exhibit. The present condition of our own manufacturing districts should plead eloquently for the increased growth of cotton in India, and we should imagine that Lord Elgin could not more worthily inaugurate his succession to the Governor-Generalship than by paying immediate and practical attention to the momentous subject.—*Mechanics' Magazine.*

The traffic receipts of railways in the United Kingdom amounted for the week ending the 26th of April, on 10,165 miles, to £526,280, and for the corresponding week of last year, on 9,911 miles, to £519,510, showing an increase of 254 miles and of £6,770 in the receipts. The gross receipts on the following fourteen railways amounted, in the aggregate, on 6,618 miles, to £403,882; and for the corresponding week of 1861, on 6,458 miles, to £399,882, showing an increase of 160 miles and of £4,000. The increase on the Eastern Counties Railway amounted to £1,722; on the Great Northern to £324; on the Great Southern and Western to £164; on the Great Western to £2,375; on the London and North-Western to £1,332; on the London, Brighton, and South Coast to £7,057; on the London and South-Western to £1,810; on the North British to £3; and on the South-Eastern to £1,136—total, £15,923. But from this must be deducted £323, the decrease on the Caledonian; £2,805 on the Lancashire and Yorkshire; £2,472 on the Manchester, Sheffield, and Lincolnshire; £1,587 on the Midland; and £4,736 on the North-Eastern—together £11,923, leaving the increase, as above, £4,000. The goods and mineral traffic on those lines amounted to £198,739, and for the corresponding week of 1861 to £217,903, showing a decrease of £19,164. The receipts for passengers, parcels, &c., amounted to £205,143, against £181,979, showing an increase of £23,164. The traffic receipts on 66 other lines amounted, on 3,547 miles, to £122,398, and for the corresponding week of last year, on 3,453 miles, to £119,628, showing an increase of 94 miles and of £2,770 in the receipts. The falling off in the goods traffic of the past week, as compared with the corresponding period of 1861, is considerable on the great lines, chiefly in consequence of the depression of trade in the manufacturing districts, but this falling off has been more than counterbalanced by the great increase in the passenger traffic in consequence of it being Easter week, and perhaps also of preparations for the International Exhibition. The traffic receipts of the past week show an increase of £7,796 as compared with those of the preceding week ending the 19th of April.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

NOTES ON CALORIFIC PHENOMENA.

By J. C. DYER, Esq.

BY assuming the materiality of heat many phenomena may be accounted for which have not yet received any solution on the opposite hypothesis or dynamical theory of heat. The purpose of these notes is to explain some of these, as depending on the entity of such an element and its agency in Nature's physical laws.

The essences of matter, the number of, and the minutest forms in which it exists, are wholly unknown to us. Its properties, and many of its mutations, have appeared so striking and uniform in phenomena that some of the "laws of physics" have been deduced therefrom, whilst other assumed laws, on which conflicting "theories" are based, remain as questions of inquiry among physicists, to account for ascertained facts.

It is very difficult, if not impossible, to afford clear explanations of the actual succession of observed effects and their proximate causes, these being reciprocally so numerous, and often so obscurely disclosed, even by the best conducted experiments, or inductively, by any theories that have been proposed.

The difficulty of solving physical questions ought not to prevent the attempt to throw some light upon them, even though it may fall short of affording settled conclusions.

We have clear evidences that matter in the aggregate, consists of two classes or sorts, viz., "ponderable," and "imponderable;" each of these are known to us under their observed conditions. The word gravity denotes the former class, so far as we can conceive its existence, for it is its sensible properties of weight or measure by which we can in any wise be assured of the existence of matter pertaining to this class. We infer the existence of the latter class from the known action and reaction between it and ponderable substances.

The most subtle conditions of ponderable matter known to us are, 1, those of the permanent gases; 2, vapours from liquids and other vaporised bodies; 3, solutions of colouring matters; and 4, emanations from odoriferous substances; the minute divisions of the last cannot be shown by any test of weight or measure, nor can they be defined even in imagination.

Although so much obscurity surrounds our inquiries concerning ponderable matter, our real knowledge of imponderable matter is involved in still greater darkness, and this dearth of knowledge concerning its nature is evidenced by the fact that three or four imponderable elements are assumed to exist and to pervade space; thus implying the existence of several of these elements, as filling the same place at the same time—an evident contradiction. Take as examples the assumed distinct elements of the electric and the magnetic fluids, and these subdivided into the negative and positive of the former and the opposite poles of the latter; then the luminous element, as subdivided into three primitive colours, besides that of common light. Then again, we have to deal with the something or nothing known to us as heat, or the calorific element. That this element, whatever may be its essence, is intimately connected with, and constitutes a portion of, each of the three other assumed elements, is abundantly proved in phenomena connected with their several mutations. To explain this connection many theories have been advanced, yet not one of them can, in our present state of knowledge, be accepted as settling the points in question. Continuing, then, to adhere to my own views of the subject, I shall proceed to set forth, as shortly as I can, the grounds of my theory of heat (as advanced and elucidated in the papers formerly read here). This theory assumes the existence of only one imponderable element, and that one the calorific, or, for shortness, heat.

In my use of the word heat it must not be taken as signifying sensible or thermometric heat only; to which sense it has been restricted by all writers on calorific phenomena, excepting those who recognise its latent state (after Dr. Black), which, implying its materiality, is disallowed by the "force-heat" advocates.

I define heat, then, to be, first, the one imponderable element that pervades matter and space throughout the universe; that, when not disturbed by chemical or mechanical forces, it is quiescent, and everywhere equally diffused; and therefore it is imponderable, or does not possess weight, because there is no central position void of or towards which this element can be drawn or gravitate; while all other bodies are impelled, by the force of gravitation in them, towards each other, and towards a common centre in the universe. The elasticity, or mutual repulsions of such bodies, is solely due to the elemental heat that pervades them—heat being, in fact, the source of elasticity, and, therefore, the eccentric force in counteracting the centralising force of gravitation. Besides this first elemental state of heat, it passes into three other conditions, exhibited in phenomena. These are, second, latent, or specific heat, when it is chemically combined with other bodies, and is not indicated or measurable by the thermometer. Third, sensible heat, which is so measurable because it is an active agent that enters into, and causes bodies to expand in bulk, and ultimately to pass from the solid to the liquid, and thence to the aeriform state, and this, by reason of its successive accumulations in that state, between the particles of bodies. And, fourth, radiating heat, which is merely its transit or flight from one body to another, the one having sensible heat in excess of the other.

I have stated these four conditions of heat to prevent misconception of my meaning when adducing the mutations of the first, or elemental state, as an agent in nature for producing the changes connected with electricity, magnetism, with light and colour, and with the entire range of meteorological phenomena, and therefore inferring the non-existence of any other imponderable element. The terms electricity, magnetism, and light serving merely to point out the phenomena attending the changes of elemental heat brought about by chemical and mechanical forces.

To give a clear view of calorific action and reaction through the range of "Nature's laboratory" would demand a treatise to embrace the general elements of physics: a task far beyond any purpose aimed at in this paper; its object being merely to state my views concerning the nature of heat, its mutations, and agency in phenomena, open to common observation. To this end a few of the striking cases of such agency will suffice.

Considering heat, then, as a material element that undergoes continual and reciprocal changes from one to the other of its conditions, we may thence account for most of the "electrical," "magnetical," and "optical" phenomena which are usually ascribed to the presence in space of three distinct elements, seemingly absurd.

The agency of heat is called into action both by chemical and mechanical forces, to be after noticed. When the elemental heat has its equilibrium disturbed either by rendering it redundant or deficient in any part of space, it will move with more or less energy to restore a quiescent state. Whenever the motion is extensive and potent the element itself becomes luminous, or acts upon the sense of vision. To cite one case from mechanical action: take the passage of the earth in her orbit; this will compress the element on the forward side, and it will rush past back into her wake. The movement thus produced will render the element visible, as in the phenomena of flashes, coruscations, ground lightning, and other luminous appearances witnessed at the places and seasons within the visible range of the earth.

It has been said that the existence of such subtle medium in space is disproved by the uniform periodic revolutions of the planets, which any retarding force would alter. This objection, however, will not hold in the case adduced. To answer it we must take into view that the disturbed element will react with a force just equal to the disturbing one—the velocity of the elemental movement—that of light being the measure, and its perfect elasticity being duly estimated, we may see that the sum of the disturbing force will be balanced by the instant return or recoil of the element, so that any retarding action upon the planet will be compensated by the general movement of the element along the orbitual zone.* To realise the instant "action and reaction" of this medium, when so displaced by the planet, we must keep in view that its velocity is to the latter far greater than planetary motion is to the most rapid movements known to us on earth.

I pass from mechanical to chemical action, in which the calorific element is united with, and separated from, other bodies. The natural combinations of heat with water may be taken as at once the most extensive and the most familiar case known to us for explaining the action of heat by its mutations. By the melting of ice, and by the evaporation of water, sensible heat is absorbed by the water and steam produced = about 140 deg. and 960 deg. Fah. respectively, thus giving the "specific heat" in them = 1,100 deg.; this being in excess of the 212 deg. thermometric heat required to raise the vapour under the atmosphere. When this vapour returns to water and to ice the entire amount of heat absorbed (both specific and sensible) is given out, and is measured by the thermometer, when water is employed to receive the heat. But when the vapour is condensed in the upper air, where the temperature is at or near the freezing point, the heat there given out does not become sensible, seeing that "perpetual frost reigns" in those high regions, as is evidenced by the ice-capped Alps below the upper stratum of clouds.

The question, then, as to what becomes of the heat thus continually ascending, given out, and disappearing, should receive a solution, which I offer thus:—"It follows that the entire amount of the calorific element absorbed in raising aqueous vapour is successively liberated in the higher regions of the atmosphere, and there becomes elemental heat, or what we call 'the electric fluid.'"†

To form a just estimate of the mutations of heat, and of its agency in electrical phenomena, we must take into view the immense scale‡ upon which vapour is continually ascending, and the vast sum of heat thus given out in the upper regions of the clouds, and over these the liberated heat, renders the element redundant, thus generating the movements of greater or less energy witnessed in the phenomena of lightning and other electrical movements. During the usual rate of evaporation, in the cooler and rainy seasons, the latent heat ascending in the vapour, and being converted into the elemental state, renders this redundant, and gives rise to the transition motions indicated by its degree of intensity, and known as the positive and negative electricity in the atmosphere. By such c[on]tinual accumulations of elemental heat in the higher regions its equilibrium is destroyed, making it in excess of its quiescent condition in space, and thus generating the movements from one to the other of these conditions.

The flux and reflux of this element, from and towards the earth, corresponds with the rates of evaporation, and undergo the diurnal changes accordingly. We may thus perceive the cause of most of the "electrical states of the atmosphere" that are invisible. But in hot summer weather, when evaporation proceeds with great rapidity, and over a large extent of surface, the air becomes saturated with vapour, when a slight depression of temperature will cause rain-clouds to form in rapid succession, and their liberated heat, becoming elemental by such large and sudden accessions, will rush forth in streams or flashes, as in lightning from thunderstorms. These movements of elemental heat are towards the earth, or into some intervening clouds, where it again becomes absorbed as latent or sensible heat. Thus the order of calorific mutations, before stated, will account for both kinds of electrical phenomena, the invisible shown by the electrometer, and the lightning from thunder clouds.

The limits of this paper forbid my entering upon the wide field of artificial electricity, or upon phenomena connected with volcanic eruptions and earthquakes, having before noticed these latter, and shown the identity of the electrical and the calorific element.‖

That electricity and magnetism are but diverse actions of one element has been established beyond question, and that this is "elemental heat" admits of being established by fair induction from observed phenomena.

I may here observe, to prevent misconception of my theory of heat, that "the etherial medium pervading space," as formerly assumed by some physicists, is in no respect analogous to the elemental heat assumed by me, nor to the agency I assign to the latter.

Apart from the vivid movements, generated by the orbitual passage of the earth, through the elemental medium, as before noticed, those caused by her diurnal rotation, through the same medium, come next to be considered, in order to see how far the calorific motions, excited by rotative action may coincide and be identical with the atmospherical magnetic currents indicated by the compass. The moving force exerted by diurnal rotation is feeble, and its effects but slight, compared with that displayed along its orbit, in proportion to the vast difference of velocity in the two cases; the motions generated are, therefore, widely different. Those produced by the surface action diminish, of course, continually, from the low to the high latitudes, with the decreasing speeds of the surface, and become *nil* at the poles.

This surface action, then, must generate continuous currents from the equator towards the poles, where the calorific element will accumulate, and be in excess of its quiescent state in space. By reason of such redundance, in the high latitudes, it will descend in luminous flashes or streams, and constitute the auroras, and other faint corruscations, so often observed in cloudless nights, and in high latitudes. The "magnetic phenomena" in those regions would appear to be no other than direct results of rotative action on the calorific element in the atmosphere.

Another incidental effect may be ascribed to this accumulation of "elemental heat" near the poles. It will there descend and become "sensible heat" in the Polar seas, and account for the fact recorded by Arctic navigators, viz., that the intense cold, during the absence of the sun's heat, does not increase beyond 75 deg. of North latitude, but rather seems to be mitigated, and the sea becomes more open thence to the highest latitude attained—about 82 deg.

The ordinary magnetic currents indicated by the variations of the needle appear, in the charts, to follow very irregular curved lines, which seem to be determined in their courses by the varied forms and elevations of the intersecting continents and their mountain ranges, thus varying the rotative action in the same latitudes. For if the ocean surface was continuous, the action of it would be uniform, and the currents produced would be in regular curves due to the impelling forces. The whole of the movements thus pointed out appear to justify the inference that magnetism is simply the mutations of elemental heat in the atmosphere.

The identity of electricity and magnetism being already established, therefore, upon the above inference, it follows that the three, so called, fluids or elements are but so many conditions of elemental heat.

The next question is a far more simple one, that of the identity of light and heat—these being only two names for the same substance. That light is a material element admits of the clearest proofs, both by mechanical and chemical tests. The former is by surface action upon it, in the familiar cases of reflecting, refracting, transmitting, dividing, concentrating, and dispersing its rays, as well as in absorbing in them to increase temperature. Chemical action is shown by the union of light with the surface atoms of bodies, and this appears in the most striking way by photography. It is also proved in all surface colours, as these are simply the fixation of light by its union with the surface atoms of bodies, and the colours depend on the shape of the atoms.

It is needless to cite any more of the numerous cases in which light is known to act upon other bodies chemically, and it is obvious if it was not a material element it could not act at all. Now the evolution of heat attends the absorption of light in all cases; wherefore sensible heat appearing, and light disappearing, clearly shows it to be a change of condition only of the same element. Again, in the colours of the spectrum the temperature increases from the pale to the dark colours, and it rises still higher outside of the coloured rays, showing that invisible or black rays are transmitted, and are a part of the same element as that of the spectrum.

The innumerable instances in which light and heat are united and flow from the same source, both natural and artificial, render it impossible to draw any line of separation, other than such as mark their degrees of intensity, and their mutations from the visible to the invisible, and *vice versa*.

I have no purpose at present, except to offer such evidences as appear to establish the identity of all imponderable matter with that of a pervading calorific element; and to show that by its mutations the classes of phenomena commonly ascribed to a plurality of such elements may be rationally explained by the agency of this one element. The subject, however, if treated in all of its bearings, would require far more labour than I can bestow on it, and a more extended knowledge of Nature's laws than I can pretend to have; so I invite more able inquirers to offer solutions of the questions raised, which cannot but be of interest to the progress of natural philosophy.

So many discordant views have appeared on the nature of heat and force, and on their connection in the order of cause and effect, that it would be rash to pronounce any theory yet advanced as having clearly solved the many questions raised concerning them—for example, how does heat act in forming steam? The usual reply, on the latent heat doctrine, is that it unites with and becomes specific in the water, and is thus a necessary constituent of aqueous vapour; and by this chemical union the vapour expands into about 1,700 times the bulk of water. By some writers steam is held to consist of the severed atoms of water, repelled from each other by atmospheres of heat, so as to fill the enlarged space due to them. This latter view is said to rest on the atomic theory of Dalton. Again, steam is held to be the product of force, and that heat is not the cause, but the effect, of the force that converts water into an elastic vapour, and, therefore, that heat has no material existence in Nature's laws.

I shall offer no opinion on these diverse views at present, having in former papers adduced so many cases that appear to me fatal to the dynamical theory of heat, and which have received no refutation or reply from the supporters of that theory.

I may here notice an objection, taken some twenty years ago, by Professor Faraday, to the atomic theory of Dalton; but that theory was not quite fairly put by him. By assuming the atmospheres of heat to be elastic, and the globular atoms hard, the former would yield to force, and the latter come into contact, and so form absolute solidity not in nature. When that essay appeared, I read, before the society, a short reply to it: thus, that Dalton's theory had sole reference to the chemical composition of bodies, all being in definite proportions of the constituent elements—that his atoms were figured merely to afford visible illustrations of the principle of combinations in the proportions shown by his experiments; that if we took the ultimate atoms of all ponderable matter, as being in themselves elastic, because of the heat that pervades them, the professor's objection entirely fails. For whatever degree of subdivision may be assigned to matter, if the minutest parts or atoms are perfectly elastic, it is clear that any compressing force applied will merely compress them into smaller spaces, with increasing elastic tension, always balancing the compressing force, and this is the ascertained case in all trials, since no substance has yet been found inelastic. For, as before said, "all kinds of matter, in their minute parts, are pervaded by the calorific element or expanding power throughout the universe.

The several cases formerly adduced as opposed to the force heat doctrine may, as before mentioned, stand on their own grounds, without further notice here. But it will not be amiss to glance at some recent assumptions made to rest on that doctrine. For instance, an eminent philosopher, F.R.S., &c., in giving an account of his interesting experiments on gases and vapours, in relation to their capacities for absorbing and giving out heat, lately read at the Royal Institution, explained the cases cited, by calling the heat evolved dynamical heat; but he gave no proofs of force being the source of the sensible heat shown. If the report of his lecture be correctly given, the force heat doctrine is illustrated in the cases following, viz.:—

When air enters a vacuum, it is heated by the stopping of its motion; when a vessel containing air is exhausted, chilling is produced by the application of a portion of the heat of the air to generate *vis viva*. Let us call the heating, in the first case, dynamical heating, and the chilling, in the second case, dynamical chilling. Let us further call the radiation of a gas, which has been heated, dynamical dynamic radiation, and the absorption of gas which has been chilled, dynamical dynamic absorption.

If the professor's words are correctly reported,* such are his views concerning the source of heat and cause of its disappearance, in the experiments in which air is compressed and expanded.

The Greek terms, so applied, convey no distinct idea as to how the heating and cooling is brought about, in the two cases given. Let us see how the plain English synonyms will serve to explain these cases, by saying that forcible force makes the heat sensible in the air, and forcible force expels it and chills the air! No light is cast upon the source of heat, by using the terms absorption and radiation to express the fact of its increase and decrease in a given bulk of air or vapour. The acts of absorbing and radiating imply the presence of matter to enter into and shoot forth from the heated and cooled bodies; so that, after all, it is the increments and decrements of a material element constituting the heat and cold in the air.

The fact that sensible heat appears and disappears in a volume of air, when by external force it is compressed, and by that of its elasticity it is expanded, admits of simple explanations on the doctrine of the specific heat in air. In these cases the heating and chilling is due to the transition of the heat in the air from the specific to the sensible state, and from the latter to the former state, so as in each case to maintain the amount of specific heat due to the varying density of the same bulk of air.

When air enters an exhausted vessel its momentum will, for the instant, slightly compress it, by striking against the sides of the containing vessel, and thus both its tension and temperature will be increased above the external air. Besides this cause of heating, the heat due to the partially vacuous space will be added to that entering with the air, and so plainly account for the heating, without calling upon the dynamics at all in the matter.

As to the cooling of air by expanding its volume, it seems odd to say that a portion of its heat serves to chill it, and thus to generate *vis viva*. It is its elasticity that does this, and the chilling is because of the sensible heat becoming specific heat in the enlarged space filled by the diminished quantity of air in it. It would appear childish to insist on explanations so familiar to all, but for the fact of such an imposing form having been given to those simple cases by an eminent professor.

Again, let us look at his case of radiating heat. This, too, is

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* The action and reaction of an elastic elemental medium upon the passage of a planet will both retard and accelerate its passage by balanced forces, thus:—Taking the inertial tangential force, as coerced by its force of gravity, into the curve of its orbit as 365; then, if the retarding action equal 1-365th, and the accelerated action of the generated current of the medium also equals 1 365th, then the periodical revolution will remain unchanged. And whatever may be the sum of these two opposite forces the result will be the same. Suppose any constant force equal to impel a vessel at ten miles resisted by any impediment equal one mile, and carried forward by a tide or current of a river equalling one mile, then the actual speed will be constant at ten miles.

† See my "Notes on Heat," in relation to atmospherical phenomena, read 9th February, 1858.

‡ The aggregate amount of vapour raised (= 5,280 millions of tons of water daily from the Mediterranean) is deduced from Dr. Halley's experiments, and stated in my paper on "Physical Force," page 7.

‖ See paper read in February, 1851.

* The more erudite terms, from the Greek, used by the professor, would be quite in place if employed to explain the "laws of physical force," or the action of "moving and statical forces," but when the effects of any kind of force are the subjects of inquiry it seems better to use the plain English words, when they, in fact, serve to convey clear notions of the result of any forcible action; and in the cases cited it seems evident that no elucidation is afforded by the terms therein employed any more than by the substituted English, though perhaps these are not quite synonymous expressions.

"dynamically" brought about. To radiate heat implies the act of its flight or transit from one place to another place in radial lines, from whence it abounds or is in excess. Now, if heat has no material existence in itself, it obviously cannot radiate at all; for if it be a nonentity, there is nothing to go from one place to another place; therefore to deny the existence of the "matter of heat," and yet to say that "it radiates," is a contradiction in terms. Neither can it be said that "physical force" acts to produce or retard motion, except through contacts of matter, of which it is a property, and not a self-existing thing, though the term "force" has of late been extensively employed in the sense of its self-existence, as acting on matter.

The gravitating and elastic properties of matter constitute their statical and moving forces, for ever balancing each other. The former of these forces would consolidate the material universe with "lightning speed" but for the reaction of the latter force. There is no reason why the force of gravity should be measured by the established laws of falling bodies, except that experiment has shown the velocities actually attained by them in vacuo. But this vacuum is the absence of air only, not that of the "elastic medium in space," and it is this that holds the poise of matter throughout illimitable space.

In my former papers I have set forth, at some length, the application of this view of heat to phenomena; and I now take leave of the subject by simply stating their title, and the dates when they were read, namely:—

1. Statement of experiments made in 1842 to find the amount of heat evolved by agitating water, under the atmospheric pressure. The table of results gave only one to two degrees temperature, and proved the heat to be no wise equivalent to the force employed, and time taken to raise it. [The tables left at the society appear to have been lost, and I have no copy of them.]
2. Paper read in February, 1851, "On the nature, and four separate states of heat, or the calorific element."
3. Paper read February, 1853, "On heat, in relation to the atmospherical phenomena, and ocean currents, caused by its mutations."
4. Paper read February, 1856, "Remarks on physical force, as applied to elemental changes."
5. Paper read April, 1856, "Notes on heat, as applied to the force-heat theory."
6. Paper read 11th January, 1859, "Summary of former papers on my theory of heat.
7. Paper read 19th February, 1861, "Notes on freezing, thawing, and evaporation of water, and the condensation of steam, to ascertain the cause of those changes."
8. The paper now read, "On calorific phenomena."

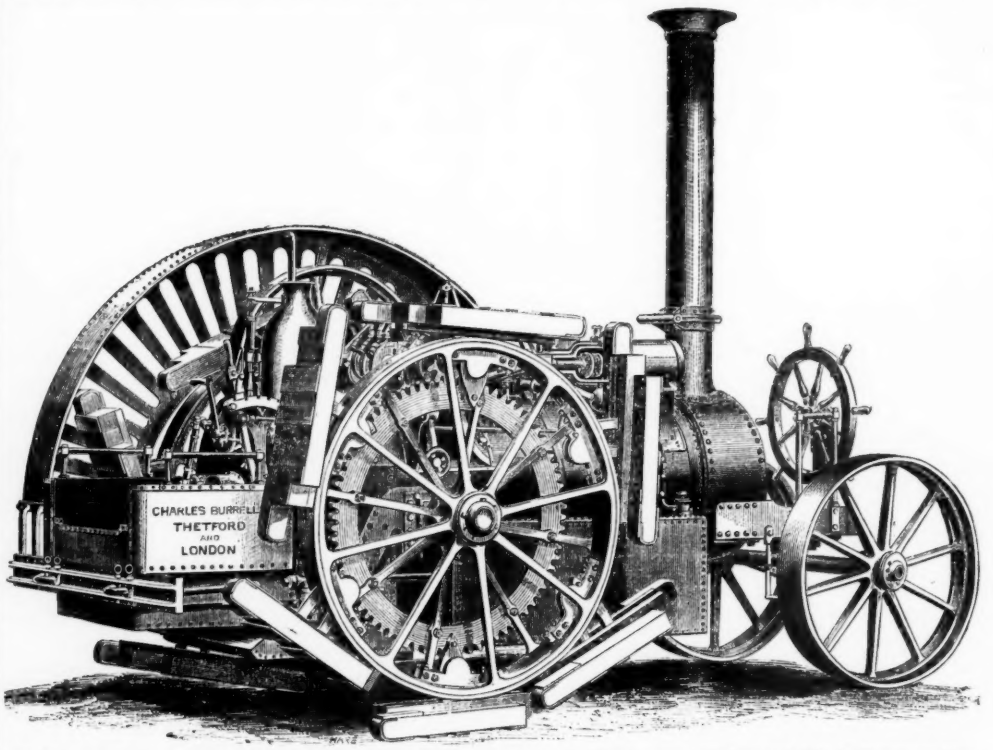
OPTICAL INSTRUMENTS IN THE EXHIBITION.

The Italian makers in this country show some fine instruments, especially in binocular microscopes, as all the profession knew they would; but, on the whole, the English collection of instruments may safely defy competition. Negretti and Zambra exhibit a collection of optical instruments, and the most delicately sensitive self-registering thermometers and barometers. They also show an improved anemometer, which records on a sheet of paper the force, direction, and velocity of the wind at every moment. The Right Hon. Robert Lowe, M.P., is also an exhibitor in this class, showing a curious pair of spectacles which magnify without glass or any other refracting medium. The collection of microscopes is, as we have said, unequalled, and with them Mr. Norman shows a wonderful series of microscopic slides containing minute sections and preparations of almost every conceivable object, animal or vegetable, from sections of the tooth of a lion to the liver or skin of a man, from the lungs of a boa-constrictor to the palate of a toad or the tongue of an alligator. One of the most curious instruments in this extraordinary collection is a machine exhibited by Mr. Peters for microscopic writing, which is infinitely more wonderful than Mr. Whitworth's machine for measuring the millionth of an inch, which excited such astonishment in 1851. With this machine of Mr. Peters it is stated that the words "Matthew Marshall, Bank of England," can be written in the two and a half millionth of an inch in length, and it is actually said that calculations made on this *data* show that the whole Bible can be written twenty-two times in the space of a square inch. We must leave a detailed description of this most extraordinary instrument to another occasion, and content ourselves now with simply saying that the words to be written microscopically are written in pencil, in ordinary characters, on a sheet of paper at the bottom of the instrument. But the pencil with which this is done communicates by a series of levers and gimbals with another minute pencil and tablet at the top, by means of which the ordinary writing of the pencil and the pencil for the microscopic writing both move in unison, though the motion of the latter is so graduated that a stroke of a quarter of an inch at the bottom is only a stroke of a quarter of a millionth of an inch at the top, the shape and character of both marks being nevertheless precisely alike in outline. As a matter of course, the microscopic writing at the top is only visible under powerful magnifiers, and the object of the machine is chiefly to mark bank-notes with certain minute signatures for the prevention of forgery. Such a precaution, no doubt, would prove an effectual stopper on counterfeit notes, if only all tradesmen supplied themselves with microscopes to examine them, just as a little ordinary care would now detect any forgery. Close by this curious instrument is another almost more curious still, with the existence of which the public are already, no doubt, aware from the fines inflicted on musical Savoyards who would play their organs in front of Mr. Babbage's house. This is Mr. Babbage's great calculating machine, which will work quadrations and calculate logarithms up to seven places of figures. It was the account of this invention written by the late Lady Lovelace—Lord Byron's daughter—that led the Messrs. Scheutz, of Stockholm, to improve upon it to such an extent as not only enabled the machine to calculate its tables, but to print its results. This improvement was at once bought up by the English Government, but it is not now shown at the Exhibition, as it is very busy at Somerset House night and day working out annuity and other tables for the Registrar-General. The small and by no means complicated machine of Mr. Babbage is in the gallery, however, and we can only echo the regret expressed by all the many visitors who come to see it that there is no one in attendance to show and explain its mode of working. Near this, also, are exhibited bullion scales, which, when weighted with 3,000 ounces, turn with the addition of a single grain, and scales for chemical experiments which the thousandth of a grain will move. Of course, these latter are under glass cases, as the addition of a sunbeam either way would almost suffice to turn them, and a moment's exposure to dust would instantly throw them out of order. Wheatstone will also show in this class a collection of philosophical and scientific instruments, and, among others, his domestic telegraph in working order.—*Times*.

Coal-Burning Locomotives.—A fact of considerable interest was stated at the annual meeting of the Northern of France Railway Company last week. The consumption of coke, which eight years since amounted to 97 per cent. of the combustible consumed, is now reduced to 31 per cent., and is expected to be still further reduced this year, in consequence of the delivery of some locomotives designed to burn coal only. The consumption of coke has also fallen off on the other French railways, so much so, indeed, that the Northern has carried much less coke to Paris of late. The Northern has now got some engines capable of drawing 600 tons.

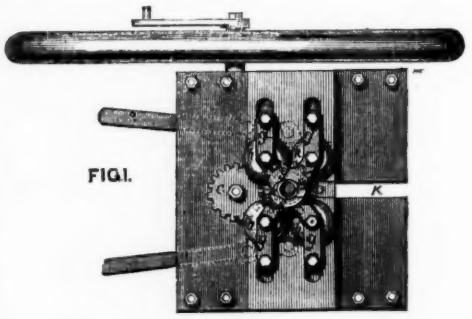
The sum which the Admiralty have decided on paying Messrs. Westwood, Baillie, and Campbell for building the iron screw steam frigate Resistance, 18, 800-horse power, including the additional fittings and work on board, and not specified in the contract, is £167,850, or rather more than £45 per ton.

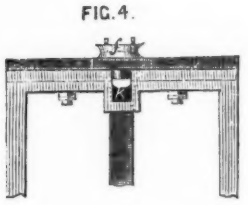
BURRELL'S TRACTION ENGINE WITH BOYDELL'S ENDLESS RAILWAY.

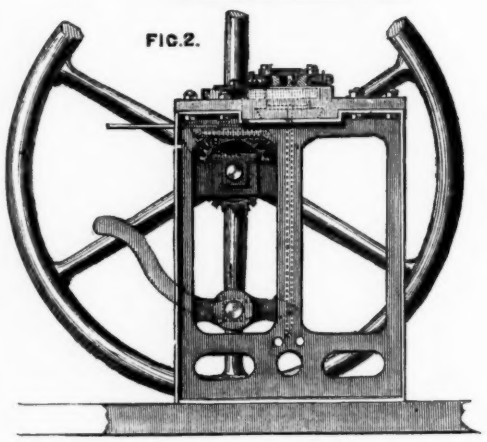


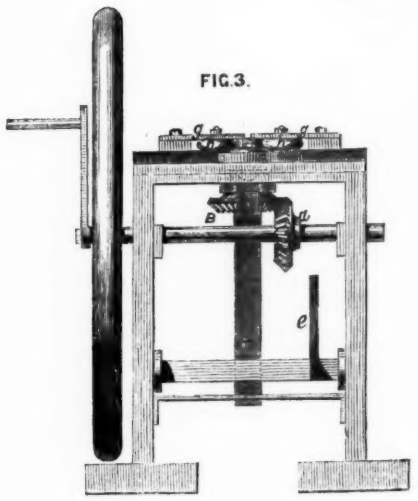
Mr. Charles Burrell, of Thetford, exhibits in Class 9, (Eastern annexe), of the International Exhibition, a traction engine fitted with the well-known endless railway of the late Mr. Boydell. In many respects it is an improvement upon the earlier engines of this class. It is rated as of 10 nominal horse-power and weighs 7 tons, whereas those originally made of the same power weighed from 9 to 10 tons. There are two cylinders, each 6½in. in diameter and for 12in. stroke, the gearing being in the proportion of 10 to 79, or 1 to 8 nearly. The gearing is of wrought iron, case hardened. At the ordinary speed of four miles an hour, the engine will take 20 tons on a level or 10 tons on an incline of 1 in 20. The workmanship is apparently of a very superior quality.

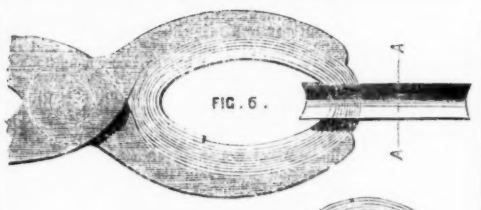
HOWELL'S CHAINS AND CHAIN CABLES.

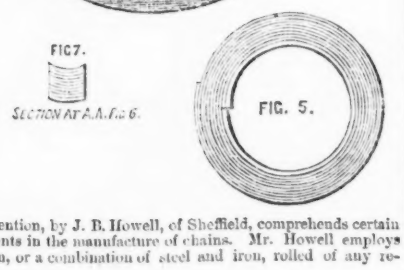










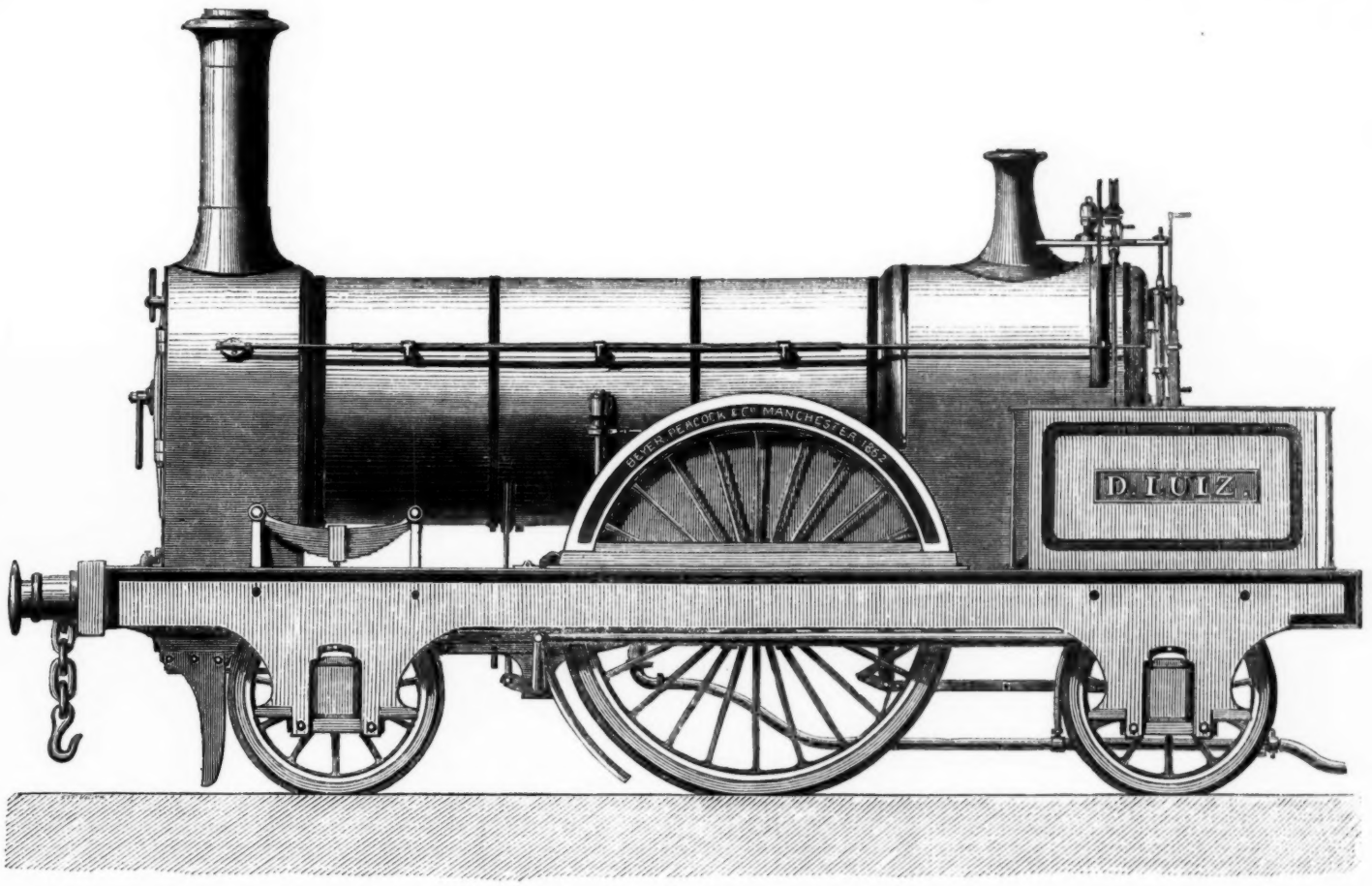


SECTION AT A.A. Fig 6.

This invention, by J. B. Howell, of Sheffield, comprehends certain improvements in the manufacture of chains. Mr. Howell employs steel or iron, or a combination of steel and iron, rolled of any required thickness and breadth, with one face concave and the other convex. The metal so rolled is formed into links of such shape as may be required by coiling the strips of metal around a core or centre which corresponds with the interior of the link to be made, and towards which the convex surface of the metal is placed. Two, three, four, or more coils are lapped continuously the one on the other, the convex surface bedding into the corresponding concave surface. For this purpose the metal bar or strip is heated in a suitable furnace to a welding heat, and while so heated it is wound up on the core or centre before mentioned, which welds it throughout as it is being coiled up, pressure by a suitable bar or part being exerted at the point of contact and welding, to ensure the uniting of the metal. To further ensure and improve the union of the coils or lamina of the link, a current or blast of air is made to impinge on the point of contact and union of welding of the metal, which has the effect of increasing the heat of the iron, and removing any oxide or scale formed on the uniting surfaces. One link is turned within the other by placing the made link partially within the core or form on which the link is to be made, a recess being cut therein for that purpose, which, with its wheel for actuating it, is made in two parts, hinged together to separate and receive the links; this, together with any made chain with which it may be in connection, remains stationary, while the new link rotates with the mandril or centre in process of manufacture.

Fig. 1 shows a plan, Fig. 2 a side elevation, Fig. 3 a front elevation, and Fig. 4 an end elevation of a machine constructed for making chains according to the invention. The motive power is applied to a fly

BEYER, PEACOCK, AND CO.'S LOCOMOTIVE IN THE EXHIBITION.



or driving wheel, on the axis of which is fixed a bevel friction wheel *a*; the rotation of this wheel, which acts on a similar wheel B attached to a vertical shaft, actuates the cog wheel C, and causes the wheel D to revolve at such a rate of speed as may be desired. The wheel D, formed with a cylindrical hole in the centre, fits and revolves on a hollow stud *x*, fitted on a bed: this stud has a notch cut in one side, coinciding with a slot *k* hereinafter mentioned. The bed slides up and down, and is attached by a connecting rod to the lever *e*, by which the wheel can be thrown into or out of gear at pleasure. A die or mould *f* also formed with a cylindrical opening in the centre is attached to the top of the wheel D. The periphery of this mould is adapted to the inner surface of the chain link, and to admit of the link when wound upon it being removed; it is formed in two thicknesses, see Fig. 4. Both the die or mould *f* and the wheel D are so made as to open or separate in a line across the diameter by a hinged joint in order that a link removed from the mould and reduced to shape may be introduced into the central space, and thus admit of the new link being wound within it upon the mould. Moulds for links of various sizes may be adapted for and used in the same machine. The guards *g*, *g*, are attached to slides movable in parallel slots which regulate their action. To these guards are attached pressure wheels *h*, *h*, which during the process of coiling or building up each link of a chain, rotate with the peripheries acting against the outer surface of the material being operated upon. Such pressure as may be necessary can be applied by means of the levers 2, 2. The strip of iron or steel, or steel and iron combined, is, in the first instance, passed between rolls in the ordinary well-known manner, the rolls being cut and adjusted to produce the required breadth and thickness, with one side convex and the other concave. At the proper heat it is then passed between the wheels *h*, *h*, into a notch in the mouth of the mould *f*, which is then caused to revolve, drawing the metal around it under pressure of the wheels, *h*, *h*, at the same time a continuous blast or jet of air is introduced between the concave and convex surfaces as they come in contact. When the link is wound or built up to the proper thickness, the machine is thrown out of gear, the top of mould *f* taken off, and the new link removed; the mould and wheel D are then opened, and the link and the previous link removed from the interior of the wheel and mould, and the new link inserted (see Fig. 5). The link, if made of a circular form is reduced to the required form or figure between the jaws of a tongs made for the purpose (see Fig. 6), before it is passed in the slit K between the opening in the mould *f* and the wheel D, as before mentioned; another link is then coiled within it, removed, reduced to shape, and placed in the same position to admit of a third link being built up within and attached to it, and so on. This operation is continued until the chain be of the required length.

Fig. 5 represents the coiled link as formed on a circular mandril or form. Instead of making the links circular, as shown, the mould may be of the form of link desired, and which is thereby produced of the shape without further trouble.

Liverpool Coal Trade.—From the coal circular of Messrs. Platt we learn that the quantity of cannel, coal, coke, and patent fuel shipped at Liverpool in April was 43,623 tons, and in the corresponding month of last year 57,121 tons, showing a decrease last month of 13,408 tons. The total shipments from January to April were 182,884 tons; same period of 1861, 188,626 tons — decrease this year, 5,742 tons. The exports of coal coastwise during April were 4,758 tons; same month last year, 8,349 tons — decrease last month, 3,591 tons. Total coastwise from January to April, 1862, 18,311 tons; same period in 1861, 25,899 tons — decrease, 7,588 tons.

Rapid Progress of Steam Cultivation.—A gentleman informs us that he saw, a few days ago, from a spot in the neighbourhood of Sutton Maddock, in this county, no less than five steam cultivators at work on adjoining farms. One was employed by Mr. Thomas Nock; another by Mr. Henry Smith, New House; a third by Mr. Brown, of Brockton; a fourth by Mr. Richard Wilson, of Acleton; and the fifth by Mr. Phillips, of Brockton—this last being the property of Mr. Cooper, of Hilton. Of these, three cultivators were Howards', of Bedford; one Smith's, of Woolston, made by Howards'; and one Robey's, of Lincoln. About six miles away, a sixth steam cultivator (Howards') was at work, on the farm of Mr. Pullen, of Albrighton. These facts illustrate not only the rapid growth of steam culture, but equally the enterprise of the Salopian farmers.—*Staffordshire Advertiser.*

BEYER, PEACOCK, AND CO.'S LOCOMOTIVE IN THE EXHIBITION.

We are enabled to present an illustration of the handsome passenger engine exhibited by Messrs. Beyer, Peacock, and Co., in the International Exhibition. We have already given its general dimensions, but it will be convenient to have them repeated here, viz., 16in. cylinders, 22in. stroke, and 7ft. driving wheels. The leading and trailing wheels are 3ft. 9in. in diameter. The boiler contains 215 tubes 2in. in diameter and 11ft. long, giving the great extent of 1,236 square feet of tube surface. The fire box is correspondingly large, the grate being 4ft. 3in. square, or 18 square feet in area. The engine is for the South-Eastern Railway of Portugal, a line of 5ft. 6in. gauge.

RIFLED CAST IRON SERVICE GUNS.

Mr. Bashley Britten has addressed the following letter to the *Times*, stating the results of the experiments made by Government with a view to test the practicability of improving the efficiency of our existing cast iron guns by rifling them on Mr. Britten's system.

"In consequence of the many cast iron guns which have burst when tried as rifled guns on different plans, it has been thought that they are not strong enough to allow the principle to be applied to them. It has not, however, been sufficiently borne in mind that the failures may not be owing to the weakness of the guns so much as to defects of principle in the methods of rifling and the projectiles employed. In some instances they have failed merely from being overstrained by excessive charges, in many others from the needless wedging or tightening of the shot in the bore. To blame the guns for this is simply absurd. My view has been that any gun may be rifled with advantage without calling upon it to bear any additional strain, and, consequently, if our old guns are safe and serviceable under the old conditions of charge they may be improved by rifling them and altering the charge so as to keep within the limits of their strength.

"The cast iron service guns which have been tried on my plan are as follow:—Two 9-pounders of 17 cwt. were fired 54 rounds in 1855. A 32-pounder of 56 cwt., rifled in 1856, has fired 300 rounds. A 32-pounder of 58 cwt., rifled in 1860, has fired nearly 900 rounds; and a 68-pounder of 95 cwt. has fired 300 rounds. Not one of these guns has shown the least sign of being injured, nor has a single discouraging fact been elicited.

"The service charge which I have proposed and used for the rifled 32-pounder is only 5 lb. of powder, and shells of 48 lb. or 50 lb., and for the 68-pounder 7½ lb. of powder and shells of 90 lb.

"In order to ascertain the probable endurance of the guns with charges like these, two more 32-pounders and two 68-pounders were ordered to be taken indiscriminately from store, and, after being rifled, to be tried to destruction in the bursting cell, using the proposed service charges, and gradually increasing the weight of the projectiles, which of course were to be made on the same principle. The results are as follow:—

"32-pounder gun, 58 cwt., rifled.—10 rounds, projectiles 48 lb. each; 10 rounds, 72 lb. ditto; 10 rounds, 96 lb. ditto. Not injured.

"32-pounder gun, 58 cwt. rifled.—10 rounds, projectiles 48 lb. each; 10 rounds, 72 lb. ditto; 10 rounds, 96 lb. ditto; 10 rounds, 120 lb. ditto; 10 rounds, 144 lb. ditto; 4 rounds, 168 lb. ditto. Burst.

"68-pounder gun, 95 cwt., rifled.—10 rounds, projectiles 90 lb. each; 10 rounds, 135 lb. ditto; 10 rounds, 180 lb. ditto; 10 rounds, 225 lb. ditto; 10 rounds, 270 lb. ditto; 10 rounds, 315 lb. ditto. Burst.

"68-pounder gun, 95 cwt., rifled.—10 rounds, projectiles 90 lb. each; 10 rounds, 135 lb. ditto; 10 rounds, 180 lb. ditto; 10 rounds, 225 lb. ditto; 10 rounds, 270 lb. ditto; 10 rounds, 315 lb. ditto. Not injured.

"In this last gun I introduced a slight alteration to the rifling, which appears to have greatly added to its endurance. From the appearance of the vent inside it will probably stand at least another series of 10 rounds of 355 shot. At present there is not the slightest fissure showing in the gun.

"It now remains for me to show what advantages may be derived from the rifling of these guns if used in the manner proposed. As I cannot attempt to give details of practice I may state fairly, in general terms, that the following points have been established:—

"1. The rifled guns have greater precision at nearly 6,000 yards than they can, as smooth bores, command at less than half that distance. In ten successive shots fired on one occasion, at 5,585 yards' distance, the mean lateral deviation from the line of aim was only 7½ yards.

"2. The projectiles for the rifled guns are shells, either plain or segmental. If plain their capacity for bursting charge is nearly four times as great as that of the round shells. The weight of the rifle projectiles is about 50 per cent. heavier than the round solid shot.

"3. The initial velocity of the 50 lb. shells fired with 5 lb. charges on one-tenth of the weight of projectile has been accurately measured by the select committee, and is reported by them to be rather over 1,209ft. per second. Now the initial velocity of the smaller Armstrong breech-loaders is stated by Sir W. Armstrong himself to be under 1,110ft. per second, while the velocity of the 110-pounder is said to be 1,210ft. The uniform charge of the Armstrong guns is one-eighth of the weight of projectile. At similar degrees of elevation, up to those sufficient to cover a distance of about 4,000 yards, the range of the rifled service cast iron guns, though fired with a smaller proportionate charge of powder, is about the same as that of the new Armstrong guns.

"4. The rifled guns are loaded with the same facility as the smooth-bores. The projectiles are nearly one-eighth of an inch less in diameter than the bore when they are pushed home; but on firing they expand and completely fill the circumference of the bore. No lubrication or extra care of any kind is required in serving the guns.

"5. The rifling I employ consists merely of a few grooves of about one-sixteenth of an inch deep. The rifled guns can therefore be used for firing round shot and large charges when high velocities at short range are required, and when sustained velocities are needed for distant firing the same guns will answer the purpose. From the nature of my rifling the round shot have no more lateral play in the bore than if the guns were smooth; and the trifling increase of windage through the shallow grooves can be compensated for by a slight increase of the usual charge. The very serious importance of this advantage is obvious after the remarkable admission that, after all our improvements, the best plate-breaker yet in the service is our old friend the 68-pounder cast-iron gun.

"6. The estimated cost at the royal gun factories of converting our old guns into rifles on my plan is something under 20s. per gun. The projectiles are not costly, and there is a saving of 50 per cent. in the charge of powder.

"By thus inviting public attention to these facts I would not have it supposed that I am an advocate for cast-iron future guns. On the contrary, I feel that they cannot be made really good rifled guns, for I dare not load them with more than very moderate charges. But is that a reason for leaving them as they are and not improving them? We have a stock, I believe, estimated at about 30,000 of them. The hopeful contractors for new guns no doubt would like to replace them all speedily. The necessity for this is greater so long as the old guns are kept in an inferior state of efficiency. But as we have this large stock on hand, and must for a long while at all events be mainly dependent upon them, is it not well to do our utmost to improve them if it may be done easily and at little expense?"

Explosion of a Locomotive Boiler.—On Monday morning shortly after two o'clock, a very sad accident took place on the London and North-Western Railway, at Harrow. A goods train had just arrived at the station, drawn by one of Fairbairn's heavy goods engines, and was pulling up, when the boiler exploded with a fearful noise, blowing the ironwork of the engine to atoms, and killing on the spot Henry Cowdry, the fireman. James Bockwith, the driver of the engine, was tossed high into the air. He had one of his arms broken, and was otherwise so severely injured as to render him incapable of giving any account as to the accident or its probable causes. Mr. Henderson, the locomotive foreman at Camden-town, soon after the news of the occurrence reached London, proceeded to the spot with a view of ascertaining the circumstances which had led to the catastrophe. Up to last night nothing had been ascertained to explain the causes which could have led to so lamentable an occurrence.

MISCELLANEA.

The Great Eastern sailed on Tuesday, for New York.

Mr. Lindsay's motion on Tuesday night to the effect that it was the duty of the Government to carry out the resolution of June 19th, 1860, with respect to harbours of refuge, was lost on a division of 77 to 115.

The London and North-Western proprietors have resolved to lease the Cromford and High Peak Railway, thirty-one miles long, now one of the most primitive channels of communication in the kingdom. The rails are of cast iron, which are, of course, to be replaced with rolled bars.

One of the mortar-vessels selected from the squadron of mortar-boats at Chatham, which were built during the Russian war, is to be immediately prepared for the reception of the trial 150-pounder rifled gun now in course of manufacture by Sir W. Armstrong, in order that some experiments may be made with it upon the iron floating battery Trusty, 14 guns.

The 10½in. Armstrong gun was proved at Shoeburyness on Wednesday week, as a smooth bore. The proof consisted of four rounds—the first with 60 lb. of powder, the second with 70 lb., the third with 80 lb., and the fourth with 90 lb. After the proof further experiments were carried on with the same gun, to ascertain the initial velocities obtained with large charges of different kinds of powder.

The *Times* says that the first of the large plate-bending machines for preparing and bending the armour-plates for the iron steamer Achilles, 50, by means of hydraulic pressure, has been erected at Chatham dockyard, in the factory adjoining the dock in which the iron frigate is building. The plates are to be bent cold. "So great," we are told, "is the force required to effect this that the hydraulic engine can be worked up to a pressure of 2,000 *tons to the square inch!*" A wonderful press indeed!

The plan suggested by Mr. Cunningham, the inventor of the patent topsail for protecting the screws of our ships of war from fouling by the wreck of spars and rigging shot away and falling alongside in action, or from hawsers towing overboard in the vicinity of the screw, was yesterday tested in Weovil Lake, off the Royal Clarence victualling yard, in the presence of several naval officers. The results were most satisfactory, and the invention has been reported upon to the Lords of the Admiralty.

The floating battery Trusty, fitted some time ago with Captain Coles' cupola shield for experimental purposes, has been refitted at Woolwich with the plates, seven in number, which were uninjured in the subsequent trial at Shoeburyness. The shield is again ready for the second trial, and will be fired at from Sir William Armstrong's heavy ordnance. The damaged plates, five in number, have not been replaced, but their vacancies have been filled with oak planks, and the interior of the cupola has been shored up with solid balks of timber, to render the shield as irresistible a target as 4½-in. slabs of wrought iron over a breastwork of oak can possibly supply. In the forthcoming experiments the shield is not intended to revolve, but will be fired at on one side only.

The report of the Madras Railway directors states that they may now congratulate the shareholders on the completion of their main or south-west line, 406 miles in length, from Madras to Beypoor. During the half-year ending the 31st of December last the opening of additional sections increased the mileage of this line under traffic to 271 miles. The 1st of April was fixed for opening 65 miles more, and on the 1st of May it was intended to open the remaining intermediate portion of 70 miles, thus completing the 406 miles from coast to coast. Of the north-west line 27 miles are now open for traffic, and a further opening will take place in the course of the year. During last year 1,124,817 passengers were carried on the company's lines without the occurrence of any accident. The works on the Bangalore branch were proceeding satisfactorily. The capital account shows that £5,020,515 had been received, and £3,192,873 expended, leaving a balance of £1,827,642. The interest account states that £917,126 had been received from the Government for guaranteed interest, and that £93,899 of net revenue had been paid by the company to the Government in reduction of the advances for guaranteed interest.

The following appointments of naval engineers have been made since our last:—D. Langlands, in the Impérieuse, as supernumerary, confirmed as first-class assistant engineer; C. D. Lacy, in the Asia, as supernumerary, confirmed as first-class assistant-engineer; Augustine Kedward and William Strachan, in the Impérieuse, confirmed as second-class assistant-engineers; Hector M. Crocker, acting second-class assistant-engineer, to the Indus, as supernumerary; George Deans, in the Coquette, confirmed as engineer; George Batchelor, acting-engineer, from the Indus to the Fisgard, as supernumerary; E. Williams, in the Coquette, confirmed as second-class assistant-engineer; Holland Harrison, in the Edinburgh, promoted to first-class assistant-engineer; Edward W. Thomas, in the Sheldrake, promoted to first-class assistant-engineer; Charles Platt, in the Marlborough, promoted to first-class assistant-engineer; Charles McKeever, in the Majestic, promoted to first-class assistant-engineer; W. H. Nicholson, in the Narcissus for the Penguin, promoted to first-class assistant-engineer; John Bradbury, in the Dauntless for the Leveret, promoted to first-class assistant-engineer; John Swanson, William Murray, and Thomas Carline, in the Agamemnon promoted to acting first-class assistant-engineers; John Hill, acting engineer, from the Asia to the Fisgard, as supernumerary; W. C. Archbold, of the Defence, confirmed as second-class assistant-engineer; and J. B. E. Warrington, of the Mullet, confirmed as second-class assistant-engineer.

At the last meeting of the City Commission of Sewers, Deputy Lott moved that it be referred to the engineer and the medical officer to examine and report whether the light from the gas-lamps in the public streets was increased or diminished by the carburetting process recently applied to them, and whether the light thrown upon the footways was not, as he submitted it was, obscured by the shadow of the boxes containing the material used in the process. In the course of a discussion on this subject, Mr. Haywood, engineer to the commission, read a letter addressed to him by Mr. Massey, secretary to the Great Central Gas Company, complaining that the Carburetting Company, in applying their process to public lamps within the City, were picking out a lamp here and there for the purpose, to the inconvenience of the company. Mr. Massey also stated that a few days ago, as the Carburetting Company's men were fitting one of their naphtha boxes to a lamp in Queenhithe it exploded. This, he added, was the third accident of the kind that had occurred within the last three weeks. The directors of the Great Central had directed him to call the most serious attention of the court to an instance of explosion in a bracket lamp in Harrow-alley. Had, he said, one of the numerous lamps fixed in the rear of the same premises ignited, instead of the lamp in question, the great probability was that, occurring as it did late in the night, the whole block of houses and buildings used as cattle-sheds would have been burnt down. The owner of the property had made a communication as to the risk she was incurring, and expressing great fear and anxiety for the future. Dr. Abraham said probably the accidents referred to, which were exceptional, were due to mismanagement, and therefore preventible. At all events, they were not of a nature to induce the Commissioners to abandon the carburetting process, by which a great saving of money was being effected in the public lighting, and which, he believed, would be eventually adopted over the entire metropolis. Mr. H. Lowman Taylor held that the saving of money was at the expense of light, for he had observed on a recent occasion late at night a sort of twilight gloom in places where the process was in use. Besides it was obvious that the boxes containing the naphtha attached to the public lamps threw shadows on the ground. Dr. Abraham said it was well known, long before the carburetting process was adopted, that at advanced hours of the night there was always a paucity of gas, consequent upon the companies relaxing their pressure. The subject, on the motion of Deputy Harrison, was eventually referred to the General Purposes Committee for deliberate inquiry and report.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

THE ARMSTRONG 10-IN. CANNON.

Sir,—Since the late trial of the 10-in. gun at Shoeburyness I have been congratulated by my friends on the supposed triumph of the views I have so long advocated. "Sir William Armstrong," they say, "has abandoned all the additions he made in 1859 to the Blakely cannon of 1855, viz., the breech-loading and the rifling, and now uses the Blakely gun pure and simple, dependent for its utility on great strength alone, that strength being obtained by building up the gun of concentric tubes adjusted in the manner first calculated by me."

So long as this was merely written or said to me I was content to explain matters to those who addressed me; but I have just seen the same thing published in the "Temple Bar" of this month.

This compels me to appeal to your kindness to allow me to explain publicly that there still exists a difference even between the Armstrong gun of 1862 and the Blakely gun; else, if the new gun succeeds, I should be reaping honour not my due, and if it fails, as I believe it must, my plans would, on the other hand, be unjustly discredited.

The difference between the Blakely gun and the new Armstrong consists solely in the material used in the construction. Sir William uses wrought iron throughout. I insist on the necessity of a lining of some homogeneous substance—brass, steel, or cast iron. I do not believe that wrought iron is strong enough to keep its shape if firing round iron shot, and I still less believe that 100 yards or 100in. of bar iron can be coiled up and welded perfectly in its whole length.

I used steel even for the outer parts, but coiled wrought iron is applicable there. Whether the building up of the guns is precisely similar I do not know. At Woolwich Arsenal each tube is made of the exact size necessary to insure the proper compression of the tube it surrounds, but whether this is done at Elswick I cannot say. Sir William publicly states that accuracy is unnecessary. I believe it to be of the utmost importance. T. A. Blakely.

May 2nd, 1862.

PRACTICAL NOTES.—BILGE INJECTIONS.

Sir,—The bilge injection being the last resort in time of danger, the forlorn hope, so to speak, of the marine engineer, and of the lives and property so often depending on his care and knowledge, is a subject well worthy of a few remarks. This is a point apt to be pooh-poohed by engine-makers in the calm security of *terra firma*, with the expression: "It is not likely they will ever be wanted." And, certainly, a very fortunate marine engineer may go to sea for years without having occasion to use them, or see them used. But the writer having, several years ago, been on shore with a vessel for some days, and afterwards concerned in bringing her safely home, though making four feet of water an hour, had thus a large measure of experience compressed into the space of two months' severe labour and anxiety.

All the remarks made in a former letter about the suction roses of bilge pumps apply with equal or greater force to the bilge injection, the rush of water to which is without intermission, and much more rapid than to any bilge pump. The plan of the accessible rose-box there shown is even of more importance when attached to the bilge injection, as from the quantity of small coals, ashes, &c., floating about at such a time, it is almost always found necessary to shut the cock to enable the rose to be cleared. It is to be remembered that, in those cases, every moment is precious, and that if the roses are formed on the end of the pipe, or made so as not to be easily got at, before the pipe can be cut, or the roses cleared, the water may have gained the mastery, and the old adage verified, "For want of a nail the shoe was lost," &c. Nothing makes a better temporary rose in these emergencies than a basket.

Every ship ought to be fitted with separate bilge injection cocks, one to each condenser, and two where there is only one condenser to a pair of engines. These should always go on to the condensers without any internal rose pipe, as such a pipe is sure to get choked, and the delay caused in getting it cleared might involve the loss of a ship.

A very dangerous practice in respect of bilge injections is beginning to prevail, and may be seen among some of the highest class vessels, both in the navy and the merchant service. This is merely providing the main injection pipe with a branch to the bilge, instead of fitting separate and distinct injection cocks. The quantity of water required to keep a pair of engines going is so great that it can scarcely ever happen that the leak into the ship will supply the whole of it. In the case of the ship previously referred to, 4ft. an hour was taken out with the greatest ease by two injection pipes, less than 3in. diameter each, and to keep the engines working properly a quantity had also to be admitted through the usual injection valve. Now, where ships are only fitted with a branch on to the main pipe, it will generally be found necessary, when injecting from the bilge, to admit water also from the sea; and, unless the very greatest care and vigilance be exercised, water may be run into the ship, instead of being taken out of her, as actually occurred in the writer's experience. And there are very few injection pipes inside of condensers but are fitted with distributing roses of some sort or other; and if such is the case they are certain to get choked up, and then the engines require to be stopped in order to clear them. These branches from the main injection to the bilge are not of themselves necessarily dangerous, but they certainly are when trusted to entirely, and to the exclusion of separate bilge injection cocks without internal roses.

Ships in which surface condensers are used ought also to be fitted with bilge injections, as they are never resorted to except in cases of emergency, and, then, injury to an air-pump chamber is but a very secondary consideration compared with the safety of a ship. Arrangements might also be made to admit of the circulating pumps being worked out of the bilge, and as they are of large size they would form useful auxiliaries in the hour of need,

The careful engineer will take the bilge injection cocks out occasionally, to insure their not being set fast when wanted.

A Sea-going Engineer.

EXPANSIVE AND ROTATORY STEAM ENGINES.

Sir,—Your correspondent, "V.P.," cannot agree with my views, and says I don't make out a good case in favour of the rotary. This I am quite willing to admit, but it is of very little importance since he has made out such an excellent case for me. I imagined the special purpose to which he alluded was perhaps driving a fan, or something in that way, in places where steam was of no object, and I am informed that in some of the iron districts an eolipile even is used for driving circular saws for cutting iron, where steam is to be had in superabundance. I am agreeably surprised to learn that the special case is, however, one of vastly more importance, and it cannot but afford pleasure to the devotees of the rotary to learn that in order to produce flour equal to the best French a rotary had to be resorted to. It is also cheering to be informed that the rotary designed for a special purpose fulfils it so exceedingly well, when, according to "V.P.," the reciprocating engine could not give the equal speed that this purpose requires.

It appears that a sufficiently uniform and steady motion for grinding corn is difficult to get from the reciprocating engine, and curiously enough there is on record, in Bourne's Treatise on the Steam Engine, third edition, p. 163, a contrivance for this self-same purpose, which, to an imaginative mind, suggests the idea of a cow with its calf, the young one being deficient in the full bovine embellishment of horns, which show out well on the mère, in the form of a parallel motion. This contrivance, called a pneumatic equaliser, and which is a pump arranged in such a way that it takes up a portion of the engine's power at one part of the stroke and returns it to it again at another, is highly eulogised in the notice appended to the sketch; though, as it is constantly changing from a driver to a driven, I cannot see how it can work without jarring in the toothed gear, with which it is connected to the engine. It is also stated that it has been applied with perfect success to cotton mills, improving the yarn produced both in quantity and quality. It is astonishing what an amount of ingenuity people will expend in making a thing radically wrong in principle serve tolerably well a required purpose. I cannot but compliment "V. P.," however, or the engineer who designed the rotary he alludes to, on the good sense he displayed in adopting, for the obtaining of a perfectly equal speed, the class of engine most likely to give it to him. At the same time, as his rotary would, doubtless, be quite as effective in giving steady motion to the machinery of a cotton mill, I think his special purpose may be made into two, and by no means the most insignificant, purposes in the arts. These might again be extended to include the whole of those in which uniform motion is an object, leaving for the exceptional cases those in which the unsteady motion of a reciprocating engine can be put up with. I myself would employ a rotary for the whole of the purposes in which rotary motion is required, and a reciprocating engine for those in which pounding is the order of the day, such as the steam hammer, the pile-driver, the riveting-machine, &c.; but I cannot bring myself to look with complacency on those engines in which this legitimate action of the reciprocating piston is interfered with and impeded by a crank and connecting rod; neither can the piston itself be made to do so, as "V. P." is fully aware of, since he recommends the reduction of the cylinder's diameter to lessen the shocks and strains attendant upon its use.

I thank "V. P." for his kindness in offering me the sketch, but I should like it in the form I solicited in my first letter. There cannot be anything contemptible in an engine that has given better results in the special case he alludes to than could be got from a common one. He states that it would be unsuitable for a screw, because it works without expansion, and travels very slowly. He is, of course, the best judge of that; but perhaps his engine may be modified for the purpose, as the reciprocating one has, and would then, doubtless, as far exceed the latter for screw propulsion as it has done for grinding corn. Expansion can easily be carried out in the rotary; and as for speed, it is stated in the *Practical Mechanics' Journal*, vol. vi., p. 92, that the patentee of a rotary (Mr. T. Elliot) possesses a working model running at 2,000 revolutions per minute—a statement, however, which I am inclined to doubt, for the sketch shows some reciprocating rods that would, in my opinion, cause the whole concern to fly to pieces, before any such speed could be reached.

I must decline, for the present at least, to give a section through the sketch which "V. P." says looks well on paper; but instead of it I send a section through his own engine, or rather through a reciprocating one, for his opinion, in which I adapt the expansion valve of my rotary to overcome some of the difficulties he points out in his letter on expansive engines. At the same time I may say that I take up the rotary where Messrs. Beale, Borrie, and others have left it, and carry it as I believe a step nearer perfection.

As "V. P." declines further discussion until I give him the cross-section, I cannot, of course, press the matter. There are, however, in his last letter two statements which I think are not correct. He says that, for its own special purpose, the rotary he alludes to "is as good a design as can be." It is a universally-admitted fact that there is nothing perfect under the sun. Again, he says, "A perfectly equal speed was required to be maintained, and this no reciprocating engine could give." A short-stroke engine with a heavy fly-wheel, such as is made in the Manchester districts for driving rolling mills when run at a high speed, will give as steady a motion to machinery as any water-wheel; and, if fitted with a good governor, will keep to its working speed under great variations of load, better, I should imagine, than any water-wheel or slow-going rotary can be made to do. If I am wrong "V. P." will, doubtless, set me right on the matter; at present, I am afraid he does not give the reciprocating engine its due. I am disposed to do so, however, and to assist in bringing it up to the state of perfection for economical working of which it is susceptible, entertaining, at the same time, a firm conviction that a rotary can be made to excel it when this perfection shall have been reached.

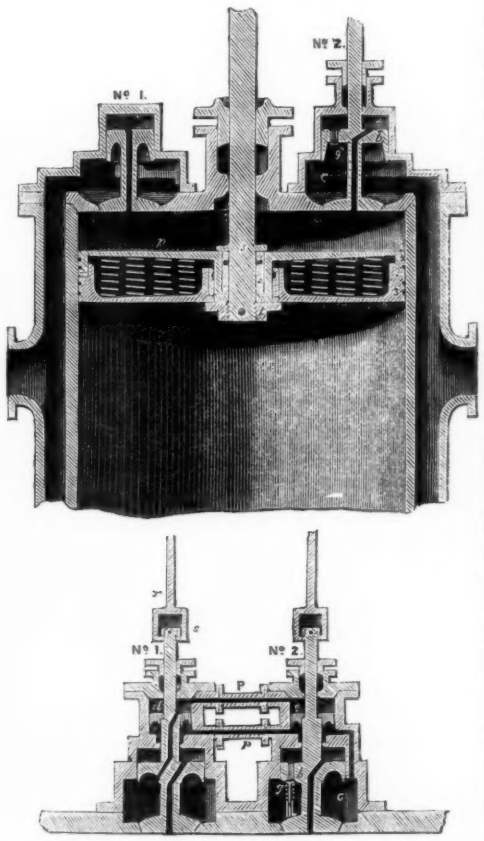
As "V. P." does not interdict further discussion of his letter of February 14th, I will, sir, with your permission, make a few more remarks upon it, noticing first some of the objections offered to his plans by "J. S. F.," who states "that toothed gearing is very liable to get out of order—that the teeth are more liable to fracture than any of the parts of the engine—that geared engines are more expensive than direct-acting ones, and that they are much dirtier." The plan of gearing engines is very common in merchant ships, and from all the sea-going engineers I have been able to consult upon the matter I learn that it gives complete satisfaction. It will, as he says, take the strains caused by the sea's action on the screw off the engines, and throw them upon the teeth; but as they appear to stand well enough at present, with the pinion on the screw-shaft, they will have a far better chance of so doing when the wheel is on this shaft, as proposed. That geared engines are more expensive than direct-acting ones requires proof. The highest-priced engines made are, I believe, direct-acting ones, and are far from being economical in any way. That they are much dirtier is also, I fear, correct. The way in which the grease is thrown about by some of the direct-acting engines is not to be equalled by any geared engine going. If "V. P." attaches no importance to the dirtiness of an engine I do; for I believe this dirt, or rather the grease, has more to do with the degradation of the naval engineers than anything else connected with the engine. The smell of melted tallow which pervades the engine-room fastens itself, like tobacco smoke, upon their persons, making them, unwittingly, a nuisance to any anti-tallow nose which they come in contact with. Royal Commissions, Admiralty orders, gold lace, &c., are powerless to deal with this; nor do I think that education, ability, or anything else will ever establish engineers on the footing of gentlemen in the service, until some remedy has been found for the horrid stench which rolls up from the tallow evaporating machines under their charge. It would be as reasonable to expect that, were a tallow candle manufactory established on board, the *chef de cuisine* should be a gun-room officer. Much has been said and written on the subject of naval engineers; the above bit of practical philosophy *à l'huile et graisse* may perhaps put the matter before them in a new light. Returning to "V. P.'s" letter of February 14th I wish to call attention to paragraphs eleven and nineteen. In the eleventh he speaks of obstacles assuming such an alarming aspect as to have deterred engineers from attempting anything like the degree of expansion necessary to the utmost economy, and specially instances the clearance in the cylinder ends. In the nineteenth he refers to the means of cutting off the steam, and wisely insists upon the necessity of reducing the waste in filling passages. If engineers would only make use of the talent which Providence has given them, and design for themselves, without slavishly copying those who have gone before them, these alarming obstacles would disappear. It would be paying a higher compliment to the memory of Watt were we to endeavour to perfect his engine, than in being content to take and keep it as he himself left it. The getting rid of all waste in filling passages, and the greatest part of that caused by clearance, appears to me such a simple affair that, in the sketch I enclose for the purpose, I can scarcely believe but that I have stumbled upon somebody else's designs. "V. P." recommends the return to the use of one eccentric, laying aside the link motion; and for sea-going engines I think he is right. The chief charm of the link-motion consists in the facility with which small engines can be reversed by it, and for locomotives or river steamers it is a valuable apparatus. The propriety of keeping a number of pieces rocking about, during the whole of a sea voyage, for the purpose only of being able to reverse the engines readily may, however, be doubted, if it can be done by other means. As the size of engines increases, so also does the weight of the link-motion, and in large engines it is found necessary to use an endless screw and toothed quadrant to work it, the merit of quick reversing being thus comparatively gone. Again, it has been found that, even when the link is reversed, the large engines, with expansion on the slides, do not move off as quickly as is desirable, and a contrivance termed an auxiliary-slide

has been added for the purpose of making them do so. This is simply a slide of smaller dimensions than the main one, a common three-ported one of the short kind, with levers for working it by hand, and with passages extending the whole length of the cylinder, its object being that the attendants may be able to admit steam into either end of the cylinders to force the pistons into motion, and so give the main valves a chance of acting. This slide is placed in the middle of its stroke when the engines are working, and as the steam plays in and out of its passages exactly the same as in the distribution valves, the waste of steam in uselessly filling passages is thus frightfully increased. This statement will hardly be credited by some; it is, nevertheless, a fact; and plenty of examples of it are to be found in and out of the service if sought for. With the single eccentric arrangement, an engineer disconnecting the rod can put the valve in any position, and force the engine into motion at will. "V. P." is therefore, I think, justified in making the suggestion he has done. I am inclined to go still farther, and recommend the use of cams exclusively. Laying aside the eccentric along with the link is very good things in their way, but not up to the requirements of the day for expansive working. In thus summarily disposing of the link-motion and the eccentric, to which I may add the slide valve, I know that I must give some good reason for it As a cam is still used for expansion, in addition to the eccentrics and the link-motion, I can shelter myself for my heresy under the plea that one cam is sufficient for expansion, distribution, and exhaustion, if properly arranged. The slide valve will have very nearly approximated to the perfection of which it is susceptible when one is placed in each cylinder cover; such cover being made as thin as prudence will admit of, and being suitably strengthened by outside ribs, the loss from filling passages being thus reduced to the thickness of the cover. As the pressure in the cylinder varies from the full steam pressure down to a vacuum more or less perfect, the equilibrium of the slide cannot be accomplished by the plan known as the equilibrium slide, nor by a piston placed at the back of it. The equilibrium slide-valve is not by any means the perfect thing it has been represented to be. It is found impossible in practice, in spite of the very best fitting of the best makers, assisted by the best of tools and surface plates, to prevent the steam from getting within the annular space at the back of it, and so destroying its partial equilibrium. A pipe communicating with the condenser is therefore placed in the cover at the back of the valve, nominally with a view to cause a vacuum in this annular space, but actually to provide an escape for the steam which thus gets in between two surfaces in contact. Some time ago we had a discussion in THE ENGINEER upon a statement made in the "Miscellanea Columna," to the effect that a plate or surface could be moved upon another surface, under any pressure of steam, as easily as in a vacuum. The equilibrium slide valve, without the pipe to the condenser, depends for its action upon circumstances that would render the above statement incorrect. However as it cannot be made to act satisfactorily without the pipe, it appears to me to give a most conclusive proof of its practical correctness.

The present arrangement for the management of the steam in the cylinder consists, with slight variations, of the following apparatus:—One slide-valve, with its spindle and guides; a link-motion, with its weight-shaft and hand-gear; two eccentrics, with their straps and rods; an expansion valve with its accessories, and two escape valves. A goodly amount of tackle, attended, it must be confessed, by but indifferent results considered economically.

I propose at once to use four valves for the whole management of the steam in the cylinder of such a construction that waste in filling passages is entirely avoided, and that such a perfect equilibrium is obtained that the valves of a cylinder of 500-horse power may be worked by the use of four rods of 1in. diameter.

The valve is shown by Fig. 1 in the accompanying sketch, and is simply a common pot-lid valve, its seat being formed in the cylinder



cover or end, and arranged in such a way that, when shut, its lower face *a* forms part of the plane of the inner surface of the cover as shown. The upper part of the valve forms a piston *b*, which slides freely, but steam-tight, in the chamber *c*. A passage formed through the centre of the valve establishes a communication between the chamber *c* and the interior of the cylinder. It will be at once evident that this valve is in perfect equilibrium under any circumstances of steam-pressure or vacuum; for, as the steam in the chamber c acts equally in opposite directions upon the valve, as also does the steam or vacuum in the cylinder. no preponderating force can be exercised upon it by either, and the valve may be worked under any steam pressure by simply the expenditure of power necessary to overcome the friction of its rubbing surfaces when not under such pressure, this equilibrium being obtained at the expense of the steam contained in the passage through the valve and the chamber *c*; the play of the piston *b* in this chamber being sufficient, and no more, to give the required lift to the valve. No. 2 shows the exhaust valve, whose arrangement is precisely the same, with the addition of a small escape valve *g* placed in the piston *b* and opening inwards to the chamber *c*, which, in this case, communicates with the exhaust, the valve *g* being secured by a suitable spring in the usual way. If from the presence of water in the cylinder the pressure rises to a dangerous amount, the escape valve *g* permits the steam or water in the chamber *c* to pass through to the exhaust, destroying the valve's equilibrium, which is at once forced from its seat and acts thus as an efficient escape valve, with the advantage for surface condensation, that the water passed through the engine is not lost.

The steam, therefore, entering by one valve and going out by another is relieved of the necessity of filling passages, loss from this cause being absolutely avoided. These valves may be worked by any of the plans now in use. I would employ, however, the plan of working them by means of a small steam piston, which has been successfully used for working the slide valves of steam hammers for years. The side sketch shows a pair of these valves arranged for working on this plan. The spindles of the valves pass up through another chamber *d* in which a small piston *e* slides steam-tight and fixes upon the spindle as shown. The upper parts of the chambers *d* are in communication with each other by means of the pipe *p*, and by means of the passage in the steam valve spindle are kept always full of steam. The lower parts of these chambers are also in communication with each other by means of the pipe *p*, and with the exhaust by means of the passage formed in the side of the exhaust chamber *c*, as shown, suitable metallic packing rings being inserted at all the places of contact to prevent leakage. The valves are thus closed by the steam pressure upon the piston *e*, and, as they rise and fall, the steam plays in and out of the chambers *d*, to and from the steam valve chamber *c*. Except from leakage and condensation no steam is consumed by this arrangement, and there is an actual gain by it, because the rods which open the valves are subjected only to a tensile strain, and may, therefore, be made of comparatively great lightness. Taking into consideration the strain that a rod of iron or steel an inch in diameter will bear, and that to which it ought to be subjected in practice, according to authorities on the matter, I am afraid that in allowing an inch of diameter, for the rods of the valves of a 500-horse power cylinder on this plan, I lay myself open to the charge of making them clumsily strong. To open these valves I would employ a cam with eight race-ways upon it, four for going ahead and four for going astern. The two for the steam valves for going ahead being arranged for any grade of expansion between given limits, not by stepped races, but by the preferable way of a curved race, the pulley which gives motion to the rod may thus be placed in a position to give any fraction of a grade of expansion. The cam would have a lateral movement upon the engine shaft, being driven by a sunk-feather and provided with a lever for moving it sideways, the only hand gear required, the valve rods sliding through guides to prevent side-play. By simply shifting the cam a few inches to one side, the pulleys giving motion to the valves would find themselves upon the reverse races, and the reversing of the engine would be accomplished quite as readily as can be done by the link motion, without the necessity of an auxiliary valve for the purpose, no matter how great the grade of expansion may be; the different grades of expansion being also given by the position of the cam on the shaft, which ought to be so arranged as to work the engine without expansion in either direction, when at the extremes of its lateral travel upon the shaft, the valve rods being connected to the spindles, as shown at *s*, to allow the valves to act as escape valves.

To effect a saving in the steam now lost from clearance, it is only necessary to construct a piston that may be run with safety close up to the cylinder ends. It is a well-known fact that the heavy head of the steam hammer may be made to fall with almost mathematical exactness to a given point any number of times by simply the cushioning action of the steam upon a comparatively small diameter of piston. This may also be done in an engine, and is done by simply giving sufficient lead to the valve. If, therefore, we substitute a flexible piston for the solid mass of cast iron at present used, no danger to the cylinder covers need be apprehended, though it be run with less than one-sixteenth of an inch of clearance. A piston for this purpose is shown in the sketch. Two plates of wrought iron P, P, are fitted together to form a telescope piston, and are kept apart and held firmly against their respective collars on the piston-rod *s*, *t*, by a series of spiral springs placed upon suitable studs inside the piston. The springs are regulated to withstand a pressure somewhat higher than the working pressure of the engine, and if this regulated amount be exceeded the springs will give, and allow the plates to approach each other. The action of the piston when working will be this:—As it approaches the end of its course, the steam-valve, having the usual amount of lead, fills the cylinder end before it with steam, which it again forces back into the steam passage; the plate upon which the steam is acting will therefore be under nearly the full pressure that its springs are capable of bearing, that is, it will be nearly in equilibrium when passing centres; and even were the plates to touch the cylinder end, no harm could be done by it. To prevent the plates from setting fast upon the rod by corrosion brass bushes 1, 2, are inserted at the places of contact. As the play of which the plates of the piston are susceptible need not exceed $\frac{1}{16}$in. or $\frac{1}{8}$in. at most, and as suitable metallic packing rings are inserted at all the places of contact 1, 2, 3, to prevent leakage, even should the springs fail, the loss from clearance can never exceed that which now results from this cause. Flexible plates might be placed in the cylinder ends instead of in the piston if preferred.

There is nothing in this cylinder arrangement absolutely new, for examples of the whole of its parts are to be found, some way or other, in daily use. Perhaps it may be said that the valves will strike hard on shunting. This, however, will depend entirely upon the shape of the cam, which can be arranged to make them strike hard or easy, as may be desired.

If this sketch serves no other purpose it will, at least, demonstrate that it is quite possible, and even easy, to make nearly the whole of the steam consumed in a reciprocating engine give out some useful effect; and that the coal now consumed in creating the "cubic feet" of steam which make their way to the condenser at each stroke of the engine, giving an effect far worse than useless, may be either left ashore, or profitably employed in propelling the vessel farther on her voyage.

Ferrol, April 28th, 1862. J. S.

PATENT TRIBUNALS.

SIR,—Happening to be in the Court of Chancery yesterday when the judgment in Blest *v.* Brown was delivered by the Lord Chancellor, I had the good fortune to hear from that highly gifted judge some remarks on legal practice, which struck me as most valuable in their application to the trial of patent causes.

It is true, no express reference was made to patent causes, but the principles enunciated by the Lord Chancellor were distinctly applicable to them; and as there is no allusion to the emphatic words of the judge in the report of the case in the *Times* of to-day, I venture to draw the attention of your readers to them.

He adverted to the defective mode of procedure in the Court of Chancery for the purpose of determining matters of fact, more especially in its admitting the bad practice of unduly extending the area of inquiry by not settling with authority the primary legal points which, if settled, would have the effect of keeping the inquiry within its due limits.

He alluded to the usual disproportion between the costs of such inquiries and the value of the matters involved in them, which was, in a great measure, due to the manner in which they were conducted. And he denounced the too frequent practice of flippant imputation of unworthy motives indulged in by counsel, insisting that a man ought to feel himself bound by moral considerations to abstain from such practice except in such cases as afforded irresistible evidence of improper conduct.

But the practical remedy suggested was the most valuable. The Lord Chancellor said he hoped that until they could agree upon an improved mode of procedure every judge would look narrowly into the evidence and give costs against any party who introduced irrelevant matter, at any rate so far as related to such matter.

Now how are these remarks applicable to patent cases? Thus: It is quite idle to think of going into evidence as to the alleged infringement of a patent until the scope of the patent has been determined by a proper and conclusive interpretation of the specification. It is against the natural order of thought upon the subject. One construction of the specification will let in evidence which another will exclude.

I understand the remarks of the Lord Chancellor to apply in principle to the present defect in practice of allowing evidence of infringement of a patent to be tendered before the question as to the exact scope of the patent has been authoritatively settled. He acted on the principle of first settling the meaning of the specification in "Hills *v.* Evans," and I am firmly convinced that if this principle were firmly adhered to in all cases much of the breath of future litigation would be withdrawn.

WILLIAM SPENCE, Assoc. Inst. C.E.

50, Chancery-lane, W.C., 29th April, 1862.

LAW INTELLIGENCE.

COURT OF EXCHEQUER, MAY 2.

(Sittings in Banco, before the LORD CHIEF BARON, *Mr. Baron* MARTIN, *Mr. Baron* BRAMWELL, *and Mr. Baron* WILDE.)

HORSFALL AND OTHERS V. THOMAS.

THIS was an action on a bill of exchange, tried at Guildhall before the Lord Chief Baron, when a verdict was directed to be entered for the plaintiffs.

The plaintiffs are the proprietors of the Mersey Ironworks, and undertook, under a written contract, to manufacture a steel gun for the defendant of certain dimensions. During the progress of manufacture some defects were discovered in the metal, which were got rid of, with the consent of the plaintiff, by increasing the diameter of the bore. The plaintiffs introduced a steel plug into the breech of the gun, of which the defendant subsequently complained, saying that it had been wilfully put there to hide a fatal defect in the manufacture. The gun was taken to Woolwich Arsenal butts and tested in the presence of the Government authorities there, and found to possess merits of no ordinary character. It was fired many times, with various charges of powder and balls of different weights, and upon one occasion threw a ball a distance of nearly six miles. Ultimately the gun burst, and, as the defendant alleged, at the spot where the plug had been put in. The defendant gave two bills in payment for the gun, and paid one of them, but the second—the subject of the action—he declined to pay, pleading that he had been induced to accept it by the fraud of the plaintiffs. At the trial, upon the opening by the defendant's counsel, the learned judge stopped the case, expressing an opinion that the defence was no answer to the action. Mr. Bovill, Q.C., moved for and obtained a rule for a new trial, on the ground that, if the facts had been proved as opened by Mr. Honyman, there would have been evidence to go to the jury in support of the plea of fraud.

Mr. Edward James, Q.C., Mr. Brett, Q.C., and Mr. J. B. Aspinall now showed cause against the rule, contending that there was no evidence of fraud in obtaining the bill, or in performance of the contract.

Mr. Bovill and Mr. Honyman, in support of the rule, urged that if the defendant had been made aware of the fact that the plaintiffs had put a plug into the gun he would not have accepted the bill; that the plug was put in to conceal a patent defect, of which the defendant had been kept in ignorance; and that there was ample evidence of fraud.

Their lordships took time to consider judgment.

WILCOX'S HOT-AIR ENGINES.

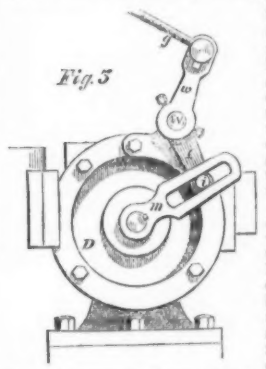
IN the American department of the Exhibition is a hot air engine made by Messrs. Wilcox, Denison, and Taylor, of Westerly, Rhode Island, U.S. As a large number of these engines are already in use in America, we may give the following description from the *Scientific American*:—

Fig. 1 is a perspective view of the engine, with its furnace complete. Fig. 2 is a vertical section, with the parts somewhat differently arranged, the better to show their peculiar action.

A is a working cylinder, and *a* a single-acting working piston. B is the changing and supply cylinder, and *b* the piston working therein. C is the main shaft, supported by the arches *r*, *r*, and having two cranks, C^1 and C^2, set nearly at right angles with each other, and connected to the two pistons *a* and *b*, as represented. H is the fly-wheel. D is the valve box communicating with the cylinder B, and with the external atmosphere through three ports *d*, d^1, d^2. M is a valve to open and close these ports at pleasure. E is a small chamber communicating freely with D, and with the lower end of both cylinders, and containing the regenerator or economiser F, composed of thin metal plates.

A and B are attached by a flange near their centres to the bed plate L. The lower portion of both the cylinders and of the chamber E are cast in one piece, and project into the flue below forming the heating surface. The bottoms of the cylinders are concave, and extend a considerable distance upward, thereby greatly increasing the extent of heating surface, and also rendering them less liable to spring under the internal pressure.

Fig. 3



The upper end of the cylinder A communicates freely with the external atmosphere through openings in its cover N, while the upper end of the cylinder B is closed by a tight head, and is made to communicate alternately with the atmosphere and the regenerator chamber E, by the action of the valve. Pistons *a* and *b* are made somewhat longer than their stroke, and are filled with a non-conducting substance, to prevent the heat, to which their lower sides are exposed, from being communicated to their upper sides. A long rod *a'* connects the piston *a* directly with the crank C^1, while the piston *b* has a rod S, passing through a stuffing box *s*, and keyed to a crosshead T. A short rod connects T with the crank C^2. The valve M has a hollow throat of sufficient width to span ports *d'* and *d''*, and the space between, and receives an oscillating or partially rotating motion from the eccentric G.

K is the furnace. The firebrick J extends over the furnace, allowing the hot products of combustion to rise through a liberal opening in the centre. This construction protects the edges of the cylinder bottom from the destructive effects of the intense radiant heat, but involves no ultimate loss of calorific effect; the heat thus retained being found in an increased temperature of the products of combustion. These latter flow around the whole base and apply the heat uniformly, and then pass to the chimney through the flue O.

This matter—the uniform application of heat—is one of great practical importance, tending materially to promote the durability of the metal. As a further preventive of overheating any part an automatic regulator, by which the expansion, or, rather, the vaporisation, of mercury contained in a vessel in the heater is caused to correspondingly close a damper in the flue, has been applied and found to maintain a very uniform temperature, preventing the heat of the metal from rising under any circumstances above a proper moderate degree.

The piston *a* is made with arms somewhat like a pulley, and a

WILCOX'S HOT-AIR ENGINES.

Fig. 1

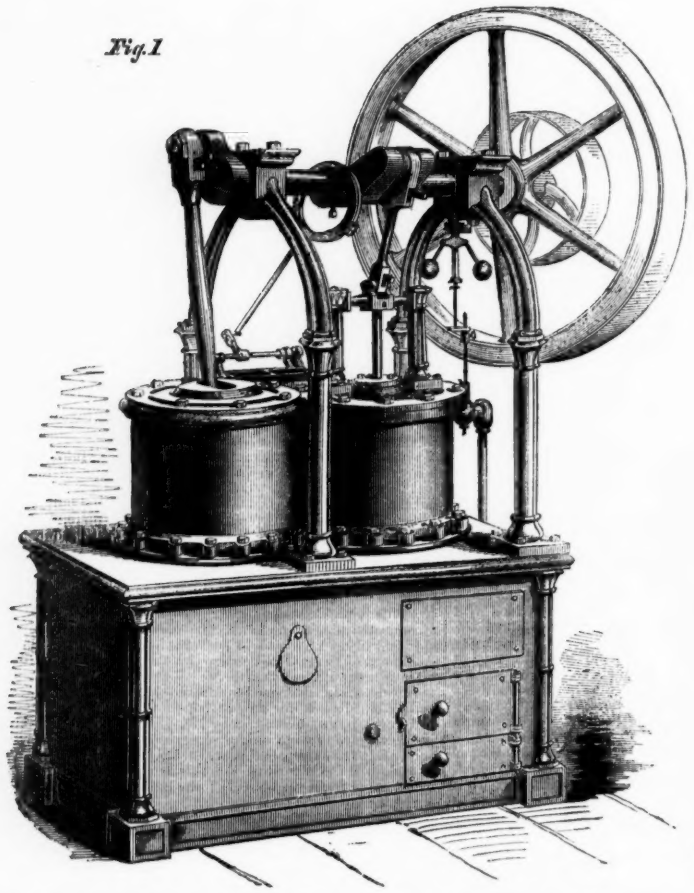
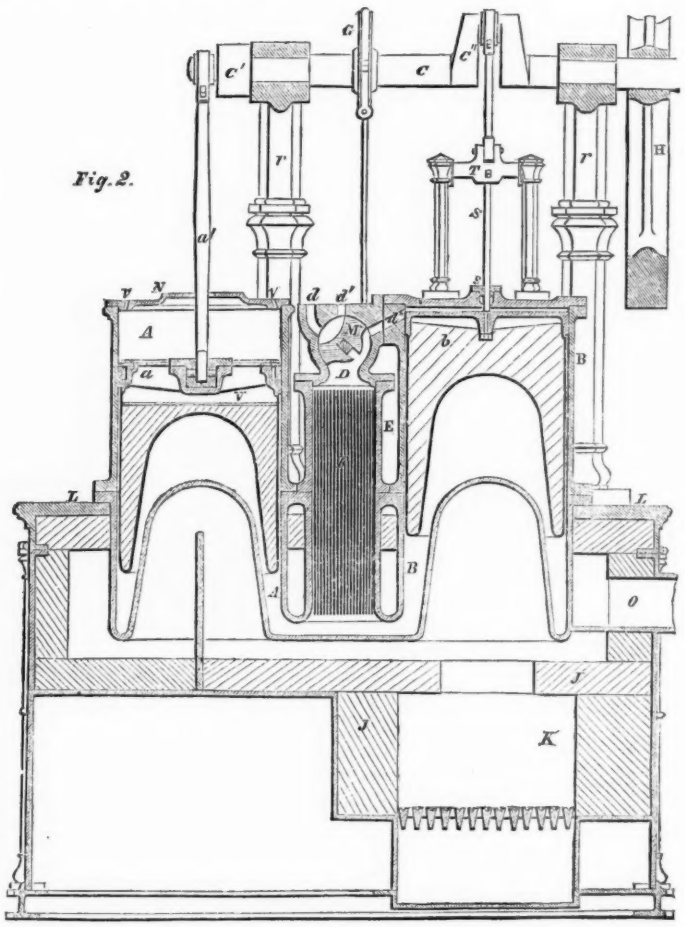


Fig. 2.



space V left between it and the filling below, so that the cool air in the top of A circulates around the joint, by which the connecting rod *a'* is attached, and thereby keeps it and the metallic packing at so low a temperature as not to burn the oil used for lubrication. As a further means of effecting this object a cover N is placed upon A, having openings *v*, *v*, through which the air above *a* is forced out as the piston rises, and a fresh supply drawn in as it descends. By this simple means the temperature of the rubbing parts is kept so low that they may be readily and perfectly lubricated.

Fig. 3 shows the valve motion. D is the end of the valve box, and *m* a slotted arm keyed on the end of the axis of the valve. I is an arm fixed upon a rock-shaft W, which receives a reciprocating motion from the eccentric G, Fig. 2, through the rod *g* and arm *w*. A steel roller *i*, carried on I, plays within the slot in *m*, and the proportions and motions are so arranged that the valve is thrown very quickly from one position to the other, and retained for a period nearly stationary at the end of each movement. This is accomplished by the peculiar action of the roller *i*, working in the slotted arm *m*.

The function of the cylinder B, and the piston *b*, working therein is to take in a supply of cool air from the atmosphere through the valve, and then, when it rises, transfer this air through the regenerator into the hot end of B, where it is expanded and its pressure is much increased. The piston *a*, being exposed to the atmospheric pressure on its upper side, and to the increased pressure obtaining in B on its underside, is forced upward, and imparts motion to the shaft C and fly-wheel H. When *a* has been driven to the extent of its motion the valve M is changed, and the heated air, now filling both B and A, is allowed to flow through the regenerator, where it parts with much of its caloric, and escapes through the port *d* into the atmosphere. The momentum of the fly-wheel then returns the piston *a* to its former position, and in the meantime *b* has taken in a fresh supply of air, to be changed over and propel *a* through another stroke.

This action and the relative motions of the two pistons and valves will be seen by means of Figs. 4, 5, 6, 7, 8, 9, 10, and 11. The circular diagram over each figure shows the corresponding position of the cranks, and the arrows indicate the direction in which the pistons are moving. In Fig. 4 the piston has completed its up-stroke and imparted motion to the engine; the valve is in position to allow the heated air to escape, and maintain a communication between the atmosphere and the space above the piston *b*, which has made half its down stroke, the space above it being filled with cool air, and the hot air below escaping through the regenerator. This action continues through the next quarter of a revolution, as is shown by Figs. 5 and 6. It will be seen that no power is expended in this operation, excepting that required to overcome friction, both sides of both the pistons being in free communication with the atmosphere, and consequently exposed to atmospheric pressure. At the position shown in Fig. 6, the piston *b* having taken in a full supply of cool air, and *a* having made half its down stroke, the valve is changed so as to cut off the communication with the external air, and open a passage between the space above and below *b*. As *a* continues to descend it compresses the warm air beneath it and that contained in the regenerator, forcing a portion over into the space above *b*. The piston *b* commences to ascend, but encounters no resistance, as there is a free communication between its two sides. At Fig. 1 the piston *a* has been forced to the end of its stroke by the momentum of the fly-wheel against the increasing pressure of the air within, which pressure acts the same as "cushioning" in a steam engine; *b* continues to rise, and has changed one-half the air above it around through the regenerator into the space beneath, by which process the air is heated and its pressure greatly increased. It will be seen that at this point *b* is moving at its highest velocity; while *a* is nearly stationary, or at its "dead point;" the air above *b* is therefore mostly changed to the hot end, while *a* remains within a short distance of the end of its stroke; and therefore, when *a* commences to ascend, it has a pressure beneath it much greater than that which resisted its descent. This pressure forces it up and imparts motion to the engine, while the pistons are alternately assuming the position shown in Figs. 9, 10, and 11. At this latter point the valve is changed, as shown in the figure, and the heated air allowed to escape, the piston *a* performing the remainder of its stroke in equilibrium. One revolution is now complete, and this process is repeated at each revolution. In practice this revolution is made in one-half of a second, or 120 in a minute.

Fig. 12 is a diagram of energy calculated for this engine from the following data, which are found in practice to be very nearly attained:—

Temperature of cool air	100 deg.
Temperature of heated air	600 "
Proportion of lost space to volume of working air	0·5
Angle of cranks	90 deg.

Area of *a* = area of *b*.
Compression = one-half stroke.

Fig. 4.

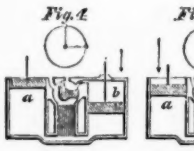


Fig. 5

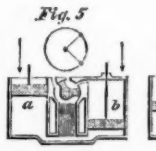


Fig. 6

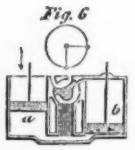


Fig. 7

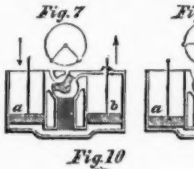


Fig. 8

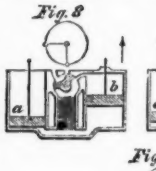


Fig. 9

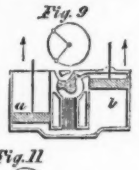


Fig. 10

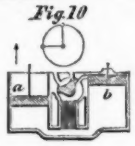


Fig. 11

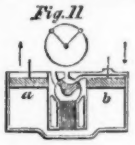
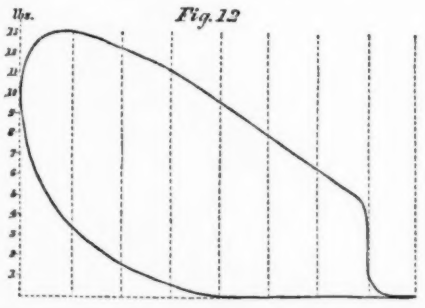


Fig. 12



Under these conditions it is found in practice that the escaping air is 260 deg. temperature, and as that is the highest to which the valve M is ever exposed, there is found to be no difficulty in keeping this valve properly lubricated.

The advantages claimed for this engine are:—

First, Smoothness of motion and little noise. These arise from the fact that the two pistons have the same stroke and are driven by crank motions, and from the absence of puppet or other noisy valves.

Second, The high speed and consequent increase of power. This is due to the smoothness of motion, the use of the regenerator, and the large amount of heating surface, by which the air is heated with sufficient rapidity. The power of air engines is limited by the amount of heating surface in the same manner as is that of steam engines.

Third, Durability. This arises from the smoothness of motion absence of percussions, the use of only one valve, and the protection of the heating surface from the direct action of the fire.

Fourth, Economy of fuel and attendance.

Dreadful Railway Accident near Kelso.—A most alarming and fatal accident took place on the Kelso branch of the North British Railway, about a quarter before six o'clock on Saturday evening. As the 3.45 train from Edinburgh was passing eastwards from Newton (St. Boswell's) Junction to Maxton station, the carriages attached to the engine, eight in number, left the rails, and the last six, with the guard's break van, broke off from the two first, and were precipitated down an embankment of about 14ft. in depth. The engine and tender did not leave the rails, and the first two carriages remained upon the embankment. The occurrence, which caused intense alarm, was attended with painful and calamitous results: one passenger was killed on the spot, three dreadfully injured, ten or twelve passengers were very seriously hurt, and others more slightly. The fallen carriages were completely shattered, and in particular the first, the passengers in which suffered most. Mr. Easton, skinner, Musselburgh, was found dead among the debris of the foremost carriage. Mr. Easton, jun., son of the deceased gentleman, was fearfully injured, as were also Mr. David Sheriff, Drem, East Lothian, and Mr. Hunter, teacher, Kelso. All these, it was believed, had sustained concussion of the brain, besides other injuries, and their survivance was regarded as extremely doubtful. A large staff of men were immediately engaged to repair the rails, clear the line, and remove the remains of the carriages. The cause of the accident will be made the subject of a strict investigation; at present it can merely be conjectured, some attributing the calamity to a started rail, others to a defective wheel.

Bursting of a Sluice near Lynn.—The Denvers Sluice, about two miles from Lynn, has burst, and the whole district of the Middle Level, the drainage of which was one of the greatest engineering exploits of modern times, is in danger of being again submerged. The existence of a hole against the eastern door of the sluice has been known for more than three weeks; but the authorities, placing implicit reliance on the stability of the work, leisurely advertised for tenders to repair the damage, and took no immediate precautions. About a week since, however, the hole was found to have seriously increased in size, and puddling was tried; but, as the hole continued to deepen at the rate of about 16in. an hour, alarm began to be felt. Early on Sunday morning last great masses of earth caved in, and in less than two hours there was a breach 20ft. or 30ft. wide round the end of the sluice, and a hole 10ft. deep under the first pair of doors. The imminent nature of the danger which threatened the district was then made apparent, and in a very short time eighteen or twenty men, with as many carts, were on the spot, and the most strenuous efforts were made to fill up the hole with earth and straw. About 11 o'clock, while the men were still at work, the tide began to rise, and its first impetus smashed in the wing next the cut. This obstacle removed, the tidal waters rushed up with increased violence, and a few minutes afterwards the two arches fell, crushing the iron doors with a report like that of a cannon, and smashing great barges almost like bandboxes. "Altogether," writes an eye-witness, "it was such a scene as has never been witnessed here before, and will never be forgotten by those who saw it." The tide now rushed up the Ouse with unrestrained fury, and the strongest fears are entertained that a high spring tide will burst the banks of the river, and lay thousands of acres of the most fertile land in the Fens under water. On the western side of the cut the water is already trickling through the bank, and a high tide may do injury which years of labour will scarcely be sufficient to repair. The Middle Level Commissioners are fully alive to the danger which threatens them, and are making every effort to avert it. Still, the utmost excitement, as may easily be imagined, prevails through the whole district drained by the Ouse. It is estimated that an outlay of at least £30,000 will be required to repair the damage at present done.

TO CORRESPONDENTS.

*** Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

NEMO.—*The sketch of crank has not been engraved, but shall appear next week.*

R. N. (Copt Hewick).—*We never recommend patent agents, but have no doubt that the gentleman you name is entirely competent and trustworthy.*

J. T.—*The premium at the best engineering works on the south side of the Thames is 400 to 500 guineas, according as the apprenticeship is for four or five years.*

OLYMPUS.—*You will best obtain the required information by advertising for it, and you will probably at the same time have the advantage of a competition among different makers.*

W. S. (Preston).—*It is the same in principle as Parkes' split bridge in use, and, we believe, patented, in 1820. We are not sure whether he employed a casting, and believe he made the opening in the brick work only.*

T. N. (Manchester).—*The Pneumatic Post Company, whose engineer is Mr. Latimer Clark, of Victoria-street, Westminster, have experimented at Battersea with a tube a quarter of a mile long and equal in area to a 33in. pipe. This was for the conveyance of mail bags in small trucks.*

W. H. N.—*We know of no such place as "Bavaria, Tyrol." A boiler intended to carry a given pressure of steam is usually tested with from one-half more to twice that extent of hydrostatic pressure. On the Eastern Counties Railway, for 130 lb. pressure of steam, the hydrostatic test to which boilers are subjected is 250 lb.*

A NAVAL ENGINEER.—*We cannot perceive that your explanation of the principle of the action of the Injector is any nearer the mark than those of others. It is true that high-pressure steam moves more rapidly into a vacuum than into the open air, but the difference is insufficient to account for the action of the Injector, which, with steam of 25 lb. from one boiler, will force water against a pressure of 40 lb. into another.*

A FOUR YEARS' SUBSCRIBER.—*The displacement of your boat at a draught of 4ft., would be about 50 tons, which therefore would be the weight of hull, machinery, and cargo. A boiler and engine large enough to give off 25 indicated horse power ought to drive it at a speed suitable for canals. A 4ft. screw with 5ft. pitch, driven at 100 revolutions per minute, ought, after making a very large allowance for slip, to give a speed of 3 miles an hour on a canal.*

W. A.—*We can give you no authoritative rules, but our judgment would lead us to recommend, for a single 9in. cylinder, 12in. stroke, making say 400 single strokes a minute with 130 lb. steam, a boiler containing at least 4 square feet of grate, 20 square feet of firebox surface, and 200 square feet of tube surface, in 1½in. tubes, 2ft. or 2½ft. high. You have not given the speed at which your engine is to work. At 400 single strokes it would exert about 100 indicated horse power, but at half the speed only half the heating surface would be necessary.*

THE INTERNATIONAL EXHIBITION.—*We have been requested to state that, in addition to Mr. Bertram's process, alluded to by us last week in speaking of the Butterley Company's beams in the Exhibition, two other patents were employed in their manufacture. Also to state that Messrs. Thomas Robinson and Sons' wood-working machinery is exhibited in motion. Also that the hydraulic press cylinder and ram of Bessemer steel, exhibited by Messrs. Bessemer and Co., were forged and finished by Messrs. Peel, Williams and Peel, of Manchester.*

IT *is a little awkward to reply to a letter having no address or signature at all, but to one of this class we may say that we should so place the cylinder that, if a connecting link were employed to join the piston rod and beam, it would incline equally each way (at mid-stroke and end-stroke) from a vertical line. This would correspond with B on the sketch sent. Do you mean to say that the actual weight of the valve and lever, weighed as loose pieces of metal, is 30 lb.? If so you must attach the lever to its fulcrum at F and weigh it at V, the long end overhauling. The effective weight would be more likely, with an 8ft. lever, to be 200 lb. or even 300 lb., but whatever it is it must be deducted from the total steam pressure to be overcome, before attempting to calculate the necessary weight or position of the ball.*

J. P. (Preston).—*If you will consult almost any work on the steam engine, or almost any one of the various engineers' pocket books, you will find a "table of hyperbolic logarithms," with directions for their use in calculating the average pressure of steam worked expansively. You are to divide the length of the whole stroke by the distance for which dense steam is admitted. In your case the quotient will be 10. You are then to find the hyperbolic logarithm of 10, or whatever the quotient may be, and add 1 to it. The hyperbolic logarithm of 10 is 2·303, which with 1 added to it becomes 3·303. Then multiply the original pressure per square inch, say 150 lb, by this number, and divide by the quotient previously found. Thus 150 × 3,303 = 495, which divided by 10 gives 49½ lb., the theoretical average pressure per square inch with expansion.*

MESSRS. SHARP, STEWART, AND CO.'S LOCOMOTIVE IN THE EXHIBITION.

(To the Editor of The Engineer.)

SIR,—Allow me to draw your attention to a slight mistake in the last number of THE ENGINEER. The locomotive engine Manchester, by Messrs. Sharp, Stewart, and Co., has six wheels, coupled, of 5ft. diameter; wheel base, 15ft. 6in.; weight on rails in working trim, 10 tons 13 cwt. front, 11 tons 12 cwt. centre; 9 tons 15 cwt. hind.

A. COLLET.

Atlas Works, Manchester, May 5th, 1862.

[*Our information was derived from the representative, in the Exhibition, of Messrs. Sharp, Stewart, and Co., who had referred us to him for particulars of their machinery.*—ED. E.]

SUCKOW AND HABEL'S BLAST.

(To the Editor of The Engineer.)

SIR,—Observing in THE ENGINEER of the 25th ult. the letters of your correspondents signed "L. E." and George Hemsley, we may state in reply that as to the plan, or the so called "Hydraulic blast wheel" of A. Martin (we enclose a sketch of the same), where "L. E." refers to as a comparison to our invention, that there is as much a difference as there is between chalk and cheese; for it is, as you perceive, only a single varied Archimedian screw fastened to a cylindrical shaft, and working horizontally in a cylinder, which lower half is filled with water. We are, and have been, aware that the idea of screw fan blast is not new, and that patents have been taken out for the same, viz., No. 1,379, J. Burch, 1853, and others; further, we do not wish to own as novel the screw or a single part of our arrangement, but claim the combination of the cone, screw vanes, catchwings, and cylinder, which propelling effect is a compound screwing and centrifugal action, as the Archimedian screw purely will not condense or compress air.

E. SUCKOW AND HABEL.

Manchester, April 27th, 1862.

(To the Editor of The Engineer.)

SIR,—In your report of the last meeting of the Institution of Civil Engineers of Ireland, there are some few errors you will oblige by correcting. In the calculation of the strength of the crane described, instead of "50½ square inches by 30½ square inches, equal to 1½ tons per inch," it should be, "53½ ÷ 30½ = 1¾ tons per inch." And again, instead of "25 by 12 = 37 tons," it should be 25 + 12 = 37 tons. There are a few other misprints, but not of much importance, except, perhaps, it may puzzle some of your readers to know what is meant by "winels;" it should be read "winch."

Drogheda Ironworks, Drogheda, May 6th, 1862. GEORGE H. STRYPE.

MEETINGS NEXT WEEK.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, May 13th, at eight p.m., "The Malta and Alexandria Cable," by Mr. H. C. Forde, M.I.C.E; and "On the Electrical Tests employed during the Construction of the Malta and Alexandria Telegraph, and on Insulating and Protecting Submarine Cables," by Mr. C. W. Siemens, M.I.C.E.

SOCIETY OF ARTS.—Wednesday, at eight p.m., "On Gold Mining, and the Gold Discoveries made since 1851," by John Arthur Phillips.

SOCIETY OF ENGINEERS.—Monday, at seven p.m., "On the Use of Coal in Furnaces without Smoke," by F. Young.

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Yearly (including two double numbers), £1 11s. 6d.

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THE ENGINEER *is registered for transmission abroad.*

Letters relating to the advertisement and publishing department of this paper are to be addressed to the publisher, MR. BERNARD LUXTON; *all other letters and communications to be addressed to the Editor of* THE ENGINEER, *163, Strand, London, W.C.*

THE ENGINEER.

FRIDAY, MAY 9, 1862.

THE ORDNANCE OF THE DAY.

NONE need now be told that great improvements have been made in ordnance since 1851. So great, indeed, is the renown of these improvements that they are not unfrequently supposed to represent new discoveries in the science of gunnery itself. To double the range of a gun, and, so to speak, to increase its precision tenfold, would, indeed, be hardly supposed to be within the scope merely of mechanical improvement in the construction of cannon. This, nevertheless, is all that distinguishes the best gun of the present day from those made a century ago. For the first cannon ever made were constructed of wrought iron, and at frequent intervals during the last five centuries guns have been made to load at the breech. As for rifling, and the whole principle of elongated, rotating projectiles, Benjamin Robins explained both, in the fullest manner, as long ago as 1740. Upon every branch of artillery construction and practice there are books in print, musty with age, in which almost all that is now known upon these subjects may be read. It is, indeed, very difficult to say what peculiarity, other than the greatest refinement of mechanism, there is to distinguish the Armstrong gun from others made long before. It is now, indeed, difficult to define what the Armstrong gun really is. Sir William appears to have thrown overboard the breech-loading arrangement, but whether breech-loading or muzzle-loading there is nothing new in either. He employs wrought iron coils according to Captain Blakely's patent, but without Captain Blakely's careful provision of an inner tube of steel, brass, or cast iron. It is practically impossible for wrought iron to withstand the repeated explosion of heavy charges of powder without stretching and ultimately cracking. Almost all large guns heretofore made with wrought iron chases have failed under continued service, and those of the Armstrong guns are being continually bored out and replaced at Woolwich. At the same time, if it were really desirable to employ forged iron for the internal tubes of guns, few private firms would think of doing so without Captain Blakely's consent, as the mere substitution of wrought iron for steel would not be a sufficient departure from his specification to constitute an original feature independent of his patent. We say this merely to show that Sir William Armstrong has no right to the credit of any invention in the gun bearing his name, which is, on the contrary, as much a Blakely cannon as any one of those made at Liverpool. All along we have been told that Sir William is an inventor, whereas, as far as guns are concerned, he is only a successful adventurer. In saying, moreover, that he was anticipated by Captain Blakely we do not mean to say that the system of the latter is at all the best as applied to guns made wholly in forged metal. The Blakely or coil system is no doubt excellent for strengthening cast-iron guns, and it is thus that, in its inventor's hands, it has received its most successful application. If the War-office had the courage to confess its mistake in taking up an invention second hand, and in allowing a person who had no claim to it to misapply it under a disguise, we might now have all our cast iron service guns greatly strengthened at a very moderate cost, and afterwards rifled, if thought necessary. Thus improved they would be every way better than the immense stock of costly wrought iron guns now on hand, few of which have ever withstood 300 rounds. The results, too, as given in another column, of Mr. Bashley Britten's practice with ordinary unstrengthened cast iron service guns rifled with shallow grooves, are, indeed, remarkable, and afford fresh ground for the belief that the costly reconstruction of our artillery has been very much like a gigantic blunder.

A gun is simply a single-acting cylinder, much the same as that of the Cornish engine, and in which the expansive force of gunpowder is employed to drive out a piston or projectile at every stroke. Make the cylinder strong enough to be safe from bursting, and bore it as truly as an engine cylinder, and the result will be an excellent gun. If the piston or projectile is to be elongated or bolt-shaped, in which case it would tumble over if fired from a smooth cylinder, we have at most only to adopt some means whereby the piston will be caused to spin rapidly on its own axis while coming out. In this case it will keep "end on" and in the proper line of flight, all which is accomplished by fitting the shot to spiral grooves in the chase of the gun, these grooves forming the "rifling" and constituting the gun a veritable "rifle." But long shot are only required for precision, and no rifled gun can project its shot, of a given weight, with a given charge of powder, with anything like the force of a shot of the same weight, fired with the same charge of powder from a smooth bore gun. In a rifle, too, the powder is exploded against a much smaller surface on the back of the shot than in a smooth bore, throwing a ball of the same weight, and thus a greater strain is brought upon the rifled gun. The conclusion is, therefore, that while rifling is only required for long range firing, which is never likely to enter largely into naval engagements, it requires the strongest guns. Now, when guns much stronger than those of cast iron are required it is clearly much better to employ mild steel, which is now made as tough as copper, of nearly double the strength of the best wrought iron, and at a considerably less cost. The best steel, at any rate in large masses, is now actually cheaper than wrought iron in the same shape. More than this, the steel is fusible and can be cast into perfectly sound and homogeneous masses of any weight, while it is exceedingly difficult to insure soundness in any large forging of wrought iron. It is not that any additional strength over and above the original strength of the material, is imparted by Captain Blakely's coils, as now used at Woolwich and Elswick, but it is because it would be exceedingly difficult, if not impossible, to insure soundness by any other means in wrought iron cylinders that so roundabout a system is resorted to. At the same time a cylinder of nearly twice the strength, and of much greater toughness, could be cast in mild steel, direct from the pig, in half an hour, and the ingot re-heated and hammered and bored out in a period so brief in comparison that the dawdling and insecure mode now practised at Woolwich and Elswick would seem a remnant of mechanical barbarism. Once made, the steel gun would necessarily do far more work than any wrought iron gun, and if Sir William's 10¼in. gun, weighing 12 tons, has thrown a 156lb. ball with from 50lb. to 90lb. of powder, one of the same size and weight in steel would as readily throw two such balls with twice the quantity of powder.

The Director of Ordnance (who is also a contractor for supplying his own guns to Government) has shifted so much from the plans with which he first obtained the favour of Lord Derby's Government that he may surprise us yet with an unreserved adoption of mild steel guns bored out of the solid. If he would only turn out a few hundred 12in. smooth bores thus made, the cost of which need not exceed £300 each, he would have placed his country under obligations much beyond those justly due to anything which he has yet accomplished.

LOCOMOTIVE BOILER MAKING.

STEAM is now generated to such an extent in boilers of the locomotive type that their construction is of great importance in respect of both economy and safety. There are now almost exactly 6,000 locomotive engines employed on our railways, multitubular boilers have been almost exclusively adopted in steam vessels, at least 8,000 have been made by the portable engine makers (Messrs. Clayton, Shuttleworth, and Co. alone having made nearly 4,750 portable engines), and boilers of the same general class are in considerable use for fixed engines in all parts of the kingdom. With the constant, although gradual, increase being made in the working steam pressure, the locomotive boiler appears destined, moreover, to supersede the Cornish and other classes of land engine boilers to a very much greater extent than at present. To obtain 500 indicated horse power on the Cornish plan, about 60 tons of boilers, occupying a space of 40ft., by 30ft. are necessary, whereas two locomotive boilers, weighing together 20 tons, and occupying a space of 10ft. by 20ft., would do the same work. The evaporative power of the multitubular boiler is practically equal also to that of its bulky rival, so that the advantages of the former are, on the whole, sufficient to compensate for a somewhat greater cost for repairs.

With regard to the material of locomotive boilers, there is an increasing disposition to employ steel instead of iron. Under the name of homogeneous metal, Messrs. Shortridge, Howell, and Co.'s mild steel has been for some time successfully used in firebox plates on the Scottish Central Railway, and Messrs. Cammell and Co.'s steel has been similarly used, for a long time, for fireboxes on the Great Western Railway of Canada. On the last-named line two boilers for heavy freight engines have been made throughout of the same steel, and have been in constant and satisfactory use for upwards of fifteen months. Indeed, with steel of a very mild quality, or, in other words, a steel containing only a very small amount of carbon, no possible difficulty could be apprehended, for not only is such steel as tough as copper, but it is as workable in the fire as the best iron, whether the object be flanging or welding. Neither, we believe, has boiler steel caused any trouble in the case of locomotives by reason of any expansion peculiar to itself, or in any way different from the ordinary expansion of boiler iron. When the steel boilers of the steam vessel John Penn were removed, it was said that their failure was owing to the excessive expansion of the steel. This was most improbable in itself, for the expansion of steel is not known to vary to any extent from that of wrought iron. It was more likely that an unsuitable quality of steel was used, perhaps puddled steel, or, at any rate, a variety containing too much carbon, and, for that reason, brittle. The very largest class of land boilers—worked, too, at 100 lb. pressure per square inch—are now made from Bessemer steel, and nothing is heard of any difficulty in the way of expansion. For fireboxes especially, we believe the mild steel plates, which are now furnished by the best makers at a price below the average of the various prices for Lowmoor iron plates, will be found even better than copper, offering greater endurance with much less weight, and at less than one-sixth of the first cost, when the difference of thickness is taken into account. For tubes, too, there is no reason, that we know of, why steel should not entirely supersede brass, especially as ordinary Staffordshire iron tubes have been already found to answer a good purpose in coal-burning engines.

The gain in strength and saving of weight by the adoption of steel for locomotive boilers are especially important. Larger and larger boilers are being constantly made, and the pressure at the same time increased. Pressures of 130 lb. to 150 lb. are very common now, whereas, only a few years ago, 110 lb. was reckoned high. To secure sufficient strength with iron would involve great weight and some risk of unsoundness in the plates themselves, as thick plates are notoriously irregular in texture. It is for no other reason than that ½in. iron would blister and crack in fireboxes that we are compelled to use copper at £100 a ton. The American engines burn wood chiefly, but even with that fuel thick iron firebox plates are inadmissible, and the difficulty is got over only by using the best iron, generally Bowling, only ½in. thick. With a sufficient number of stay-bolts this is abundantly strong, and very durable. It is a fact frequently noticed that a thick copper tube plate, or that portion of it below the tubes, will, after a short time, lose half its thickness by burning while the remaining portion may last six or seven, or even, in some cases, fifteen years. We suspect, moreover, that it is to the use of thick boiler plates, and especially to the connection of the barrel and smoke-box by thick angle iron, that we owe the phenomenon of "furrowing," which is a gradual corrosion of the substance of the plates, generally close to the smoke-box or in the smoke-box tube-plate itself. To this corrosion was due the fatal explosion, in July, 1861, on the London and

North-Western line, a case which has already resulted in much litigation, and which gives promise of much more. The reason why we refer such cases of corrosion, sporadic although they are, to the use of thick plates, is partly because, among 9,000 locomotives running in the United and Confederate States of America, all having boilers of thin iron ($\frac{1}{4}$in. to $\frac{5}{16}$in.) we are assured that such corrosion is entirely unknown. That it is not owing to peculiarities in the water employed appears certain, because, of a dozen more engines, constantly using water from the same wells, only one or two perhaps will, on examination, show signs of "furrowing." It might be said that, for this reason, the phenomenon could not be attributed to the use of thick plates, inasmuch as those in all the engines might be of equal thickness, the majority, nevertheless, being exempt from "furrowing." This, however, only brings the phenomenon back again into the region of mystery, whereas the "working" of a thick plate upon the unyielding edge of a heavy angle iron, the boiler, meanwhile, being under the united influences of heat and tension, does afford some plausible explanation of the result in question. It will be worthy of close attention whether the whole difficulty does not disappear, as we believe it will, with the introduction of thinner plates of steel. As for angle iron, its rejection will be attended with a saving of weight and rivetting, and with plates which will bear flanging, with a probable gain of strength. The French and American locomotive makers have long since discarded angle iron altogether, and among our own builders it has been, to a considerable extent, dispensed with by the adoption of the straight boiler, in which the firebox is flush with the barrel. By far the larger number of the locomotives in the Exhibition have flush boilers, and although there is nothing really new in this mode of construction, its adoption is equivalent to a decided practical improvement. This would be even greater were the smoke box, at least for outside cylinder engines, made entirely cylindrical, the front tube plate being flanged and rivetted in the boiler as in Sir W. G. Armstrong and Co.'s engine in the Exhibition. The cylinders would be fastened as securely and as readily as at present, and really with as little weight.

The whole saving of weight by the adoption of steel for locomotive boilers of the largest class should be between one and two tons, the cost of moving which in an express engine, is not under 1½d. per mile run, or nearly £200 a year for its ordinary mileage. The whole saving of weight, however, cannot be realised while rivetted joints are retained, the strength of which is hardly more than one-half that of the whole plate. For large boilers many makers already employ double-rivetted joints, the strength of which is believed to be one-fourth greater than that of single-rivetted joints. So, too, plates with thickened edges are used to some extent, as in Messrs. Fairbairn and Sons' engine in the Exhibition. But welded joints are the only means of preserving the full strength of the material, and we do not doubt that boilers welded up on Mr. Bertram's plan will be found the strongest. Locomotive boilers indeed have occasionally been made with the longitudinal seams welded up solid, and we observe that some of the Sheffield steel makers are now making lap welded tubes of mild steel up to a diameter of 3ft. Presuming that, as these can be made of a diameter of 3ft., they can be made of any size, they seem to offer an excellent material for the barrel of locomotive boilers, and we shall be glad to hear of their practical adoption. Krupp, meanwhile, is preparing to roll steel of a width of 15ft., so that a locomotive boiler barrel of the very largest size can be rolled up and welded whole from a single plate.

We trust that the time is not far distant when those abominations—midfeathers—will be entirely abandoned in locomotive boilers. They are still retained, in a few cases, under they pretence that, when placed longitudinally in the firebox, they promote the combustion of coal. As arranged, however, in the Wolverton engines, we cannot believe that they are of the slightest service, while we are well aware that nearly all the "midfeathers" in the London and North-Western fireboxes are constantly leaking. A large firebox, with a dead plate on the grate, a perforated fire door, a deflecting baffle plate and careful firing, will accomplish, we believe, all that can be desired in the way of burning coal in locomotives.

LITERATURE.

Memoir of the Life of Sir Marc Isambard Brunel. By Richard Beamish, F.R.S. London: Longman, Green, Longman, and Roberts. 1862.

A memoir of the Life of Sir Marc Isambard Brunel, if executed even with a moderate degree of merit, would necessarily possess great interest for engineers of every class and grade. But here we have a work which not only possesses this interest, but is also greatly enhanced in value in consequence of the intimate acquaintance with Brunel's greatest undertakings which the author enjoyed, and of the clear and effective manner in which he has embodied his knowledge in the pages before us. Mr. Beamish was one of Brunel's most active and valuable engineering coadjutors during the construction of the Thames Tunnel, and the detailed account which he here gives of that great work constitutes an admirable contribution to engineering literature.

The life of Sir Marc Brunel is here traced with care from his birth at Hacqueville, near Gisors, in Normandy, in 1769, down to his death in Park-street, Westminster, in 1849; his escape from France with a forged passport, his labours in America, and his subsequent struggles and achievements in our own country, being all set forth in language so clear and unaffected, and withal so soundly technical where necessary, that Mr. Beamish's work will doubtless take a very high place among professional biographies.

While the author certainly extenuates the faults of the elder Brunel—his over-fondness for great enterprises, his deficient regard to their commercial bearings, and his excessive love of approbation and sensitiveness to criticism—he does not attempt to conceal them; but, doubtless, leaves us to infer that their true cause lay less in him than in the people from whom he sprung. It would be idle to expect that the life of a man born and bred in France should be in all respects pleasant to Englishmen, if judged by our own standards. We are bound to remember that Brunel was a Frenchman, and that single fact will serve to transmute many of his faults, if not into virtues, at any rate into national and, therefore, forgiveable characteristics.

Brunel was essentially a mechanical genius, and owed all the eminence which he won to that circumstance. At the same time we think Mr. Beamish would have done well to have shown, if he could, how far and in what manner he corrected and informed himself by the study of the works of his predecessors and contemporaries. We very much fear, however, that in this respect there is not much to be said of him, for it has always seemed certain to us—and Mr. Beamish's book only confirms us in the opinion—that the great fault of both the Brunels, father and son, lay in the indulgence of an overweening confidence in themselves, and in a corresponding disregard of the opinions and knowledge of others; and it is for this cause that we, for our part, never can consent to class them among the greatest minds. Great they may have been, but it cannot be said that they were

> "As the greatest only are,
> In their simplicity sublime."

They were, we fear, quite without reverence for, or even deference to others, and believed almost exclusively in themselves.

Still, Sir Marc Isambard Brunel was a memorable personage, and the life of him which Mr. Beamish has here produced will be received with great profit and interest by our readers, and will worthily take a permanent place in every professional man's library.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

360. Gustav Lindemann, Manchester, "Improvements in applying gas for the purpose of singeing or dressing yarns or threads and woven fabrics, and for obtaining heat for other purposes."—*Petition recorded 11th February, 1862.*

451. Emil Moritz Stoehr, Manchester, "Improvements in the manufacture of manganese, and in the combinations of manganese with other metals."—A communication from Oscar Eugen Prieger and Ferdinand Carl Prieger, Schloss Gereuth, near Eburn, Bavaria.—*Petition recorded 20th February, 1862.*

710. William Turner, Hockley, Nottinghamshire, "Improvements in the construction of bakers' ovens, and in the use of furnaces and other apparatus connected therewith, and in the means or appliances employed therein."—*Petition recorded 14th March, 1862.*

714. Constantine Nicolaus Kottula, Bell Isle, London, "Improvements in the manufacture of combined soaps."—*Petition recorded 15th March, 1862.*

729. William Edward Gedge, Wellington-street, Strand, London, "Improvements in the manufacture of crinolines"—A communication from Jules Libert, Boulogne-sur-Mer, France.—*Petition recorded 17th March, 1862.*

901. James Moore Clements, Birmingham, "Certain improvements in sewing machines for performing the various kinds of work necessary in stitching, button and eyelet-hole working, embroidering, and sewing generally."—*Petition recorded 31st March, 1862.*

911. William Turner, Hockley, Nottinghamshire, "Improvements in machinery or apparatus employed in the manufacture of dough, and especially of fermented dough."—*Petition recorded 1st April, 1862.*

938. William Helme, Caldbeck, Cumberland, "Improvements in fire lighters."

939. Robert Morten, Stockton-on-Tees, "Improvements in refrigerators or apparatus for cooling liquids, parts of which improvements are also applicable to distillation, surface condensation, heating air for blast furnaces, and other similar purposes."—*Petitions recorded 3rd April, 1862.*

956. Thomas Silver, Bury-street, St. James', London, "Improvements in governors for regulating the speed of steam and other engines."—*Petition recorded 4th April, 1862.*

1010. James Bullough and John Bullough, Baxenden, near Accrington, Lancashire, "Improvements in looms for weaving."—*Petition recorded 9th April, 1862.*

1021. Daniel Fryer, Carlton-square, Old Kent-road, Surrey, and William James Williams, Arundel-street, Strand, London, "Improvements in the method of, and apparatus for, letting on and cutting off the supply of gas to groups or districts of street and other lamps from a central point or depôt."

1038. Andrew Trimen, Adam-street, Adelphi, London, "The protection and solidification of magnesian limestone and other stones, and for the prevention of the passage of water through the same."—*Petitions recorded 10th April, 1862.*

1054. Joseph Bunnett, Deptford, Kent, "Improvements in revolving shutters, and in machinery for producing the same."—*Petition recorded 12th April, 1862.*

1070. John Dargue, Cobden-street, Lister Hills, Bradford, Yorkshire, "Improvements in machinery for preparing and combing wool and other fibrous materials."—*Petition recorded 14th April, 1862.*

1079. Jacob Taylor, Lyon Mill, Oldham, Lancashire, "Improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun."

1080. Thomas Harper Bennett, Winchester House, Southwark, Surrey, "Improvements in the manufacture of hats, caps, or other coverings for the head."

1081. Francois Alexandre Le May, New Orleans, and Charles Frederic Girard, Washington, U.S., "Improvements in the construction of revolving and repeating fire-arms, part of which invention is also applicable to other arms."

1082. Richard Roche, Southsea, Hampshire, "An improvement in gun carriages."

1083. Charles Rogers Heap, Great George-street, Westminster, "An improved construction of railway chair."—A communication from Antonio Gabrielli, Turin, Italy.

1085. George Bridson, Manchester, "Improvements in the manufacture of wire ropes, and in the preparation of wire for such manufacture."

1086. John Platt, Oldham, Lancashire, and William Cheetham, Moscow, Russia, "Improvements in looms for weaving."

1087. John Platt and William Richardson, Oldham, Lancashire, "Improvements in machinery or apparatus for cleaning wool and other hairs of animals from burrs and other foreign matters."

1088. Richard Atkinson Peacock, St. Helier, Jersey, "Improvements in constructing and working lock gates for docks, harbours, canals, and navigable rivers."

1089. William Clark, Chancery-lane, London, "Improvements in ornamenting fabrics and other surfaces."—A communication from Messrs. Eugène Siess and Charles Prosper Coindreau, Boulevart St. Martin, Paris.

1091. Ferdinand Carl Philippson, Munzstrasse, Berlin, Prussia, "Improvements in steam hammers."—A communication from Louis Schwartz Kopff, Chausséestrasse, Berlin, Prussia.

1092. James Crossdale, Rotherfield-street, Islington, London, "Certain improvements in boots and shoes for ventilating same."

1093. Rupert Rains, Crescent, Bridge-street, Blackfriars, London, "Improvements in apparatus for freezing, cooling, and churning."—A communication from Georges Toselli, Faubourg St. Martin, Paris.—*Petitions recorded 15th April, 1862.*

1094. Stephen Barrett, Clifton-street, Finsbury, London, "Improvements in projectiles."

1095. Frederic Newton Gisborne, Adelaide-place, London Bridge, London, "Improvements in the construction of electric targets for rifle and gun practice."

1097. John Barbour, Liverpool, "Improvements applicable to upholsterers' and other hand hammers."—A communication from William Thomson, Toronto, Canada.

1098. Walter Ferguson Lock, Haylands, near Ryde, Isle of Wight, "An elongated projectile to be shot from smooth-bored ordnance, and which shall retain during its flight the longer axis in the direction of its line of flight similarly to elongated projectiles propelled from rifled ordnance."

1099. John Wilson Hadwen, Kebroyd Mills, Halifax, Yorkshire, "Improvements in the treatment and application of soft silk waste."

1100. David Stott, Frith House Mills, Stainland, Yorkshire, "Improvements in the manufacture of rings from paper, millboard, or pasteboard, applicable for steam or other pipe joints, bobbin ends, or other purposes, and in the means or apparatus employed therein, which are also applicable to the manufacture of rings from other flexible substances."

1101. James Mackay, Liverpool, "Certain improvements in projectiles for fire-arms."

1102. John Martin Rowan, Glasgow, Lanarkshire, N.B., "Improvements in manufacturing articles of cast steel."

1103. Robert Cochran and Robert Cochran, jun., Paisley, Renfrewshire, N.B., "Improvements in producing ornamental fabrics."

1104. Frederic Pelham Warren, East-court, Cosham, Hampshire, "Improvements in apparatus for steering sea-going vessels."

1105. Matthew Cartwright, St. John's-row, Hoxton, London, "Improvements in the manufacture of models, and of plates or pieces for artificial teeth, and in combining or amalgamating india-rubber and gutta-percha with metals for the manufacture of artificial plates or pieces, and for other purposes."

1106. William John Marsden, Sheffield, Yorkshire, "Improvements in eye-shades."

1107. William Edward Newton, Chancery-lane, London, "An improvement in setting artificial teeth."—A communication from David Steinberg, San Francisco, U.S.

1108. William Edward Newton, Chancery-lane, London, "Improvements in the manufacture of cannon and other ordnance, and of solid and hollow cylinders for shafting and other purposes, of wrought iron or steel, or both combined."—A communication from David Tomlinson Yeakel, Lafayette, Indiana, U.S.

1109. John Stanton, Birmingham, "Improvements in apparatus or machinery to be used in stamping or piercing metal washers and other similar articles."

1111. John Ashbury, Manchester, "Improvements in the permanent-way of railways."

1112. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in railway and common road carriages."—A communication from Claude Marie Bathias, Paris.

1113. John William Ford, Shooter's-hill, Kent, "Improvements in sewing machines."—A communication from Gordon McKay, Boston, and Robert Henry Mathies, Manchester, U.S.

1114. John Weston, Upper Whitecross-street, St. Luke's, London, "Improvements in machinery for morticing, drilling, and dove-tailing, and in tools to be used therewith."—*Petitions recorded 16th April, 1862.*

1115. Charles Denton Abel, Southampton-buildings, Chancery-lane, London, "Improvements in the manufacture and production of the chromates and the bichromates of potash and of soda."—A communication from Louis Alexandre Taillandier, Argenteuil, France.

1117. Victor Fleury, Rue de la Paix, Paris, "Improvements in clocks and other time keepers."

1118. William Hodgson Hutchinson, Bury, Lancashire, "Improvements in the manufacture of ammonia or its salts, and cyanogen or its compounds, from refuse gluten."

1119. John Griffiths, Liverpool, "Improvements in propelling ships and other navigable vessels."

1120. William Harling, John Matthew Todd, and Thomas Harling, Burnley, Lancashire, "Improvements in looms for weaving."

1121. Frederick Tolhausen, Faubourg Montmartre, Paris, "An improved machine for making bricks, tiles, and the like articles."—A communication from Victor Duprat, Canéjan, de la Gironde, France.

1122. James Murphy, sen., Glasgow, Lanarkshire, N.B., "Improvements in looms."

1123. John Pugh Temperley, Soho Ironworks, Bolton-le-Moors, Lancashire, "Improvements in the air pumps of steam engines."

1125. Jean Louis Perin, Rue du Faubourg, St. Antoine, Paris, "Improvements in machinery for morticing wood."

1126. Henry Gardner, Leeds, Yorkshire, "Improvements in machinery for breaking and preparing flax and other fibrous substances."

1127. Charles Denton Abel, Southampton-buildings, Chancery-lane, London, "Improvements in the manufacture and production of certain alloys containing cadmium."—A communication from Henri Catherine Camille du Ruolz and Anselme Louis Marie Fontenay, Paris.

1128. Richard Archibald Brooman, Fleet-street, London, "Improvements in taps and valves."—A communication from Jean Antoine Clement, Antoine Crozy, and André Moratear, Boulevart de Strasbourg, Paris.

1129. Richard Archibald Brooman, Fleet-street, London, "Improvements in buffing apparatuses and in draw-springs."—A communication from Richard Dover Chatterton, Coburg, Canada West.

1130. William Anderson, Shaftesbury-street, London, "Improvements in tubular steam generators."

1133. William Clark, Chancery-lane, London, "Improvements in the manufacture of railway rails."—A communication from Jean Baptiste Delrieu, Boulevart St. Martin, Paris.

1134. Joseph Cedric Rivett, Prestolee New Mills, Farnworth, Lancashire, and John Muir Hetherington, Manchester, "Improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning."

1135. Ralph Wedgwood, Barnes, Surrey, "Improved apparatus for facilitating the saving of life in cases of fire."—*Petitions recorded 17th April, 1862.*

1136. Robert Dennison, Lancaster, "Improvements in reaping and mowing machines."

1137. Edwin Dove, Hunter-street, London, "Improvements in matches and fuzees, and apparatus for containing and igniting the same."

1138. Joseph Scott Phillips, College-crescent, Finchley-road, Middlesex, "A new method and apparatus for the propulsion of vessels through the water."

1139. John Shanks, Barrhead, Renfrewshire, N.B., "Improvements in apparatus for promoting ventilation, also applicable to drying stoves."

1140. Moses Masters, New Kent-road, Surrey, "Improvements in artificial legs."

1141. Richard Stuart, Graham Stuart, and Henry Hill, Sheffield, Yorkshire, "Improvements in fastening flyers upon spindles."

1142. Benjamin Rhodes, Old Ford-road, Bow, Middlesex, "Improvements in the machinery for and in the method of making, as also in the materials to be employed in the manufacture of cylinders, tubes, and other vessels from paper and other materials or fabrics."

1144. Benjamin Browne, King William-street, London, "Improvements in breech-loading fire-arms."—A communication from Felix Célestin Palis, Place de la Bourse, Paris.

1145. Edward Loysel, Cannon-street, London, "Improvements in locks and fastenings."

1146. William Rose, Hales Owen, Worcestershire, "Improvements in the manufacture of tubes, more especially applicable to the barrels of fire-arms and ordnance."

1147. Alexander Parkes, Liverpool-street, Birmingham, "Improvements in the manufacture of rollers for surface printing and embossing."

1148. Alfred Nicholson Wornum, Store-street, London, "Improvements in pianofortes."

1150. Henry Lumley, Chancery-lane, London, "An improved rudder."—*Petitions recorded 19th April, 1862.*

1154. John Pickard and Thomas Morris, Preston, Lancashire, "Improvements in furnaces for the prevention or consumption of smoke."

1156. Sandiforth Featherstone Griffin, New Adelphi Chambers, London, "Improvements in the construction of vessels of war and batteries on land."

1158. Edwin Francis Clarke, Waterloo, near Liverpool, "Improvements in propellers for steamships and other vessels."

1159. Richard Archibald Brooman, Fleet-street, London, "Improvements in jackets or protectors for covering metal and other surfaces, to prevent loss of heat by radiation."—A communication from Charles Louis Ruquois, Marseilles, France.

1160. Frederick Tolhausen, Fleet-street, London, "An improvement in horse-shoes."—A communication from Paul-Eugène Cément, St. Amand (Marne), France.

1161. Thomas Attwood, Lewes, Sussex, "Improvements in kitcheners."

1164. James Chapman Amos, The Grove, Southwark, Surrey, "An improved mode of, improvements in and apparatus for, supplying surface condensers with water, part of which improvements is applicable to blowers and rotary pumps generally."

1165. Christopher Crabb Creeke, Bournemouth, Hampshire, "Improvements in the construction of drain and other pipes."—*Petitions recorded 21st April, 1862.*

1170. Charles Webster, Park Steps, Ilkeston-road, Radford, Nottinghamshire, "Improvements in self-acting fountains adapted for garden engines, fire engines, and for raising and forcing water from mines, wells, and other places."

1171. Arthur Warner, Threadneedle-street, London, "Improvements in the construction of vessels of war and in floating or other batteries."

1172. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in apparatus for propelling and manœuvring ships."—A communication from Jean Pierre Victor Le Rouge and Jacques Henri Charles de Berley, Paris.

1173. George Scoville, Wood's Hotel, Furnival's inn, London, "Improvements in pistons for steam engines."—A communication from Augustus James Scoville and Augustus Hervey De Clereq, Bloomington, Illinois, U.S.

1174. Robert Roby, Bury St. Edmunds, Suffolk, "Improvements in the construction of apparatus for rolling or crushing land."—*Petitions recorded 22nd April, 1862.*

1176. Luke Holden, Burnley, Lancashire, "Certain improvements in harness for animals of draught and burden."

1180. William Carpenter, Greenwich, Kent, "An improved method of printing in colours."

1182. Alexander Robertson, Bachelor's-walk, Dublin, and Richard Barter, St. Anne's, Blarney, Ireland, "Improvements in apparatus for

distributing and projecting fluids either for surgical, sanatory, or domestic purposes."

1186. GEORGE TOMLINSON BOUSFIELD, Loughborough Park, Brixton, Surrey, "Improvements in the construction of elliptic springs for wheel carriages and other purposes."—A communication from Jabez Marshall Woodward, Brooklyn, Kings, New York, U.S.

1188. WILLIAM EDWARD NEWTON, Chancery-lane, London, "An improved fertilising composition."—A communication from John McAuley Gallacher, Roxbury, Norfolk, Massachusetts, U.S.

1190. CHARLES EDWIN HEINKE, Great Portland-street, London, "Improvements in diving helmets, dresses, and apparatus, parts of which improvements may also be employed for extinguishing fires in ships and other confined places."—*Petitions recorded 23rd April*, 1862.

1194. JOHN BOND, Burnley, Lancashire, "Certain improvements in projectiles, which improvements are also applicable to horns attached to vessels for war purposes."

1196. JOHN WINSBORROW, Samson-terrace, Marlborough-road, Dalston, London, "Improvements in wet gas meters."

1198. JOSEPH ADOLPHE TRAVERSIER, South-street, Finsbury, London, "Some improvements in making ladies' bonnets."

1200. GEORGE WASHINGTON BELDING, King-street, Cheapside, London, "Improvements in harrows or cultivators."—A communication from Willis Churchill, Newark, New Jersey, U.S.

1202. ROBERT MUSHET, Coleford, Gloucestershire, "An improvement or improvements in the lining, repairing, or 'fettling' or puddling furnaces."

1204. RUDOLF ZIMARA, St. Petersburg, Russia, "Improvements in stoves for heating and ventilating buildings."—*Petitions recorded 24th April*, 1862.

Invention Protected for Six Months by the Deposit of a Complete Specification.

1244. WILLIAM TAYLOR GLIDDEN, Massachusetts, U.S., "A new and useful mode of restoring phosphatic guano."—A communication from Louis Harper, Brooklyn, New York, U.S.—*Deposited and recorded 29th April*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

1067. ROBERT HARRINGTON, Colonade, Albany-road, Camberwell, Surrey.—Dated 28th April, 1859.

1090. CHARLES HANSON GREVILLE WILLIAMS, Regent-square, Gray's-inn-road, London.—Dated 30th April, 1859.

1111. LYMAN REED BLAKE, Massachusetts, U.S.—Dated 3rd May, 1859.

1075. WILLIAM MCINTYRE CRANSTON, New Broad-street, London.—A communication from Walter Abbot Wood, Hoosick Falls, Rensselaer, New York, U.S.—Dated 29th April, 1859.

1083. JOSEPH TOUSSAINT, Welbeck-street, Cavendish-square, London.—Dated 30th April, 1859.

1085. EDWARD FRANCIS, Wrexham, Denbigh.—Dated 30th April, 1859.

1182. HENRY CLARKE, Wakefield, Yorkshire.—A communication from Thomas Narburgh, St. Louis, Missouri, North America.—Dated 11th May, 1859.

1092. THOMAS HALL ARROWSMITH, Bolton, Lancashire.—Dated 2nd May, 1859.

1109. WILLIAM SELLERS, Philadelphia, Pennsylvania, U.S.—Dated 3rd May, 1859.

1095. WILLIAM BAYLISS, Monmore-green, Wolverhampton, Staffordshire.—Dated 2nd May, 1859.

1106. THOMAS WILLIAM MILLER, Her Majesty's Dockyard, Portsea, Southampton.—Dated 3rd May, 1859.

1115. ROBERT MUSHET, Coleford, Gloucestershire.—Dated 3rd May, 1859.

1123. JOSEPH FELIX ALLENDER and DANIEL ROWLEY, Brierley-hill, Staffordshire.—Dated 5th May, 1859.

1150. ROBERT MUSHET, Coleford, Gloucestershire.—Dated 7th May, 1859.

1151. ROBERT MUSHET, Coleford, Gloucestershire.—Dated 7th May, 1859.

1173. GEORGE BELL, Wandsworth, Surrey.—Dated 10th May, 1859.

Patents on which the Stamp Duty of £100 has been paid.

975. WILLIAM HARTLEY, Bury, Lancashire.—Dated 1st May, 1855.

986. HENRY LEE, jun., Lambeth, Surrey, and JOHN GILBERT, Hackney-road, London.—Dated 2nd May, 1855.

988. MARIE AMEDIE CHARLES MELLIER, Rue de Seine, St. Germain, Paris.—Dated 2nd May, 1855.

Notices to Proceed.

3217. JOHN ROSINDELL, Mile-end, London, "An improved method of, and apparatus for, separating solid from liquid substances."—*Petition recorded 24th December*, 1861.

3228. THOMAS SIMMONS and THOMAS TIMMINS, Birmingham, "Certain improvements in urns or vessels for holding and supplying hot water, tea, coffee, or other liquids, separately or conjointly, as also in the stands for the same."

3229. JABEZ JONES, Liverpool, "Improvements in the manufacture of lead, tin, and other metals, or amalgamation of metals of a like nature fusible at a low temperature into sheets of any thickness or length, and in the apparatus connected therewith."

3235. RICHARD NEEDHAM, Dukinfield, Cheshire, "Improvements in apparatus for cleansing steam boilers, and lubricating the pistons of steam engines, and for an improved steam trap."

3237. JOSEPH NOTTINGHAM PALMER, Fenchurch-street, London, "Improvements in cooking stoves and ships' ranges."—A communication from John Russell, Sydney, New South Wales."—*Petitions recorded 26th December*, 1861.

3238. WILLIAM HAWKSWORTH, Oldham, Lancashire, "Certain improvements in carding engines."

3243. THOMAS WILLIAM ATLEE, Birmingham, "Certain improvements in cocks or taps for drawing off fluids."

3247. JEAN JOSEPH HECTOR FAJOLE and PASCAL ACHILLE AGOSTINI, Courbevoie, France, "An improved composition or improved compositions suitable for painting, varnishing, and coating."—*Petitions recorded 27th December*, 1861.

3250. ARTHUR WARNER, Threadneedle-street, London, "Improvements in the manufacture of cases or receptacles for oil fuses and other articles used in the military and naval services."—*Petition recorded 28th December*, 1861.

3258. JOHN BELLAMY PAYNE, Chard, Somersetshire, "Improved machinery for the manufacture of laid and other twine, lines, ropes, bands, and other cordage, whether made of hemp, flax, or other fibrous substances, or of wire."—*Petition recorded 30th December*, 1861.

3264. NEIL MCHAFFIE, Summer-street, Mile-end, Glasgow, "Improvements in ventilators or valves for regulating the passage of air or other fluids, whether of a gaseous or liquid form."

3268. JOHN HASLAM, Preston, Lancashire, "Improved apparatus for winding, holding, and letting go cords, bands, or chains, particularly applicable to window blinds."—*Petitions recorded 31st December*, 1861.

6. THOMAS CHARLES CLARKE, Liverpool, "Improvements in the construction of apparatus for heating and circulating water and other liquids."

8. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in shears or scissors, chiefly applicable to be employed in the manufacture of lace."—A communication from Pierre Joseph Henninot and André Carpentier, Candry, France.

11. BENJAMIN RHODES, Old Ford, Bow, London, "Improvements in forming or making straight and bent pipes, and bends for pipes, and also vessels of various shapes, and in coating or protecting objects and articles of various forms, and in the apparatus to be employed therein."—*Petitions recorded 1st January*, 1862.

22. GEORGE JEFFRIES, Golden Ball-street, Norwich, "Improvements in breech-loading fire-arms."—*Petition recorded 2nd January*, 1862.

27. WILLIAM EDWARD GEDGE, Wellington-street, Strand, London, "Improvements in apparatus for dressing, cleaning, or sifting grain."—A communication from Louis Appolinaire Haton, Passage des Petites Ecuries, Paris.—*Petition recorded 3rd January*, 1862.

61. HENRI CHARVET, Lille, Nord, France, "Improvements in the spinning of cotton, and in its various applications."

63. BENJAMIN THOMPSON, Birmingham, "Improvements in ordnance and fire-arms, and in projectiles to be used therewith."—A communication from Edward Heaton, New Haven, Connecticut, U.S.—*Petitions recorded 9th January*, 1862.

77. WILLIAM HENRY PRIECE, Southampton, "Improved apparatus for signalling upon railways."—*Petition recorded 10th January*, 1862.

82. HENRY CHARLTON, Birmingham, "Improvements in the manufacture of certain kinds of shoes for mules and horses."—*Petition recorded 11th January*, 1862.

153. LOUIS MARTIN, Rue Gaillon, Paris, "Improvements in the treatment of mineral oils, and in the apparatus connected therewith."

166. EDMUND PACK, Queen-street, London, "Improvements in laths for Venetian blinds, in painting such laths, and in raising and lowering Venetian blinds."—*Petitions recorded 22nd January*, 1862.

710. WILLIAM TURNER, Hockley, Nottinghamshire, "Improvements in the construction of bakers' ovens, and in the use of furnaces and other apparatus connected therewith, and in the means or appliances employed therein."—*Petition recorded 14th March*, 1862.

735. BRERETON TODD, Bissoe and Perran Smelting Works, near Falmouth, Cornwall, "Improvements in the manufacture of antimony and the oxide of antimony."

736. WILLIAM BARFORD, Peterborough, Northamptonshire, "Improvements in rollers for rolling land."—*Petitions recorded 17th March*, 1862.

759. FREDERICK WARNER, Crescent, Cripplegate, London, "Improvements in cocks or taps."—*Petition recorded 18th March*, 1862.

776. ROBERT MARTIN ROBERTS, Kensington, London, "Improvements in obtaining and applying motive power."—*Petition recorded 20th March*, 1862.

911. WILLIAM TURNER, Hockley, Nottinghamshire, "Improvements in machinery or apparatus employed in the manufacture of dough, and especially of fermented dough."—*Petition recorded 1st April*, 1862.

1003. JOHN LAWSON, Hope Foundry, Leeds, Yorkshire, "Improvements in balling cotton and thread."—A communication from Adolphe Alphonse Poullier, Lille, France.—*Petition recorded 8th April*, 1862.

1012. WILLIAM DAVIES, Llanelly, Carmarthenshire, South Wales, "Improvements in puddling, balling, and reheating furnaces."

1015. COLIN MATHER, Willow Bank, Broughton, near Manchester, "Improvements in spittoons."—*Petition recorded 9th April*, 1862.

1030. HENRY DEACON, Appleton House, Appleton, Lancashire, "Improvements in the manufacture of caustic soda."—*Petition recorded 10th April*, 1862.

1055. NICHOLAS NUSSEY, Holbeck, near Leeds, Yorkshire, "Improvements in machinery or apparatus for preparing and combing wool, flax, hair, cotton, silk, and other fibrous materials."—*Petition recorded 12th April*, 1862.

1065. FREDERICK TOLHAUSEN, Rue du Faubourg Montmartre, Paris, "A telegraphic dial printing apparatus."—A communication from Jean Baptiste Rousse and Henry Vivès, Rue du Faubourg Montmartre, Paris.—*Petition recorded 14th April*, 1862.

1101. JAMES MAKAY, Liverpool, "Certain improvements in projectiles for fire-arms."

1113. JOHN WILLIAM FORD, Shooter's-hill, Kent, "Improvements in sewing machines."—A communication from Gordon McKay, Boston, and Robert Henry Mathies, Manchester, U.S.—*Petition recorded 16th April*, 1862.

1244. WILLIAM TAYLOR GLIDDEN, Massachusetts, U.S., "A new and useful mode of restoring phosphatic guano."—A communication from Louis Harper Brooklyn, New York, U.S.—*Petition recorded 29th April*, 1862.

And notice is hereby further given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days next after the date of the Gazette (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 3rd May, 1862.

2136, 1s.; 2204, 3d.; 2317, 6d.; 2318, 3d.; 2319, 7d.; 2320, 3d.; 2321, 1s. 7d.; 2322, 6d.; 2323, 7d.; 2324, 3d.; 2325, 1s. 1d.; 2326, 3d.; 2327, 3d.; 2328, 9d.; 2329, 3d.; 2330, 3d.; 2331, 10d.; 2332, 10d.; 2333, 7d.; 2334, 6d.; 2335, 3d.; 2336, 3d.; 2337, 3d.; 2338, 3d.; 2339, 3d.; 2341, 6d.; 2342, 7d.; 2343, 3d.; 2324, 7d.; 2345, 3d.; 2346, 3d.; 2347, 7d.; 2348, 3d.; 2349, 3d.; 2350, 3d.; 2351, 5d.; 2352, 3d.; 2353, 10d.; 2354, 7d.; 2355, 6d.; 2356, 3d.; 2357, 10d.; 2358, 9d.; 2359, 9d.; 2360, 3s. 10d.; 2361, 3d.; 2362, 9d.; 2363, 5d.; 2364, 3d.; 2365, 2s. 3d.; 2366, 3d.; 3367, 12s. 1d.; 2368, 5d.; 2369, 6d.; 2370, 3d.; 2371, 6d.; 2372, 3d.; 2373, 1s. 4d.; 2374, 3d.; 2375, 3d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2598. C. H. HOLT, *Huddersfield*, "*Steam engines and boilers, &c.*"—*Dated 18th October*, 1861.

These improvements relate, First, to employing two vertical cylinders, one over the other, to work the same crank shaft, such crank shaft being placed between the two cylinders, and the steam after being used at a high pressure in the one cylinder, being used at a low pressure in the other. Secondly, the improvements relate to forming the cylinder piston with the inside of the top and bottom plates, forming the groove for the packing inclined, and the corresponding parts of the packing rings also inclined and divided in width into two parts, so that springs applied between these parts may have a tendency to force them down the inclined surfaces against the cylinder in which such piston works, and thereby obtain a close packing. Thirdly, the improvements relate to applying packing to rotary pumps or meters formed by the rotation together of two toothed or corrugated surfaces in a chamber, such packing being forced down inclined planes against the revolving wheels by springs or other elastic medium. Fourthly, the improvements relate to applying vertical fire chambers to steam engine boilers, such chambers being fed with fuel at the top, and having the front and back thereof formed of water tubes, the front tubes, by preference, being inclined and "louvre" formed. The patentee also forms the boiler vertical, with vertical tubes for the passage of the products of combustion from the fireplace. There may be one or more of such fireplaces around the lower part of the boiler, and sometimes he also applies a fireplace on the centre of the boiler. Fifthly, the improvements relate to regulating the pressure of steam from a steam boiler by applying to the steam passage a pair of valves (one above, the other below) connected together, and to a corrugated undulatory dome of thin metal, adapted to yield somewhat to the passage of steam, and thereby admit of the action thereon of a weighted lever on the outside thereof, the weight on which lever may be varied to suit the pressure required.

2599. W. STREATHER, *Northampton*, "*Wind engines.*"—*Dated 18th October*, 1861.

The object of this invention is to simplify the construction of wind engines and windmills, and render them applicable to many purposes, such, for instance, as the sawing of wood and stone, the grinding of clay, thrashing, and the cutting of chaff (as well as to the grinding of corn). For these purposes the patentee has a wind shaft furnished with a cast iron or suitable head, into which the whips of the sails are securely fitted and fastened, the said wind shaft being made, arranged, and acting in manner after described. This engine is furnished with a fly wheel, also with pulleys for communicating its motion to the different machines that are required to be actuated. The structure for containing the same consists in a tower constructed in a circular or other form, and of timber, by preference, as follows:—A bottom curb of timber is securely bolted or fastened down to a brick, stone, or other suitable foundation, raised to such height as may be deemed requisite, the framing of the tower being half dovetailed into the curb, and fastened with wedges or bolts, or by other suitable means at the top of the tower. The said framing is at top secured into a platform of cast iron, by preference, and bands of iron or other suitable contrivance are passed round the outside of the framing; the spaces between the same are filled with segmental pieces tightened by wedges, and the whole braced firmly together at different heights in the tower. The said platform at the top of the tower forms a curb and tramway.

2625. A. CALVERT, *Manchester*, "*A new engine to be propelled by compressed atmospheric air or steam.*"—*Dated 21st October*, 1861.

This invention consists in supplying compressed atmospheric air or steam from a reservoir or boiler to one or two cylinders, each cylinder containing two pistons, each lower piston containing one or more vacuum valves for supplying the upper pistons with the air or steam when the expansive force of the compressed air or steam is expended. The valve and the cushion chambers for the upper pistons are the same in principle as those described in the specification of letters patent granted to the present patentee on the 14th September, 1860 (No. 2218), with the addition of means for conveying the compressed vapour or air from the cushion chambers to the steam or air chest, and an alteration in the construction of the admission valve, which is annular, and fits on the exterior of the cylinder. The exhaust ports consist of annular rows of holes for the escape of the air or steam; these holes are placed at such a distance from the ends of the cylinder that the requisite space may be left for the cushions above referred to. Each air cushion is in communication with the chest containing the annular admission valve, the said chest being supplied by the reservoir or boiler; and, when the air or steam in the cushion chambers becomes compressed to a greater degree than that in the chest, the surplus pressure is forced back into it. The lower pistons are actuated by toggle joints, and when a single cylinder is employed the piston is counterbalanced. The said lower pistons have a traverse of about one-fourth of the length of the cylinder, the motion being imparted to them by a cam; the upper pistons are connected to a crank shaft, or they may be connected by a beam. During the commencement of the stroke the two pistons in each cylinder travel together, but when the lower piston has completed its stroke the compressed air or steam is instantly admitted between the two pistons, and impels the upper one forward until it arrives at the end of the cylinders. Each cylinder is made to receive the compressed air or steam for propelling the piston during its upward stroke. When the air or steam is admitted between the pistons the crank is at or near the point where the full leverage is obtained. The duration of the admission of the compressed air or steam is regulated by a movable inclined tappet, which gives a larger or smaller amount of the compressed air or steam to the cylinder, but in every position of the inclined tappet the compressed air or steam enters at its full force, that is to say, so long as the engine is driving its load; but supposing the load to be suddenly thrown off, as in trip hammers and rolling mills, the lower end of the tappet being bevelled off, the regulator would be moved a greater height, and would lift the tappet so that the admission valve would not be operated upon.

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2606. C. CHEYNE, *Great George-street, Westminster, and* T. R. MOSELEY, *Lewisham*, "*Signalling on railways.*"—*Dated 18th October*, 1861.

For the purposes of this invention, at or near each of the ordinary semaphore signal posts, by preference in a room in the vicinity thereof, but it may be in any convenient locality, the patentees place an instrument containing a train of wheels kept in motion by a spring or weight, or it may be other similar contrivance, by means of which a slip of paper may be propelled continuously and approximately at a regular speed past a number of marking instruments. Each of these marking instruments is put in connection with an electro-magnet, or similar electric apparatus, which, when an electric current is passed through a wire—of which there is one corresponding with each marker—moves its marker, and brings it into contact with the travelling strip, thus producing a mark thereon. The instrument is also furnished with a galvanic battery, the poles of which are connected with the several electro-magnets or similar electric apparatus, but the electric current does not all times flow through the magnets or electric apparatus, a gap being left in each of the circuits; and these gaps are bridged over from time to time to complete the circuits, when it is desired that the current should pass, and that the markers should mark the paper.

2616. C. DE BERGUE, *Dowgate-hill, London*, "*Sleeper chairs for the permanent way of railways.*"—*Dated 19th October*, 1861.

This invention comprises the casting or forming sleeper chairs with a dished or curved and hollowed or flatly-tapered base or bottom (to be used with the convex or projecting side downwards), with cross ribs or webs, or with one or more circular or other ring-like ribs or webs, or with a rib or ribs in addition to such ring-like rib or ribs within the upper or concave side of such bed plate (base or bottom). Also the invention comprises the casting or forming sleeper chairs, as above set forth, with parts of the ribs or webs fashioned for forming a seat for the rail, on which the rail may be firmly bedded, and so that the rail and sleeper chair may be secured together by one fastening only. Also the invention comprises the casting or forming sleeper chairs, as above set forth, with ribs or webs or projections from the convex or lower side of such sleepers, so as to admit of the adaptation and fastening of the tie-bar to the under side of the sleeper, and securing it thereto by means of the same bolt or fastening which secures the rail above.

2626. J. S. PHILLIPS, *Finchley-road, London*, "*Apparatus for the propulsion of vessels through the water.*"—*Dated 21st October*, 1861.

The principle of this invention will be manifested by means of a hoof-shaped paddle made of metal, like the hoof of a calf, or any other animal, or the shape of the webbed foot of a diver or other swimming bird. This paddle is to be applied or affixed to a wheel or wheels on the side of the vessels, or underneath, entirely or in part, in fact, in whatsoever part of a vessel may be found most suitable and convenient. The upper or back part of the proposed propeller is to act as a screw propeller, and the under or open sole of the hoof as a paddle. And the said "hoof screw paddle" is to be applied or affixed to the radius of a wheel, or on long bands, as in a dredging machine, if found advisable.—*Not proceeded with.*

2632. J. H. JOHNSON, *Lincoln's-inn fields, London*, "*Apparatus for facilitating the passage of trains up steep gradients on railways.*"—*A communication.*—*Dated 21st October*, 1861.

According to this invention it is proposed to attach to the front of a train, which is about to ascend a steeper gradient than the ordinary locomotive engine is competent for, a peculiar apparatus consisting of a frame mounted upon two four-wheeled "bogies" at the front and rear ends. The centre portion of this frame carries two shafts, which are each provided with a fast and loose grooved pulley or drum. Round the two fast pulleys or drums is passed a flat rope, guided on to them by the loose pulley, and having one end fixed in a permanent manner at the top of the incline or gradient, while it is kept distended by a heavy counter weight at its opposite end or bottom of the machine. Rotary motion is imparted to the fast pulleys or drums, so as to cause the train to wind itself up the incline by means of an endless travelling rope extending along the incline, and actuated both at the top and bottom end thereof by any convenient prime mover, one of which acts upon the ascending part of the endless rope, and the other upon the descending part. The ascending side of the endless rope is passed round a grooved pulley fast on the end of one of the drum shafts, and the descending side of the same rope is passed round a grooved pulley fast on the end of a central shaft, situate between and parallel to the two drum shafts. This central shaft carries a friction wheel or pinion, which imparts motion to two larger friction wheels respectively keyed on to the two drum shafts, and bearing upon opposite sides of the circumference of the central friction wheel or pinion, against which they are forcibly held by the tension of the flat hauling rope passing round the drums. On motion being imparted to the endless rope, the hauling drums are rotated, and, by acting upon the stationary hauling rope, wind up the train, the rope passing over the drums and being left on the line as the train passes over it.

2644. A. BEVAN, *Gravesend*, "*Construction of iron vessels, and iron-plated ships of war.*"—*Dated 23rd October*, 1861.

That part or portion of this invention which relates to the construction of the frames of ships consists in the substitution for the ordinary single or double angle irons, and the rivetting together thereof, for the purpose of forming the frames or ribs and structural arrangements, by which the required form and strength or power of resistance is given, and the means provided for supporting the outer skin or shell, of a series of rolled bars of suitable sections, combined together chiefly by means of dovetails, and framed or secured together in a box-like form, placed at suitable intervals apart, they in turn forming, in conjunction with the horizontal strengthening pieces, stringers, or their equivalents, a series of cellular divisions, by which the surface of the plating is supported in the greatest number of parts or the unsupported area reduced to a minimum. In cases where the armour plating can be applied direct to the framing of the ships the patentee attaches or connects the plates thereto by means of dovetailed projections from the back of each box-like vertical rib or frame taking into grooves formed in suitable ribs or projections rolled thereon. Instead of the frames terminating with the line of the upper deck, he continues them to the full height of the bulwarks surrounding the upper deck, and he frames the whole together by means of a rolled bar or rail forming a cap, bar, or bulwark-rail, having a projecting head or nose-piece along each edge, the under side or under face of the bulwark-rail being under-cut or dovetailed, so as to securely frame the external plating or shell with the vertical box ribs or frame pieces. In war ships the vertical plates forming the bulwarks, being of a sufficient thickness to resist projectiles, may be pierced with loopholes or apertures for permitting the discharge of small arms, the recesses formed by the vertical box frames and the cap bar or bulwark rail forming a shot-proof mantlet for each marksman. Instead of rolling armour plates plain and of uniform thickness throughout, and attaching them by drilling holes therein and rivetting or bolting them to the sides of the ship in the ordinary manner, and instead of providing vertical division bars or frame pieces, between a pair of which bars each plate has to be slid, and instead of lapping holes into the back of armour plates and screwing therein to plain or hooked bolts, or any of the contrivances which have heretofore been proposed, he rolls plates with ribs at the back thereof, in two or more places in the width thereof, as, for instance, at each vertical edge, and in the middle of the width thereof, or there may be two of such ribs or projections. He forms a dovetailed groove in each of the outer projections, into which one of the two dovetails at the back of the flat bar of each vertical box frame or rib is made to take, while the other of the projecting dovetails takes into the groove formed in the projecting rib of the said vertical plate, and thus they are, as it were, clamped together.—*Not proceeded with.*

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2602. B. TAYLOR, *Birmingham*, "*Brace webs.*"—*Dated 18th October*, 1861.

The inventor proposes to employ woollen or worsted webbing with india-rubber, thereby obtaining more brilliant dyes in wool than in cotton, and at much less cost than by using silk. He can employ worsted warp and cotton weft, the weft not being visible; or he can use worsted face with cotton weft and cotton back.—*Not proceeded with.*

2612. J. COOPER, *High Town, near Leeds*, "*Carding engines.*"—*Dated 19th October*, 1861.

This invention consists in enclosing the under surface of the "licker in," and of the main carding cylinder, with a curved, double concave screen, such screen being so placed as to be just clear of the card teeth. This screen may be formed of a grating of wire or other material, or of strips or laths of wood arranged in the form of a Venetian shutter, or otherwise, its object and effect being to allow the dust and dirt to pass through, and to arrest the filaments or fibres (commonly called "fly" or waste, which, as they accumulate, will be again taken up by the card teeth and worked in with the other material.—*Not proceeded with.*

2622. J. SMITH, *Bradford*, "*Combing cotton, &c.*"—*Dated 21st October*, 1861.

This invention has reference to a previous patent, dated 7th February, 1859, No. 346, and consists, First, in forming or constructing the framing or comb bed in inclines, by which the combs are successively lowered into position to receive the feed or supply of cotton or other fibre, and raised again for operating upon it. Secondly, in the employment of a series of knives or plates arranged and operated so as to press the fibre into the

teeth of the combs. Thirdly, in the application of a cam or finger for giving a quick impulse to the combs at the change of direction from the screw lines, so as to remove each quickly out of the way of the succeeding comb. Fourthly, in the application of cogs or teeth on the under side of the combs and cog wheels gearing therein, for impelling them forward on the line of transit to the other screws. Fifthly, in a method of making or constructing the screws for propelling the combs by wrapping or coiling a rod to form the thread around a spindle, and securing it thereon with pins driven through into the spindle or by screws inserted therein, or by other suitable means of fastening. Sixthly, in supporting the drawing off rollers on a pillar, and passing the driving spindle through the same. Seventhly, in taking the cleansed cotton or other fibre from the drawing leather by means of a card roller and doffer plate. Eighthly, in extracting the seeds from the combs by placing the rollers over the points of the teeth.—*Not proceeded with.*

2024. E. OLDFIELD, *Salford*, "*Self-acting mules for spinning and doubling.*"—*Dated 21st October*, 1861.

This invention consists, First, in an improved combination of parts for effecting the first and second changes in the position of the long lever, which is connected to the cam shaft as in the mules known as Roberts' self-actors. The inner end of the long lever is supported by a vertical lever, which is acted upon when the carriage is nearly out by a stud on the carriage connected to the faller lock; this stud coming against the vertical lever effects the first change. The second change is effected when the faller is locked by the said vertical lever, which is acted upon by a spring, following the stud above referred to, and allowing the long lever to drop on to the lower notch of the said long lever. By this means the long lever can never slip through two changes, except at the times required. The Second part of the invention consists in an improved arrangement of parts for tightening the backing off chain. This is effected by a vertical lever with an inclined slot connected to the copping motion and faller lock; the stud fitting in the inclined slot is fixed in another lever, in which is a stud for a pulley, around which the backing off chain passes; as the lever connected to the faller motion lowers the stud fitting in the inclined slot is drawn back, thereby moving the pulley in the required direction for tightening the backing-off chain. The Third part of the invention consists in an improved combination of parts for preventing the rise of the faller until the spindles are turned round to coil the yarn up the spindles, thereby preventing snarls. To the drum or tin roller shaft is attached a pinion gearing in a wheel loose on a stud in the carriage; on the boss of the bracket carrying this stud is a friction clip, similar to those employed for backing off or winding on in the mules known as Roberts' self-actors; the friction clip acts on a catch projecting from a lever connected by a link to the faller shaft. When the faller is unlocked the rise of the faller, acting on the link, throws the catch into gear with the wheel driven by the pinion, thereby preventing the faller rising, excepting at the proper speed, for coiling the yarn on the spindles.

2027. W. E. GEDGE, *Wellington-street, Strand, London*, "*Manufacture of flannel.*"—*A communication.*—*Dated 21st October*, 1861.

In the manufacture of twilled flannels it is proposed by this invention to take threads of combed wool (Austrian, French, or other), warping, dressing, and weaving by the usual means, using a woof of combed wool of a number regulated by the quality of flannel to be made. The web will be buried and picked by means of arcnaceous cloths, and then scoured. When it is desired to render the fabric less shrinkable, it will be slightly fulled, then bleached with sulphur, and folded for sale. In manufacturing another description of flannel, known as "Rolwards" it is proposed to take threads of combed wool of a thickness suited to the thickness to be given to the fabric, warping, dressing, and weaving by the usual means, using a woof of combed wool, and twilling and picking if necessary, but if the knots are neither strong nor numerous it will suffice to raise or nap the stuff after wetting.—*Not proceeded with.*

2628. F. FENTON, *Fishguard, Pembroke*, "*Obtaining and treating fibrous substances.*"—*Dated 21st October*, 1861.

This invention consists in treating all that class of plants known to botanists as the Endogene and the leaf-stalks, leaves, and the bark of all the exogenous tribe of vegetation, by means of dilute solutions of acids, alkalines, and ammonia, thus producing fibrous material of great commercial value.

2645. S. YOUNG, *Belfast*, "*Spindles and flyers of machinery for spinning and twisting flax, hemp, jute, cotton, &c.*"—*Dated 23rd October*, 1861.

This invention consists in a new and improved mode of constructing the spindles of spinning and twisting machines, and of combining the flyers therewith, and connecting the bobbins thereto, whereby the twisting spindle and flyer can be driven at any desired speed without vibration; and, further, in making the bobbin spindle revolve with, but only at the same speed as, the bobbin, and its blade not to project above the bobbin, whereby the inventor is enabled to make this part of the spindle very small in diameter, and, consequently, also the barrel of the bobbin.—*Not proceeded with.*

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

2555. A. V. NEWTON, *Chancery-lane, London*, "*Machinery for dressing or cleaning wheat or other grain.*"—*A communication.*—*Dated 12th October*, 1861.

This invention cannot be described without reference to the drawings.

2570. A. V. NEWTON, *Chancery-lane, London*, "*Grain and grass harvesters.*"—*A communication.*—*Dated 16th October*, 1861.

This invention relates, First, to an improvement in the sickle-driving mechanism, whereby the power is transmitted from the driving wheel to the sickle in a very direct manner, the parts employed to effect this object admitting of a perfect self-adjusting movement of the sickle and finger bar, so that they may conform to the inequalities of the surface of the ground. The invention relates, Secondly, to an improved arrangement of the seat, whereby the same may be adjusted to compensate for the different adjustment of the finger bar, and the machine kept in a nearly balanced state on its axle at all times. The invention relates, Thirdly, to an improvement in the reel, and consists in hanging the reel shaft in such a manner that it will play or work as the machine moves along, corresponding to the play or movement of the sickle produced by the latter conforming to the inequalities of the surface of the ground, thereby preventing the self-adjusting movement of the sickle from racking or injuring the reel. The reel arms are also secured to their shaft in such a way as to ensure a firm and ready attachment of the former to the latter. The invention cannot be described without reference to the drawings.

2594. J. GOUCHER, *Worksop, Nottinghamshire*, "*Beaters and drums used in thrashing machines.*"—*Dated 18th October*, 1861.

This invention consists, First, in forming the working side of the uprights between which the grooves are formed in the beaters, for which letters patent were granted the 31st July, 1860, No. 1856, with teeth or nitches. Secondly, in forming the drum ends of cast malleable iron or steel, with facings round the edges to give strength and lightness, and in forming the drum beaters of cast or wrought iron or steel, with beds and projections for the heater plates to fit in.

2617. W. C. E. CAMBRIDGE, *Bristol*, "*Harrows.*"—*Dated 19th October*, 1861.

The object of this invention is to simplify the construction of harrows by reducing the number of parts employed in securing the tines in position. This improvement the patentee proposes to employ in connection with an invention of his for which he obtained letters patent 25th October, 1860, and which consists mainly in forming the tines of cross-heads and fitting these cross-heads into a trough or double-flanged iron beams. The present invention may, however, be also applied with advantage to other constructions of harrow than that above referred to. The invention cannot be described without reference to the drawings.

2630. N. D. P. MAILLARD, *Dublin*, "*Ploughs.*"—*Dated 21st October*, 1861.

This invention relates to a novel mode of constructing that part of the plough which turns over the earth after it has been cut away or separated from the land. By this invention a considerable portion of the ordinary turn furrow or breast of the plough is dispensed with, and in place thereof a series of vertical rollers or cylinders are employed to turn over the earth. The object of the improvements is to reduce the friction of the earth against the several parts of the plough as much as possible, and therefore, in carrying out this invention the inventor not only uses rollers or cylinders as a means of turning over the earth instead of the ordinary breast, but he also introduces horizontal rollers in the sole plate, and another set of vertical rollers at the back of the plough for the purpose of maintaining the plough in a vertical position. The vertical breast rollers are mounted in a frame or arms which turns on a centre pin near the fore part of the plough, so that, by pushing the vertical roller frame outwards, and setting it at any given position, the furrow may be wider or narrower as it may be required or considered desirable.—*Not proceeded with.*

2641. R. A. EROOMAN, *Fleet-street, London*, "*Reaping machines.*"—*A communication.*—*Dated 22nd October*, 1861.

This invention consists in the employment of a rake head to take the place of one of the ribs or vanes of the reel in gathering the grain or crop to the platform, which rake head is made to act as hereafter explained. The teeth of the rake project beyond the ribs, and come close to the platform. When the rake head reaches over the platform at the cutting blades it leaves the circle of the reel, and passes over the surface of the platform in a horizontal direction, or nearly so, and pushes or pitches the cut corn or other crop from off the side of the platform; the rake then rises, and regains its position as a rib or vane of the reel. The rake is connected with machinery, which works it by means of an arm. The machinery consists of an eccentric with a pulley fastened to the reel post in connection with a crank and levers attached to the reel shaft, the end of which passes through the vertical eccentric.—*Not proceeded with.*

2647. J. W. WILSON, *Barnsley*, "*Improvements in machinery for digging and cultivating the soil, and in steam engines for agricultural purposes.*"—*Dated 23rd October*, 1861.

These improvements in machinery for digging and cultivating the soil consist of a revolving shaft furnished with an eccentric connected by links to crank shafts, to which are attached spades and picks, in such a manner that the spades and picks enter and are drawn out of the soil at any angle to its surface, whereby the operations of loosening and turning the soil are effected with less power and more effectually than heretofore. The improvements in steam engines for agricultural purposes consist in mounting the bearing wheels on bushes, through which the crank shaft works. The leading or guiding wheels are acted upon by a steering apparatus, consisting of a worm and worm wheel and pinion and sector, or other equivalent arrangement of parts. The speed of the engine is reduced to suit the speed of the bearing wheels by a counter shaft, which is driven from the crank shaft by pulleys and chains, or by gearing, and the counter shaft is provided with a set of differential wheels for equalising the action of the chains or gearing in going round curves.—*Not proceeded with.*

CLASS 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

2590. R. AYTOUN, *Edinburgh*, "*Apparatus to be applied to chimneys or flues for improving the draught therein, and for preventing down draughts.*"—*Dated 17th October*, 1861.

According to one modification, whereby this invention is, or may be, carried out in actual practice, the apparatus consists of a horizontal valve seat or frame, fixed air-tight on the interior of the chimney or flue, either immediately above the fire grate or in any other part of the chimney, or in or upon the chimney top. The actual working face of the seat is formed at an angle, and the valve itself—which is counterbalanced by a weight along the back edge—is fitted to vibrate on knife-edge or other centres or journals carried by the frame, a suitable stop being fitted upon the frame to prevent the valve from opening back too far. The valve opens upwards, and partially opens or closes the flue passage, in accordance with the requirements of the draught, but always ensuring such an escape area as best suits the draught action. Whenever there is a tendency to a "blow down," to produce what is known as a "down draught," the external pressure from above at once closes the valve, and the discharge of smoke downwards is immediately checked.

CLASS 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

2546. E. CORKE, *Tunbridge Wells*, "*An improved instrument to be attached to the bayonet or barrel of a rifle, or other fire-arm, for estimating distances.*"—*Dated 12th October*, 1861.

This instrument is intended to be attached with facility on the bayonet or barrel of a rifle or other fire-arm, the purpose being to place it as far from the eye as possible, so that the object to be aimed at shall entirely fill the aperture of the said instrument or gauge, to the exclusion of all surrounding objects. The said instrument consists of a gauge with a vertical slot or aperture, furnished with a vertical slide in the usual manner. Each side of the said aperture is marked with a scale to suit objects of different heights, ranging at distances from 50 yards upwards.—*Not proceeded with.*

2577. W. BIDDELL, *Birmingham*, "*Shot.*"—*Dated 15th October*, 1861.

The inventor takes iron in a molten state, and alloys it with nickel, arsenic, or lead, preferring the oxides of these metals. He employs of nickel about one ounce to the pound of iron; when arsenic is used he employs about eight ounces to ten pounds; and when lead is used, about two pounds to ten pounds of iron. These are to be intimately mixed with the molten iron. He can employ each alloy separately with the iron, or all combined, and the proportions will admit of much variation. The hot metal is then granulated by being run over a polished surface through combs which regulate the size, the polished surface being agitated during the operation. The shot being thus produced he proceeds to coat it to prevent oxidation. This may be done by galvanising, tinning, coating with mercury, or any other equivalent process. He can also, by this process, make shot of iron alone unalloyed.—*Not proceeded with.*

2281. R. HAYES, *Manchester*, "*Gun and ammunition carriages.*"—*Dated 17th October*, 1861.

This invention consists in constructing gun carriages so that one or two men may be able to draw or push them about in connection with rapid infantry movements thus effecting a saving of horse labour. This the inventor accomplishes by using three wheels, instead of the four now adopted, one wheel being placed on each side of the carriage, and one in the centre of the front part, immediately before the axle. The fore wheel, over the pivot of which the gun rests, is slightly larger than the side wheels. The framework of the fore wheel rests upon the axle of the side wheels, in the centre of which is a pivot, by which the carriage is turned right or left in its movements. The horizontal motion of the piece is effected by means of a handle projecting from the swivel towards the gunner in rear, the vertical motion being obtained by a rack and pinion.—*Not proceeded with.*

2593. J. CROSTHWAITE and T. E. ARMAN, *Liverpool*, "*Targets.*"—*Dated 18th October*, 1861.

This invention consists in constructing the circular part of the target in a separate piece, and mounting it so as to swivel on points, that either side may be presented to the front. The invention also consists in a method of protecting the marker who is in rear of the target. Also in an improved system of signals to be used therewith.—*Not proceeded with.*

2600. W. SADLER, *Tredegar-place, Bow-road*, "*Armour plated ships.*"—*Dated 18th October*, 1861.

Heretofore it has been proposed to build armour plated ships so that the sides of the ship slope outwards to a certain height above the keel, and then make a sharp angle and incline inwards up to the bulwarks, and the object of this construction is, that shot, when striking the sides of the ship, may, in place of penetrating, glance off in consequence of the great inclination of the sides to a horizontal plane. It has heretofore, however, been proposed, in all ships designed in this manner, to make the angle bend at and near the bow of the ship under the water line—an arrangement which greatly injures the sea-going qualities of the ship. Now according to this invention the inventor makes the angle bend above the water line, both at the bow of the ship and elsewhere; and also he makes this bend further above the water line at the bow than the distance it is above the water line at the midship section.—*Not proceeded with.*

2601. P. ROBERTSON, *Sun-court, Cornhill, London*, "*Cartridges.*"—*A communication.*—*Dated 18th October*, 1861.

This invention consists in the combined processes of making the cases of cartridges of gun-cottonised paper or fabric, and waterproofing the same by collodion.

2603. T. W. COWAN, *Greenwich*, "*Breech-loading ordnance.*"—*Dated 18th October*, 1861.

This invention consists of an improved form of breech-piece, which the inventor proposes to apply to all sorts of guns. The barrel of the gun is mounted upon the usual carriage, and is made without a breech chamber. The breech-piece is formed separately, and is mounted upon an axis or trunnion at right angles to the direction of the bore of the gun; it is arranged so as to turn or rotate upon this axis. This piece has two, three, or more recesses or chambers formed symmetrically in it, the mouths opening up from the axis outward; these form chambers for inserting the charge, and each in its turn coming into the line of the barrel, and fitting closely to it either by means of a bridle, or by wedges, or such like arrangement; thus, while one of the chambers is being fixed, the chamber behind, or rather, since they radiate, the succeeding chamber is being loaded, and the one before that is being cleaned; as the one discharges, another comes into position already charged and ready for discharging, while the successor is being loaded, and so on; the vent-holes may be formed into each chamber in the ordinary manner.—*Not proceeded with.*

CLASS 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

2544. N. STRAM, *Ashby-street, Northampton-square, London*, "*Watches.*"—*Dated 11th October*, 1861.

Watches called "remontoir" have already been made, that is to say, watches that can be wound by means of an axis, on the end of which is a head adapted to the pendant of the watch. Watches have also been made called "reversible," that is to say, the works of the watch are contained in an open-faced case, which is itself enclosed in a second open-faced case, so that, the interior case being reversible, it forms with the exterior case a hunting watch, if its back is adapted to the open ring of the exterior case, or an open-faced watch if its dial is placed beneath the ring of the outer case. This invention consists in the combination of the above two systems. For this purpose the interior case which contains the watch movement is fixed on a pivot adapted to a joint fixed on the middle part or "collier" of the exterior case (as has before been proposed), so that by reversing the interior case on this pivot a hunting watch or an open faced watch is obtained. The winder consists of a head fixed on the end of an axis connected with the works of the watch; this head is exactly opposite to the pivot uniting the two cases, so that the head always comes to the same point of the middle piece of the exterior case. At this point an opening is made to admit the head, and this opening is made in such manner that, when the exterior case is closed, the watch has the appearance of an ordinary open-faced watch, or an ordinary hunting watch.

2548. S. R. CARRINGTON, *Stockport, Chester*, "*Hats and caps.*"—*Dated 12th October*, 1861.

This invention consists in indenting or corrugating the felt, or other material of which the body of the hat or cap is formed, at the lower part of the crown of the hat or cap, through the band, the leather or pad being tight, so as to fit the head of the wearer, whereby, at each indent or corrugation in the felt or other material as aforesaid, the patentee obtains an aperture for the admission of the air into the interior of the hat or cap whilst being worn. He also carries the indentation or corrugation of the felt or other material as aforesaid from the band to the apex of the hat or cap, or to any intermediate distance thereof.

2559. H. J. DISTIN, *Great Newport-street, Leicester-square, London*, "*Metal musical wind instruments.*"—*Dated 14th October*, 1861.

This invention cannot be described without reference to the drawings.

2591. W. CROOME, *Kilmeredon, Radstock, near Bath*, "*Lamps.*"—*Dated 18th October*, 1861.

The patentee claims the combination of the reflecting reservoir with the wick holder, level with, or raised slightly above, the top of the reservoir, with the reflecting reservoir wholly or in part surrounding the wick holder, with the reflector placed above as described.

2592. H. J. DISTIN, *Great Newport-street, Leicester-street, London*, "*Metal musical wind instrument.*"—*Dated 18th October*, 1861.

This invention consists in placing a knuckle or loop on the tube of the ordinary bugle, distant about two or three inches from the mouthpiece aperture; and opposite thereto, or nearly so, on the other side of such tube there is an additional length of tube extending round the coil of the tube of the bugle until it reaches the tube, about an inch below the knuckle, and there is a cylinder attached to the ordinary mouthpiece with wind passages therein, so constructed that, when it is intended to produce the sound of a bugle, the wind passages are open through such cylinder, and the knuckle or loop throughout the bell, and the communication or passage to the additional tube is closed, and when it is intended to produce the sound of a trumpet, such cylinder, by being turned partly round, closes the communication or passage through the knuckle, and leaves the lengthened tube open throughout to the bell.—*Not proceeded with.*

2593. E. PEYTON, *Birmingham*, "*Frames of metal bedsteads.*"—*Dated 18th October*, 1861.

This invention consists in casting, or otherwise fixing, the dovetail tongues on the side and end frames of metal bedsteads at an angle; and in forming the dovetail grooves into which the tongues are to be inserted at a corresponding angle.

2596. J. LAWSON and H. CARTER, *Woolwich*, "*Metal musical wind instruments.*"—*Dated 18th October*, 1861.

This invention relates to improvements in the construction of metal wind instruments, whereby the inventors obtain in one instrument the combination of both the tones and the properties of the bugle and the trumpet, and which is readily converted from a trumpet to a bugle, or *vice versâ*; they further adopt a particular combination of metals in producing these combined instruments.—*Not proceeded with.*

2640. H. B. FOX, *Liverpool*, "*Metallic bedsteads.*"—*Dated 22nd October*, 1861.

This invention consists in adopting and applying wooden foot boards and wooden cornices to iron and other metallic bedsteads, and in the case of French bedsteads also a wooden head-board; and in some cases the patentee proposes to attach false or hollow covering posts to the foot-board, and also to the head-board in the case of French bedsteads.

CLASS 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting Glass, Pottery, Cements, Paint, Paper, Manures, &c.

2525. T. TIDMARSH, *Dorking*, "*Artificial manure.*"—*Dated 9th October*, 1861.

In carrying out this invention the patentee collects any available animal or vegetable matters, such as peat, turf, twitch, stubble, bone, skin, or any such like materials, and by means of heat reduces them to an alkaline ash. He mixes with about 18 cwt. of this compound 6 cwt. of human night soil, 5 bushels of quick lime, and about 40 gallons of animal urine or farm-yard liquor; the whole being intimately combined, is then broken up, pulverised, and mixed with 35 lb. of vitriol; or, to make a ton of the mixture, he takes about 25 bushels of the ashes, and mixes with it about eight pails of human night soil, adding 25 gallons of stable urine, and then combines the whole with 4 bushels of lime, and finally adds about 25 lb. of vitriol. When about to use this he applies it as follows:—If for wheat, flax, or such like crops, he either drills it in with the corn, or applies it as a top dressing. For roots, such as mangel wurtzell, turnips, and such like crops, if drilled or sown broadcast, the manure may be distributed by a drill, or as most convenient. If there be indications of the fly attacking the crop, he adds, in addition to the previous quantity of manure, an equal additional quantity, which he applies as a top dressing, and, if possible, when the ground is moist, either with dew or rain. For potatoes he prefers to plant them in sets, and then to put the manure over the seed before covering it up.

2526. J. SCHWARTZ, *Osborne-street, Whitechapel, London*, "*Manufacture of sugar.*"—*Dated 9th October*, 1861.

In carrying this invention into effect the inventor places the molasses in a tank fitted with a perforated coil of steam pipe, and adds thereto water and blood. By means of steam circulating in the coil, and discharging into the vessel, he raises the saccharine solution to, and maintains it for a time at, the boiling point. He next runs it through bag filters of fine texture into cylinders filled with animal charcoal. The solution having passed slowly through animal charcoal is now in a refined state, and either colourless and transparent or of a light straw colour. It is next boiled in the vacuum pan until a maximum granulation is obtained. The contents of the vacuum pan are then discharged into a heater (an open pan heated by a steam jacket), where an even temperature is maintained while the operation of filling into moulds is going on. The moulds, after standing to cool, are raised into heated floors, when, in due course, the treacle separates from the granulated sugar, and runs from the mould into suitable vessels.—*Not proceeded with.*

2527. W. J. WILLIAMS, *Warnford-court, London*, "*Charging illuminating gas with the vapour of the hydruret of carbon.*"—*Dated 18th October*, 1861.

This invention consists in causing illuminating gas, in its passage from the meter to the burners, to pass through a series of rows of perpendicular cords or threads, or their equivalents, saturated with hydro-carbon liquid, by which it becomes charged with hydro-carbon vapour, and as the gas is liable to become overcharged with the vapour, and cause a waste of the hydruret of carbon, often becoming very troublesome by condensing and filling up the pipes, obstructing the flow of the gas, and flowing out at the burners when opened, the inventor causes the gas to pass through a condenser, where the excess of hydro-carbon vapour is condensed, and the liquid resulting from the condensation flows back to the evaporating chamber, or some other receptacle, from which it can be returned to the evaporator, while the gas in a properly charged state passes on to the burners.—*Not proceeded with.*

2540. C. N. KERNOT, *West Cowes, and* M. D. RUCKER, *Fenchurch-street, London*, "*Method of obtaining ammoniacal salts and other valuable products from liquors or substances containing ammonia, and for utilising the residuum.*"—*Dated 11th October*, 1861.

The patentees claim the precipitation of ammonia, and obtaining its salts and other valuable products from solutions or substances containing ammonia by sulphate of zinc, or other sulphates, and by solutions prepared from bones and other phosphites of lime and magnesia, coprolites, apatite, phosphorite, or other mineral phosphates, with hydrochloric, sulphuric, or other acids, as described.

2550. V. PIRSON and A. DEYSSER, *Brussels*, "*The application of a new material in the manufacture of paper, cardboard and yarns.*"—*Dated 13th October*, 1861.

In the manufacture of paper, cardboard, and similar articles the inventors use the lucern root or Spanish trefoil, and treat it in the same manner as linen and cotton rags are operated upon in the manufacture of paper, that is to say, after being picked and prepared, it is subjected to the lye washing, then opened, put out to bleach, and afterwards placed in the refining mortar. The paste thus obtained is used in the same way as the ordinary pulp is now used in the manufacture of paper, either alone, or mixed with other substances, such as rags and similar articles.—*Not proceeded with.*

2553. R. C. FURLEY, *Edinburgh*, "*Rendering pills tasteless.*"—*Dated 23th October*, 1861.

This invention consists in covering pills with albumen.—*Not proceeded with.*

2562. F. B. HOUGHTON, *Kensington*, "*Apparatus employed in reducing straw and other vegetable substances in the manufacture of pulp for making paper.*"—*Dated 14th October*, 1861.

For the purposes of this invention the patentee employs a boiler of a cylindrical form, with hemispherical ends, and within this boiler a shaft or axis works, passing through a stuffing box at one or both ends. On this shaft are fixed several bent or curved blades, the edges of which are bent up, so as to form scoops; these blades are fixed at intervals all round the shaft, and they are of a length to come within a few inches of the inner surface of the boiler. To this shaft rotatory motion is communicated, by which the materials under operation are continuously moved and raised out of the alkaline solution in the lower part of the boiler, which is about one-third filled with that fluid. The boiler is heated from the interior by water circulated in closed pipes or tubes, on Perkins' principle. At the upper part of the boiler is a hole through which the straw or other vegetable materials are introduced, and there is also a blow-off steam pipe and a safety valve at the top of the boiler; at the bottom of the boiler there are manholes for withdrawing the charge, also a pipe or pipes to draw off the

liquid and the water introduced into the boiler to cool it and to wash th vegetable matters before withdrawing them from the boiler. When the boiler and the materials therein are to be cooled water is pumped into the boiler, for which purpose one or more pipes connected with suitable forcing machinery are used.

2507. C. D. ABEL, *Southampton-buildings, Chancery-lane, London, "Apparatus for the simultaneous manufacture of white lead and vinegar."—A communication.—Dated 18th October*, 1861.

These improvements have reference to the simultaneous manufacture of white lead and vinegar, where a lead corroding room is placed above the room containing the tubs wherein the formation of vinegar is being carried on; the acetic acid escaping from the vinegar tubs is caused to rise into the lead corroding room, and to assist in the conversion of metallic lead into carbonate of lead.

CLASS 9.—ELECTRICITY.—NONE.

CLASS 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

2494. G. NARES, *Portsmouth, Lieut. R.N., "Effecting communication between places."—Dated 5th October*, 1861.

This invention relates to a peculiar construction of kite, and to the cords of attachment by which it is flown. The patentee makes a kite somewhat of the form of a boy's kite, with a central stem on which the two halves of the kite are movable, the one on the other, the cross bar or stretcher at the top being jointed at that point for the purpose. He forms the kite of canvas, or other suitable material, and adjusts the jointed stretcher between them at the back, by which arrangement he is enabled to adjust and set the kite with more or less surface of resistance, as may be suitable for the breeze or gale of wind blowing at the time. He flies this kite with two lines, one being in the position usually adopted in flying a kite, but having a thimble or hoop fixed to it near the kite, through which a second line is rove, which passes towards the lower part of the central stem of the kite; a stop is placed on this line to limit the length between the thimble and the kite, and a swivel is introduced on the first line. This apparatus is principally applicable for saving life in cases of shipwreck, but may be used for carrying a line across a river or other place. The kite is flown in the ordinary manner of a kite by the first line; when it is over the place to which the line is to be carried the first line is slackened, and the second line held, which immediately brings the kite to the ground. This kite may also be used to pull a man ashore from a wreck, he being in the water, and by preference supported by a life buoy or belt. This kite is also furnished with a suitable tail.

2495. W. CLARK, *Chancery-lane, London, "Gas regulator and purifier."—A communication.—Dated 5th October*, 1861.

For the purposes of this invention a plug or mass of felt, wadding, or flock is placed in an enlargement or chamber made in the base of the burner, through which the gas passes, and is thereby purified and burns under a constant and steady pressure.—*Not proceeded with.*

2497. W. SQUIRE, *Upper Montague-street, Bryanstone-square, London, "Machinery for planing and shaping wood."—Dated 5th October*, 1861.

The chief object of this invention is to plane the opposite faces of planks or blocks of wood simultaneously, and thereby ensure perfect parallelism. This result the patentee obtains by the use of a novel combination of machinery, wherein a pair of cutters, rotating in vertical planes, and capable of receiving a nice adjustment, operates simultaneously upon opposite sides of the work, which work is fixed in and carried forward between the rotating cutters by means of a travelling carriage. This carriage is so constructed as to hold securely either a single plank or block, and present the vertical sides to the cutters. Or a pile of planks may be so packed therein as to present their edges to the cutters. By a slight modification the machinery may be made to plane inclined faces, or by a change of cutters the machine may be adapted to cut mouldings.

2500. W. CALLCOTT, *Park Village East, "Producing scenic effects."—Dated 7th October*, 1861.

The patentee claims the production of scenic effects by means of a combination or combinations of glass, painted or distempered, prepared and framed, or supported in position with rollers or cylinders (constructed and faced in any required form, or of any substance), such rollers being supported and worked behind the glass so painted, distempered, and prepared, the whole essentially as described.

2503 J. E. J. SANSUM, *Lower Kennington-lane, London, "Machinery for washing malt."—Dated 7th October*, 1861.

This invention has for its object to arrange the mixing implement or instrument in such a manner that it may always act on the surface of the liquor, or but little below the same, whereby the admixture or combination of the meal with the liquor, as the former is gradually poured in, will be more perfectly and speedily effected.—*Not proceeded with.*

2504. F. J. EVANS, *Horseferry-road, London, "Apparatus for generating gas."—Dated 7th October*, 1861.

In carrying out this invention instead of using, as heretofore, a series of horizontal retorts set side by side in a furnace for generating a given amount of gas, the patentee employs, in lieu thereof, a vertical retort of large capacity, and of peculiar construction, enclosed within a furnace or oven, and surrounded by a heating flue which leads from the fire-place, and rises spirally around the retort until it reaches the exit opening to the chimney. The invention cannot be described without reference to the drawings.

2511. S. BREMNER, *Ludgate-hill, London, "Printing machines."—Dated 8th October*, 1861.

This invention consists, First, in a peculiar construction and arrangement of single cylinder printing machines, whereby such machines are rendered more certain and effective in action and are much more compact than the same class of machines hitherto employed. Secondly, in an improved mode of driving or actuating printing machines.

2512. J. EVANS, *jun., "Cefn Mawr, Ruabon, Denbighshire, "An improved miner's lamp."—Dated 8th October*, 1861.

This invention cannot be described without reference to the drawings.

2513. J. E. GRISDALE, *Cheapside, London, "Tickets or passes for railway and other purposes."—Dated 8th October*, 1861.

The object of these improvements is a safe guard to the companies or others issuing such tickets, against the transfer of such tickets or passes to others than the persons entitled to use the same, and this object is effected by manufacturing or producing, in any simple and convenient manner, and by the aid of photography, tickets or passes, each of which bears upon a conspicuous part of it a portrait of the person to whom the ticket or pass is issued.—*Not proceeded with.*

2491. P. O'CONNOR, *Havertree, near Liverpool, "Gas stoves for heating and warming."—Dated 5th October*, 1861.

Hitherto, in the application of gas for raising the temperature of liquids, it has been usual to apply the gas to the vessel containing the water, or to a supplementary vessel placed alongside, and communicating with the main body. By this invention, however, contrary to all others, the stove or apparatus is almost entirely immersed in the water, and the gas is conveyed therein to by a flexible or jointed tube, so that, as soon as the desired temperature has been obtained, the said stove or apparatus can be removed from amongst the water. The principal part consists of a U, serpentine, coiled, or other suitable-shaped metallic casing, exposing a large surface to the water for effective distribution of the heat. The gas from the tube above referred to is burned at jets fixed in a T or other bracket, by preference under a part of the apparatus formed into an arch, and combustion is maintained by a supply of air received at one end of the apparatus, the products being carried through the apparatus to the other end, whereby a small intercepting inverted cup, situated just over the surface, they are thrown on to and absorbed by the water being heated, thus preventing the escape of noxious effluvia into the atmosphere.—*Not proceeded with.*

2515. T. BAGGS, *Green-terrace, and* J. T. PARKES, *Almorah-terrace, London, "Treatment of india-rubber and vulcanite as applied to various purposes."—Dated 9th October*, 1861.

This invention consists in certain processes and methods of manufacture and treatment applicable to india-rubber and vulcanite, whereby those materials are rendered applicable to a great variety of useful and ornamental purposes. One portion of this invention relates to the colouring of india-rubber and vulcanite, and is effected by incorporating or combining coloured glass, pipe clay, and other suitable colouring substances or agents with the india rubber and vulcanite.—*Not proceeded with.*

2516. W. SMITH, *King-street, West Smithfield, London, "Measuring and regulating the pressure of gas."—Dated 9th October*, 1861.

This invention relates, First, to that kind of meter termed a consumer's compensating gas meter, and consists in the mode of constructing the level pipe, which is so arranged that it can be adjusted to the proper level by means of a stud or button at the exterior of the meter, the said level pipe being made of a flexible material, such as vulcanised india-rubber, or, if preferred, of lead. At the outlet of the meter the patentee places a float in water, on which the outlet pressure acts, and to the float is connected a cone working in a valve, for the purpose of regulating the pressure of the outlet gas. Secondly, to prevent the obtaining of gas when the meter is tilted, and so made to measure incorrectly, a rod, swinging on a pivot or pivots, is hung to the back plate of the meter, which, when the meter is tilted, swings forward and comes in contact with a projection on the measuring wheel; as its rotation is thus arrested the supply of gas is stopped. This is only applicable when the meter is not sufficiently tilted to expose the centre opening. Thirdly, to regulate the throw of the diaphragm in dry gas meters he places a crank on the valve-shaft and inserts a small lever in a socket made in the extremity of the said crank, to which the connecting rods of the diaphragms are attached. The small lever is fixed by means of set screw, therefore, when it is required to change the throw of the diaphragm, it is only necessary to loosen the set screw and adjust the small lever. Fourthly, to the metal plates used on the diaphragms of dry gas meters, instead of covering the edges and face of the same with leather, he makes a smooth edge by a piece of metal turned over the edges, and so dispenses with the leather facing. Also in dry meters he arranges the inlet and outlet pipes within the outer casing, for convenience of packing. Fifthly, the invention relates to single-light governors, but it may also be applied to more lights. It is constructed in the following manner:—A cone, which can be adjusted by a screw cut on the stem of the same, is fastened on the outlet pipe of the regulator, and beneath it is placed a diaphragm (made of a flexible material, such as india-rubber), and has a hole pierced in the centre serving for a valve; any variation of the pressure of the gas raises or lowers the flexible diaphragm, and enlarges or lessens the aperture in the diaphragm through which the gas passes; thus, when the pressure increases, the passage is lessened, and *vice versa*. Sixthly, to indexes of all kinds of meters, to make all the hands on the dials turn in the same direction, he uses an intermediate pinion between the usual wheels and pinions.

2519. J. NORMAN, *Glasgow, "Improvements in hammers to be worked by steam or other elastic fluids, and in anvils for the same."—Dated 9th October*, 1861.

This invention consists, in the First place, in making the piston chamber in two or more longitudinal parts, and square in cross section, or of other convenient form, which will prevent the turning of the piston or plunger, and so dispense with separate guides. The piston or plunger is, of course, shaped to correspond, and the surfaces may either be accurately fitted and scraped to work steam-tight, or the ordinary piston packing may be adopted. The piston and rod are, by preference, made in one forging, and the bottom cover and stuffing box are passed upon it from below, and bolted to the piston chamber. Or the cover and stuffing box may be formed in longitudinal parts, either continuations or not of the sides of the chamber. The piston chamber may either be bolted as a whole to the standard or framing, or one part of it may be cast thereon. A single central framing or standard may serve to support two or more hammers placed on opposite sides of it, or circularly round it. The improvements in anvils comprise several modifications, in all of which the anvil is adjustable, so that different cresses may with facility be brought under the hammer. These cresses may be formed on the anvil, or the anvil may be formed with sockets to receive them. In one modification the anvil block is held in a transverse bed formed for it in the stool, which is, by preference, cast jointly with the sole plate and standard of the hammer. One side of the bed, and the same side of the block are grooved vertically, or formed with locking projections and recesses, and the block is held in any of its positions by means of a wedge key between its other side and the other side of the bed. In other modifications the anvil block is made so that it can be turned either about a vertical or horizontal axis to bring a different cress under the hammer, provis on being made, by means of grooves and keys or otherwise, for locking it firmly in any of its positions, and for bedding it in a solid manner.

2520. G. DAVIES, *Serle-street, Lincoln's-inn, London, "Machinery for manufacturing shoes for horses and other animals."—A communication.—Dated 9th October*, 1861.

The main framing of the machine supports, in suitable bearings, three shafts, connected together by gearing, and caused to rotate at the same speed. Below these shafts, and at right angles thereto, are two horizontal mandrils in a line with each other, fitted so as to be capable of sliding longitudinally in fixed guides. At their inner ends these mandrils are fitted respectively with dies, one being a male die, the form of the transverse section of which corresponds with the desired form of the interior of the shoe, and has square projections, one on each side, below the point corresponding with the heel of the shoe. The other is a female die, the inner side of which is formed to fit the exterior of the former, and has at its lower part two recesses (one on each side) opposite to the projections on the other die, and also a taper recess at the top where the toe of the shoe comes. The former are to turn the back caulks of the shoe, and the latter to form the toe caulk or tip. The end or face of the female die has projections on it which form the grooves and nail prints in the shoe. These two dies have a reciprocating motion to and from each other, imparted to them by cranks or other gear connected to two of the shafts above named, the female die having a regular motion, and the male die an intermittent one, being stationary during half the revolution of its shaft. There is a slide so arranged as to work vertically in guides in the framework, and in the lower part of this slide is an opening through which the male die freely passes, and to the outer face of this slide are attached two jaws, each of which is furnished with a recess of the form of one half of the exterior of the shoe, so that, when the said jaws are closed upon the male die, and the two dies are brought to the proper distance apart, their four surfaces combine to form a mould of the desired form of the shoe. The jaws are kept apart by a spring, and brought together by their lower ends (which are wedge shaped) coming between two bevelled projections on the frame each time the slide descends. The slide is caused to rise and fall at proper intervals by a crank attached to the third of the above mentioned shafts. The portion of the jaws which contain the recesses project some distance in front of the lower portions, and in the under side of such projecting parts there are grooves which serve as guides to the iron under operation, and prevent its lateral displacement during the bending thereof to form the shoe. The machine is provided with a suitable cutter for cutting the iron off into proper lengths to form a shoe, the movable part of which cutter is operated by the mandril of the male die.

2521. H. B. COATHUPE, *Junior United Service Club, and* F. H. WALTHAM, *Palace-street, Haverstock-hill, London, "Improvements in obtaining or producing and applying embossed or raised and engraved or indented metal or other surfaces."—Dated 9th October*, 1861.

The main feature of this invention consists in taking a mould in plaster, paper, sulphur, glass, metal, gutta-percha, wax, starch, gum, or any other vegetable or mineral substances, simple or combined, from the ordinary printing types or lines or designs drawn or executed on copper, steel, wood, or other surfaces, which mould is then to be scraped and smoothed down to the finer lines, thereby leaving an indented impression on the mould, reading the ordinary way from left to right; then from the mould produced a second mould of plaster material or papier mâchiè is to be taken, which will then bear the same letters, lines, or designs raised, but backwards; a cast in metal is then to be taken from it, and an indented plate will be produced precisely similar to those produced by the tedious process of engraving; this is to be filled in with coloured or plain inks, pitch, sealing wax, or other substance, the plate being faced by friction.

2524. J. J. RUSSELL, *Crown Tube Works, Wednesbury, "Hand stocks and dies for cutting screws."—Dated 9th October*, 1861.

For the purposes of this invention, in constructing hand stocks and screw dies to be used therewith, the central part of the stock is made with a circular opening or recess of suitable dimensions to receive a die, which, in place of being made in two pieces, as is ordinarily the case when making dies for the common hand stocks, is made of a single piece, and of a circular or cylindrical form; the die is retained within the recess or opening in the stock by means of the projecting heads of two screws screwed into the stock at opposite points of the diameter of the die. The die is of steel, and is made with cutting edges projecting inwards at four points at equal distances apart on the inner circumference of the die, and these cutting edges are made, by preference, somewhat bell-mouthed where they first begin to cut or tap the end of a tube or rod. A die thus formed will admit of being again and again reformed after it is worn away and blunted, by simply softening it and hammering its exterior opposite where two sets of the projecting cutters are situated, so as to force such opposite cutters towards the centre of the die, and then hammering it opposite where the other two sets of cutters are situated, so as to drive those cutters also towards the centre. The die is then to be made complete by screwing in the proper screw tap, and by again tempering the die.

2532. J. STEVENS, *Birmingham, "Connectors and adjusters for connecting and adjusting crinolines."—Dated 10th October*, 1861.

This invention consists in so bending sheet metal that it shall partially or entirely clip the material of the crinoline, whether of steel, whalebone, cane, or other material, and in so cutting and dividing such metal clip that springs shall be formed for pressing the material forming the crinoline compactly together, such spring or springs being readily passed in, but to offer a sufficient resistance to prevent the crinoline voluntarily expanding without the spring or springs being liberated for that purpose.—*Not proceeded with.*

2533. L. CHRISTOPH, *Paris*, W. HAWKSWORTH, *Linlithgow, N.B., and* G. P. HARDING, *Paris, "Cast steel and other metal tubes."—Dated 10th October*, 1861.

This invention consists in making conical, cylindrical, or other shaped tubes without welding, by a peculiar mode of drawing or rolling, or of drawing and rolling combined, either in a hot or cold state. In drawing or rolling tubes of an uniform diameter throughout, according to this invention, a peculiar form of mandril is employed, having two or more swellings or enlargements thereon, the one which comes into action first being rather smaller than the others, which should be of a gradually increasing size. The draw plate to be employed with these mandrils is made considerably thicker than the ordinary draw plate or wortle, and has a conical draw hole or aperture therein to correspond to the graduated sizes of the enlargements on the mandril. In the making of conical or tapered tubes, such, for example, as are required for gun barrels, the patentees employ a conical mould or matrix, into which a tube is introduced after it has been rolled to a tapered form, and through this tube a mandril, similar to the one above described, is drawn, so as to expand and elongate the tube until it fills entirely the conical mould or matrix, the result being a conical tube with a cylindrical bore. This tube may have rifle grooves indented or drawn therein, in lieu of cutting such grooves by using a mandril having suitable projections thereon, and to which a proper rotatory motion is imparted during the time it is being drawn through the tube or barrel. The tubes or blanks are originally produced either by casting in the form of hollow cylinders, or piercing or boring them from a solid bar or block, or by punching.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

FINISHED IRON TRADE: *Demand Subsiding: Hopeful Tone*—BOARD OF TRADE RETURNS: *Falling off in the Export of Iron*—COAL TRADE: *Brisk Competition*—GENERAL HARDWARE TRADES *Diminished Home Demand: Accounts Unpaid: Foreign Demand: Orders for China and the Continent: Fancy Trades Active*—SUCCESS OF BIRMINGHAM FANCY GOODS IN THE EXHIBITION—EXPORT OF HARDWARES: *Government Returns Dissected*—METROPOLITAN CARRIAGE COMPANY BUYS THE SALTLEY WORKS.

THE iron trade must be reported quieter this week than it was last. There are fewer orders in hand, and scarcely so much being inquired for now as at that time; and by makers who do not occupy a first position rates are beginning to be accepted which are a yet more unfavourable indication of the state of the trade than the paucity of orders. The tone, however, both in Birmingham yesterday and in Wolverhampton on the day before was tolerably cheerful. There is a general conviction that we have seen the worst, and that a very decided improvement is near at hand. It is feared, however, that it is not so near as to produce much effect during the current quarter.

The Board of Trade returns for March show that the total value of the exports of British manufactures in that month was £9,664,694, which, although a smaller sum than that which represented the value of our foreign trade in March last year and the year before, yet is an increase upon the total value of the products exported by us in either of the preceding months of this year. Coal, copper, lead, tin, certain descriptions of iron, tin plates, and machinery were among the exemptions to the diminution, as compared with 1860 and 1861. Indeed, certain of these show a considerable increase. The following table shows the value of the iron in its various forms which we exported in March in this and the two preceding years:—

	Month of March.		
	1860.	1861.	1862.
Iron, pig and puddled	£86,502	£75,018	£98,105
,, bar, angle, bolt, and rod	203,030	175,609	160,748
,, railroad	294,097	253,968	198,818
,, wire	20,314	30,852	18,678
,, cast	61,582	39,433	35,025
,, hoops, sheet, and boiler plate	101,206	67,632	73,892
,, wrought	181,194	159,327	160,725
Steel, unwrought	70,387	70,194	66,438
Total iron and steel	998,922	872,033	814,429

The totals which we here give show that our export trade in iron of all sorts is seriously declining. As compared with March two years ago, we sent away iron in that month this year worth less by £184,493. And a comparison with a year later shows still more unfavourably to our present trade, inasmuch as the reduction upon that period was 26 per cent. on £343,349. Further, comparing the first quarter of 1859 with the corresponding period this year, we find that the trade of this year in iron and steel has fallen below that of three years ago to the extent of £554,419, the total figures in each year being for the earlier period £2,603,699, and for the later £2,049,280. At the same time the reduction is not so great as it seems, inasmuch as iron is lower in price than it was three years ago. Still, allowing for the reduction, the falling off in the trade is sufficiently marked. Dissecting the table, and comparing March this year with March last, we find that the increased exportation of pig and puddled iron was confined to France and Holland; but the shipments to those countries were on a scale of unusual importance, owing, probably, to the requirements of the national dockyards for the construction of armour-plated ships. There was also an increased exportation of angle, bar, bolt, and rod iron to those countries, and in a smaller degree to Turkey, India, and Australia. The falling off in railroad iron extended to all countries, except France, Prussia, and Sweden; and to the first of those countries the increase was nearly fourfold. There was an augmented exportation of cast iron to France, Russia, and the United States; but the supplies sent to other countries were on a small scale. The increase in hoops, sheets, and boiler plates extended to all countries, except the Hanse Towns, Spain, the United States, and Canada. The small improvement in wrought iron was limited to the exports to Holland, Prussia, Spain, and South Africa. The increased exportation of steel in the earlier portion of the year was not maintained in March, but the demand in France promises soon to compensate for the great falling off in the consumption of British steel in the United States, which, however, yet remains the principal market for our steel manufactures.

Excepting in samples of the highest class there continues to be much competition amongst colliery proprietors for the orders that are to be obtained. In consequence the rates continue to rule low.

As with regard to the iron so also with reference to the general hardware trades of Birmingham and Wolverhampton and their surrounding districts, there is a slightly quieter trade now than at the time of our last report. Fewer orders are coming in, and they are for miserably small quantities. The utter incapacity of the ironmongers in the great manufacturing districts of the home market to order with a probability of selling the goods is now being felt. Further accounts already due in those districts are most difficult to get in. Manufacturers and factors are, therefore, in many instances being restricted in certain of their operations by such accounts being withheld. The foreign trade, however, keeps tolerably good; and orders are being executed in different branches which show how extensive are the demands that are made by foreign nations upon the producers of useful metal goods in Great Britain, and at the same time how much we are benefitted by the opening up of any country, however remote to our commerce. We adverted last week to the valuable specifications that were reaching the ironmasters of this district from China. We now learn that orders of no less proportionate value are under execution by the producers of hardwares here. Already we have begun to make large numbers of the rice box, which, resemble an artistically painted cheddar cheese, almost every Chinaman is seen carrying under his arm when he does not expect to be home at the next meal-time. In China these goods are made of a material somewhat resembling our commonest paper pulp, but heavier. We can make them of tin, paint them quite in the Chinese fashion, and sell them at, it is computed, one-fourth the price of the native-made article. The durability of the metal box will not, of course, be so great as that of one of the paper; but its very low price will, a Chinese merchant who has been in this disrict is convinced, obtain for it a very wide sale. This article, however, is only a specimen one, and we advert to it because of its extensive use and size. Numerous other articles there are in general use in that distant empire, sample orders of which are being executed in Birmingham, and which same native authority is confident will produce others of considerable dimensions. On the Continent, also, discoveries are being almost daily made which show that in France and throughout the south of Europe hardware goods are being manufactured in a clumsy style and at high prices that can be sent from this district in every way superior in quality and style, and at much under the Continental prices. Whilst, therefore, the prevailing condition of the trade in hardwares is not such as to afford satisfaction, the prospects are in every way encouraging. In Birmingham the fancy trades continue to improve, the leading houses are most of them well employed, and, the confidence being general that the Birmingham wares of this class are distancing all competitors in the race which is now being run at South Kensington, we are looking for a yet larger trade in this description of goods.

The Government returns, extracted from above, show that the

producers of the useful metals other than iron are doing a better trade than are the ironmasters.

	Month of March		
	1860.	1861.	1862.
Copper, unwrought	35,748	26,577	[illegible] 345
„ wrought	139,465	114,273	23,738
Brass, all sorts	12,731	19,144	14,429
Lead, ditto	30,437	34,148	41,118
Tin, unwrought	25,364	18,475	33,278
„ plates	149,365	77,974	142,998
Zinc, all sorts..	9,428	7,989	11,182

The copper trades, including the rolling of yellow metal sheathing, seem to have been prosperous in a very large degree; the only markets which show any diminution of the demand, as compared with the corresponding period of last year, being those of France and America. The Italians were large purchasers, and a very great increase took place in the exports to India. There was an almost equal increase in the shipments of the unwrought metal, France and Holland doubling their demands, whilst Belgium took three times the quantity that she received in the corresponding period of last year. The shipment of lead to the United States rose from three tons, at that time, to 433 tons, and there was also an increased exportation to India and Australia. The demand for unwrought tin shows a much greater increase, and it extended to all countries, the exports to France nearly doubling, and those to Turkey being augmented in nearly the same proportion. The great increase in the exports of tin plates was due chiefly to the unexpected and suddenly enlarged demand of America, which was more than three times that for the same article in the preceding year. Excepting France, almost every other country shows a decline. Hardwares fell from £288,489 to £215,030, extending to all countries except France, Holland, and India. The exports to France were, indeed, nearly double the value of those of the corresponding period of last year, and almost four times as much as that in 1860. Small arms show a nearly fourfold increase, the value of the exports being £94,085 against £24,361 last year, and £21,217 in 1860. The increased value of the exports of machinery was due to the extensive consignments of steam engines to Spain and Australia. Other descriptions of machinery show a decline, notwithstanding shipments on an extended scale to Russia and Holland. The value of the steam engines exported was £148,649, and that of other machines £167,515, against £97,868, and £213,273 respectively, in the corresponding period of last year.

The Metropolitan Railway Carriage and Wagon Company have made an arrangement, which is described as "most satisfactory and advantageous," to purchase the works and old-established business of Messrs. Joseph Wright and Sons, railway carriage builders, of Saltley, near Birmingham.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

Northern Matters: *State of Trade: Middlesbro': Shipments of Coal and Iron from the Tyne: The Marna (s. s.): Legislative Protection for Miners: The Claud Hamilton (s.); Sunderland Dock Extension*—Comparative Railway Traffic—State of Trade: *Sheffield: Leeds*—North-Eastern Railway: *Nidd Valley Branch*—Manchester, Sheffield, and Lincolnshire Railway: *Cheshire Midland: Grimsby and Cleethorpes*—Engineers' Certificates: *Discussion in the Hull Town Council*—Mersey Docks and Harbour Board—*Manufacture of Steel Guns: Important Case*—State of Employment at Manchester: *Machinists and Foundries*—Traction Engines: *Great Weights Moved at Glasgow*—Other Scottish Topics: *Institution of Engineers in Scotland: Steam Ploughing in Ayrshire.*

Although, as was to be expected from the present disjointed condition of commercial affairs, business in the North is generally in a by no means satisfactory condition, the last weekly returns of the North-Eastern Railway show a falling off of £4,735—and that, too, in Easter week—as compared with the corresponding period of 1861, a cheerful report is made from the Middlesbro' district by a correspondent of the *Newcastle Chronicle*, who observes:—"Our manufactories still continue to work away steadily. Although no extra push is made in any department, yet all are kept fully employed. The export during the last week has been about 3,000 tons of pig and manufactured iron, an increase as compared with the preceding weeks. In addition to the continental trade going on our firms continue to receive a fair share of home orders. Messrs. Hopkin and Co. have this week received an order for 5,000 tons of rails from the North-Eastern Railway Company. These rails are to be manufactured out of hammered piles, a process which continental railway companies adopted some time ago. It has the property of making the heads of the rails much harder, and consequently causing them to wear longer than the old or present rails in use on most of the English lines, which often have a sort of 'cheesey' appearance. This order will give full employment to the rail mills belonging to this firm, which have lately been rather slack. The other orders this firm are executing are principally for single iron and fish pieces, of which they make a large quantity. No progress has yet been made with the erection of the new steel works we mentioned a fortnight ago, although arrangements have been made for the laying in of lines of rail from the Stockton and Darlington Railway, which runs close past the plot of ground purchased for that purpose. We hear it is the intention of the company, who propose starting the steel works, to erect three blast furnaces, as well as the other works named. Messrs. Gilkes, Wilson, and Co. are about completing a contract they have had on hand for the last nine months for malleable iron girders, for railway bridges between Cockermouth and Workington. Some of the girders are very large, being in some instances 80ft. long and 8ft. deep, with flanges top and bottom, and they are made of plate ⅝in. thick. We understand that this firm is likely to obtain an order for a number more of such girders, but of greater dimensions, for a line west of Bishop Auckland." There was an increase of 13,509 tons in the shipments of coal from the Tyne last week; the shipments of coke also increased 1,078 tons, but those of iron decreased to the extent of 3,449 cwt. The Morna, s. s., a fine vessel built by Messrs. Pile, Spence, and Co., has been on view during the last few days in the Swainson dock, West Hartlepool; she is intended for the passenger trade between Leith and the metropolis, and will shortly be placed on the station. A meeting of miners' delegates was held at Newcastle on Saturday, at which it was stated that a petition, signed by 17,000 miners connected with the counties of Northumberland and Durham, had been entrusted for presentation to Sir Fitzroy Kelly. The petition, which is also said to have received the approval of seventy-five members of Parliament, prays that the House will adopt some immediate measures for the better protection of the miner—such as making it imperative upon coalowners to sink a second shaft in all mines which are now only wrought with one, increasing the number of mine inspectors, &c. The gallant fellows who so heroically exerted themselves on the occasion of the Hartley catastrophe, a few weeks since, are to receive suitable medals and pecuniary rewards at a public meeting to be held at Newcastle on the 20th inst. The Claud Hamilton, a handsome steamer built by Messrs. C. Mitchell and Co., of Walker, for the Intercolonial Royal Mail (Australian) Steam Navigation Company, has just made a satisfactory trial trip, her steaming qualities fully answering the expectations formed respecting them. Mr. Abernethy, C.E., has delivered a report on Sunderland dock extension matters to the River Wear Commission, but the document has not yet obtained publicity; when it arrives at that stage we shall not fail to refer to it.

In accordance with a practice which we have adopted under this head in previous years we proceed to compare the receipts of the various great railway systems, with the amounts acquired upon them in the corresponding period of 1861. To April 27th the totals stand thus:—

System.	1862.	1861.
Caledonian	£191,302	£186,136
Eastern Counties	399,293	401,255
Great Northern	412,819	439,319
Great Western	846,091	848,020
Lancashire and Yorkshire.. ..	515,621	590,336
London, Brighton, &c.	245,633	238,584
London and North-Western ..	1,292,206	1,350,594
London and South-Western ..	279,262	276,451
Manchester, Sheffield, &c... ..	225,419	248,528
Midland	614,863	645,023
North-Eastern	564,763	611,745
South-Eastern	217,115	233,395

It will be considered, perhaps, that, taking into account all the grumbling which has been indulged in, things might have turned out much worse; but when it is remembered how vast and varied the resources of this country are, and what a large class of solidly rich individuals are to be found in it—while railway traffic has a natural tendency to expand, under ordinary circumstances, from the gradual increase of population, the development of new lines, &c.—the results appear just what they might have been anticipated to prove. As regards the probable effect of the Exhibition, it will doubtless materially benefit the South-Eastern and several of the lines more or less connected with the prosperous agricultural districts; but it is impossible that the great decrease which appears on the Lancashire and Yorkshire, London and North-Western, and North-Eastern can be recovered—at any rate this half-year. But it is to be hoped that the visit of M. Mercier to Richmond—reported during the last few days—affords grounds for anticipating that at last there is "a good time coming" across the Atlantic, and if so, comparative prosperity will soon be experienced again *chez nous.*

A steady demand for steel, of both crinoline and other kinds, continues to be experienced at Sheffield—where trade generally, however, is in a very stagnant state—for home consumption as well as exportation. The manufacturers of edge tools are well employed, and some of them have large orders on hand for tools required for shipbuilding purposes. The edge tool trade is not so brisk as it was a short time since. A satisfactory trade in steel continues to be done with France, but the same cannot be said with regard to general manufactured goods. The puddlers and other operatives engaged in the iron trade at Leeds continue fairly employed.

The Nidd Valley branch of the North-Eastern Railway system, which has been some little time on hand, was opened for traffic yesterday week. The branch leaves the main line on the west side, about two miles north of Starbeck, and the length of railway formed has been 11 miles. The cost of the branch, which has only a single line of rails, has been £8,000 per mile; and the vast system of the North-Eastern is carried by it into a district in which varied mineral, agricultural, and manufacturing resources will now receive an increased development. The attention of capitalists has several times been directed to the best means of opening out the riches of the valley of the Nidd and the adjacent districts. As long ago as 1816 Telford suggested or projected a canal down the valley, thence by way of Knaresborough to the river Ouse, and thence to the Humber and the German Ocean. The scheme, however, was never realised. Some time about 1829 an idea was also entertained of making a horse-tramway up the valley, with a canal communication to Knaresborough, and so forward to other parts. The Leeds and Thirsk Railway Company subsequently obtained powers to make a branch railway up the valley. Both these schemes failed, but the credit of the North-Eastern has now overcome all difficulties.

Seven miles of the Cheshire Midland Railway, between Altrincham and Knutsford, has been officially inspected by Captain Rich on behalf of the Board of Trade, and will be open for traffic to-morrow (Saturday). The Manchester, Sheffield, and Lincolnshire Company are lessees of the undertaking, and will work the traffic. The remainder of the line to Northwich is in an advanced state, and is expected to be opened in the course of August. The Manchester, Sheffield, and Lincolnshire Company are also making good progress with a line from Grimsby to Cleethorpes, a spot which is expected to be turned to some little account as a watering-place.

A curious discussion took place at the last meeting of the Hill Town Council in reference to a new engine erected at the Stoneferry Waterworks. The sum of £3,800 is due to the contractors, Messrs. Hawkes, Crawshay, and Co., but the payment of this money is held back in consequence of a difference as to who is the right party to certify as to the engine being complete and in thorough working order. Mr. Marillier, the late engineer who superintended the erection of the engine, had given a certificate; but the town clerk upon reading the terms of the contract found that it was requisite for the resident engineer to certify as to the correctness of the engine. Mr. Dale, the present resident engineer, declined to counter sign Mr. Marillier's certificate, as there was still some little work required to complete the engine, and besides he had not seen the specifications. The present question was, therefore, whether the council should act upon the certificate of Mr. Marillier alone, and at once pay the money, or require Mr. Dale to examine the specifications and report as to whether the engine was perfect. Mr. Mayfield thought the council ought to have the certificate of Mr. Dale. Mr. Samuelson, on the other hand, said a £10 note would make the engine perfect, and it would be a great shame to keep large contractors like Messrs. Hawkes, Crawshay, and Co., out of £3,800, until Mr. Dale, the present engineer, made himself acquainted with the engine. Mr. Marillier was the person who had superintended the erection of the engine, and he was the proper person to certify to its correctness; therefore, it was out of place to call upon Mr. Dale to interfere in the matter. After discussion, the decision to which the council came was, that Mr. Dale should be required to examine the specifications and the engine, and report upon it when complete.

Economy seems to be at last the order of the day with the Mersey Docks and Harbour Board. At the last meeting, it having been reported that an extension of the north sea wall for the protection of a new battery now in course of erection would cost £31,000, the work was agreed not to be proceeded with. As the Government undertook the erection of the battery, it seems strange that it does not also undertake the erection of the defensive sea wall. It certainly appears a half ludicrous idea that after a battery has been commenced for the protection of the coast it should be considered necessary now to construct a sea wall to protect the battery. The next question will be what can be thought of to protect the sea wall.

A mattter of some interest came before the Court of Exchequer on Friday, an application being made for a new trial in the case of Horsfall and others against Thomas. The plaintiffs, proprietors of the Mersey Steel and Ironworks, had brought an action, which was tried before the Lord Chief Baron, who gave a verdict for the plaintiffs. They had, under a contract, engaged to manufacture a steel gun for the defendant of certain dimensions. During the progress of manufacture some defects were discovered in the metal, which were got rid of, with the consent of the plaintiff, by increasing the diameter of the bore. The plaintiffs introduced a steel plug into the breech of the gun, of which the defendant subsequently complained, saying that it had been wilfully put there to hide a fatal defect in the manufacture. Their lordships took time to consider.

So far as Manchester is concerned the state of employment does not appear to be becoming worse—indeed, it is even slightly better than it was a few weeks since. Capt. Palin, the chief constable, officially returns the position of the Manchester machinists and foundries as follows:—Machinists, working full time with all hands, 11; working full time with a portion of their hands, 26; on short time, 9; stopped altogether, 1. Foundries working full time with all hands, 5; working full time with a portion of their hands, 15; working short time, 4.

The use of traction engines for drawing heavy weights on common roads seems to be exciting a good deal of interest in Glasgow. Thus, last week an iron screw steam boat, of considerable tonnage, built by Messrs. Davidson and Wood, was drawn, stern foremost, on a strong truck up North-street, along West-street, Vincent-street, and Patrick-road, and down to the large Finnieston crane, where it will be launched into the river. The engine puffed stentoriously, making the very houses tremble, and leaving conspicuous rut marks. The engine employed, which was built by Messrs. A. Chaplin and Co., of Cranstonhill Engine Works, was again used, on Thursday, by Messrs. Randolph, Elder, and Co., in drawing a large boiler (weighing, with truck, 33 tons) from their works in Dale-street to the large crane on the South Side. The experiment was attended with equal success, the distance, which is about half a mile, being accomplished in fifteen minutes. Under the usual system of drawing heavy loads shorts distances it would have occupied 300 men one hour to do the same work.

One or two other Scottish topics invite attention. Mr. W. Johnstone has been re-elected president of the Institution of Civil Engineers in Scotland; and Professor Macquorn Rankine, Mr. W. Simons, and Mr R. Bruce Bell have been chosen presidents. At the last meeting of the fifth session, the pecuniary position of the institution was shown to be extremely satisfactory. Mr. H. Purnell described "hot water circulating apparatus for warming purposes," which had efficiently worked in warehouses in Glasgow during the last winter. A paper was also read on "Boring Apparatus for Mines," by Mr. G. Simpson; and a description of "Lubricating apparatus for Locomotive and other steam-engines," was given by Mr. P. Stirling. Discussions followed these papers, and votes of thanks were awarded their authors. Mr. Fowler has been exhibiting his steam plough in Ayrshire at the invitation of the Agricultural Association of that county. The field selected—a stubble one, of about ten acres in extent—was well adapted for bringing out the qualities of the steam cultivator, being of a light friable loam, with a mixture here and there of a little clay. The plough was first tried, and as soon as the wire ropes were adjusted the engine set the plough in motion, and off it went at the rate of about three and a half miles an hour, turning over the stubble beautifully. Four ploughs being attached the ploughing was performed at the rate of about a Scotch acre an hour. A seven-tined grubber was next attached, and stirred up the soil to a uniform depth of at least 7in. The digger was next tried; it turned over the ground to a depth of about 8in., and astonished the farmers present by the effectual way in which the operation was performed. The general idea among the agriculturists on the ground was that the steam plough was a great success.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£ s. d.	Dis. p. ct.
IRON, English Bar and Bolt:—			
in London	pr tn	5 15 0	3
in Wales	„	5 0 0	„
in Liverpool	„	5 10 0	„
Staffordshire Bars [Deliv. into boats at wks]	„	7 0 0	1
Sheet, Sngl.	„	8 10 0	„
Dbl.	„	10 0 0	„
Hoop [Nom. rates last qr. d'y for favourite brands]	„	8 0 0	„
Rod, round	„	7 0 0	„
Nail Rod, sq	„	7 5 0	„
SHIPPING IRON, Staffordsh. Bars [Delivered in Liverpool 10s. per ton less.]	„	7 0 0	2
Sheet, Single	„	8 15 0	„
Double	„	10 5 0	„
Hoop	„	8 5 0	„
Rod, Round	„	7 0 0	„
Nail Rod, Square	„	7 5 0	„
IRON, Rails, in Wales, cash	„	5 5 0	nett
„ „ 6 months	„	5 7 6	„
Old, to cut up	„	0 0 0	„
Railway Chairs, in Wales	„	4 0 0	„
in Clyde	„	4 15 0	„
Pig No. 1, in Clyde	„	2 12 6	„
3-5ths No. 1 & 2-5ths No. 3		2 13 0	„
No. 1, in Wales	„	3 10 0	„
No. 1, in Tyne and Tees	„	2 12 0	„
Ditto, Forge	„	9 0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	„	3 10 0	„
Welsh Forge Pig (all Mine), at the Port	„	3 5 0	„
Acadian Pig, Charcoal	„	7 10 0	„
Scotch Pig, No. 1, in London	„	0 0 0	„

		£ s. d.	Dis. p. ct
IRON, Swedish, Indian assortments	pr tn	11 5 0	2
Russian C C N D to arrive	„	16 0 0	„
STEEL, Swedish Keg, ham.	„	15 10 0	2½
Ditto, rolled	„	15 0 0	„
Fagot	„	17 0 0	„
SPELTER, on the spot	„	18 7 6	net
To arrive	„	18 10 0	„
Hard, remelted	„	17 0 0	„
ZINC, in sheets	„	24 0 0	„
COPPER, Tile, 14 to 28 lb.	„	93 0 0	2
Tough Cake	„	96 0 0	„
Sheathing and Bolts	pr lb.	0 0 11	„
Sheet	„	0 0 11	„
Bottoms	„	0 0 11½	„
Old	„	0 0 9	„
Yellow Metal	„	0 0 9	„
Burra	„	96 0 0	„
Russian do.	„	0 0 0	„
LEAD, British Pig	„	20 0 0	„
Spanish	„	19 0 0	„
W. B.	„	21 5 0	„
Sheet	„	20 10 0	„
TIN, English Block, nom.	„	114 0 0	„
Bar „	„	115 0 0	„
Refined „	„	119 0 0	„
Foreign Banca	„	124 0 0	„
Straits	„	113 0 0	„
TIN PLATES, Charcoal, IC	pr bx	1 9 0	„
Ditto IX	„	1 15 0	„
Coke, IC	„	1 2 6	„
Ditto IX	„	1 8 6	„
Do. at Newport, 1s. pr bx less		—	„
Do. at L'pool, 6d.	„	—	
CANADA, Plates	pr tn	12 0 0	
QUICKSILVER	pr bt		

Rails.—The market continues steady and prices unaltered.

Scotch Pig Iron.—A considerable amount of business has been done during the past week, and prices have been well maintained, the market closing quiet but firmly at 53s. 3d. sellers and 53s. buyers cash. Mixed Nos. Warrants f.o.b. in Glasgow; No. 1 Gartsherrie, 57s. 6d.

Spelter firm at £18 5s. to 7s. 6d. per ton. The stock on the 1st inst. was large, being 4,729 tons.

Copper in limited demand, and may be brought under current rates.

Lead in fair request.

Tin.—English rather dull of sale. Foreign is quoted £122 to £123 for Banca, and £113 for fine Straits, and market dull.

Tin Plates.—But few sales reported this week and prices rather weaker.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Teak	15 10	17 0	15 0	16 0
Quebec, red pine	3 10	4 10	3 5	4 0
yellow pine	3 0	4 0	3 0	3 15
St. John, N.B., yel.	5 0	5 10	5 0	5 10
Quebec, oak, white	5 0	5 10	5 0	5 10
birch	3 10	4 0	4 0	0 0
Memel	0 0	0 0	0 0	0 0
elm	3 10	4 15	3 10	4 15
Dantzic, oak	3 10	6 0	3 10	6 0
fir	2 15	3 10	3 0	4 0
Memel, fir	3 10	4 0	3 10	4 0
Riga	3 5	3 10	3 10	3 15
Swedish	2 15	3 0	2 15	3 0
Masts, Queb. rd pine	5 0	6 0	5 0	6 0
yl. pine	5 0	6 0	5 0	6 0
rd pine	0 0	0 0	0 0	0 0
Lathwood, Dantz, fm	6 0	6 10	6 0	7 0
St. Peters.	8 0	8 10	9 0	9 10
Deals, per C., 12 ft. by 3 by 9 in.				
Quebec, wht. spruce	13 0	18 0	15 0	19 0
St. John, wht. spruce	14 0	16 0	15 0	17 10

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Yel. pine, per reduced C.				
Canada, 1st quality	17 0	18 10	17 10	19 0
2nd do	12 0	12 10	12 0	13 0
Archangel, yellow	13 0	13 10	14 0	15 0
St. Petersbg. yel.	12 0	12 10	12 10	13 10
Finland	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	15 0
Gothenburg, yel.	10 0	11 10	10 0	12 10
white	9 10	10 0	9 10	11 0
Gefle, yellow	10 0	11 0	11 0	12 10
Soderhamn	10 0	10 10	11 0	12 10
Christiania, per C 12 ft. by 3 by 9 in. yellow	22 0	25 0	22 0	24 0
Deck plank, Dntz per 40 ft. 3 in.	0 14	1 4	0 14	1 4
Staves, per standard M				
Quebec, pipe	70 0	75 0	80 0	85 0
puncheon	16 0	18 0	16 0	18 0
Baltic, crown pipe	160 0	170 0	170 0	180 0

SCOTCH PIG IRON REPORT.

	s.	d.	
No. 1 Gartsherrie	58	0	f.o.b Glasgow.
„ 1 Coltness	57	6	do.
„ 1 Calder	53	9	do.
„ 1 G.M.B.	52	6	do.
„ 3 Do.	51	3	do.
M. Nos. Do.	51	9	do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths „ 3 .. G.M.B.	Cash prompt	53	3	per ton.
	1 mo. open	53	6	do.
	2 mos. „	53	9	do.
	3 „ „	54	0	do.

MANUFACTURED IRON.

	£ s. d.	
Bars, Govan	6 0 0	
„ Common	6 10 0	
Drumpeller, Common	6 10 0	
Do. Best	7 10 0	
Cramond Scrap Bars Delivered in London	10 5 0	less 5 per cent.
Plates and Sheets	9 0 0	to £9 10s.
Rails	6 5 0	
Pipes	4 17 6	
Chairs	3 15 0	

Glasgow, 7th May, 1862.

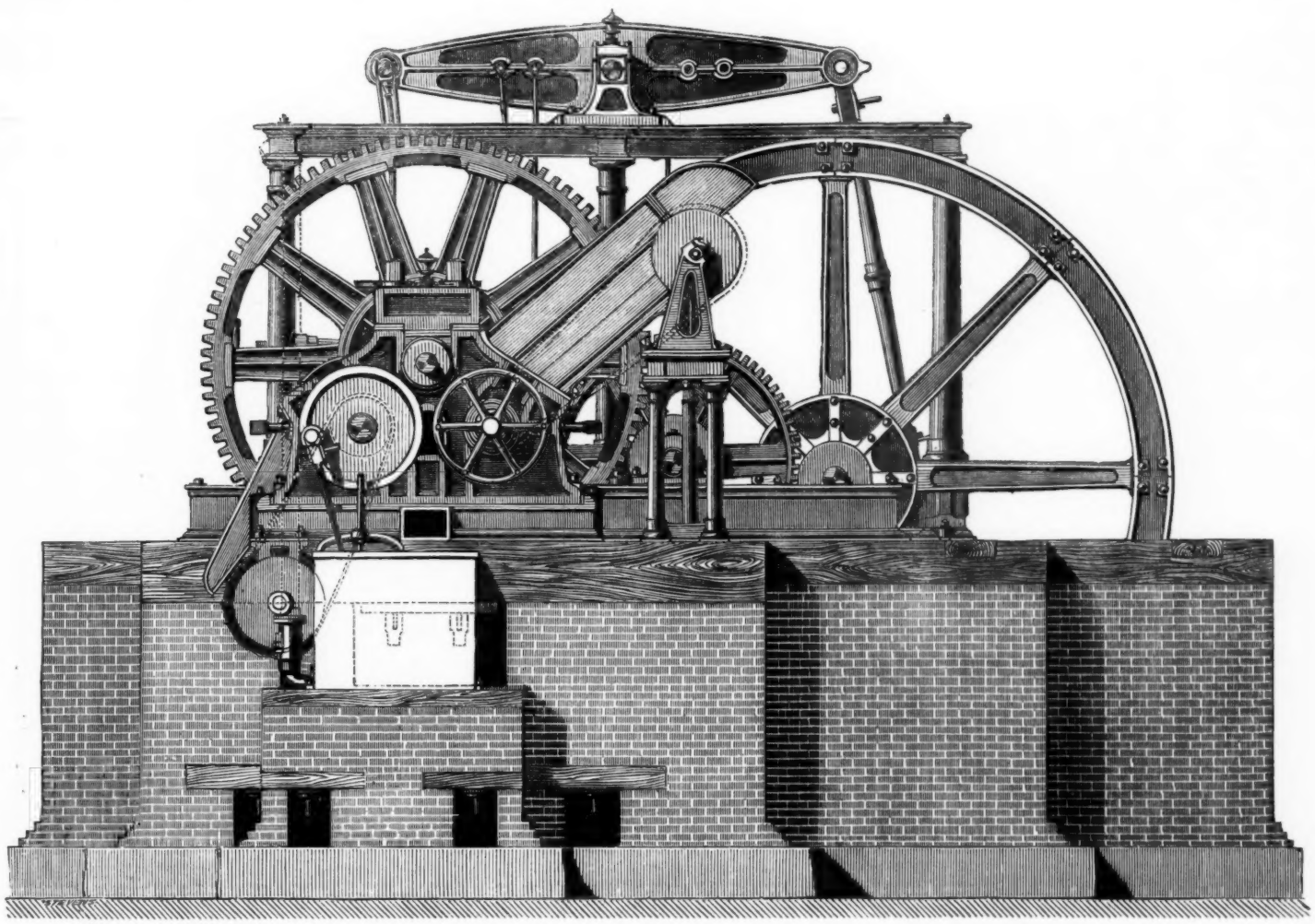
The pig iron market has given way in price, having steadily declined from 53s. 10½d. cash to 52s. 10½d. accepted to-day, closing firmer; buyers 53s., sellers 53s. 3d.

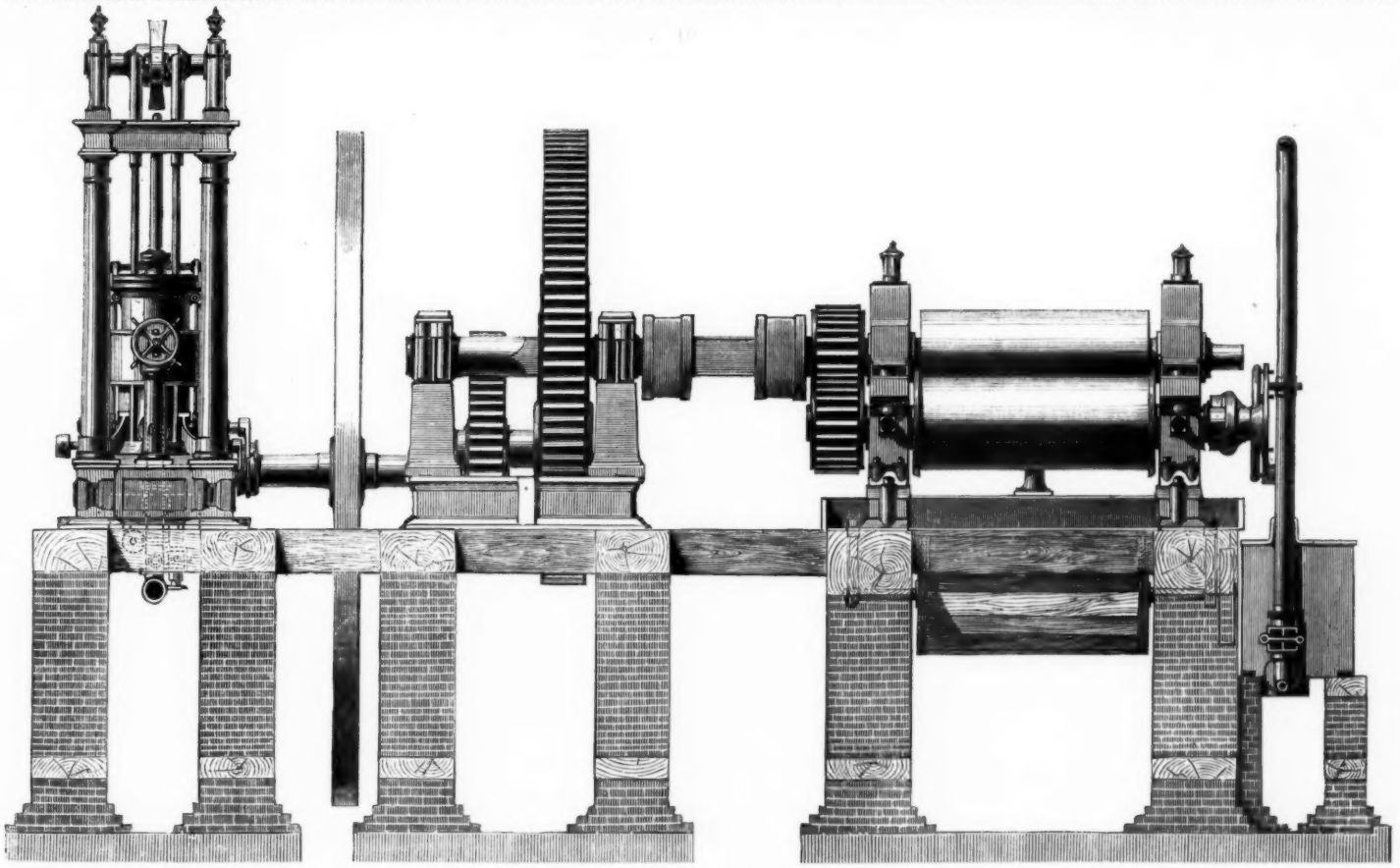
Operators for a fall have taken courage again, and a fair quantity of iron has been sold for future delivery.

Exports last week were 13,815 tons, against 14,734 tons in the corresponding week of last year.

Shaw, Thomson, and Moore, Metal Brokers.

MIRRLEES AND TAIT'S SUGAR-MILL IN THE EXHIBITION.





Among the contributions to the western annexe of the International Exhibition of 1862, the machinery for the extraction of the juice of the sugar cane is worthy of considerable attention. Even to a professional eye not accustomed to this class of machinery, the strength and proportions of all the parts both fixed and movable appear to be greatly in excess of the power capable of being developed by the size of engine attached, yet experience has proved that this strength is absolutely necessary.

Sugar cane contains from 80 to 90 per cent. of its own weight of juice, holding in solution about 20 per cent. of pure sugar. Of this quantity about one-half is, by the usual process of manufacture, obtainable in the form of crystalline sugar, while the remainder is converted into molasses and rum.

In order to express from the cane the greatest possible amount of juice, many ingenious modes of pressing have been suggested and tried, but have all yielded in amount of work done to the method of crushing by rollers, and of this form of machines experience has proved a well proportioned 3-roller mill to combine in the highest degree the requirements of simplicity, efficiency, and durability.

As an example of the best practice of the present day, by those exclusively employed in this class of machinery, a description of that now being exhibited by Messrs. Mirrlees and Tait, of Glasgow, may not be uninteresting, being a specimen of the largest size now in use, and capable of expressing easily 4,000 gallons of juice per hour, equivalent to, say, two tons of sugar.

It consists of a 6-columned high-pressure beam engine, having a cylinder 22in. diameter, with a stroke of 4ft. 6in. The usual working pressure employed is 70 lb. per square inch. The steam is admitted to the cylinder by the usual 3-port slide valve, cutting off at three-fourths of the stroke, while a further degree of expansion is provided for by a separate gridiron expansion valve having a link motion adjustable to any length of stroke when the machinery is in motion. For this manufacture, however, much importance is not attached to any nice degree of expansion, as the engines are invariably worked to the utmost extent of their capability, while the heat of the exhaust steam is economically made use of in the clarification and evaporation of the cane juice. For this latter reason also the high-pressure engine is preferable, as well as on account of its greater simplicity.

The power of the engine is transmitted, and the speed of the rollers reduced to the required velocity by a heavy train of compound gearing, all firmly secured to a massive cast iron bed-plate on the same level as the engine.

The mill, as before stated, is a 3-roller mill having rollers 33in. diameter and 7ft. long. The bed-plate, which also forms a trough for the reception of the cane juice as it falls from the rollers, is of cast iron, and weighs over 5 tons. On the opposite sides are fixed the headstocks or mill cheeks which carry the bearings of the three

rollers. These are necessarily very heavy, having to receive the whole strain of the work performed, which may be at this point taken as the whole force of the engine acting through a leverage 16 to 1.

The centres of the top roller are a fixture, being placed directly in a line with the shaft of the large gearing wheel. It is secured from rising by heavy covers of cast iron fixed down by four wrought iron bolts, 4½in. in diameter, which, extending downwards completely through the metal of the headstocks and mill-bed, are secured by cottars and wrought iron plates underneath the heavy timbers, on which the mill rests. By thus carrying these bolts down through, not only is the headstock relieved from strain, but the additional elasticity of a long bolt and timber beam is obtained, permitting the top roller to yield to a certain extent to the extraordinary pressure occasioned by the frequent gluts of canes supplied to the mill. The side rollers are of the same dimensions as the top roller, having in addition, however, strong flanges at each end, between which the top roller revolves, thus preventing the canes escaping past the ends of the rollers. The two side rollers are each separately adjustable in a horizontal direction to any required distance from the top roller by means of powerful set screws, fitted into the outer ends of each headstock. Each of the side rollers is adjusted separately in relation to the top roller. The front roller, or that which first receives the canes, is usually kept at a distance of from half an inch to 1½in. apart from the top roller, so as readily to bite and take through the mass of canes supplied to it from the cane table, which is a malleable iron plate the same width as the rollers, and rising from the front roller at a considerable angle to about 5ft. high. This table is attached to cast iron sides, which confine the canes sideways when falling into the mill. They are attached to the headstocks at each side, and also to a cast iron framework, which carries the driving mechanism of the cane-carrrier proper.

The cane-carrier consists of two endless chains, revolving on two drums, one of which is placed at the top of the cane table, and the other at any distance, according to the length of cane-carrier required, but which, with a mill of this size, is generally from 100ft. to 120ft. These chains may either be at the ends of the drums or closer, but are connected together by strips of board fastened to each link about 5in. or 6in. broad, and generally of the same length as the rollers, forming a complete endless travelling table. Motion is given to this table by a pair of pitch chain wheels, one on the end of the front or cane roller gudgeon, and the other on the upper drum shaft, and of such proportions that the surface of the table shall move at a rate of from one-sixth to one-third slower than the surface of the rollers. An ingenious double cane friction clutch is provided whereby the carrier may be instantly stopped or started. An apparatus of similar design is also attached to the other side of the mill for receiving the megass or crushed cane, after being deprived of its juice, and carrying it clear of the mill house for the purpose of being stacked or otherwise made use of.

In the manufacture of sugar this megass or refuse cane is the principal, and, in many cases, the only fuel employed, and the state in which it is delivered from the mill is a matter of importance. Should the back roller be too close for the amount of canes passing through, the megass will be reduced almost to a state of powder which, when dry, is too light and volatile to be of much use as fuel; and, again, if the rollers are not close enough the megass will contain too much juice, to the serious loss of the planter, and will, if not very speedily dried, again suffer deterioration as fuel by the acid fermentation which immediately sets in. The quality of the megass is again affected by the velocity with which it is passed through the mill, and on this point almost every maker and every planter has particular prejudices. A speed of roller surface of about 18ft. per minute is found to produce very good results, delivering the megass in good quality, and extracting, with the rollers properly adjusted, between 65 and 75 per cent. of juice from the cane.

In estimating the amount of work that can be done by a mill of the above description, the speed of the cane carrier, with an idea of the manner in which it is loaded, will give the quantity of canes passing through the mill in a given time. In a machine of this size the cane carrier will be continually kept filled with canes to a depth of from 12in. to 14in.; which, at 7ft. wide and 15ft. per minute, will give about 6,500 cubic feet per hour; and this quantity, packed in this manner, will yield about 4,000 gallons of cane juice, equivalent to, say, two tons of dry sugar per hour. Although, as already stated, the mill can easily express this quantity of juice, under ordinary circumstances, with canes of average ripeness, yet, in order fully to provide for the occasional expression of more watery cane, the pump which receives the juice as it flows from the mill-bed, and delivers it to the steam clarifiers, or other receivers, is made of sufficient capacity to raise at least one-fourth more.

It is from carelessness in the regular distribution of the canes over the cane carrier that sugar grinding machinery incurs its severest trials. Should a few feet of the cane carrier be but thinly supplied with cane, and followed by a large dense bundle, the engine has time to fly away at a high speed, when it may be brought to a dead stand in a few strokes by a mass of canes utterly out of proportion to the spaces at which the rollers are set; hence the extreme necessity for extra strength in the gearing and framework.

Mills of such large dimensions as above described are mostly required for the island of Cuba, where, from the immense extent of land under cultivation, and the comparatively short period (from four to five months) in which the crop has to be manufactured into sugar, not only has a large amount of work to be performed in the given time, but there must be the utmost security against breakage of any important parts—a condition which, we hesitate not to say, this machinery fully secures. Instead of one mill of such large proportions as the above it is occasionally the practice to connect two mills of smaller size to the same engine. These, for an engine of the power of the one described, would have had rollers 30in. diameter and 6ft. long. Next to Cuba in the employment of such large crushing power rank Demarara, Penang, Mauritius, Surinam, and Porto Rico, while mills with rollers 26in. and 28in. diameter, and 5ft. long, may be found all over the East and West Indies, Port Natal, and even the Sandwich Islands.

We may add that the great mill which we have described is exhibited in motion.

LONDON FIRES IN 1861.

THIRTY-FIRST ANNUAL REPORT.

By William Baddeley, C.E.

The year 1851 has always been spoken of as the year of the Great Exhibition: 1861 will long be remembered as the year of the great fire. Heavy though many of our fiery visitations have been, never since the Fire of London in 1666 have its inhabitants witnessed such an appalling conflagration as that which broke out in June last in Southwark. Nor is this the only distinguishing feature of the year; fires generally have been not only more numerous but more serious in their results during the period under review than in former years.

It has been well observed "that the very elements of nature—man's best servants—are among his most inveterate and remorseless enemies. Who knows not that, when curbed and restrained by the power of man, fire is, of all others, his most valuable servant? When kept safe, as a prisoner within iron bars and brick walls, who knows not the endless uses to which fire may be advantageously applied? Without this servant man must remain in the condition of a savage; for not only is fire indispensable to prepare his food, and, in these latitudes, to throw around his dwelling a genial glow of cheerfulness and comfort, but most of the necessaries and all the conveniences of life, the arts, and manufactures trades and occupations are dependent upon it for the means of their existence. And yet, while kings may lay down their crowns in acknowledgment of the services of fire, and while every grade of labour may pile their many tools to form a pyramid in honour of its worth, how jealously must it be guarded, how strongly must it be coerced, how resolutely kept down in subjection."

"Woe when loose from all its ties,
And to its growing rage no bar:
Swift the conflagration flies,
Like an elemental war.
On each hand, above, around,
Is death and desolation found."

When once beyond the limits to which its prison bars confine it, it has an almost irresistible power. Unlike everything else, it can multiply itself indefinitely. It converts almost everything it touches into its multiplying self. Verily, "how great a matter a little fire kindleth."

The total number of fire calls given at the engine stations of the brigade, during the year 1861, was 1,409. Of these 1,183 were actual fires, 135 were chimney fires, and 91 were false alarms. Of these fires 53 resulted in the total destruction of the premises, 332 were cases of serious damage, and 798 of slight damage. The fires of 1861 show an increase of 127 over those of the previous year, and are 391 in excess of the average of the twenty-eight years during which the Fire Brigade has been in operation. The number of totally destroyed—53—is no less than 25 in excess of 1860, and 13 beyond the average proportion of the past twenty-eight years. The first fire calls have been given at the engine stations by 16 inmates, 859 strangers, 296 police-constables,* and by the electric telegraph in 12 instances. Of these fires 14 have been self-extinguished, 261 have been put out by the inmates without external aid, 343 have been extinguished by the inmates with casual assistance, and the extinction of 565 have devolved upon the regular firemen. In nearly two hundred instances parish engine-keepers are reported to have rendered useful and efficient aid, but full justice has not been dealt out to them in these reports.

The total destruction of the premises in 53 cases is attributed to the distance of the nearest brigade engine stations, the hazardous character of the trades, the highly inflammable nature of the contents, and a late or insufficient supply of water.

In addition to these fires it is believed that the number of accidents in which the fire is quietly extinguished by the inmates, and of which no tidings ever reach the fire stations, are four times as numerous as those which are known and reported.

The monthly distribution of last year's fires is shown by the following table, with their fatalities, &c. :—

Months.	Fires.	Chimney Fires.	False Alarms.	Fatal Fires.	Lives Lost.
January	127	14	6	5	5
February	74	10	5	2	3
March	92	14	6	2	2
April	89	16	6	2	4
May	109	13	8	1	1
June	88	12	12	2	5
July	104	7	15	1	2
August	107	8	7	3	5
September	111	11	6	3	7
October	85	14	6	0	0
November	107	4	3	1	1
December	90	12	13	1	1
Total	1,183	135	91	23	36

The fatal fires may be classed as follows:—

Lives lost by personal accidents, from ignition of bedding or wearing apparel	17
Lives lost by explosion of gas	1
,, fusee composition	1
,, steam boiler	2
,, fictitious paraffin	3
Killed by falling walls, &c.	4
Inability to escape from burning buildings (5 fires)	8
	36

From the foregoing analysis it is gratifying to observe the very marked diminution of those painful calamities which, but a comparatively few years ago, were of such frequent occurrence, viz., the agonising spectacle of the inmates of a burning building crying from the windows for help, and crying, alas! in vain. Thanks to the well-organised system of fire-escapes which now pervade this metropolis, whenever human aid can avail, it is always near at hand. During the past year 620 night fires have been attended by the conductors of the Royal Society for the Protection of Life from Fire, and ninety-nine persons rescued from impending danger by their heroic and praiseworthy exertions. The following are the particulars of the localities of the fires at which these highly important services have been rendered, and by whom:—

				Conductor's names.	Lives saved
January	23	No.	56 Lower Whitecross-st.	Bresneham	3
March	6	,,	10 Brick-lane, Spitalfields	Wood	2
,,	12	,,	119 Leadenhall-st.	Preston	4
April	1	,,	8 Cambridge-st., Golden-sq.	Robinson	1
,,	15	,,	67 Skinner-st., Bishopsgate-st.	Steer	4
May	19	,,	2 Marchmont-st., Brunswick-sq.	Salsbury	2
,,	23	,,	67 Oakley-st., Lambeth	Sell	3
,,	,,	,,	20 Penham-st., Brompton	Whatley	1
June	16	,,	21 Mecklenburgh-sq.	Salsbury	2
,,	17	,,	63 Church-lane, Whitechapel	Wood	2
,,	,,	,,	36 Little Pulteney-st., Golden-sq.	Robinson	7
,,	20	,,	32 High-st., Kensington	Stanning	4
,,	21	,,	38 Newington Causeway	Semmens	5
,,	23	,,	94 High-st., Whitechapel	Wood	5
July	1	,,	10 Marlborough-rd, Chelsea	Whatley	7
August	16	,,	2 Queen-st., Ratcliff	Hardway	2
,,	25	,,	33 Upper-st., Islington	Vircoand Baddeley	2
,,	27	,,	40 Conduit-st., Bond-st.	Bailey	13
,,	29	,,	8 Kent-st., Borough	Tapsell	3
,,	,,	,,	15 Crisp-st., Poplar	Horton	9
September	18	,,	4 Crown-ct., Shoreditch	Eilbeck	1
October	3	,,	5 Richard-st., Limehouse	Hardway	4
,,	6		Bull-ct., Tooley-st.	Dunk	4
November	19	,,	13 Little Pulteney-st., Golden-sq.	Robinson	2
,,	24	,,	432 Oxford-st.	Miller	3
,,	26	,,	18 Upper-st., Islington	Virco	4
					99

The Royal Society for the Protection of Life from Fire have now seventy-three fire-escape stations in full operation in the metropolis, forming an almost unbroken chain (albeit some of the links are long ones) from Holloway to Peckham, north and south; and from Poplar to Kensington, east and west. In order to meet the public wish, the society have been obliged, in several instances, to deviate from the principle with which they originally started, of establishing fire-escape stations at half mile distances asunder, so that no house should be more than a quarter of a mile from a station. When the society shall have been able to supply these intervening localities (some of which are very poor, as well as very populous), their arrangements may be regarded as perfect. The fitness and perfection of their machines, as well as the vigilance and well proved bravery of their men, leave nothing to be desired on those heads. The harmonious co-operation and assistance rendered to the Fire Brigade, with the zealous support received from the police under the direct orders of the commissioners, have raised the fire-escape force to well-deserved importance, and, coupled with the priceless value of the services so continually rendered by its members, have made it one of the most popular institutions of the age.

* The second call has been given by constables in 250 instances.

The following table shows in each case the occupancy of that part of the premises in which the fire originated, illustrating the relative liability to damage by fire of various trades, manufactures, and private dwellings:—

Occupation.	Totally destroyed.	Seriously damaged.	Slightly damaged.	Total.
Apothocaries and dealers in drugs (no laboratories)	—	—	1	1
Bacon dryer	—	—	1	1
Bakers	—	6	15	21
Do. pie	—	—	1	1
Barge and boat builders	1	1	—	2
Baths	—	—	1	1
Do. public, and wash-houses	—	1	—	1
Beer shops	1	2	7	10
Booksellers, binders, and stationers	—	4	19	23
Brewers	—	—	2	2
Brickmakers	—	1	1	2
Brokers and dealers in old clothes	—	8	15	23
Builders	6	5	1	12
Butchers	—	4	8	12
Cabinet-makers	4	16	13	33
Carpenters and workers in wood	9	22	38	69
Chandlers	—	8	10	18
Charcoal and coke, dealer in	—	1	—	1
Cheesemongers	—	1	5	6
Chemists (including all places having laboratories)	1	4	6	11
China and glass, dealers in	—	1	2	3
Churches	—	—	5	5
Coach makers	—	1	2	3
Coal merchants	—	—	2	2
Cocoa-nut fibre manufacturers	—	2	—	2
Coffee shops and club houses	—	7	10	17
Colour makers	—	2	1	3
Composition frame maker	—	1	—	1
Confectioners and pastrycooks	—	6	3	9
Coopers	2	—	3	5
Cork cutters	—	1	2	3
Do. burner	—	1	—	1
Cornchandlers	1	5	4	10
Currier and leather dresser	—	—	1	1
Distiller	—	1	—	1
Drapers, linen, woollen, and mercers	—	14	35	49
Drysalters	—	—	2	2
Dyers	—	1	2	3
Eating houses	—	3	9	12
Engineers, mechanical	1	—	2	3
Fancy box makers	—	2	2	4
Farming stock	—	1	2	3
Fellmongers	1	6	1	8
Felt maker	—	1	1	2
Floor cloth manufacturer	—	1	—	1
Flour mills, steam	1	—	—	1
Do. water	—	2	—	2
Flower makers, artificial	—	—	1	1
Founders	—	6	2	8
French polishers	—	2	1	3
Furrier and skin dyer	—	—	1	1
Grocers	1	12	13	26
Gun maker	—	—	1	1
Hair merchants	—	2	—	2
Hat makers	—	1	5	6
Hay and straw salesmen	1	2	—	3
Hemp dresser	—	1	—	1
Hospital	—	—	1	1
Hotels and club houses	—	—	5	5
India-rubber manufacturer	—	—	1	1
Ink makers, printing	—	—	2	2
Japanners	—	1	1	2
Lamp-black maker	—	—	1	1
Laundresses	—	—	5	6
Looking glass maker	1	—	—	1
Lucifer-match makers	—	2	4	6
Manure, dealer in	—	1	—	1
Marine stores, do.	—	2	9	11
Mast and block maker	—	—	1	1
Mat maker	—	1	—	1
Mattrass maker	—	—	1	1
Mill maker	—	1	—	1
Milliners and dressmakers	—	5	10	15
Musical instrument maker	—	—	1	1
Oil and colourmen	—	6	11	17
Oil works	—	1	—	—
Oakum manufacturer	1	—	—	1
Organ maker	—	—	1	1
Painters, plumbers, and glaziers	—	—	2	2
Paper stainer	—	—	1	1
Photographist	—	1	—	1
Pianoforte makers	2	3	1	6
Pickle manufacturer	—	—	1	1
Printers, letter-press	—	2	5	7
Do. copper-plate	—	—	2	2
Do. lithographic	—	—	1	1
Private dwelling apartments	3	34	277	314
Provision merchant	—	1	—	1
Public places of entertainment (music halls)	—	1	1	2
Quill merchant	1	—	—	1
Rag merchants	—	1	7	8
Railway	—	—	4	4
Rice mills, steam	—	1	—	1
Rope makers	—	5	1	6
Do. wire	—	—	1	1
Sack makers	—	2	—	2
Sail makers	—	—	2	2
Sale shops and offices (no hazardous goods)	2	19	47	68
Saw mills, steam	1	2	2	5
Scale maker	—	—	1	1
Schools	—	3	4	7
Ships	—	2	1	3
Ship-builder	—	—	1	1
Do. iron	—	1	—	1
Soot merchant	—	—	1	1
Spice merchant	—	1	—	1
Stables	1	8	12	21
Sugar refiners	1	—	1	2
Tailors	—	2	12	14
Tallow melters, wax chandlers, and soap boilers	1	1	2	4
Tanner	—	1	—	1
Timber merchant	1	—	—	1
Tinmen, braziers, and smiths	—	5	8	13
Tobacconists (manufacturer slightly)	—	3	6	9
Toy warehouses	1	1	2	4
Under repair, or building	2	4	4	10
Unoccupied	1	1	9	11
Upholsterers	—	3	2	5
Victuallers, licensed	1	14	37	52
Vinegar works, steam	—	1	—	1
Wadding manufacturers	—	—	2	2
Wagons, on the road	—	—	2	2
Warehouses	—	3	5	8
Do. Manchester	—	—	1	1
Do. French fancy	—	1	1	2
Waterproof canvas manufacturers	1	—	1	2
Weaver, trimming	1	—	—	1
Wharfs	1	1	3	5
Wine and spirit merchants	—	2	5	7
Wire drawer	—	—	1	1
Workhouses	—	1	2	3
Workshops (no hazardous goods or processes)	—	9	8	17
Total	53	332	798	1,183

The daily distribution of fires has been as follows:—

Monday	166
Tuesday	167
Wednesday	167
Thursday	185
Friday	166
Saturday	155
Sunday	177

The distribution throughout the day and night, as follows:—

	A.M.	P.M.
First hour	81	25
Second hour	76	27
Third hour	51	28
Fourth hour	53	32
Fifth hour	38	42
Sixth hour	21	45
Seventh hour	24	83
Eighth hour	20	80
Ninth hour	21	92
Tenth hour	18	104
Eleventh hour	26	84
Twelfth hour	26	86

The average number of fires has been rather more than three per day, but this average has obtained in a comparatively small number of instances only, there having been—

14	days on which there was no fire.		
49	" "	1	49 fires.
62	" "	2	124 "
77	" "	3	231 "
84	" "	4	336 "
44	" "	5	220 "
24	" "	6	144 "
9	" "	7	63 "
2	" "	8	16 "
365	" "		1,183 "

The causes of fire, so far as could be ascertained, have been as follows:—

Accidents, unforeseen, and for the most part unavoidable	9
Apparel ignited on the person	9
Areas, lights thrown down	6
Breaming a barge	1
Candles, various accidents with	129
" ignited bed curtains	62
" " window curtains	50
Carelessness, palpable instances of	5
Children playing with candles	1
" " fire	13
" " lucifer matches	7
Cinders put away hot	17
Coke, hot	3
Copper, improperly set	1
" fires	7
Cork, burning of	1
Fires, sparks from	77
Firing casks	1
Flues—blocked up	7
" defective, overheated, &c.	39
" foul, ignited	21
" copper	11
" hot air	3
Fumigating bugs	1
Furnaces, and forge fires	17
Friction	2
Gas, escape of, from defective fittings	51
" accidents in lighting	10
" burning too high, or in contact with combustible matters (drapers, 25)	43
Gasfitters at work	2
Hearths, defective	3
" fires made on	2
Hot plates	2
" flue of	2
Intoxication	18
Lamps, oil	6
" paraffin	6
" spirit	1
Lighted paper thrown down	11
Lime, slaking (1 by rain)	5
Linen, drying or airing before fire (upset by cats, 2)	58
Locomotive engines, sparks from	2
Lucifer matches and fuzees, accidentally ignited (by cats, 3)	23
" making	4
" using	5
Oil and grease, heating of	4
Ovens, defective or overheated	5
Paraffin oil, drawing off fictitious	1
Pipe, iron, overheated	1
Pitch, heating of	4
Plumbers' fires on roofs	3
Shavings, loose, ignited	37
Smoking meat	1
Spirits, bottle of, bursting	1
Spontaneous ignition of coals	1
" " dung	1
" " hay	1
" " lamp-black	6
" " phosphorus	2
" " rags, wet	2
" " sawdust, oily	3
Steam boilers, heat of	7
" explosion of	2
Steam pipes overheated	3
Stoves, defective, improperly set, or overheated	10
" drying	8
" galley	2
" gas	5
" ironing	5
" portable charcoal	4
" pipe	9
Suspicious	37
Tallow and wax, melting of	2
Tapers, wax	2
Tobacco, unextinguished	59
Wilful	72
	1,054
Unknown	129
Total	1,183

The number of instances in which insurances were known to have been effected upon the

Building and contents was	294
Building only	104
Contents only	371
No insurance	414
	1,183

From this return it might be imagined that buildings were very much uninsured, while the contrary is the fact; but from the circumstance of the building being insured by the landlord, or by an agent, without the tenant having any knowledge of the matter, it continually happens that the firemen are unable to get the information within the limited time for making their returns to the insurance companies.

It has been well observed that in London fires are such "every day occurrences" that they are regarded as matters of course, and not as preventible calamities, the number and magnitude of which are regulated by the amount of care, or of carelessness, shown in the use of those agencies which give rise to such casualties.

A reference to the known causes of fire, therefore, is both useful and suggestive. On looking over the foregoing list it will be seen that more than a hundred fires were, in various ways, occasioned by the use of gas; and practical men well know that the greater number of these accidents might have been prevented by the exercise of a very moderate degree of caution. Captain Shaw, the superintendent of the Fire Brigade, in his annual report to the insurance offices, says:—"It would probably be a hopeless task to attempt to put a stop to the steadily-increasing use of gas, which is the most economical and convenient of all modes of lighting." But, were it possible, is it in any way desirable to do so? Is not gas, when fairly used, the safest as well as the best of lights? And where is the substitute that can for one moment be put in competition with gas, either as regards convenience, economy, or safety? The late Mr. Braidwood, although using gas extensively himself, entertained a strong prejudice against it; his theory of the excessive heat evolved in the burning of gas has been exploded by the researches of scientific men, who have demonstrated that, in proportion to the light obtained, the heat evolved in the combustion of gas is less than from any other source of artificial illumination. Notwithstanding the extensive use of gas in private houses, the number of accidents therein from that cause are very small, the greater number occurring in shops and warehouses.

(To be concluded next week.)

SOCIETY OF ARTS.

April 23rd, 1862.

HENRY COLE, Esq., C.B., in the Chair.

ON THE EFFECT OF PRIZES ON MANUFACTURES.

By SAMUEL SIDNEY.

(Concluded from page 282.)

MR. BIGELOW (of Boston, U.S.) said he had been much connected with the Mechanics' Association of Massachusetts, and had had the opportunity of witnessing the effects of the prize system, more particularly in New England, which was looked upon as the hot-bed of inventions and Yankee notions; and he would say that, in his opinion, the system of prizes had advanced the arts and sciences, and had promoted the improvement of machinery, particularly in the working of metals very much indeed. The Mechanics' Association of Massachusetts, which was one of the oldest in the United States, was in the habit of holding exhibitions every three years, and these exhibitions were very noted, and brought together inventors from all parts of the United States; far more so than the more local exhibition which had been referred to—the Franklin Institute, in Philadelphia. There were three classes of prizes usually awarded. A gold medal was given for inventions of great merit and utility, but it was never awarded a second time to the same person, unless it was for some improvement upon his own invention. If he only kept up the standard of his workmanship the gold medal was not again awarded to him. He was sorry to say that, at the approaching Exhibition, America would be very inefficiently represented, owing, in a great measure, to the present unfortunate political position of that country, and the few American exhibitors who had come over would appear under very unfavourable circumstances. They were limited as to space, and would not be able to show their goods in a proper manner, but those who had brought their inventions hoped to receive a prize if their productions were such as to merit it. For his own part he could say he had brought over what he considered an invention of great utility, which had never been exhibited before, and he believed it would attract considerable attention, and he hoped to gain a prize. If no prizes had been given he should not have spent his time and money in bringing his invention to this country and keeping the only specimen of the machinery he had idle for six months. He was satisfied the prize system was the true way of promoting improvements. It had been found to answer well in America. They had produced some good things there, many of which had been adopted in this country.

Mr. Callow did not rise for the purpose of criticising the merits of Mr. Sidney's paper, but merely to remark upon the fact that no gentleman, as he was aware, who had received a medal, had spoken of the effect it had upon himself. He thought that fact tended to favour the view taken by Mr. Sidney.

Mr. Salomons had the satisfaction of stating that he had received a medal.

Mr. Bishop thought considerable service would be rendered by any gentleman who would furnish a paper on the means of selecting the best jurors. It appeared to him that all that had been said led to this end. He gathered from the paper that Mr. Sidney was not so much opposed to medals themselves as to the mode in which they were distributed. In the Exhibition of 1851 a great many things came under his notice with respect to which he thought no prizes ought to have been awarded. In one department a watch was exhibited, and the prize was awarded for a novelty in the key, the hollow being placed in the watch instead of in the key. This had been used by Bréguet many years before. Mr. Bramah exhibited a lock, for which a prize was awarded on the ground that it defied picking; but he (Mr. Bishop) had picked that lock thirty years ago. Another thing which came under his notice was a specimen of printing in two colours, by one impression, to prevent forgery. That was a matter which he very easily imitated, and he sent a specimen to the jurors who awarded a prize for the invention. It was a process which was known to Albert Durer, and was one of the most simple applications of the typographical art. Again, distinction was given to Mr. Dent's clock upon what he considered a very questionable adjustment of the fly-wheel, and in the department of preserved provisions a prize was awarded for a process which had been rejected by the Admiralty before the prize was given. Having paid a great deal of attention to the progress of mechanical improvements, he would express his opinion that prizes were a great inducement to persons to bring forward their ideas. At the last Paris Exhibition a premium was offered for an improved ship's log, when a young man, a watchmaker, with whom he was acquainted, was induced by the premium offered to send one, the result of his own ingenuity, being a competitor amongst sixty others. He agreed that the system of the distribution of medals hitherto adopted had been a great failure, but at the same time he believed that formed a great inducement to persons to try their skill.

Mr. Philip Palmer begged to ask whether the jurors at the forthcoming Exhibition intended to call in the assistance of associate jurors, as was the case at the former Exhibition.

Mr. Bishop suggested that great assistance would be given to the jurors by the articles exhibited—especially any great novelty—being accompanied with a full written or printed description. It would also facilitate their inspection by the public. In the Paris Exhibition he affixed to his articles descriptions in three different languages, and it was his intention to follow the same plan on the present occasion.

Mr. Sidney said he had supported the theory of his paper by facts; his opponents had only given their individual opinions. They approved of the system of awarding prizes to competing manufacturers, as a means of rewarding "dormant talent," but they had not cited any instance of dormant talent having been thus discovered and rewarded. They said, and he agreed with them, that "merit ought to be rewarded wherever found;" but they neither explained how it was to be found, nor how it was to be rewarded, by such prizes as were generally distributed. The gentlemen confounded the advantage of an exhibition or fair—at which manufacturers, however obscure, might make public their inventions or improvements, and find customers, who were the best possible prizes—with the fallacious results of the verdicts of juries or judges. Exhibitions did offer means of comparison, did encourage competition in quality and price, did enable obscure, inventive, and manufacturing talent to find observers and customers. But as to the assumed advantage of the prize system, they if anywhere should have been made manifest at the Great International Exhibition of 1851. He challenged the supporters of prize awards to competing manufacturers to show one instance, amidst the 170 council medals, of obscure merit thus distinguished. He (Mr. Sidney) did not ask whether it was pleasant to such persons as Messrs Penn, Messrs. Maudslay and Field, Messrs. Whitworth, or Mr. Nasmyth, to be distinguished by council medals, although he believed he might safely say that every eminent English manufacturer looked on the offer of prizes with contempt; but he asked what the public gained by a nominal competition, which was really a lottery confined to a few established reputations, except in one or two instances, where the award was the result of a compromise or a job. Sir Joseph Paxton's fame was made by the building, and not enhanced by the medal, which was also bestowed for "flowers embroidered on muslin." The best speech of the opposition was that of Mr. Corbet, who not having heard his paper, was very happy in combating arguments which he (Mr. Sidney) had not urged. He (Mr. Sidney) utterly denied having made, or intended to make, any attack on the Royal Agricultural Society—a society which had rendered the greatest possible service to the country by its prizes for live stock, and its exhibitions, at which breeders and manufacturers were brought in contact with their customers. Unquestionably prizes had had a large share in improving our racehorses, our cattle, and our sheep, but in these cases there was an easy trial, an admitted standard of perfection, and a large class of judges trained to the task. But he had drawn several illustrations of the failure of the prize system from the records of the Royal Agricultural Society, because they were accessible and complete for a period of twenty-two years, and in those records he found a confirmation of all the opinions laid down in his paper. A large proportion of the sums awarded had fallen regularly year after year to great manufacturers of established reputation. For instance, two manufacturers had in fifteen years divided £560 out of about £650 awarded to drills, and yet all the principal manufacturers were agreed that drills could only be tested by a comparison between the work and the result many months later. He had seen forty drills in nominal competition. The confused judges took refuge in the safe course of rewarding those who had always been rewarded, and whose reputation needed no stamp. It could not be denied that corn-reaping and grass-mowing machines had been invented without rewards from the Royal Agricultural Society, and that machines of both classes had received first prizes, although quite unfit for the average work of the farmer. Steam cultivation was an established fact before the Royal Agricultural Society ever offered a prize for it; but, as he had shown in his paper, the system of the society had given premiums to toys—to colourable improvements—and to mechanical tricks, such as the Eagle mowing machine, which won the first prize at Salisbury. He could conceive rare instances in which prizes might promote the development of mechanical inventions, but in most instances money would be more wisely expended in promoting public trials, such as those of steam cultivators, without requiring a verdict from judge or jury. But, as a general rule, prizes for competing manufacturers, and especially for what might be called standard manufactures, led either to stereotyped awards, the undue prominence of a few great firms, or to sham improvements and novelties of no value, except to win the aproval of amateur judges. Prizes for the invention of something much needed could do no harm. Prizes bestowed by societies on eminent merit did honour to those societies, but an invitation of manufacturers to compete with each other in the production of articles which were to be sold at a profit was an invitation to rely on an advertisement, and not on honest work—to make something better than they ever intended to make again.

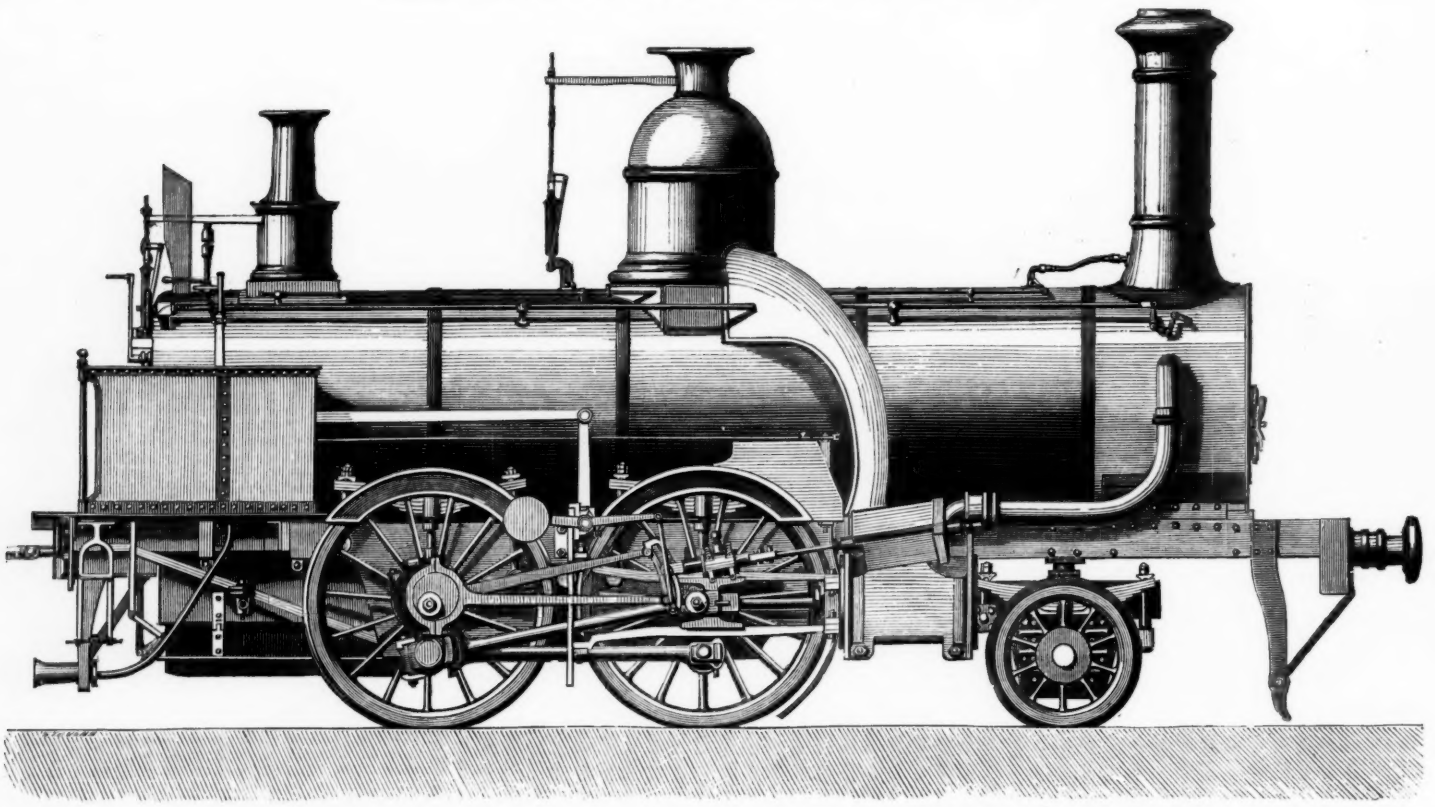
The chairman said even if Mr. Sidney happened to be in the plight of a disappointed exhibitor, which he did not think was the case, he was quite sure he would not be disappointed in the thanks the meeting would give him for having brought this subject before their attention. A number of observations had been made, upon which, if time permitted, he should have offered some comments. With regard to the working of juries and the system of prizes, he had reported to the Board of Trade upon the Paris Exhibition of 1855, and any one who was anxious to see how the system worked in Paris would, he believed, find in that report a tolerably impartial opinion upon the subject. One gentleman had remarked upon the number of prizes awarded at the French exhibitions. He had no doubt the statistics given that evening were pretty correct, but this remarkable fact appeared in the Exhibition of 1855, that with 22,000 exhibitors 14,600 rewards of one kind or another were assigned, so that there was an exhibitor and a half for every reward. The tendency of the system in France, as he had no doubt it would be in this country, was to "make things pleasant." That was so far wholesome, because he looked to it as an extermination of the system which intervened between the consumer and the producer, and which he thought was mischievous. A gentleman had spoken of the difficulty of getting jurors. That difficulty could scarcely be exaggerated, and if they applied the principle to themselves he might ask them how, in the management of their business, they would select persons to judge, whether they were doing a thing right or wrong. There could, however, be no doubt that prizes induced people to come forward as exhibitors. It was to be remarked that in France, where more prizes were given away than in any other country, the Exhibition of 1855 was presided over by Prince Napoleon, who had given a most emphatic opinion against the awarding of prizes; and if they took the trouble to read the report which his Imperial Highness had made upon the Exhibition they would find that he had gone most philosophically into the whole subject of prizes, and had thoroughly exhausted it. He would only mention the heads of what he considered the Prince had proved most conclusively—the fallacy of prizes; the public consumption was the best reward; the juries were beyond public opinion, and that public opinion would best decide for itself; that the organisation of juries was vicious; and that their decisions were illusory, without harmony or consistency. He (Mr. Cole), when British Commissioner in 1855, was restricted from doing more than making his own observations upon the action of juries in France. The great object of exhibitors was to prevent anything of their own being overlooked, and, without any corrupt intention, an exhibitor or a friend of his would, perhaps, say to a juror, "Don't overlook that article;" and it need hardly be said how much influence such a remark might have. There was an almost morbid desire on the part of the French juries to give medals to the English exhibitors. The French were so eager to reward anything of a distinguished character that they conferred upon Professor Faraday, who was not himself an exhibitor, the high distinction of a Commander of the Legion of Honour, because a brother of the Professor was an exhibitor of a very ingenious lamp, which gave a thread of connection with Professor Faraday. It happened that there was a number of things exhibited at Paris which had nobody to back them up, and these were overlooked. He supposed they would all agree that there had been no more important invention in the present age than the uniform penny postage. At that exhibition postage stamps were exhibited, but Rowland Hill was not there, and they were passed by almost unnoticed. He believed they would also agree that there was no greater evidence of commercial activity than was displayed in the organisation and conduct of such a newspaper as the *Times*, and yet the exhibition of a copy of the *Times* in its first year of publication, together with one of the date of the Exhibition, was a matter which attracted very little attention. One gentleman had asked the question whether it was probable that at the approaching Exhibition, associate jurors would be called in? He had no authority to state anything upon the subject of juries; but he had no doubt Dr. Playfair, who "made things pleasant" on the last occasion, would do the best he could on the present one. He would conclude by expressing a hope that, as in Paris there was a reward to every exhibitor and a half, on the present occasion they might be able to carry it out to such an extent as to give a medal to every exhibitor. He had now to propose a vote of thanks to Mr. Sidney for the gallant attack upon the system of prizes, which he had no doubt would fructify, and the next time they met to discuss this subject he had no doubt they would be more disposed to agree with him on it.

The vote of thanks having been passed,

Mr. Sidney acknowledged the compliment, and remarked that he had the satisfaction of knowing that the most successful manufacturers of the day were opposed to the system of prizes.

STEAM AT THE EXHIBITION.—It appears that there is hardly one-half as much steam to be had as is wanted for working the machinery in the western annexe. The six boilers will supply about 500 indicated horse power, whereas 1,000 at least are needed.

HARTMANN'S LOCOMOTIVE IN THE EXHIBITION.



Richard Hartmann, of Chemnitz, in Saxony, sends his 179th locomotive to the International Exhibition. The general construction of this engine is shown in the above illustration. It is of a class employed upon the railways penetrating the more mountainous districts of Saxony, where there are gradients of 1 in 40, and curves of 275ft., or hardly more than four chains radius. The wheel base, it will be seen, is very short, and the leading wheels are, furthermore, arranged to swivel, by means of a pair of radial bars, around a pin nearly under the middle of the engine. This is the arrangement of the Bissell truck, illustrated in The Engineer of July 29th, 1859 (page 80, vol. viii.), and in extensive use in America. In Bissell's arrangement, however, the front end of the engine, in moving laterally upon the bed plate over the axle of the leading wheels, is made to rise to a slight extent upon inclined surfaces. Mr. Hartmann employs flat plates to take the weight, stops being employed to prevent any chance of the engine moving too far, laterally, upon the truck, supposing the flanges of the wheels did not suffice to control this motion.

The engine has 15in. cylinders, and 22in. stroke. The coupled wheels are 4½ft. in diameter, each pair carrying 10 tons 8 cwt. The whole weight of the engine, in working trim, is 28 tons. The area of the grate is 11½ square feet, that of the fire-box 70 square feet, and that of the tubes 790 square feet.

Foreign and Colonial Jottings. — The rolling stock of the Eastern of France Railway Company now comprises 614 engines, 526 tenders, 1,593 carriages, and 11,190 trucks. The company is now building its own trucks and will add 400 to its stock during the current half-year. M. Timbrinck, one of the engineers attached to the undertaking, has invented a smoke-consuming apparatus which has yielded satisfactory results, and which is expected to lead to an extended consumption of coal in connection with passenger trains. The King of the Netherlands, in making his first visit to Overyssel (the Lancashire of Holland), inspected the works belonging to Messrs. G. H. Salomonson and Salomonson and Van Heel, at Nyverdal, which were splendidly decorated for the occasion. The weaving shed, containing 600 looms, made by Joseph Harrison and Sons, at Blackburn, was first examined, and two direct-acting steam engines of 92-horse power, made by Messrs. Woolstenhulme and Rye, Oldham, were started for the first time, by his Majesty, and afterwards christened after the King and Queen. Afterwards, a visit was paid to the newly-erected bleachworks, and his Majesty was struck with the whole appearance of this establishment which is filled by the machinery of Messrs. Jackson Brothers, Bolton.

Model of West Hartlepool.—Among the articles in the International Exhibition, which will be regarded with special interest by visitors from the north, is a model of West Hartlepool, exhibited by Mr. Ralph Ward Jackson. The model was executed by Mr. W. C. J. West, of London, and reflects great credit upon the artist, as it is one of the best specimens of the art in the Exhibition. It is nine feet in length and six in breadth. The warehouses, lighthouses, and docks are shown upon a proportionate scale, as are likewise the ships in the harbour, from the largest vessel down to the tiniest tug. The following statistics of the rapid increase of West Hartlepool show its rapid progress:—In June, 1847, the harbour of 12 acres (constructed on the barren western shore of Hartlepool Bay, on the east coast of England), and the first (coal) dock of 8 acres were opened. The harbour has since been enlarged to 44 acres. In June, 1852, the second (merchandise) dock of 14 acres was opened; also No. 1 Graving Dock, 350 feet long. In June, 1857, the third (merchandise) dock of 10 acres was opened; also No. 2 Graving Dock 330 feet long. Timber dock and timber ponds, covering a water area of 24 acres, and timberyards of upwards of 20 acres, have since been provided. The extensive warehouses comprise a floor area of 13 acres. Upwards of 25 miles of railway are laid down for traffic approaches and accommodations to the docks. The area occupied by these works alone is 245 acres; and ships of 2,000 tons and upwards are easily accommodated. In 1847 the number of ships entering was 460; and 5,964 in 1861. In 1847 the coal shipped was 54,202 tons; and 975,319 tons in 1861. In 1853 the foreign merchandise exports commenced from the manufacturing districts *via* West Hartlepool. The returns to her Majesty's Customs were £23,846 in the year ending December, 1853, and £5,929,909 in the year 1861. The foreign imports also commenced in 1853, consisting of grain, 16,150 qrs.; flax and hemp, 901 tons; timber, 531 tons; general goods, 4,885 tons. In 1861 the foreign imports were—Grain, 204,724 qrs.; flax and hemp, 4,083 tons; timber, 57,250 tons; general goods, 19,446 tons. In 1847 the population of the whole district—constituting now the New Town of West Hartlepool — did not exceed 300 persons; but it now numbers about 14,000. [It is a pity that by way of wind-up some particulars are not given as to how many bondholders have been ruined or impoverished by all this boasted progress].

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

Thursday, April 8th, 1862.

Mr. Francis Campin, President, in the Chair.

ON COAL.

By Robert C. Patterson.

The author, after a brief introduction on the importance of coal to Great Britain, said that he proposed considering the subject he brought before the meeting in three ways, viz., geologically, chemically, and commercially. The geological formation in which coal is found is known by the term carboniferous, or mountain limestone; it occurs between the magnesian limestone on the top and the old red sandstone beneath. The mountain limestone forms the base of the series; above this limestone is the millstone grit, which is, however, only a local development; next in order come the coal measures, which are often the only as they are always the most essential representatives of the great carboniferous system. The mountain limestone is so called from its mineral character and frequent development in bold hilly masses, many of which are of considerable magnitude; the thickness varies, but often amounts to 2,000ft. The rock is usually hard, it forms the depository for numerous crystalline minerals, and ores of lead and zinc, with other metals. The millstone grit consists of a series of sandstones, composed of sandy and quartz ore pebbles, sometimes fine but generally very coarse; it is extensively developed in Northern and Central England. The coal measures consist of alternations of sandstones and shales, with beds of coal and ironstone, total thickness 2,700ft. and more. One of the most notable features in its composition is the frequent recurrence of seams of coal and bituminous shale, all bespeaking an enormous profusion of vegetable growth, and a long continued epoch in the world's history, when conditions of soil, moisture, and climate conjoined to produce a flora since then unparalleled either in tropical forms or abundance. It is this profusion of vegetable growth, now converted or mineralised into coal, which distinguishes the carboniferous from all other systems; pines, palms, treeferns, gigantic reeds, club mosses, and other kindred forms of shale enter into many of the sandstones and constitute thick beds of coal. The various deposits which form the coal measures do not occur in regular horizontal planes, as might be supposed. No doubt when first deposited they were in this condition, but they have, at various times, been subjected to immense disturbances from the eruption of igneous rocks, greenstones, clinkstones, basalts, &c., which are often associated with them in disrupting overlying and interstratifying masses. Another proof of disturbance by an upheaving force from below is afforded in the concave form of the strata; besides which the strata have been broken and splintered in various directions, and hence the slips, faults, dykes, &c., which the miner encounters in traversing a single stratum. The author, after referring to the palæontology of the carboniferous system, passed on to the question of the origin of coal and its formation, giving the two hypotheses that have been received by different geologists with varying degrees of favour. They are known as the drift theory and the theory of submergence. The first is that the plants of which the coal is composed were drifted down by rivers, and deposited along with layers of mud and sand in estuaries, several rivers discharging themselves into one estuary, some chiefly carrying down sand, whilst others transported plants, mud, and other heterogeneous *debris*. The other theory is that the plants which form the coal measures grew upon the same spot that the coal now occupies, and that the vegetable matter must have grown and accumulated in dense masses for many years, then the land is supposed to have sunk and become the basin of a lake, into which rivers carried mud and silt, these overlying the vegetable matter gradually consolidated into shales and sandstones, while the vegetable matter itself underwent the process of bitumenisation and mineralisation, and was thus converted into coal. This being done it is supposed that the basin of the lake was again elevated, so as to become once more the scene of luxuriant vegetation, again submerged and overlaid by new deposits of sandstone and shale, once more elevated and covered with plants and again submerged, and this alternative process is supposed to have taken place as often as there are beds of coal in any particular coal field. The author then passed on to the second part of his subject—

Coal Chemically Considered.—Coal is an organic compound of a highly complex character, consisting ultimately of carbon and hydrogen, together with smaller quantities of nitrogen, oxygen, and sulphur. Iron and manganese are sometimes found, and occasionally other metallic oxides.

Ordinary illuminating gas obtained by the destructive distillation of coal, consists of light carburretted hydrogen, carbonic oxides and olefiant gas, to which last named, as containing the greater amount of carbon, the illuminating power is mainly due. A variety of other compounds are eliminated in this distillation, as sulphuretted hydrogen, ammonia, sulphide of ammonium, bisulphide of carbon, and tar, which will be mentioned hereafter.

These have all been successfully got rid of by the gas maker, although the bisulphide of carbon resisted their attempts at purification for a long time. The tar that results from the distillation is one of the most complex substances with which modern chemistry has made us acquainted. The hydrocarbons which are to be obtained from it by distillation at various temperatures are almost innumerable; among them are aniline and paraffin, substances which have of late created a considerable amount of interest, and the former especially been the cause of large fortunes accruing to gifted individuals, through whose skill and ingenuity the constituents of such an apparently worthless compound as coal tar have been converted into the most beautiful and choice products of the laboratory. The colours known as mauve, Magenta, Solferino, azuline, &c., are produced by different processes of oxidation of aniline; these colours —in contradistinction to those previously in use—are not bleached by the action of air or other oxydising agents. Analagous colours are also obtained from naphthaline, another and more plentiful constituent of coal tar. Carbolic acid, also, a constituent of coal tar, has lately found an important application in the deodorisation of sewage, and has been found to be highly successful, since it not only deodorises, but has, also, an antiseptic action which prevents the further decay of the organic matter in the sewage, while, at the same time, it does not detract from its fertilising power. Floating on the surface of the tar is a liquid of pestiferous odour, due to sulphide of ammonium and free ammonia; from this all the ammonia of commerce is obtained, in the form of either the sulphate or the chloride. Mr. Patterson then referred in detail to the combustion of coal in furnaces, and the means used to ensure the combustion of smoke. He then said that it had long been a dispute among chemists whether the amount of heat given out is in direct proportion to the amount of carbon contained in the fuel. For his own part the author thought that hydrogen in coal was of no use whatever, as it could only combine with oxygen, and did so combine, in the proper proportions for forming water it passed up the chimney as steam, carrying with it an enormous amount of latent heat, which could only be supplied by the combustion of a large amount of carbon which would otherwise have been usefully employed. He was supported in this opinion by Dr. Lyon Playfair and the late Robert Stephenson. This brought the author to the third and last division of his subject.

The following is a table showing the chemical composition of different kinds of coal:—

	Carbon.	Hydrogen.	Nitrogen.	Sulphur.	Oxygen.	Ash.	Evaporative Power.
Anthracite	91·44	3·46	0·21	0·79	2·58	1·32	9·46
Ebbw Vale	89·78	5·15	2·16	1·02	0·39	1·50	10·21
Bines Coal	88·66	4·63	1·43	0·33	1·03	3·96	9·94
Duffryn	88·26	4·66	1·45	1·77	0·60	3·26	10·14
Ponty Pool	80·70	5·66	1·35	2·39	4·38	5·52	7·47
Coleshill	73·84	5·14	1·47	2·34	8·29	8·92	8·00
Dalkeith Jewel Seam ..	74·55	5·14	0·10	0·33	15·51	4·37	7·08
do. Coronalwn Seam	76·94	5·20	A trace.	0·38	4·37	3·10	7·71
Wallsend Elgin	76·09	5·22	1·41	1·53	5·05	10·70	8·46
Fordel Splint	79·58	5·50	1·13	1·46	8·33	4·00	7·56
Grangemouth	79·85	5·28	1·35	1·42	8·58	3·52	7·40
Broomhill	81·70	6·17	1·84	2·85	4·37	3·07	7·39
Shenardagh (Irish) ..	80·03	2·30	0·23	0·76	In ash	10·80	9·85

Coal Commercially Considered.—Coal differs considerably in its physical properties, and has obtained various names in the market. It may be divided into two varieties. Coal containing bitumen and coal without, the first known as bituminous, the second as anthracite. The following are two or three of the principal divisions of bituminous coal.

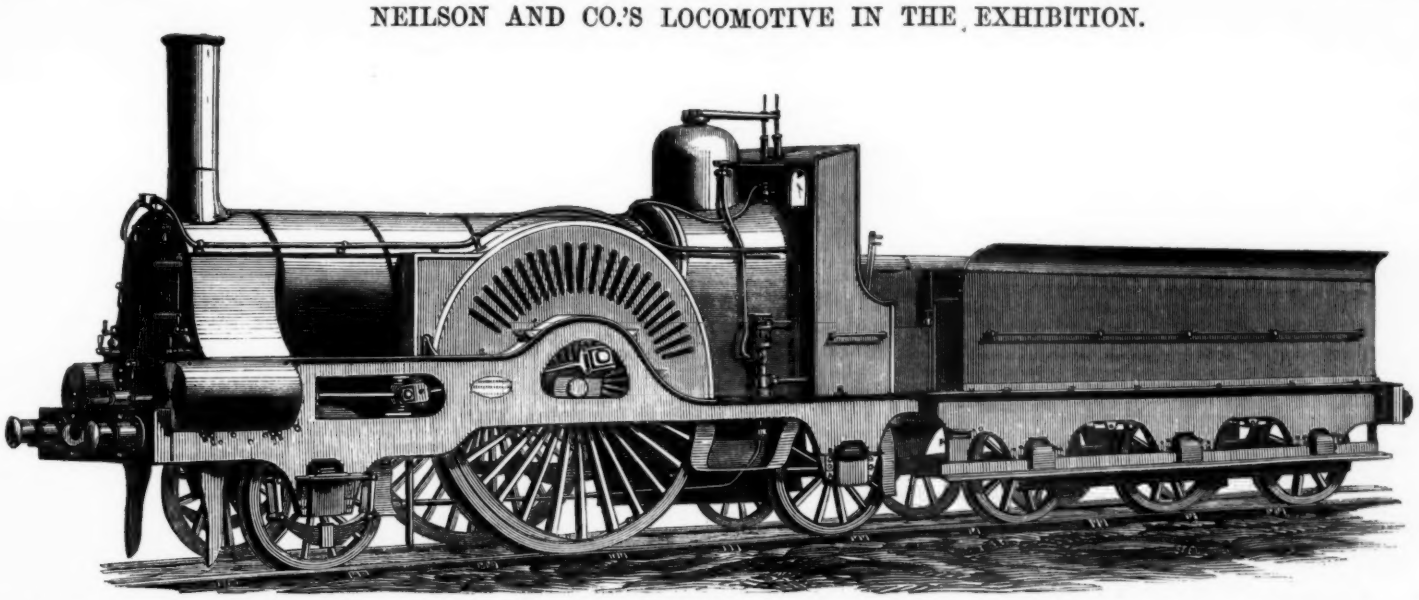
Caking or Pitching Coal, easily recognisable by its velvet or greyish black colour. When thrown into the fire it breaks into small pieces, but, on the continued action of heat, the pieces re-unite into a solid cake; it burns readily, but, on account of its caking quality, is likely to clog the fire unless frequently stirred.

Cherry Coal resembles somewhat in external appearance caking coal; when exposed to heat it cracks and flies, but does not cake; it burns with a clear yellow, and is very brittle, from which quality great loss is occasioned in mixing it.

Cannel Coal has little lustre, is very compact and smooth in texture, and breaks with a large conchoidal fracture; it burns readily without melting, and has been used as caradees, whence the name. It is extensively used in the manufacture of gas.

Anthracite Coal is composed almost entirely of carbon, with a

NEILSON AND CO.'S LOCOMOTIVE IN THE EXHIBITION.



little ash, and sometimes a small percentage of volatile matter. It is sometimes very hard, has a high lustre, and is often irradescent.

The author then passed on to the consideration of that important modification of coal known as coke, describing the different methods of manufacture, but more especially that adopted by the London and North-Western Railway Company for making coke, at the Camden station, for the use of the locomotive engines, giving a lengthened account of the operation and a description of the ovens used there. The question of the relative efficiency of coal and coke is one of great importance, and one to which a good deal of attention has lately been paid. The author here stated that he had experienced great difficulty in treating this part of his subject, as he found that no two parties who had investigated it, and made experiments as to the comparative evaporative power of coal and coke, agreed in their results, and he had therefore come to the conclusion that it would be very much more satisfactory, both to the gentlemen present and himself, if instead of giving his own opinions he laid before them the results of several experiments that had been made. In 1858 Mr. Longridge, in connection with Sir William Armstrong and Dr. Richardson, made a series of experiments at Elswick, with a view of settling this much vexed question. They found that the evaporative power of the coal, compared with that of the coke, was, weight for weight, as 100 to 89, the actual numerical quantities being

Water evaporated from 32 deg. by 1 lb. of coal = 12·54 lb.
Ditto by 1 lb. of coke made from same coal = 11·16 lb.

But this was scarcely the correct way of stating the question. To produce that coke, the coal was reduced one-third in amount, 100 lb. of coal producing 66 lb. of coke; consequently, taking the above figures, it will be found that whilst 1 lb. of coal will evaporate 12·54 lb. of water, the same coal converted into coke will only evaporate 11·16 × ·66 = 7·44 lb. of water, so that the true proportion was as 100 to 58. Mr. Hawksley, in a series of elaborate experiments, obtained results widely differing from these. As the engineer of the Nottingham Gas Company and of the Nottingham Waterworks Company, he had an opportunity of trying the evaporative power of the coke as contrasted with that of the coal from which it was made. Under the furnace of a pumping engine, raising a known quantity of water a known height, he found that on the average of a year's working from 20 cwt. of coal (Midland Counties) 11¼ cwt. of coke were obtained; he then ascertained that 6 cwt. of coke would evaporate exactly the same amount of water as 7 cwt. of coal. It followed, therefore, that it required almost precisely 3 tons of coal reduced to coke to produce the effect of 2 tons of the same coal, and consequently there was a loss in converting the coal into coke for the purpose of generating steam; but considered only in reference to weight, coke had an advantage over coal in the proportion of 7 to 6. A few years ago the London and North-Western Railway Company instituted a series of experiments to determine whether coal could be advantageously used in substitution of or in combination with coke in locomotive engines; the experiments were made with Hawksbury coal. A consumption of 25 lb. of coke was found to equal that of 35 lb. of coal in working effect, and 8¼ lb. of water were evaporated by 1 lb. of coke against 5¾ lb. by 1 lb. of coal.

Mr. Patterson, after commenting upon and assigning reasons for the discrepancies observable in the results different experimentalists had arrived at, concluded his paper by a few observations on the various calculations that have been made as to the future supply and duration of our coal fields.

English Engineering in Russia.—After years of discussion it has, at length, been decided that Odessa shall be paved and drained, and an English contractor having been selected for the work, there is now a certainty that this "City of Palaces" will in a few years become one of the most remarkable cities in Europe, and deserve the name it has acquired, "Queen of Southern Russia." Hitherto the unpaved streets and consequent clouds of dust, perpetual in summer, has rendered Odessa unbearable, and in winter the streets have been a quagmire. But all this is to be changed. During the past six weeks, rival engineers and contractors from England, France, Austria, and Hungary, have been in Odessa, competing with native contractors for the works comprised in the town improvements, and their presence, combined with the fact that the long pending question of paving and draining assumed a shape more tangible, created an unusual degree of interest and excitement. The rival propositions were submitted to the municipality a fortnight ago, and a few days afterwards it became known that those from the English contractors were most acceptable, and that the contract would be given to Messrs. Peto and Betts, represented by Mr. Hartland, C.E., or to Mr. George Furness, the contractor for the Great Outfall Works at Plaistow, in connection with the Metropolitan Drainage, and who has been most successfully represented by Mr. Bayliss, C.E., the same contractor's engineer for the Pernambuco Railway. It was generally believed that Messrs. Peto and Betts, having the support of great local influence, would obtain the contract; but the committee, after several interviews with the representatives of the respective contractors, unanimously agreed to entrust this great undertaking to Mr. Furness. The works at present contracted for will cost £800,000, but it is expected that the town will ultimately expend in public and private improvements upwards of one million and a half sterling. It is reported that when the contract was signed, Mr. Bayliss, addressing the Committee, said it was his glory and to their honour that he could affirm the contract had been obtained without douceur or promise of douceur to any individual in the country. This is a very auspicious inauguration of such a public work, and if, as is to be sincerely hoped may be the case, the contractor can make a similar statement at the termination of his contract, the 29th of April, 1862, will be the commencement of a new era, not only for Odessa, but for the whole Russian empire.

We are enabled to present an illustration of the fine express locomotive exhibited by Messrs. Neilson and Co., of Glasgow, in the western annexe of the International Exhibition. From its large proportions, good construction, and neat finish, this engine has attracted much attention. A brief notice of it appeared in The Engineer of the 2nd inst., but its principal dimensions may be repeated here. Built for the Caledonian Railway, and upon the plans of Mr. Benjamin Conner, locomotive superintendent of that line, the engine has 17½in. cylinders, 24in. stroke, and 8ft. 2in. driving wheels. The leading, trailing, and tender wheels are 3ft. 8in. in diameter. The engine weighs 30 tons 13 cwt. in working trim, the weight on the driving wheels being 14 tons 11 cwt. (or over 7½ tons on a single wheel); leading wheels 9 tons 5 cwt., and trailing wheels 6 tons 17 cwt. The weight of the engine, empty, is 27 tons 5 cwt. The extreme wheel base is 15ft. 8in. The boiler is 3ft. 10in. in diameter and contains 192 tubes 1⅞in. in diameter and 11ft. 6in. long, giving 1,094 square feet of external surface. The fire-box surface is 96 square feet. The boiler has been tested by hydrostatic pressure to 200 lb. on the square inch.

The tender has an extreme wheel base of 11ft. 5½in. and will contain 1,600 gallons of water, and has a coke space of 140 cubic feet. Its average weight in working order is 22 tons, and, empty, 12 tons 10 cwt. The extreme wheel base of engine and tender is 33ft. 8in., the gauge of the line being 4ft. 8½in.

The wheels are of solid wrought iron throughout, the driving wheels being especially handsome forgings. They have each 28 arms and the counter weights are forged in solid, as a part of the rim, as shown in the illustration. The outward finish of the engine is plain but neat, and all but the finished iron work and the smoke-box and chimney is painted a deep and rich blue. Altogether Messrs. Neilson and Co.'s engine is one of the finest examples of locomotive construction in the Exhibition.

INSTITUTION OF CIVIL ENGINEERS.

April 29th, and May 6th, 1862.

John Hawkshaw, Esq., President, in the chair.

The first paper read was "On the Sea Dykes of Slesvig and Holstein, and Reclamation of Land from the Sea," by Mr. John Paton, M. Inst. C.E.

After referring to the vast extent of land enclosed by these dykes, as being probably greater than in any other part of the world, the author pointed out the changes to which the west coast of Denmark had been subjected, and the influence which variations had had on the dyke works. In illustrating this part of the subject, the line of demarcation between the elevation and depression of the Scandinavian peninsula was alluded to, and it was shown that south of this line there had been no general depression of the land for many centuries, an old Viking harbour, on the island of Romoe, being instanced as having undergone no change, although local variations had taken place. An account was then given of the principal storm floods which had occurred on the Danish coasts during a period of two thousand years. The traditional state of the coast before the Christian era was then described, and its condition in A.D. 1240, and in 1860, was shown by diagrams, from which it appeared that the old boundary of the main land was outside the present islands, the collective area of which originally amounted to 1,500 square miles. The author believed that these variations were owing to a general subsidence of the land (and not as understood by the term encroachment of the sea), and facts were adduced of the existence of vast submarine forests, and even submarine tumuli, in which stone and flint weapons had been found, assigned to an age nearly four thousand years ago. These forests, and also submarine peat bogs, in which were distinguished the fen plants of fresh water, together with trunks of trees, were met with almost everywhere on the coast, under the present surface of the sea, sometimes being covered with a depth of 12ft. of water. It was considered, for various reasons, that the sudden and general depression of the land probably occurred about 2,000 years ago; while, at the same time, it was pointed out that local subsidence and other variations had taken place. A great part of the marsh land rested on peat moss and on water containing peat, which continued to sink until far below the level of the sea. The Wilster and the Kremper marshes in Holstein, covering an area of about twenty square miles, were illustrations of these changes. It was stated that when a boring was made, for the purpose of testing the nature of the ground, the rod suddenly dropped 16ft., and a stream of gas rushed upwards and burned for several days. When a high rise of tide occurred in the North Sea, salt water springs had burst forth from the marshes; and, had the pressure continued, the utter destruction of these marshes would no doubt have been the result. Immense exertions had been made to remedy the evils arising from these peculiarities. The phenomena noticed in these marshes, together with the salt water eruptions and curious storm floods, were considered as highly important in the design and construction of engineering works, and as affording the means of satisfactorily accounting for some of the most tremendous disasters on record, hitherto attributed to the bursting through of the protecting lands. It was believed that this view was confirmed by that remarkable case the formation of the Zuyder Zee, originally a fertile land of nearly two millions of acres, although a marsh resting on peat bogs. The author considered that the destruction of the isthmus between Steveren and Medemblik was the effect, and not the cause, of that great eruption, and that the district was destroyed by the pressure and eruption of water from below, consequent on the sudden and great elevation of the water in the North Sea; and instances were adduced, showing a communication between the wells of that district and the North Sea. Other local peculiarities were pointed out, and the island of Amrum was stated to have risen 20ft. since the time of the earliest recorded flood. Similar occurrences had taken place in other countries, but there were no positive traces of such upheaving on other parts of the west coast, or on the islands. Heligoland had lost seven parishes in less than 200 years.

Although, in many places, the sea had washed away the shores and cliffs, yet this was comparatively of limited extent, and a greater area of marsh land had been restored since the embankments were made; the inner marshes being always lower than the outer, while the forelands continually increased. The Lyster Deep, drainage of the country to the westward, and deep fiords on the eastern side of the Duchies were then noticed, as well as the formation of the Agger Channel, which occurred during the greatest storm flood on record, that of 1825. This storm flood arose from the south west, and some curious phenomena were observed during its continuance, the water rising to an extraordinary height and with singular rapidity, while it fell as suddenly. The author considered that this flood as well as others could not have arisen simply from the effects of violent gales in the North Sea, and he attributed them to volcanic movements of the bottom of the sea; alluding to the phenomena observable during the earthquake in Jutland, in 1841. In further corroboration it was remarked that, from the twelfth to the nineteenth century, two hundred and fifty-two earthquakes had occurred in the Scandinavian Peninsula and Iceland; the movements in the former being usually from S.W. to N.E., or almost invariably the direction in which the most disastrous storm floods affected the Danish coast. It had been stated by Mr. Mallet that, during the Great Earthquake at Lisbon, the sea was much agitated along the coasts of Holland and Friesland, and vessels were dashed against each other; shocks of earthquakes and tremblings being felt at several places, in Holstein, the water in the wells rising so high as nearly to inundate the land in some places, while the River Eider was particularly agitated. The effect of these storms upon the islands, and the protection afforded by the "Dunes" were then commented on. The disappearance of the dunes between the island of Amrum and the Eiderstedt was attributed to the washing away of the land on the eastern side; while at the same time it was pointed out that, at particular places, where the sandy dunes were levelled by occasional floods, they were singularly productive of grasses, a rental of £3 per acre having been realised, and under certain conditions good crops of grain had been obtained.

The construction of the dykes was then described in detail; historical records being given of the earliest forms, including the "Halligs," remnants of large tracts of land, which were shown to be of great antiquity. It was considered that the preservation of the Halligs and of the islands was of vital importance to the whole of the marshes, the full force of the sea being broken on them before reaching the main land. It was not noticed, as a curious fact, that while the forelands were forming rapidly, the Halligs were as rapidly decreasing; and that, consequently, the beneficial influence they exercised would probably cease with time. The island of Pellworm was specially instanced, as possessing a vast influence on the maintenance of the marsh district; although owing to its isolated and exposed situation, the peculiar nature of the soil, and the gradual depression of the land, it was somewhat questionable if the strong and perfect stone dykes, or indeed any other works, except the enclosure of the intervening space between the main land, would absolutely free the island from danger. The dykes were classified as summer dykes, inside, and outside or sea dykes. The former were the most ancient, having been constructed by the early settlers on the "Warfths," as a protection against occasional tempests. Details of the various forms of dykes were then given. Generally, in Slesvig, a slope of three to one was used on the seaward side, to a height of ten to twelve feet above the ordinary level of the water. There was then a cess, or bench, of ten, twelve, or fifteen to one, according to circumstances, the section being entirely dependent on the position, the extent of the foreland, its height above the ordinary flood level, and its exposure to the direct action of the waves and wind. The variations in the rise of the water on different parts of the coast had a considerable influence on the height of the dykes; and it was shown that a high level of the crown was not always desirable, the banks on the island of Pellworm being instanced as illustrations. The application of the curved stone facing for defending the dykes appeared only to be justified under peculiar circumstances, and by the want of straw and the scarcity of labour in the time of danger; as it was thought to prevent the natural rising of the ground, and to cause a depression at the foot of the facing, besides being very expensive. The materials for and the mode of formation of the dykes, and the various plans of protection adopted, were then treated of. Above the ordinary flood levels grass plots, covered or uncovered with straw matting, were shown to be of much importance; while in exposed places, where every ordinary tide reached the dykes, the sea slopes were sometimes covered with straw matting, stitched down in a peculiar manner, or they were pitched with stone, or protected with fascine or hurdle works. These and other methods had all been adopted with uniform advantage, under the circumstances in which they had been employed, particularly that of protecting the slopes with twisted strawbands. It was stated that there was no feature in connection with the dykes of greater importance than the projecting works or groynes, and diagrams were exhibited, illustrative of the extent to which they were now being carried out, some being constructed of great length, nearly 8,000ft., with the object of connecting one of the small islands with the main land. Numerous examples were given of their advantages in exposed localities, as at Schlenkulen, in Holstein, where there was a depth of water of from ninety to one hundred feet. The author thought the skilful manner in which the dyke inspectors both in Slesvig and in Holstein had overcome the difficulties, entitled them to the highest commendation. He then alluded to the precautionary means adopted in time of danger

pointing out that, by the laws regulating the dyke lands, the inhabitants of the "Koogs" contributed to the maintenance of the dykes, according to the position of their land, its exposure to danger, and the intrinsic value of the soil.

In conclusion, the author reviewed the general advantages of these works in England, Holland, and Denmark, and the results which had already been accomplished, as well as those which still remained to be achieved. He considered the true test of successful engineering enterprises to be, not so much the perfection of the gigantic works which had been raised up as monuments of skill, but rather the benefits they conferred upon the world. Judged by this standard, it was contended that no other engineering works were of more paramount importance than reclamations from the sea. It was observed that the country, which was originally a trackless waste, now consisted of some of the richest land in Europe, furnishing, together with the kingdom of Denmark, corn to England to an extent only surpassed by two other great states of the world, besides vast numbers of cattle, sheep, and horses. These results were then compared with what had been accomplished in the Lincolnshire fens and in Holland, and it was remarked that the three marsh countries were capable of affording a larger supply of grain than was now imported from America, Russia, and Prussia combined. Indeed, independently of other great enclosure works, it was estimated that theannual revenue of those countries was at least eight millions sterling, a sum equivalent to more than the net passenger receipts of all the railways in the United Kingdom. There were still upwards of 600,000 acres of land in England and Ireland, worth from £20 to £60 per acre, which might yet be reclaimed, and if similar districts in other countries were added to this calculation, the magnitude of the results could scarcely be overrated. It was remarkable that, notwithstanding the many advantages attending reclamation works, which could now be effected at a less expenditure than formerly, by the judicious application of steam power, such enterprises were still regarded with suspicion and distrust, although they afforded the means of the soundest and most profitable application of capital.

The second paper read was "On Reclaiming Land from Seas and Estuaries,' by Mr. James Oldham. M. Inst. C. E.

It was remarked that, considering the character of the river Humber and its tributaries, and the nature of the soil and the geological formation of the district, it was not surprising that the foreshores, except where efficiently protected by artificial works, should be easily washed away, and the water become loaded with a vast mass of earthy matter, to be again deposited in less disturbed situations. In addition to these natural deposits, the surface of the low lands was frequently raised, and rendered available for cultivation, by a system of "warping," the process of which was described, such as had been practised on the Trent, the Ouse, and the Don.

The degradation of the land on the whole of the sea-coast of Holderness, from Bridlington to the Spurn, was then pointed out. It was found, by observations extending over a considerable period, that on forty miles of coast the loss amounted on an average to two yards and a quarter per annum; but the progress was far from uniform, in some places no change being perceptible, and in others as much as ten or fifteen yards disappearing in twelve months. As bearing on this branch of the subject, an extract was given from a paper, which was read at the meeting of the British Association in 1853, "On the Character and Measurements of Degradation of the Yorkshire Coast," by Dr. J. P. Bell.

The phenomena of tidal deposits and accretions in the formation of new land having been explained, it was shown that the greater part of Sunk Island, and of the immediate locality, had accumulated during the last seventy or eighty years. This island was situated at from seven to eleven miles from the Spurn, on the north bank of the estuary of the Humber, having a line of coast of about six and a half miles. It contained 7,000 acres of enclosed land under cultivation, the property of the Crown; and adjacent to it, and forming an addition to the mainland of Yorkshire, there were about 3,000 acres of rich alluvial soil. The accretions in the Humber and on Sunk Island were found to rise, until the surface of the land was coincident with the average level of all tides. When this point was attained, marine plants appeared; and as soon as the surface of salt water accretions was covered with vegetable life, they were considered suitable to be embanked Various opinions were entertained as to the source of the material forming these accretions. The author believed that it proceeded from the sea face of the coast of Holderness, as it could only come in with the tide, and be deposited at the time of high water. In support of this view a quotation was made from "The Geology of the Yorkshire Coast," by Professor Phillips; and a paper "On the Chemical Constitution of the Humber Deposits," by Mr. J. D. Sollitt, read before the British Association in 1853, was also referred to.

In practical operations on the Humber, endeavours were in the first instance made to secure a thoroughly uniform surface to the land to be enclosed. Thus, a year or two before embanking, the ground was drained by "gripping," so as to let off the whole of the standing pools, and allow the depressions to silt up. The permanent drainauge of the land was provided for by a sluice, the size and the level of the cill of which were determined by the rise and fall of the tide, and by the extent of land to be drained. With regard to the sectional form and area of the bank itself, where the outer face was exposed to a heavily rolling sea, the slope should be gradual: and if the soil to be used in its construction was light, then the bank must have a wide base, and there should be a puddle wall in the centre to prevent leakage. If a slip took place in a tidal embankment, fascines or fagots should not be employed, as they were liable to act as conductors for the water.

In illustration of these remarks, the works of the last embankment, for enclosing 700 acres of new accretion, at Sunk Island, were described. They were commenced in April 1850, and were completed in the December following, the tide having been excluded by the 1st of July; and they were executed under the direction of the author as engineer, Mr. G. C. Pauling being the contractor. The total length of embankment was 6,067 yards. That portion which had to encounter the storms of the Humber was 3,943 yards in length, its greatest height being 8ft. 10in., width at the base 61ft., and at the top 4ft. The outer face had a slope of 5 to 1, and the inner of 1½ to 1. The remaining portion of the embankment was 2,124 yards in length, had an average height of 6ft. 3in., though in one part it was 7ft. 6in. high, was 32ft. wide at the base, and 3ft. at the top. The outer face had a slope of 3 to 1, and the inner of 1 to 1. In making the embankments, the material removed in forming the drains round the inside of the inclosure was employed; where this was not sufficient, the contractor was permitted to excavate from the foreshore, provided the cutting did not exceed 4ft. 6in. in depth, and did not approach within 6ft. of the bottom of the outer slope. Channels were cut to allow the water which accumulated in these pits to run off after every tide; and within four years these pits were silted up, by tidal deposit alone. The banks were raised at once to the height of ordinary spring tides, the natural creeks being left open. These were then filled up simultaneously, and the whole of the banks brought to a uniform level, to the full height required. The first bank cost 10s. 6d., and the second 4s. 6d. per lineal yard; or at the rate of 5½d. and 4½d. per cubic yard on the average respectively. The banks were perfectly watertight from the first, and the greatest settlement in any part was not more than 15in.

Details were then given of the self-acting draining sluice, or clough, which was provided with tidal doors, and had been erected at a cost of £380. It appeared that the foundation consisted of timber piles, and that the superstructure was composed of brickwork with stone copings. The hollow quoins, the framing of the gates, and the top cills were of English oak; the bottom cills being of elm timber. A door, capable of being raised or lowered by machinery, was provided, to admit of the outfall, which was liable to be silted up in dry seasons, being occasionally scoured; and this door could be used, in very dry seasons, for admitting a quantity of tidal water, to fill the fence ditches.

Soon after the exclusion of the tidal water, the marine grasses decayed, and fresh water grasses gradually appeared. In about three years a tolerably good surface of pasture was naturally formed, and on Sunk Island there arose a spontaneous growth of white clover. Some remarks were then made on the value of this land for tillage, and it was stated that the tenants on Sunk Island admitted that they frequently obtained six imperial quarters of grain per acre. Flax was also produced in large quantities and of fine quality; and root crops, as potatoes, turnips, mangold wurzle, &c.

The third paper read was "On Reclaiming Land from Seas and Estuaries." by Mr. J. H. Müller (of the Hague).

The author stated that he understood works of this class to comprise an area either of salt marsh, samphire ground, slake, mud, or sand, lying more or less above the level of low water, and being reclaimed from the sea by means of embankments, and drained by natural means through the sea banks. Reclaiming land was frequently looked upon as a hazardous speculation, owing to the probable contingencies where water had to be dealt with, and to the benefits being generally prospective. It was often condemned on account of the state of the ground, which was pronounced to be unsuitable for the purpose. But the question should not be determined in that way; for the value of the ground, before being reclaimed, was no measure of the merit of the proposal, which could only be decided by comparing the cost of the necessary works with the improved value that would be given to the land, when that operation had been accomplished.

After contending that the effect of reclaiming or draining land was to remove the cause of malaria or ague, and not, as had been erroneously asserted, to produce it, the author proceeded to point out that, in designing such works, the object should be to enclose the largest area, with the least length of bank, and the smallest average cross section. These points were regulated by the direction of the sea bank, to which attention was next called. It was sometimes recommended that the sea bank should be, as nearly as possible, parallel with the current, and at an angle to the prevailing winds. But experience seemed to show that, where creeks did not interfere, a different system was preferable; and that one side should be boldly exposed to the full force of the gales, and that the current should be allowed to act upon it almost at right angles, if, at the same time, that one side would shelter, or protect the two other sides. By this arrangement a less extent of bank required supervision during gales, and it also presented advantages during construction. The line of the embankment should, if practicable, cross creeks at right angles, and at the same level; and in all cases care must be taken to secure the bottoms of the creeks by aprons to prevent them from becoming deeper.

The extent of land to be reclaimed at any one time was then considered, and it was argued that large areas were the least expensive in the end; for if a small area was selected at first, some portion of the original sea banks would be useless, when an increase became desirable. If the banks could not be constructed entirely on the salt marsh, it was preferable to go to half-tide level. The difficulty in the construction did not increase with the size of the area reclaimed, but depended upon the openings left in the banks. As instances;—in reclaiming a piece of land of 1,000 acres, by a bank three quarters of a mile in length, the seat of which was six feet below the level of high water, only one opening seven chains in width was left. In another case, in reclaiming 1,700 acres, by a bank four miles in length, the seat of which was eight feet below high water, three openings, of five, seven, and twelve chains in width, were left. In neither case was the speed of the outgoing current materially increased, during the progress of the works, nor indeed until the cross section of the openings was diminished. In completing the latter work the aprons were raised eighteen inches, or two feet at a time, by wood work, stone, and clay. It was expected that the current would increase in the third opening, when the two others were raised; but this did not occur, as the water within the enclosure did not reach so high a level as that without; in fact, it never attained to high water mark. When the aprons were above the level of the reclaimed land, the current on leaving became violent. This could not, however, be avoided in finally closing a bank.

Between the old sea-bank and the edge of low water the soil might be divided into four distinct classes:—the salt marsh, of clay, about the level of summer spring tides; then samphire ground, slake or mud, or rich alluvial matter, to half tide; next, hard sea sand; and lastly, near low water mark, quicksand. Banks entirely on the salt marsh were the easiest and the strongest that could be made. Those on samphire ground and mud were the most difficult; slips were of constant occurrence, the use of wagons and horses was impossible, and a large proportion of the material was washed away as it was deposited before the bank was consolidated, and raised above high water mark. In fact, for waste, settling, and contingencies, from 60 to 100 per cent. of the original quantity must be calculated upon as necessary. If a storm arose during the progress of the works, the slopes could not be protected; and, indeed, a bank constructed on such a bottom was always unsafe. When the line of the embankment was laid at the half-tide level, or about the limit of vegetation, and on hard sand, it was possible to make the whole of the reclaimed land fit for cultivation, and this plan need not cost more, and was safer than by adopting the higher but softer bottom. Banks on a lower level were not advisable.

Having stated the conditions to be observed in the direction and situation of the banks, the next question requiring attention was the cross section. This naturally divided itself into two parts:—the main body to resist the dead weight of the water when at rest, and the mode of protecting the slope to enable it to resist the action of the water when in motion. With regard to the first point, the best cross section was that, where the centre of gravity came nearest to the bottom, and to the toe of the bank. For this reason steep slopes with a cess, or bench, about the level of high water, were preferable to flat slopes without a cess, or bench. Sand standing at its natural slope was sufficient to resist still water.

Breaches in banks were attributable either to a small percolation of water underneath the seat, or to the defence, or protection of the slope being insufficient. Frequently it was not possible to obtain clay in sufficient quantities to form a puddle wall in the centre of the bank; and if the force of the wave was strong enough to break through stone and wood, clay would not be able to resist it. Sometimes, at extraordinary high tides, a breach would occur above the cess, but this rarely happened, and the time during which danger could arise was so short, that the evil might be remedied before the next returning high tide. When the water rose above the top of the bank, the back, unprotected slode was liable to be damaged, and thus to lead to a breach. This might be averted by driving stakes into the top of the bank, and placing planks, supported by clay, or other materials, behind them.

With respect to the protection of the slope, there was a difficulty in ascertaining correctly the force of sea-water when violently agitated. Mr. Storm Buysing had stated, in his work on hydraulic engineering, that the shock of the water and of floating objects against slopes increased in the same ratio as the sine of the angle formed by the slope with the horizon. De La Coudraye and Brémontier contended, in their theory of the motion of waves, that the water only moved vertically up and down, without any horizontal displacement. It was well known that the sea had the power to destroy banks, and to displace stones of considerable weight; and the engineer must be guided by experience, in dealing with these matters, rather than by speculative opinions.

The materials employed for the defence of slopes were of three different kinds, clay and grass flags, wood, and stone When banks were constructed on salt marshes, the body consisted of clay taken from the adjoining excavations. In this case it was advisable, after trimming the slopes, to sow coarse and meadow grass and clover seeds, and to protect the whole with a crammat. The crammat, which cost threepence or fourpence per square yard, was composed of a layer of clean barley straw, about two inches thick, evenly laid, and fastened to the clay by straw bands, or strands, sixty to ninety stitches being made per superficial yard. In two or three years the bank was so consolidated that the mat did not require renewal. When these banks were on a lower level than the salt marsh, a protection of clay and grass was insufficient. In such cases a layer of clay protected by stone, at a slope of four or six to one, was employed in England, but without a cess, or bench. This afforded the requisite strength, but it was expensive, and, as usually constructed, it needed much repair. The author thought that, when the bank was constructed on samphire ground, as within a comparatively short period a new salt marsh or foreshore would be formed, it would be sufficient to protect the slope of the bank with wood, and that the slopes above the cess need not be protected, nor be flatter than three to one.

A description was then given of the protection by fascine work. This consisted of layers of fagots, five or six inches in thickness, placed in a direction up and down the slope of the bank, the thick ends overlapping the thin ends of the lower rows. These were fastened down by stakes, which were left eight inches above the fagots, and were connected together by means of willow binders, or "wattles," something like hurdle work. When the proper sort of wood was obtained, this protection would endure from five to seven years, and was quite able to resist the action of the tide. The strength of this kind of protection might be increased, by increasing the number of the stakes and binders, or by filling in with stone, firmly wedged between the rows of stakes. The stone defence, as commonly constructed by the Dutch, on islands exposed to the ocean, was formed thus: when the slope was trimmed, a layer of clay, twelve inches to eighteen inches in thickness, was spread over it, covered sometimes with a crammat. Over this, bricks in one or two courses were laid, and then from six inches to twelve inches of brickbats, on which stones from twelve inches to eighteen inches in depth were set. This work, though very durable, was costly, and hence should only be adopted where security rendered it necessary; as, for instance, for banks near to low water mark. Details were then given of four different cross sections, and it was observed that, with a stone defence, the slopes were recommended to be flatter, and the banks to be higher, than where wood protection was employed; for it was expected that the former would be built in more exposed situations. In some cases it had been found advantageous to introduce rows of oak stakes, at intervals above the surface of the stone, to break the force of the waves.

In the construction of sea walls, or banks, the most difficult operation was that connected with the crossing of creeks, before alluded to, especially when the bottom was 10ft., 20ft., or more under low water mark. In England the usual plan was to fill in large quantities of material from the sides; but this was a costly method. In Holland, on the contrary, the custom was to raise the bottom uniformly to the level of low water by means of cradles. The cradle was formed of brushwood, bound together by ropes and osiers, and was usually from 2ft. to 3ft. thick. It should be made on a flat sand, or silty ground, about 3ft. below high water, of the full length of the opening, and of proportionate width; being perfectly flexible, it adapted itself to the inequalities of the ground. It was stated that particular attention must be paid to the stakes, or fastenings, by which it was held down, as the safety of the cradle depended entirely upon them. After being so secured, it was weighted with clay, brickbats, and stones. The mode of constructing a cradle, of floating it to its place, and of sinking it in the centre line of the intended embankment, were then minutely described. The sides of the opening were next protected with similar cradles, the lower end of each resting on that first laid. Subsequently other cradles were sunk over these, until the work reached low water mark, when the width of the embankment was gradually increased, by throwing in sods on the flood side, protected by fascine work, weighted with stone. The same process was then pursued on the ebb side. When the surface of the creek was level with, or above low water, cradles were not required. In such cases the ground was covered with a thin layer of clay, protected by an apron of fascine work.

In conclusion, the mode of constructing the banks themselves, by side cuttings at least 20ft. from the foot of the slopes, was described; and it was urged that each part undertaken should be raised to its full height in one tide, the exposed side being covered with a thin layer of clay. In the next tide this should be provisionally protected by a crammat, and before the ensuing spring tide the work should be finally protected with stone or wood.

INTERNATIONAL EXHIBITION OF 1862.

LIST OF JURORS IN CLASSES AND SECTIONS.

Class I.—Mining, Quarrying, Metallurgy, and Mineral Products.

1. Samuel Blackwell, F.G.S., Dudley, Mining Engineer; 2. J. A. C. da Neves Cabral, Portugal, Inspector of Mines; 3. Charles Combes, France, Member of the Institute, Inspector-General, and Director of the School of Mines; 4. Devaux, Belgium, Member of the Department of Science of the Royal Academy of Belgium, Inspector-General of Mines; 5. Lieut.-General Alex. Gerngross, Russia, Director of Mining Department; 6. Sir W. Logan, Canada, Director of the Geological Survey of Canada; 7. Francisco Luxan, Spain, Senator; 8. Sir Roderick Murchison, F.R.S., F.G.S., Chairman, London, Director-General of the Geological Survey and of the Government School of Mines, 16, Belgrave-square, S.W.; 9. C. Overweg, Zollverein, Landowner, Letmathe; 10. J. Percy, M.D., F.R.S., F.G.S., London, Professor of Metallurgy to the Government School of Mines, 2, Craven-hill, W.; 11. Arcangelo Scacchi, Italy, Senator, Professor of Mineralogy; 12. Warington W. Smyth, M.A., F.R.S., F.G.S., London, Professor of Mining to the Government School of Mines, 27, Victoria-street, S.W.; 13. Thomas Sopwith, F.R.S., F.G.S., Newcastle, Mining Engineer, 43, Cleveland-square, W; 14. K. Styffe, Sweden, Director of the Royal Polytechnic Institution, Stockholm; 15. Peter Tunner, Austria, Director of the Imperial Mining School in Leoben; 16. H. Hussey Vivian, M.P., F.G.S., Swansea, Mine Owner, 5, Upper Belgrave-street, S.W.; 17. Nicholas Wood, F.G.S., Newcastle, Mining Engineer.

Class II.—Chemical Substances and Products, and Pharmaceutical Processes.

Section A.—*Chemical Products.*—1. Frederick Anthon, Chem. D., Austria, Professor of Chemistry, Prague; 2. Balard, Chairman, France, Professor of the College of France, and of the Faculty of Science; 3. E. H. von Baumhauer, M.D., Netherlands, Professor of Chemistry in the University of Amsterdam, and Member of the Academy 56, Brompton-crescent, S.W.; 4. A. Bernays, Ph. D., India Professor of Chemistry, St. Thomas's Hospital; 5. Chandelon, Belgium, Professor of Chemistry, University of Liége; Member of the Royal Academy of Medicine; 6, E. Frankland, Ph. D., F.R.S., Foreign Secretary to the Chemical Society, 42, Park-road, St. John's Park, Haverstock-hill, N.W.; 7. Professor G. Forchammer, Denmark, Secretary to the Royal Society of Science, Copenhagen; 8. Wm. Gossage, Warrington, Chemical Manufacturer, 2, Oxford-court, Cannon-street, E.C.; 9. T. Graham, F.R.S., London, Master of the Mint, Vice-President of the Chemical Society, 4, Gordon-square, W.C.; 10. A. W. Hofmann, London, F.R.S., Ph. D. President of the Chemical Society; Professor of Chemistry Government School of Mines, 9, Fitzroy-square, W.; 11. N. Kunheim, Ph. D., Zollverein, Manufacturer, Berlin; 12. A. V. Lourenço, Portugal, Professor of Chemistry at the Polytechnic of Lisbon 13. Dr. A. Müller, Sweden, Professor of Chemistry at the Roya Agricultural Academy, Stockholm; 14. Raffaele Piria, Italy Member of the Italian Parliament, late Minister of Public Instruction, Naples; Professor of Chemistry; 15. James Young, F.R.S.E., F.C.S., Edinburgh, Chemical Manufacturer, 25, South-street, Thurloe-square.

Section B.—*Medical and Pharmaceutical Products and Processes.*—1. Dr. Wurtz, France, Professor of the Faculty of Medicine; 2. Von Fehling, M.D., Zollverein, Professor of Chemistry at Stuttgart; 3. Daniel Hanbury, F.L.S., London, Pharmaceutical Chemist, 1, Plough-court, Lombard-street, E.C.; 4. Salvatore de Luca, Italy

Professor of Chemistry; 5. T. N. R. Morson, F.L.S., London, Pharmaceutical Chemist, 38, Queen's-square, Bloomsbury, W.C.; 6. J. M. Neligan, M.D., Dublin, Great Western Hotel, W.; 7. Theos. Redwood, M.D., London, Secretary to the Chemical Society and Professor of Pharmacy to the Pharmaceutical Society, 19, Montague-street, Russell-square, W.C.; 8. A. Schroetter, Ph. D., Austria, General Secretary of the Imperial Academy of Science; Professor of Chemistry, Vienna; 9. Robert Warington, F.C.S., London, Vice-President of the Chemical Society, Apothecaries Hall, E.C.

CLASS III.—SUBSTANCES USED FOR FOOD.

SECTION A.—*Agricultural Produce.*—1. Constantine Ardanaz, Spain; 2. James Buckman, Cirencester, Professor at the Royal Agricultural College, Cirencester, 22, Sussex-place, Regent's Park, N.W.; 3. Buffet, France, late Minister; 4. J. D'Andrade Corvo, Portugal, Professor at the Agricultural Institute, and at the Polytechnic at Lisbon, Member of the Academy of Science; 5. Elsner Von Gronow, Zollverein, Member of the Royal Board of Agriculture, Kalinowitz; 6. C. Wren Hoskyns, London, Member of the Council of the Royal Agricultural Society, 27, Berkeley-square, W.; 7. Stefano Jacini, Italy, Member of the Italian Parliament, late Minister of Public Works; 8. Jacquemyns, Belgium, Member of the Chamber of Representatives and of the Chamber of Commerce at Ghent; 9. J. W. Larking, Turkey, The Firs, Lee, Kent, S.E.; 10. Chas. Lawson, Edinburgh, Seedsman, 43, Glo'ster-place, Hyde Park, W; 11. P. Möller, Sweden; 12. Lord Portman, London, President of the Royal Agricultural Society of England, 5, Princes-gate, W.; 13. M. E. Rodocanachi, Greece, Merchant, 3, Gloucester-square, Hyde Park, W.; 14. Nicholas-Tchernaye, Russia, Member of the Scientific Committee of Crown Lands, 58, Brompton-square, S.W.; 15. E. W. Thomson, Canada, President of the Board of Agriculture; 16. Ch. Woolloton, London, Hop Merchant, 246, High-street, Borough, S.E.; 17. Count H. de Zichy, Austria, Land and Mine Owner.

SECTION B.—*Dysaltery, Grocery, and Preparations of Food as Sold for Consumption.*—1. Boussingault, Chairman, France, Member of the Institute, Professor to the Conservatory of Arts and Manufactures; 2. A. Campbell, M.D., India, Superintendent at Darjeeling, Great Western Hotel, W.; 3. James Carey, S. American Republics, Colonial Broker, 36, Mincing-lane, E.C.; 4. E. T. Foord, Ionian Islands, Merchant, 6, Crosby-square, E.C.; 5. F. Hicks, London, Sugar Refiner, 11, Little Alie-street, E.; 6. Jacob Zollverein, Councillor of Commerce, Halle on Saale; 7. Henry L. Keeling, London, Fruit and Grocery Warehouseman, 3, Monument-yard, E.C.; 8. E. Lankester, M.D., F.R.S., London, Superintendent of Food Collection, South Kensington, 8, Savile-row, W.; 9. H. Letheby, M.B., F.L.S., London, Officer of Health of City of London, 41, Finsbury-square, E.C.; 10. S. Mavrojani, Greece, 26, Gloucester-square, Hyde Park, W.; 11. Baron Riesse Stallburg, Austria, Member of Austrian Parliament, Landowner; 12. Adolfo Targioni Tozzetti, Italy, Professor of Zoology, Royal Museum of Natural History, Florence; 13. C. Woodhouse, Mauritius, Colonial Broker, Mincing-lane, E.C.

SECTION C.—*Wines, Spirits, Beer, and other Drinks, and Tobacco.*—1. J. S. Bowerbank, F.R.S., London, Distiller, 3, Highbury-grove, N.; 2. Ch. Buxton, M.P., London, Brewer, 7, Grosvenor-crescent, S.W.; 3. Gordon W. Clark, London, Wine Broker, 72, Great Tower-street, E.C.; 4. J. A. Van Eyck, Ph. D., Netherlands, Director of the Palace of Industry in Amsterdam; 5. E. C. Ionides, Greece, Merchant, 51, Inverness-terrace, W.; 6. D. Leiden, Zollverein, Councillor of Commerce, Cologne, Westminster Palace Hotel, S.W.; 7. Monny de Mornay, France, Director of Agriculture in the Ministry of Agriculture, Commerce, and Public Works; 8. Noetzlin-Langmesser, Switzerland, Wine Merchant, Basel; 9. A. H. Novelli, London, 6, Grosvenor-street, W.; 10. A. Odelberg, Sweden; 11, Arthur Otway, Ionian Islands, Army and Navy Club, George-street, Pall-mall, S.W.; 12. George Phillips, London, Principal of Laboratory to the Excise Office, Somerset House, W.C.; 13. Jos. Prestwich, F.R.S., London, Wine Merchant, 10, Kent-terrace, Regent's Park, N.W.; 14. Marquis-Gen. Emilio Bertone di Sambuy, Italy; 15. Robert Schlumberger, Austria, Member of the Chamber of Commerce, Vienna.

CLASS IV.—ANIMAL AND VEGETABLE SUBSTANCES USED IN MANUFACTURES.

SECTION A.—*Oils, Fats, and Wax, and their Products.*—1. J. Ben Heath, Italy, Italian Consul General; 2. P. J. Kerckhoff, M.D., Netherlands, Professor of Chemistry in the University of Gröningen; 3. S. Marcoran, Ionian Islands; 4. Emmanuel Mavrogordato, Greece, Merchant, 56, Westbourne-terrace; 5. T. J. Miller, M.P., London, Spermaceti Manufacturer, Dorset Wharf, Millbank, S.W.; 6. W. A. Miller, F.R.S., London, Professor of Chemistry, King's College, London, King's College, W.C.; 7. A. Payen, France, Member of the Institute, Professor to the Conservatory of Arts and Manufactures, and Professor to the Central School of Arts and Manufactures; 8. Emil Seybel, Austria, Member of the Chamber of Commerce, Vienna; 9. Stas, Belgium, Member of the Department of Science of the Royal Academy of Belgium; 10. Dr. Stein, Zollverein, Professor, Dresden; 11. T. Thompson, M.D., India, Superintendent of the Botanical Gardens, Calcutta, 5, York-gate, Regent's Park, N.W.; 12. W. W. Williams, London, Soap-maker, 31, Westbourne Park, W.; 13. Geo. Wilson, F.R.S., London, Manager of Price's Patent Candle Works, Wandsworth-common, S.

SECTION B.—*Other Animal Substances Used in Manufacture.*—1. Capt. C. Bagot, South Australia, 8, Inverness-terrace, W.; 2. Bella, France, Director of the Agricultural Institution of Grignon; 3. Samuel Birchall, New South Wales, Wool Merchant, Gresham Club, E.C.; 4. George Busk, F.R.S., London, Secretary of the Linnean Society, 15, Harley-street, W.; 5. Robert Czilchert, Austria, Landowner; 6. Sir Frederick J. Halliday, K.C.B., India, late Lieut.-Governor of Bengal, 28, Cleveland-square, W.; 7. J. G. Homere, Greece, Merchant, 4, The Terrace, Kensington-gardens-gardens, W.; 8. J. Jowitt, Queensland, Wool Merchant (James Scott and Co.), 11, King William-street, E.C.; 9. Antonio Marchetti, Italy, Member of the Italian Parliament; 10. J. J. Mechi, London, Alderman, 4, Leadenhall-street, E.C.; 11. P. L. Sclater, F.R.S., London, Secretary of the Zoological Society, 11, Hanover-square, W.; 12. L. Schooler, Zollverein, Privy Councillor of Commerce, Duren; 13. J. Stebut, Russia, Professor of Agriculture in the Agricultural College, Gorigoretsk, 58, Brompton-square, S.W.

SECTION C.—*Vegetable Substances used in Manufactures, &c.*—1. T. Archer, F.R.S.E., Edinburgh, Director of Industrial Museum, Edinburgh; 2. Barral, France, Member of the Imperial Society of Agriculture; 3. Robert Fauntleroy, London, Hardwood Merchant, 99, Bunhill-row, Finsbury, E.C.; 4. J. D. Hooker, M.D., F.R.S., V.P.L.S., F.G.S., London Director Royal Botanic Gardens, Royal Gardens, Kew, S.W.; 5. J. B. Hurlbert, LL.D., Canada; Sir Robert Kane, F.R.S., M.R.I.A., Dublin, Director of Museum of Irish Industry; 7. J. Miers, F.R.S., F.L.S., Brazil, Temple-lodge, Hammersmith, W.; 8. Filippo Parlatore, Italy, Professor of Botany, Royal Museum of Natural History, Florence; 9. W. Henry Peat, South American Republics, 11, Mincing-lane, E.C.; 10. George Peterson, Russia, Member of the Scientific Committee of Crown Lands, and of the Council of Manufactures, 56, Brompton-square, S.W.; 11. R. Riddell, India, late Superintending Surgeon, Nizam's Army, Deccan, 7, The Grove, Clapham, S.; 12. W. W. Saunders, F.R.S., Tasmania, Vice-President of the Linnean Society; 13. Chev. de Schwarz, Austria, Chairman, Imperial Councillor, Director of the Austrian Consulate General, Paris; 6, Onslow-crescent, S.W.; 14. M. A. Sevastopoulo, Greece, Merchant, 18, Leinster-gardens, W.; 15. Dr. Thiel, Zollverein.

SECTION D.—*Perfumery.*—1. E. Moll, France, Professor at the Conservatory of Arts and Manufactures; 2. W. Odling, M.D., F.R.S., London, Professor of Practical Chemistry, Guy's Hospital, Guy's Hospital, S.E.; 3. Sept. Piesse, London, Distiller of Perfumes, 2, New Bond-street, W.; 4. Eugene Rimmel, London, Perfumer, 96, Strand, W.

CLASS V.—RAILWAY PLANT, INCLUDING LOCOMOTIVES AND CARRIAGES.

1. Wm. Baker, C.E., London, Engineer to London and North-Western Railway Company, 63, Gloucester-place, Hyde Park, W.; 2. G. P. Bidder, C.E., London, late President of the Institution of Civil Engineers, 24, Great George-street, Westminster, S.W.; 3. Flachat, France, Consulting Railway Engineer; 4. James Kitson, Leeds, Mayor of Leeds, Manufacturer of Locomotive Engines; 5. Kruger, Zollverein, Director of Royal Machine Factories, Dirscham; 6. J. E. McConnell, Wolverton, late Locomotive Superintendent of the London and North-Western Railway Company; 7. F. Spitaels, Belgium; 8. Arch. Sturrock, Doncaster, Locomotive Engineer, Great Northern Railway, G. N. Railway, King's-cross, N.; 9. Duke of Sutherland, Chairman, London, Stafford House, S.W.; 10. Col. Yolland, R.E., F.R.S., London, Inspector of Railways, 17, Westbourne Park, W.

CLASS VI.—CARRIAGES NOT CONNECTED WITH RAIL OR TRAM ROADS.

1. Jos. Holland, London, Carriage Builder, 254, Oxford-street, W.; 2. H. M. Holmes, Derby, Coach Builder, 38, Margaret-street, Cavendish-square, W.; 3. George Hooper, London, Coach Builder, 28, Haymarket, W.; 4. Gen. Morin, Chairman, France, Member of the Institute, Director of the Conservatory of Arts and Manufactures; 5. J. N. Peters, London, Coach Builder, 96, Park-street, Grosvenor-square, W.; 6. Viscount Torrington, London, 4, Warwick-square, S.W.

CLASS VII.—MANUFACTURING MACHINES AND TOOLS.

SECTION A.—*Machinery employed in Spinning and Weaving.*—1. Boettcher, Zollverein, Professor at the Industrial School, Chemnitz; 2. Callon, France, Chief Engineer to the Imperial Corps of Mines; 3. J. Cheetham, Staleybridge, Cotton Spinner, Reform Club, Pall-mall, S.W.; 4. M. Curtis, Manchester, Machine Maker; 5. Ben. Fothergill, London, Consulting Engineer, 65, Cannon-street, E.C.; 6. Kindt, Belgium, Inspector of Industry for the Minister of the Interior; 7. J. G. Marshall, Leeds, Flax Spinner.—SECTION B.—*Machines and Tools employed in the Manufacture of Wood and Metal.*—1. J. Anderson, Woolwich, Assistant Superintendent Gun Factories, Royal Arsenal, Woolwich; 2. W. Fairbairn, F.R.S., Chairman, Manchester, Engineer; 3. Robt. Mallett, F.R.S., London, Vice President of the Irish Institution of Civil Engineers, 11, Bridge-street, Westminster, S.W.; 4. Rev. H. Moseley, M.A., F.R.S., Bristol, Canon of Bristol, Council of Military Education, 13, Great George-street, Westminster, S.W.; 5. Dr. Rülmann, Zollverein, Professor in Hanover; 6. Seguier, France, Member of the Institute; 7. J. Whitworth, F.R.S., Manchester, Engineer, Fenton's Hotel, St. James's-street, S.W.

CLASS VIII.—MACHINERY IN GENERAL.

1. L. R. Bodmer, Switzerland, Consulting Engineer, 1, Lansdowne-villas, Notting-hill, W.; 2. Chevalier de Burg, Austria, Imperial Councillor, President of the Society of Arts and Manufacturers at Vienna; 3. Earl of Caithness, London, 17, Hill-street Berkeley-square, W.; 4. M. Chevalier, Chairman, France, Senator, Member of the Institute; 5. J. Hawkshaw, F.R.S., F.G.S., London, President of the Institution of Civil Engineers, 43, Eaton-place, S.W.; 6. J. Hick, C.E., Bolton, Civil Engineer; 7. J. M. de Ponte Horta, Portugal, Professor of Mathematics at the Polytechnic of Lisbon; 8. W. M. Neilson, C.E., Glasgow, Civil Engineer; 9. J. Penn, C.E., London, Mechanical Engineer, Lee, Kent, S.E.; 10. O. Pihl, Norway, Civil Engineer, 29, Upper Berkeley-street, W.; 11. Du Pre, Belgium, Honorary Chief Engineer of Bridges and Roads; 12. W. Macquorn Rankine, Glasgow, Professor of Mechanics in the University of Glasgow; 13. F. B. Taylor, United States, Mechanical Engineer and Designer, 4, South Parade, Chelsea, S.W.; 14. H. Thomas, Zollverein, Manufacturer, Berlin.

CLASS IX.—AGRICULTURAL AND HORTICULTURAL MACHINES AND IMPLEMENTS.

1. C. E. Amos, C.E., London, Consulting Engineer to Royal Agricultural Society, The Grove, Southwark, S.E.; 2. Col. Challoner, London, 11, Charles-street, Berkeley-square, W.; 3. C. J. Dannfelt, Sweden, Inspector, Royal Agricultural Academy; 4. G. Devincenzi, Italy, Member of the Italian Parliament, late Minister of Agriculture, Naples, 44, Thurloe-square, S.W.; 5. E. Egan, Austria, Member of the Imperial Agricultural Society; 6. Viscount Eversley, F.G.S., London, 9, Eaton-place, S.W.; 7. J. Gibson, Dalkeith; 8. B. S. Jörgensen, Denmark, Chairman of the Royal Agricultural Society, Denmark; 9. Wellington Lee, United States, Civil Engineer, 17, Norfolk-street, W.C.; 10. Lord Talbot de Malahide, F.R.G.S., Dublin, 81, Jermyn-street, S.W.; 11. Hervé Mangon, France, Engineer to the Imperial Corps of Bridges and Roads, Professor at the School of Bridges and Roads; 12. De Mathelin, Belgium, Member of the Upper Council of Agriculture; 13. J. Miller, Falkirk; 14. J. C. Morton, London, Editor of the *Agricultural Gazette*, 41, Wellington-street, W.C.; 15. Sir Joseph Paxton, M.P., F.L.S., London, Engineer and Architect, 7, Pall-mall East, W.; 16. Marquis de Perales, Chairman, Spain; 17. Pintus, Zollverein, Manufacturer, Berlin, 38, Sydney-street, S.W.; 18. Sir John Villiers Shelley, Bart., M.P., London, 1, St. James-place, S.W.

CLASS X.—CIVIL ENGINEERING, ARCHITECTURAL AND BUILDING CONTRIVANCES.

SECTION A.—*Civil Engineering and Building Contrivances.*—1. Delesse, France, Engineer to the Imperial Corps of Mines, Professor of the Normal School, President of the Geological Society; 2. J. Kelk, London, Contractor, Exhibition Building, W.; 3. Koch, Zollverein, Government and Architectural Councillor, Berlin; 4. Leclerc, Belgium, Inspector of Agriculture and Engineer of Bridges and Roads; 5. Maurice Loehr, Austria, Imperial Councillor of the Board of Trade and Public Works; 6. C. Manby, C.E., London, Hon. Sec. to the Institute of Civil Engineers; 7. T. Page, London, Civil Engineer, Middle Scotland-yard, Westminster. S.W.; 8. Sir J. Rennie, F.R.S., F.G.S., London, Civil Engineer, 5a, Spring-gardens, S.W.; 9. Marquis of Salisbury, K.G., Chairman, London, 20, Arlington-street, S.W.; 10. Cesare Valerio, Member of the Italian Parliament.—SECTION B.—*Sanitary Improvements and Constructions.*—1. Neil Arnott, M.D., F.R.S., London, author of Works on Heating and Ventilation, &c., 2, Cumberland-terrace, Regent's Park, N.W.; 2. J. W. Bazalgette, C.E., Engineer to Metropolitan Board of Works, Spring-gardens, S.W.; 3. Bommart, France, General Inspector in the Imperial Corps of Bridges and Roads; 4. Sir Joseph Olliffe, London, Physician to British Embassy, Paris; 5. R. Angus Smith, M.D., F.R.S., Manchester, Secretary to the Manchester Literary and Philosophical Society; 6. J. Sutherland, M.D., London, Inspector of Burial-grounds, 41, New Finchley-road, N.W.—SECTION C.—*Objects shown for Architectural Beauty.*—1. Stavros Dilberoglue, Greece, 13, Barnsbury Park, N.; 2. S. L. Donaldson, Ph. D., London, Professor of Architecture, University College, Bolton-gardens, Russell-square, W.C.; 3. Theo. Jordan, Russia, Member of the Imperial Academy of Fine Arts, 12, Brompton-square, S.W.; 4. A. L. J. Meier, N. Germany, Architect, 26, Gloucester-grove West, Old Brompton, S.W.; 5. Gilbert Scott, R.A., London, Architect, 20, Spring-gardens, S.W.; 6. Syd. Smirke, R.A., London, Architect, 79, Grosvenor-street, W.; 7. W. Tite, M.P., F.R.S., London, President of the Royal Society of British Architects, 42, Lowndes-square, S.W.; 8. Trélat, France, Professor to the Conservatory of Arts and Manufactures.

CLASS XI.—MILITARY ENGINEERING, ARMOUR, AND ACCOUTREMENTS, ORDNANCE, AND SMALL ARMS.

SECTION A.—*Clothing and Accoutrements.*—1. Major-General Sir Frederick Abbott, C.B., London, 13, Inverness-terrace, W.; 2. Colonel Joseph Hudson, London, Superintendent of the Royal Military Clothing Establishment, 13, Victoria-street, Pimlico, W.; 3. Moisez, France, Commissary-General; 4. Viscount Ranelagh, London, Col. South Middlesex Volunteers, 7, New Burlington-street, W.; 5. Major Russell, Egypt, 62, Moorgate-street, E.C.; 6. Gen. Paolo Solaroli, Italy, Aide-de-Camp of his Majesty, &c.—SECTION B.—*Tents, Camp Equipage, and Military Engineering.*—1. Treuille de Beaulieu, France, Colonel of Artillery, Director of the Centra Depot of Artillery; 2. General Sir J. Burgoyne, Bart., G.C.B. Chairman, London, Inspector-General of Fortifications, War-office, Pall-mall, S.W.; 3. Captain Douglas Galton, R.E., F.R.S., London, Assistant Inspector-General of Fortifications, 12, Chester-street, Grosvenor-place, S.W.; 4. Major-General Hon. James Lindsay, M.P., London, 25, Portman-square, W.; 5. Colonel Henry Owen, R.E., C.B., Plymouth, Commanding Royal Engineers, Plymouth, 52, Bedford-square, W.C.—SECTION C.—*Arms and Ordnance.* 1. Sir William Armstrong, F.R.S., C.B., London, Superintendent of Royal Gun Factories, Athenæum Club, S.W.; 2. Lieutenant-General Giovanni Cavalli, Italy; 3. General Guiod, France, Commander of the Artillery of the 1st Division; 4. General the Hon. A. Gordon, C.B., F.R.G.S., London, General in Command, Curragh Camp, 7, Argyll-street, W.; 5. Major-General Hay, London, Inspector of Musketry at Hythe, United Service Club, Pall-mall, S.W.; 6. Colonel Messoud Bay, Turkey; 7. Micheels, Belgium, Lieutenant-Colonel of Artillery, Sub-Inspector of the Manufacture of Arms; 8. Nicholas Novitzky, Russia, Colonel of the Russian Imperial Guards, 27, Alfred-place, S.W.; 9. Westley Richards, Birmingham, Rifle-maker, 39, St. James's-place, S.W.; 10. Colonel St. George, C.B., R.A., Woolwich, President Ordnance Select Committee, 11, Rutland-gate, S.W.; 11. Lord Vernon, London, 12, Great Marlborough-street, W.; 19. Weyersberg, Zollverein, Manufacturer, Solingen.

CLASS XII.—NAVAL ARCHITECTURE, INCLUDING SHIPS' TACKLE.

SECTION A.—*Ships for purposes of War and Commerce.*—1. Rear-Admiral Fitzroy, F.R.S., London, Chief of Meteorological Department, Board of Trade, 38, Onslow-square, S.W.; 2. Rear-Admiral P. Lisiansky, Russia, Imperial Russian Navy; 3. Robert Napier, Chairman, Glasgow, Iron-ship Builder, 5, Montague-place, W.C.; 4. Paris, France, Rear-Admiral; 5. J. D. A. Samuda, London, Ship Builder, 7, Gloucester-square, Hyde Park, W.; 6. Isaac Watts, C.B., London, Chief Constructor of the Navy, 8, Horsley-place Villas, Paddington, W.—SECTION B.—*Boats, Barges, and Vessels for Amusement.*—1. Right Hon. Milner Gibson, M.P., London, President of the Board of Trade, 3, Hyde Park-place, W.; 2. Sir W. Snow Harris, F.R.S., Plymouth; 3. Perdonnet, France, Superintendent of Railways, Professor to the Central School of Arts and Manufactures; 4. Rear-Admiral Washington, F.R.S., London, Hydrographer to the Admiralty, 7, Oxford-square, Hyde Park, W.—SECTION C.—*Ships' Tackle and Rigging.*—1. Clapeyron, France, Member of the Institute, Engineer-in-Chief to the Imperial Corps of Mines, Professor to the School of Bridges and Roads; 2. H. D. Cunningham, F.R.G.S., Portsmouth Union Club, Trafalgar-square, W.C.; 3. W. S. Lindsay, M.P., London, Shipowner, 8, Austin Friars, E.C.; 4. Rear-Admiral R. S. Robinson, London, Controller of the Navy, 61, Eaton-place, S.W.

CLAS XIII.—PHILOSOPHICAL INSTRUMENTS AND PROCESSES DEPENDING ON THEIR USE.

1. Sir David Brewster, K.H., F.R.S., Edinburgh, Principal of Edinburgh University; 2. Charles Brooke, F.R.S., London, Surgeon to Westminster Hospital, 16, Fitzroy-square, W.; 3. Dr. Dove, Chairman, Zollverein, Professor of Natural Philosophy and Principal of the Academy of Sciences, Berlin; 4. J. P. Gassiott, F.R.S., London, Wine Merchant, Clapham Common, S.; 5. James Glaisher, F.R.S., London, Superintendent of the Meteorological and Magnetical Department, Greenwich Observatory, 1, Dartmouth-place, Blackheath, S.E.; 6. Colonel Sir H. James, R.E., F.R.S., Southampton, Superintendent of Ordnance Survey; 7. G Karsten, Denmark, Professor, Kiel; 8. Edouard Kraft, Austria, Member of the Council of Civil Engineers, Vienna; 9. Mathieu, France, Member of the Institute, and of the Bureau of Longitude, Examiner at the Polytechnic; 10. Carlo Metteucci, Italy, Senator; 11. Major-General Sabine, R.A., F.R.S., London, President of the Royal Society, 13, Ashley-place, Westminster, S.W.; 12. Wm. Thomson, F.R.S., LL.D., Professor of Natural Philosophy, University of Glasgow; 13. C. Wheatstone, F.R.S., London, Professor of Experimental Philosophy, King's College, 7, Chester-terrace, Regent's Park, N.W.

CLASS XIV.—PHOTOGRAPHY AND PHOTOGRAPHIC APPARATUS.

1. H. W. Diamond, M.D., London, Twickenham-house, Twickenham, S.W.; 2. A. F. J. Claudet, F.R.S., London, Photographer, 11, Gloucester-road, Regent's Park, N.W.; 3. Baron Gros, Chairman, France, Senator; 4. Lord Henry Lennox, M.P., London, 51, Portland-place, W.; 5. C. T. Thompson, London, Official Photographer, Science and Art Department, South Kensington Museum, W.; 6. J. Tyndall, Ph. D., F.R.S., London, Professor of Physics, Royal Institution, Albemarle-street, W.

CLASS XV.—HOROLOGICAL INSTRUMENTS.

1. Dr. Frick, Zollverein, Professor of Physics, Froiburg; 2. Ch. Frodsham, London, Chronometer Maker, 84, Strand, W.C.; 3. Rt. Haswell, London, Watch Tool Maker, 49, Spencer-street, Clerkenwell, E.C.; 4. E. D. Johnson, London, Chronometer Maker, 9, Wilmington-square, W.C.; 5. Laugier, France, Member of the Institute and of the Bureau of Longitudes; 6. Sylvian Mairet, Switzerland, Watchmaker, Löcle; 7. Rear-Admiral Manners, F.R.S.A., 8, Henrietta-street, Cavendish-square, S.W.; 8. Viscount de Villa Maior, Chairman, Portugal, Director-General of the Agricultural Institute, Professor of Chemistry at the Polytechnic of Lisbon, and Member of the Academy of Science, 91, Sloane-street, S.W.; 9. Lord Wrottesley, F.R.S., London, late President of the Royal Society, 1, Albemarle-street, W.

CLASS XVI.—MUSICAL INSTRUMENTS.

1. W. Sterndale Bennett, Mus. D., London, Professor of Music, University of Cambridge, 50, Inverness-terrace, W.; 2. J. R. Black, M.D., United States, 23, Sumner-place, S.W.; 3. Th. Böhm, Zollverein, Court Musician, Munich; 4. Right Hon. Sir George Clerk, F.R.S., Chairman, Edinburgh, Chairman of Royal Academy of Music, 43, Eaton-square, S.W.; 5. Fétis, Belgium, Member of the Department of Fine Art of the Royal Academy of Belgium, Director of the Royal Conservatory of Music; 6. Lissajous, France, Professor of Physics to the Lyceum of St. Louis; 7. Sir F. Gore Ouseley, Bart., Mus. D., Professor of Music, University of Oxford; 8. Ernst Pauer, Austria, Professor of Music, 3, Cranley-place, S.W.; 9. Wm. Pole, Mus. B., F.R.S., London, Professor of Civil Engineering, University of London, 3, Storey's-gate, Westminster, S.W.; 10. Earl of Wilton, G.C.H., London, 7, Grosvenor-square, W.; 11. Henry Wylde, Mus. D., London, Professor at the Royal Academy of Music, 6, Burwood-place, Hyde Park, W.

CLASS XVII.—SURGICAL INSTRUMENTS.

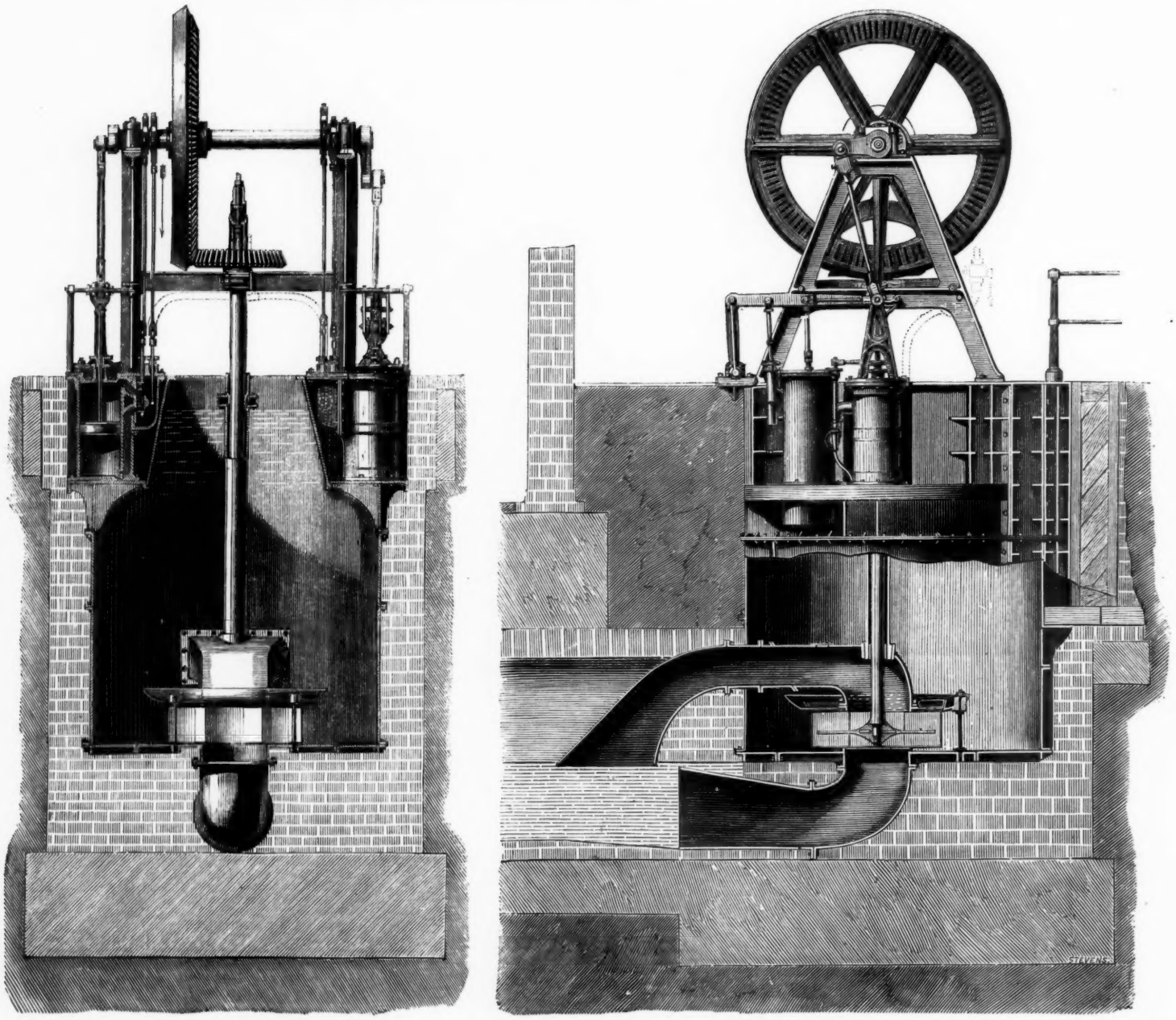
1. Thomas Bell, F.R.S., London, Vice-President of the Royal Society, Athenæum Club, S.W.; 2. Wm. Bowman, F.R.S., London, Surgeon to King's College Hospital, 5, Clifford-street, W.; Arthur Farre, M.D., F.R.S., London, Physician for Diseases of Women and Children to King's College Hospital, 12, Hertford-street, Mayfair, W.; 4. F Seymour Haden, F.R.C.S., London, Surgeon, 62. Sloane-street, S.W.; 5. James Luke, F.R.S., London, Consulting Surgeon, London Hospital, 3, Broad-street-buildings, E.C.; 6. Nélaton, France, Professor to the Faculty of Medicine; 7. James Syme, F.R.S.E., Edinburgh, Chairman, Professor of Clinical Surgery, University of Edinburgh.

CLASS XVII.—COTTON.

1. Henry Ashworth, Bolton, President of the Manchester Chamber of Commerce, Fenton's Hotel, St. James's-street, S.W.; 2. Thos. Bazley, M.P., Chairman, Manchester, Calico Printer, 3a, King-street, St. James's, S.W.; 3. Sir James Campbell, Glasgow, Warehousman; 4. Dolfus, France, Manufacturer; 5. Max, Dormitzer, Austria, President of the Chamber of Commerce, Prague; 6. Duhayon-Brunfaut, Belgium, Manufacturer and Judge of the Chamber of Commerce at Brussels; 7. E. Knapp, Zollverein, Manufacturer, Betzingen; 8. J. Murray, Manchester, Cotton Spinner, 16, Bryanstone-square, W.; 9. E. Loria, Egypt, Merchant, 32, Pelham-street, S.W.; 10. Wetter Müller, Switzerland, Banker, St. Gall; 11. Alex. Scherer, Russia, Member of the Council of Manufactures; 12 Giovanni Vonwiller, Italy.

(To be concluded next week.)

EASTON, AMOS, AND SONS' APPOLD DRAINING MACHINE.

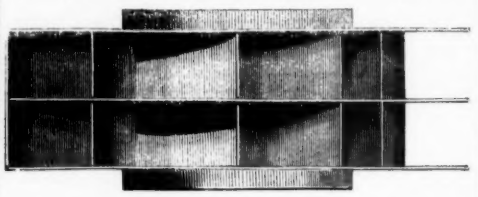


Messrs. Easton, Amos, and Sons, the eminent constructing engineers of The Grove, Southwark, exhibit, in the International Exhibition, a patent Appold pump, or draining machine, with condensing engines attached, and capable of lifting 100 tons of water per minute to a height of 6ft., an effort representing 41 effective horse power. Our illustration represents one of the same class of draining machines, although not the one actually erected in the western annexe. The pump fan, of which we give a horizontal and transverse section, is 4ft. 5in. in diameter, the opening on each side for the inlet of water being about one-half that diameter, or say



2ft. 3in. The pump is driven at a speed of 118 revolutions per minute by a pair of condensing engines of 20in. cylinders and 2ft. stroke, making 50 revolutions per minute, and working steam of 50 lb. pressure cut off at one-fourth stroke. We have no means as yet of testing the ratio of efficiency or useful effect of the pump exhibited, but if the average pressure in the cylinders, and throughout the stroke, is 25lb. per square inch, as we should suppose it must be, the indicated horse power, at the working speed, would be 95, and the useful effect, in lifting 100 tons of water 6ft. high per minute, would be 43 per cent. of the whole power exerted. At the Exhibition of 1851, however, the jurors found that these pumps were capable of giving off as much as 69 per cent., in useful effect, of the power applied.

The great tank employed as a reservoir for the water pumped in the Exhibition contains 24,000 gallons, or rather more than 100 tons of water, which is circulated and employed in condensing the steam



from the engines. At present, however, there is so little steam to be had that the pump is seldom worked, although it was running on the 1st and 3rd instant.

Iron-cased Frigates.—Messrs. Westwood, Baillie, Campbell, and Co., of London Yard, Poplar, have just manufactured five hydraulic armour-plate bending machines, having their patent traversing gear, for H.M. dockyards. These powerful and massive machines (each weighing about 40 tons) are capable of bending and twisting armour plates of 5ft. wide up to 7in. or 8in. thick, and of any length, to any shape required for iron-cased frigates; these operations being performed upon the armour plates while cold, effect a great saving of time, fuel, &c. The fibre of the plate, also, is subject to no deterioration from the action of the heat, which, under the usual method, it would necessarily have to undergo. These machines are also exceedingly useful for effectually bending or straightening keel bars, large shafts, or any similar large pieces of iron while cold.

Railway Engine Drivers' Short Time Movement.—At a meeting at Manchester a notice of which was, through an accident, omitted last week, a number of petitions from Manchester, Salford, Sheffield, Bristol, Leeds, and other places were submitted. The petitioners state that they are frequent travellers by railway, and are deeply interested in the safety and good management of the system of locomotion; that the engine drivers and firemen who have the care and management of locomotive engines on railways are required to perform their labour for a very large number of hours consecutively, and frequently during the hours of the day and night continuously; that the system of thus overtasking the physical powers of engine drivers and firemen is increasing, and is an evil which is not only productive of much injury to them, but is fraught with danger to the public; and that the petitioners are impressed with the conviction that many deplorable catastrophes on railways have resulted from the inability of men, wearied with continuous overwork, adequately to perform their duties. The petitioners, therefore, pray that a bill may be passed into a law by Parliament, for restricting railway companies from entrusting their servants with the care and management of locomotive engines for an unlimited number of hours consecutively, and that such other measures may be adopted for remedying the evil complained of as may seem meet to the House. Petitions from the men themselves, praying for inquiry into their case by Parliament, were also handed in, and several statements were made as to the nature of the evidence which would be laid before a committee of inquiry. Among other things it was stated that in the northern district, starting from Preston, a man would have one day's rest, and then go to work for twenty-four hours continuously. This, it was said, was done to save an engine. Cases of accident, resulting from this long continued labour, were also quoted. The petitions were ordered to be forwarded to Mr. J. M. Cobbett, M.P. for Oldham, who will call the attention of the House of Commons to the subject on an early day.

Steam Cultivation.—Messrs. Coleman, of Chelmsford, have brought out a new steam cultivator for which they claim the merits of economy and simplicity. With respect to the first recommendation, the first cost is about £150 less than the steam ploughs hitherto placed before the public. With respect to the simplicity attained, it may be best to enter a little more into detail. The whole of the round-about ropes which surrounded the field to be operated upon have been got rid of, pulleys and match-blocks have been discarded, and there is simply an engine close under the hedge-row on one side of the field and a light anchor on the other, straight and direct between which the ploughs or cultivators pass, the whole weight of actual work resting on the engine, and the anchor having to bear nothing but the back-draught, which does not take more than about one-horse power. The system is, in fact, one of direct action. The draught ropes lead straight from the winding-drums to the implements without being passed round match-blocks; two implements are used, one of which ploughs or cultivates from the anchor to the centre of the field, when it draws out its shares and returns to its starting point, while the other takes up the work from the centre of the field to the engine. By this arrangement only 200 yards of rope are coiled on each drum in a field 400 yards wide, and the engine is always drawing one implement in full work towards itself, while that out of work runs back on the unbroken ground into a proper position for starting against its full breadth. The throwing of one implement out of work and the other in occupies only an instant. The anchor, being only used to resist the back pull of the empty implement, is very simple and light, and requires to be shifted about every two or three crossings—that is for every 8ft. or 12ft. of land ploughed—and this is easily effected by one man The engine shifts itself. The land is worked to within about 8ft. or 9ft. of the fences on each side of the field, and the headlands are not wider than is required to turn horses at plough. For the working of the whole five men are required—one at the engine, one at the ropes, two at the implements, and one at the anchor; and with this force an 8-horse engine can readily cultivate seven acres per day to the depth of 9in.

Bessemer Metal.—Bessemer iron and steel is now extensively used in Messrs. Platt's cotton machinery. In the Exhibition the same material is employed in the boiler of Messrs. Merryweather's steam fire engine, in Shanks and Co.'s tools, and in a carriage exhibited by Messrs. Bennion and Healey, of Liverpool.

TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

MR. C. S. TWIGG (of Cardiff) *desires to have the address of Mr. Flintoff, gas engineer.*

I. C. D.—*There are a great number of hydrostatic presses in London, every one of which affords an example of the practical working of the "hydrostatic paradox."*

A. W. L.—*There are some hundreds of books which "would give instruction to a young amateur engineer," but you have not informed us what kind of instruction you require.*

R. C. E.—*If, as you say, you are a constant subscriber to* THE ENGINEER, *you will have seen similar questions answered in our correspondent's column within the last few weeks. Please refer to some of the late numbers.*

I. L.—*Consult the Locomotives Act, contained in* THE ENGINEER, *of August 23rd, 1861. The Act does not empower any magistrate, other than the Lord Mayor of London and the Commissioner of the Board of Works, to interdict the running of locomotives, although if they infract the regulations prescribed by the Act, the owners may be summoned and fined. You can procure the cases by sending through a newsagent to the publisher.*

SWINTON.—*The building for the Exhibition of 1851 was 1,848ft. long and 432ft. wide, the area roofed in being about 799,000 square feet. The present building is 1,150ft. long on the south front, the whole space roofed in being 998,000 square feet. The western annexe, included in this space, is 975ft. long, and for 720ft. is 200ft. wide, the remainder being 150ft. wide, its area alone being 4½ acres. The eastern annexe is 775ft. in total length, but having a large open court, has but 96,000 square feet, or 2¼ acres, under cover. The total space covered by the whole building, as given above, is exclusive of galleries.*

A. W.—*We know of no work treating specially upon the wear and tear of rails and rolling stock. The nature of railway traffic at the present time renders the particulars given in Dr. Lardner's* Railway Economy *of little use. The rails on that portion of the Great Northern Railway, between London and Peterborough, lasted rather more than seven years. The same and other companies have since paid £11 10s. a ton for rails made to special specifications and guaranteed for seven years. The best wrought iron rails are worn out in two years on the North London Railway, which has the heaviest traffic of any line in the world. Twenty years is a good lifetime for locomotives.*

CUMBERLAND.—*We cannot, just now, recall the rule for calculating the strength of cast iron single-flanged beams, with the flange at the top. Very few would think of using such beams at all, as they would hardly be reckoned safe, except for light loads. If your beams were laid with the flange downwards the rule would be as follows: the breaking weight applied in the middle would be equal to the product of the area of the bottom flange in square inches multiplied by the whole depth of the beam in inches, and this again by 76, the final product being divided by the length of the beam, in inches, between the supports. Your flanges, 6in. by 1¼in., contain 9 square inches, the depth of the beam is 10¼in., and the length, between supports, 15ft. or 180in. Hence 9 × 10¼in. × 76 = 2,457, which, divided by 180, gives 13·6 tons as the central breaking weight of each beam. The corresponding breaking weight, when equally distributed, would be twice this, or say 27 tons, the whole six beams having an ultimate strength of 152 tons. For a load at rest we should not apply above 50 tons as a safe limit, but with the flange placed the wrong way, as you propose we would not consider the six beams safe under a greater distributed load than 20 tons over the whole.*

CAST IRON ENGINE BEAMS.

(To the Editor of the Engineer.)

SIR,—Will you please inform me where the largest iron beam has been cast in Great Britain, in a flask in 1859.

I cast one for the Tredegar Iron Company, for a blast engine; each side weighed

	Tons.	cwt.	qr.	lb.
	26	1	3	14
Add	26	1	3	14
Total	52	3	3	0

CHARLES JORDAN.

Pillgwenlly Iron Foundry, Newport, Mon., May 12, 1862.

[*We should suppose Mr. Jordan's to be among the heaviest beams cast.—Ed. E.*]

THE STRENGTH OF LOCOMOTIVE CRANKS.

(To the Editor of The Engineer.)

SIR,—Can any of your readers give a formula or data of any kind for finding the breaking force exerted in the following way:—One-half of a locomotive crank with 10½-in. throw (for 21-in. stroke) 6½in. in diameter in the shaft and in the wrist, and having arms each 4½in. thick and 4½in. apart, was subjected—first to a force of 150 tons hydraulic pressure through the centre line of the shaft, which had no perceptible effect; secondly, a force was next applied of 200 tons in the same manner, which closed the arms with a permanent set of ¼in.; thirdly, a force was again applied of 250 tons through the same centre line, which fractured the crank thereon completely through in the wrist. What was the exact pressure in tons at the wrist, and where was the neutral axis of tension and compression? Because it would be tension on one side of the wrist and compression on the other.

I would also like a formula (if any) for any other similar results, with different dimensions, &c., broken in a similar manner. NEMO.

May 5th, 1862.

MEETINGS NEXT WEEK.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, 20th May, at 8 p.m., continuation of the paper on "The Malta and Alexandria Submarine Cable," by H. C. Forde, M. Inst. C.E. And on "The Electrical Tests employed during the Construction of the Malta and Alexandria Telegraph," and on "Insulating and Protecting Submarine Cables," by Mr. C. W. Siemens, M. Inst. C.E.

SOCIETY OF ARTS.—Wednesday, 8 p.m., on "The Republic of Liberia, its Products and Resources," by Gerald Ralston, Consul-General for Liberia.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.—Thursday, 7.30., p.m., on "Steam Boiler Explosions," by Mr. Charles B. King, M.E.

THE ENGINEER *can be had, by order, from any newsagent in town or country, and at the various railway stations; or it can, if preferred, be supplied direct from the office on the following terms:—*

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THE ENGINEER *is registered for transmission abroad.*

Letters relating to the advertisement and publishing department of this paper are to be addressed to the publisher, MR. BERNARD LUXTON; *all other letters and communications to be addressed to the Editor of* THE ENGINEER, *163, Strand, London, W.C.*

THE ENGINEER.

FRIDAY, MAY 16, 1862.

RAILWAY ACCIDENTS.

FROM the papers on railway accidents, lately read by Captain Galton and Mr. Brunlees before the Institution of Civil Engineers, it appears that in the seven years, or 2,557 days, ending the 31st December, 1860, there were 540 accidents upon all the lines of railway in the kingdom. This is at the rate of one accident for rather less than every five days. The proportion of accidents resulting from unascertained causes was 6 per cent. only of the whole, or one such accident every 80 days on the average. But within the last two months and a half we have had a considerable number of railway accidents, happening from unascertained, if not inexplicable, causes. All these have been cases of trains leaving the line while under way and generally at high speed. Very lately a train ran off the North Kent Railway, one or two persons being killed, an additional number injured, and every soul in the train put in mortal terror. A like accident happened at nearly the same time on the Lincolnshire or "loop line" of the Great Northern. A train next left the rails while running at high speed, near Gloucester. Last week an express train ran off the North British line, near Kelso, and at least two passengers were killed, the rest being confronted with all the terrors of a fearful railway catastrophe. The same week a train got off the rails on the Brighton Railway, fortunately without fatal results. And finally we have the particulars of another and fatal disaster of the same class, on the London Chatham and Dover Railway. In none of these cases, so far as we have learned, has the real cause of the train going off the line been ascertained. It has been supposed in each instance that, in consequence of continued rains, the line had become disturbed—being probably thrown out of gauge, and in the case of the North Kent accident the coroner's jury expressed an opinion, in their verdict, that greater care should be given to the sleepers and treenails. The imperfection of the line, at least a palpable and conspicuous imperfection, sufficient to arrest the attention of a coroner's jury, was only conjectural, however. If we look at the subject for a moment we cannot suppose that the managers or servants of any railway company would wilfully allow any portion of their line to remain for a moment in an imperfect condition, and we must presume, therefore, that whatever imperfection there were, beyond that common to all railways, must have been such as to elude ordinary observation. That there is no improbability in this presumption is apparent from the history of a number of other railway accidents. Thus it never came out why the train in which Dr. Baly was killed ran off the South-Western line at Wimbledon, nor could a coroner's jury exactly ascertain, last July, what it was that caused a North Staffordshire train to plunge off the rails between Burton and Tutbury. It is certainly calculated to arouse uncomfortable feelings in the mind of every one who travels on a railway that, without any visible and, as railway men insist, without any preventible cause, passenger trains will suddenly burst the gauge or mount the rails to leap headlong down an embankment. And yet the startling fact remains, all unaccounted for.

Mr. Bidder has said that none of our lines are safe at speeds above 30 miles an hour, and Mr. George Robert Stephenson not long ago put forth a pamphlet in which he took ground against high speeds as being both extravagant and dangerous. As all or nearly all of the accidents we have just noticed occurred to trains running at comparatively high speeds, Messrs. Bidder and Stephenson would appear to have abundant facts on their side. Had they declared that it was unsafe to work ordinary railway traffic over imperfectly-constructed lines, none would have disputed them. And yet this is all that the accidents we have been considering really prove, and thus, without any perversion of the opinions of the eminent engineers in question, we may construe their declarations as authoritative as to the imperfections of our present railway construction. For it is sufficiently manifest that it cannot be mere speed, *per se*, but the obstructions to speed which are dangerous. We can still run down to Bristol in two hours and a half, and, on the broad gauge, accidents (at least from running off the line) are, happily, almost out of the question. Her Majesty travels between Osborne and Balmoral—the double journey being upwards of 1,400 miles in length—by a quick train, nowhere restricted to Mr. Bidder's limit of safety. But the nearly two and a half millions of yards of line over which the royal train takes its way, down and back, are subject to extra inspection and repair before the signal is given to start. And whenever we hear of a railway accident from an unascertained cause we may be quite sure, however the wreck of timbers and the crash of wheels may disguise it, that the running gear or the line was faulty in some vital part. No perfect train, perfectly managed, can run off a perfect line—presuming only that such things can be. If, as happens so frequently just now, the defect which leads to disaster cannot be exactly discovered, it may be suspected, with much confidence, in the line itself. Let us suppose that, after a succession of rains, or after a frost sets in or breaks up, any of our lines were levelled and gauged, at intervals of one yard, for 50 or 100 miles. Will it not be supposed that an enormous aggregate of untruth would be disclosed? The result, we are sure, would startle such of our unpractised engineers as are accustomed to suppose that the surfaces of railway bars, *in situ*, are continuous mathematical planes, and that the invariable width of the narrow gauge is 4ft. 8½in. Attention would no doubt be directed to those vegetable fastenings the "treenails," of which there are upwards of 125,000,000 in the railways of the kingdom, exclusive of the substantial iron fastenings on the broad gauge. Upon every one of these 125,000,000 perishable pegs, a certain measure of safety depends. Liable as they are to rot, and, at the very least, to bend, chafe, and work loose, we cannot wonder at the suspicion which coroner's verdicts so frequently cast upon them, nor at the recommendation of some of our very best engineers that they be cast aside altogether and iron spikes substituted in their places. Even in America, notorious for railway accidents, there are no lines in which the rails are fastened down with wooden pegs, iron spikes being always employed—at least four to every sleeper. Many of our sleepers, too, of unseasoned fir, are hardly better than if baked in clay, the chairs sinking bodily into them half way through their thickness, with a proportionate license for lateral aberration. Could we have a commission of practical men, into whose eyes, open to every detail of defective construction, no official dust could penetrate, we believe we should soon hear the doom of "treenails" and unsound sleepers. The South Eastern Railway Company, we understand, have already commenced the substitution of iron spikes for the wooden fastenings heretofore used on their line, and we have hopes that the example will be adopted by other companies, believing as we do that many accidents traceable to no other source may be safely set down against "treenails."

ORDNANCE IN THE EXHIBITION.

OUR progress, since 1851 in the construction of ordnance, is pretty fully illustrated in the Exhibition, which contains examples of Armstrong, Whitworth, Blakely, Lancaster, Krupp, Bessemer, Mersey and other cannon. Eleven years ago, when the minds of men were more or less occupied with thoughts of universal peace, ordnance neither deserved nor obtained any large share of popular notice. Now it is otherwise, and it is doubtful if the polished coils from Woolwich and the death dealing machinery in the same line, exhibited by private makers, do not engross more attention than is directed to all the mechanism in the famous western annexe. The idea can hardly be dislodged from the popular mind that great discoveries in gunnery and the construction of guns have been made within the last few years, and it is not, therefore, needless for us to say that no discovery, in the proper sense of the word, has been made, unless the production of guns in steel by Krupp and Bessemer be a discovery. As for wrought iron guns, breech-loading guns, and rifled guns, they are not merely old but mediæval. Let us consult, for a moment, Commander Scott, R.N., one of the best authorities on the subject of ordnance. In a lecture delivered, last January, before the United Service Institution, he said:—

"It may cause surprise to hear how early rifled guns were used. In the arsenal of St. Petersburg is a gun 2¾in. in diameter, and 62in. in length of bore, which was rifled in nine grooves in 1615. This gun is a breech-loader, and there are several wall pieces and rifled muskets in the French and other museums, which were grooved about this date on plans that have been lately revived. In 1661 the Prussians experimented at Berlin with a gun rifled in thirteen shallow grooves. In 1694 Nuremburg had a gun forged and rifled, which was tested on several occasions. In 1696 the elliptical bore was known and had been tried in various parts of Germany. In 1745, the date at which Robins was experimenting in England, the Swiss already possessed small rifled pieces. In 1746, Munich had a rifled breech-loader made, and T. Senner was engaged in rifling various guns. In 1816 Reichenbach rifled a bronze gun with seven grooves. This piece is still in possession of the family in Bavaria, and has been fired with pointed leaden balls. In 1816 to 1819 M. Ponchara, a distinguished French artillery officer, was making various experiments with an old gun which he had rifled with thirteen grooves.

"In 1833 Montigny of Brussels invented a breech-loading rifled piece, and the Belgian government had a gun made on the plan. The arrangement of the breech apparatus was simplified in 1835 In 1836 the late Emperor of Russia, Nicolas, sent for the inventor, and ordered breech-loading guns of 18 and 24-lb. calibres to be made and rifled on Montigny's plan. 1,800 rounds had been previously completed in his presence from a 12-pounder. When these guns were prepared 262 shots were fired in one day from the 18-pounder 110 shots continuously on successive days from both the 18 and 24-pounders. Neither wad nor grease was used, but the commission presided over by General Samarakoff rejected the plan. After this, Montigny, the son of the former, went to England, but his applications for an extended trial were unsuccessful. In 1845 Major Cavalli, a Sardinian officer, commenced his experiments on rifling, and these seem to have inspired Wahrendorf with a similar aim. Cavalli used a copper ring for closing the breech joint, and he also tried a copper tube in the breech of his gun, which was rifled with two grooves for a plain iron shot. In 1846 the Swedish Baron Wahrendorf, before mentioned, affixed lead to the side of elongated projectiles mechanically, and used a gun rifled with shallow flat grooves. In 1847 Major Cavalli rifled an 8-in. gun, and attained good results, until the copper breech-ring was blown out. The breech of the gun subsequently gave way, just as happened in his later experiments in England. In 1851 Wahrendorf's plan of coating the shot with lead was tried at Berlin with a 12-pounder rifled in six grooves, and a slow twist. The shells for this experiment were cast with two long and four short projections or studs, over which the lead coating was run. Wahrendorf also rifled guns with two grooves, on a plan similar to that of Cavalli, but the lead-coating, his own peculiar plan, was preferred by the Prussians. In Sweden, however, Wahrendorf's own country, the officers generally were opposed to the lead-coated or forced-ball system (so called from the projectile's outer surface of lead being larger than the bore, which necessitated sliding at the breech), and a lieutenant in the Swedish navy named Engstrem, affixed hard wood bearings or buttons to an iron projectile. This plan was tried against Wahrendorf's lead-coating system, but nothing transpired as to which had the advantage until, in the Annals of the Swedish Academy of Sciences, which were published in 1859, the preference was accorded to the Engstrem system. Both plans were afterwards tested in France in 1857 by order of the Emperor Napoleon, but neither seems to have been considered as a great success.

"In 1856 General Timmerhans, of the Belgian Artillery, invented a wad which, by taking the rifle grooves, gave rotation to elongated shot. His guns were rifled with two, four, and six grooves, with one turn in 18ft., but the results were not sufficiently good to cause an adoption of the plan. Indeed every system that has been tried, which does not give rotation to the balls from grooves in the bore, has failed in such manner as to show the impracticability of beneficially applying any other arrangement than that of rifling both gun an projectile. Not only plans of rifling, but also systems of breech-loading, have been continually brought forward, which have been sometimes identical with, and at others trifling modifications from, those of more ancient date; and it is also a fact that nearly every modern plan of grooving was used at least 250 years ago in muskets which seem to have been fired with round leaden balls. These necessarily gave little accuracy, and hence rifling did not supplant the smooth-bore for muskets until an elongated ball was used, and it has not yet caused the smooth-bore great gun to be set aside. It should however be remembered that the mechanical fit was unknown in the early age of rifling, and it has been reserved to Mr. Whitworth to be the pioneer in the path of shaping the shot so accurately as to centre itself in a grooved gun. M. Cavali certainly made very good practice with an iron shot, but this was from its tight fitting which necessarily, like Wahrendorf's plan, required a breech-loader; but it was not until the precision of Mr. Whitworth's guns became known, that great accuracy from muzzle-loaders was regarded as even possible.

"The first breech-loading gun upon record was used by the English (and on this account I mention it) in 1428 at the siege of Orleans, but whether made in England or not is uncertain. France very early made breech-loaders, and her museums, as well as those of Strasbourg and Bavaria, contain breech-loaders of very early date, and in England there is also a large collection of foreign guns. Passing over, however, the breech-loaders of former years, it may be remarked that, in later days, not even the experiments of the elder Montigny, successful as they were, nor the later improvements of his son, succeeded in bringing breech-loading into general use; but, in 1842, Wahrendorf brought forward a plan which for simplicity and strength is still unrivalled. It consists of a round bolt passing through and across the breech, and supporting a valve from which a handle extends to the rear of the gun. When the gun is to be loaded the bolt is withdrawn, and the valve pulled out by its stem or handle; and when this operation is completed, the valve is pushed in, and the bolt shot across behind it; and they are then set tightly together by the turn of a screw upon the

handle, which projects out of the rear of the gun. The effect of the discharge is to push the valve more tightly against the bolt, and the greater the force of the explosion, the more is the valve itself extended. Even should an escape of gas occur, which is unlikely, no great damage can be done; but, in all the experiments, the valve, from being on the principle of the steam piston, seems to have perfectly closed the breach. The gun of 1812 was designed for firing round shot which were covered with lead so as to close the windage. The plan was tried at Shoeburyness, and on board the Excellent, but the results came far short of the inventor's expectations. Indeed, cutting off the windage entirely, from which such great results were formerly expected, is now found to be a disadvantage. Wahrendorf subsequently introduced an oblong instead of a rounded bolt for the breech apparatus of his rifled guns, and one of these is now under trial by the Ordnance Select Committee—the Service plan of closing the breech by a screw-stopper, and the later plan of effecting the same object by a pair of wedges, having proved equally unsatisfactory.

"Cavalli's plan of breech-loading is very similar to that of Wahrendorf, but the apparatus is less simple; there were several of his rifled guns at the siege of Gaëta, but so many accidents happened with them in the trenches that, on the bursting of a pivot-gun, which reduced the gun-boat to a wreck, the Sardinians, or rather the Italians, following the example of the French and Americans, abandoned the breech-loading, and are now only making muzzle-loading guns. Thus while, after more than four centuries of trial, other nations are giving up the movable breech because it does not unite perfect closing of the breech with the solidity essential for heavy guns, we are still going from plan to plan in the hope of effecting what will, even if successful in closing the breech, be scarcely safe with the heavy charges necessary to give the high velocity of projectile which is requisite for smashing armour plates. But I must here go back a step to mention one Treuille de Beaulieu, whose researches, following his previous experience of warfare, have so much influenced the rifling of the guns of European nations, and to whom France owes her present system. Long had he to struggle against opposition, and to bear the contemptuous treatment of his proposals by committees.

"In the case of the elder Montigny we have already seen that, although the Emperor Nicholas invited him to St. Petersburg, and the results were most satisfactory, the committee of the Russian Artillery, after putting all kinds of obstacles in his way, obliged the unfortunate inventor to discontinue his labours in their country; and, but for this jealousy, so unfortunate for the Russians, they might have met us at Sebastopol with rifled guns."

We have thought it best thus to show, at some length, what had been done in respect of breech-loading rifled ordnance prior to the advent of those examples upon which, for the last three years, so much attention has been directed. When Mr., now Sir William, Armstrong first turned his attention to guns it was as a mechanical engineer, and it was the same with Mr. Whitworth. Whatever those gentlemen have accomplished has been in the way of improved construction only. If there be any invention in the Armstrong gun it is the invention of Captain Blakely, or, to go further back, of Professor Treadwell, of the United States, or even, perhaps, that of Mr. Peter Rothwell Jackson, of Salford. Captain Blakely proposed, and, luckily, patented the use of coils shrunk successively upon an inner tube of cast iron, brass, or steel, as early as 1855, or two years before the then Mr. Armstrong had taken up the plan. In the United States, however, Professor Daniel Treadwell not only made cannon nearly twenty years ago, with welded coils shrunk successively upon an inner tube, in some cases of wrought iron and in others of steel, but he published a pamphlet on the subject, one which, dated 1845, is still in existence, and in the hands of military men in London. But on the 6th November, 1834, Mr. Jackson, of Salford, patented a mode of constructing cylinders for hydraulic presses by successively shrinking wrought iron or steel hoops upon a thin cast iron cylinder. Mr. Jackson in the same year made a press the cast iron portion of which was 19½in. bore and ⅞in. thick, and successively shrunk on three series of wrought iron hoops, each 2in. in thickness, thus making the walls of the cylinder 6⅞in. in total thickness. This press has been in use ever since, and Mr. Jackson has informed us that it will bear a strain of 10 tons per square inch, or 3,000 tons in all. The hoops are not coils, it is true, but plain rings, and it is only in this respect that the mode of construction differs from that of Captain Blakely, whose patent completely forestals the Armstrong system, except only in the injudicious practice, pursued at Woolwich and Elswick, of making the inner tube of wrought iron instead of steel. Mr. Jackson was anxious, twenty-eight years ago, to apply his system to the construction of heavy guns, but his friend, the late Mr. J. G. Bodmer, who had met with no success in introducing his own plans to the notice of Government, dissuaded him from the attempt.

With these facts, therefore, we cannot magnify our present class of rifled ordnance into anything like a great or recent invention. The Armstrong and Whitworth guns in the Exhibition are remarkable chiefly for the excellence of their workmanship, and to this is due the great range and precision which they have attained. They are at the same time costly, and, in some important respects, faulty in construction. This, although perhaps sufficiently known to our readers already, will be shown presently.

The Armstrong guns are exhibited both by the Secretary of State for War and by the Elswick Ordnance Company. A 7in. breech-loading gun, mounted on a carriage, stands in the nave. According to common rating this would be a 42-pounder, as its bore would receive a 42 lb. round shot. Inasmuch, however, as an elongated shot, weighing 110 lb., is used, it is rated as a 110-pounder, just as the 10½in. smooth bore, which was lately tried at Shoeburyness, is rated as a 300-pounder, although, up to the time a flaw was discovered in its bore, it had not been rifled, and had never fired a shot heavier than 156 lb. The 7-in. guns are now generally made to weigh 85 cwt., and we presume that exhibited is of this weight, the original 7-in Armstrong gun, weighing 70 cwt., having been found too light. The charge with 110 lb. solid shot is 14 lb. of powder, or one-eighth the weight of the projectile. With 81 lb. shells the charge is 12 lb. of powder. The gun is made wholly of wrought iron, and the coils, Sir William Armstrong has stated, are not shrunk upon each other with any calculated strain, as recommended by Captain Blakely, but are simply shrunk very tightly one upon another. The bore of the gun is rifled with a great number—about 40 we believe—fine grooves, the direction of which is transverse to the grain of the iron in the coils. That the material, under such circumstances, can withstand the severe discipline of the lead-coated shot, which is stripped from end to end in an exceedingly small fraction of a second, is most improbable and it is the fact that, after a considerable number of discharges, the bore of the larger guns becomes so far damaged as to require the removal of the inner coil and its substitution by a new one. In any case, too, wrought iron is, from its softness, unsuited to the tremendous concussion exerted in the explosion of the charge of powder.

Under the gallery is also exhibited a smaller breech-loading gun, rated as a 70-pounder, and so stained by acid as to bring out the grain of the iron visibly to the eye. This gun has the openings for the vent-piece or breech piece at the sides, a plan which has already resulted in several accidents on board ship and elsewhere. The breech pieces, when made of hard steel, were being constantly broken to pieces, but instead of making them of mild steel they are now made of wrought iron, and, being still found treacherous, the opening for them is sometimes made in the upper side of the gun, so that when, as is frequently the case, they blow out of the gun, they may have a better chance of clearing the gunners and ships' crew. In the present gun, it is to be noted, the breech is closed by a wedge instead of a screw, the wedge pressing against a breech-piece or stopper, upon the face of which, and projecting a little into the bore, is a piece of thin iron or tin plate formed like the cup leather of a hydraulic press. This cup is to prevent, as much as possible, the escape of gas at the breech when the gun is fired. A similar cup, made of cardboard, has been used by the Prussians for breech-loading guns, and answered tolerably well with light charges. It will be understood that a fresh cup is applied to the face of the stopper every time the piece is loaded, as, whether the escape of gas is prevented or not, the cup is blown to pieces by the force of the explosion.

Near by is another Armstrong gun of the same diameter of bore as the last noticed, but which is a muzzle loader not yet rifled. It is about equal in bore to a 32-pounder, and, when rifled, is expected to throw a 70 lb. elongated shot. Sir William's plan of rifling muzzle-loading guns is called by him the "shunt system," and may be described as follows:—The gun has three grooves, and the projectile has three raised ribs cast upon its sides. In addition to the usual twist of the grooves, that edge which, as the shot goes in, is the driving edge, is curved for a short distance, and about half way down the gun, in a direction contrary to that of the twist, the groove being thence continued to the breech with the same pitch as at the muzzle. Thus, in going in, the "spin" of the shot is twice changed, say from left to right and from right to left. The opposite edge of the groove, or that edge which directs the shot in coming out, has an uninterrupted twist all the way, and thus the groove, although its edges are parallel throughout except at the short curve already mentioned, is wider on the muzzle side of that curve than on the breech side. But at less than 2ft. from the muzzle a narrow inclined surface rises from the bottom of the groove, and in a few inches attains such a height as to be nearly flush with the bore of the gun. Let us now look at the projectile. The raised ledges cast on its sides do not reach quite to the bottom of the grooves, but upon one side of each ledge there is fixed a strip of zinc projecting slightly beyond the ledge itself. As the projectile goes into the gun, the twist of the groove carries it at first, we will say, to the left. The short curve in one edge of the groove next gives the shot a sudden movement to the right, shifting or "shunting" it to a new position in the bore. The shot finally reaches the bottom or breech of the gun, by the groove, being again turned, in its descent, to the left. In coming out the shot spins continuously to the left, the curved edge of the groove being no longer the guiding edge, but as it approaches the muzzle the zinc ribs of the shot wedge themselves upon the inclined surfaces already described, and upon these depend the centreing of the shot and the prevention of any vibration as it leaves the muzzle, these conditions being essential to accuracy of flight. Such, with some length of description, is the "shunting" system of rifling, and it is this which constitutes a muzzle-loading gun, thus rifled, a veritable "shunt" gun.

In the gun trophy erected on the south side of the nave are a few Armstrongs rated as 9 and 12-pounders, the latter of 3in. bore, 7ft. 6in. long, and weighing 8 cwt. 2 qr. 11 lb. The bore is 6ft. 3in., or 25 calibres long, and there are 38 grooves with a twist of one in 9ft. 6in., which is about half as quick as the twist of the Whitworth 12-pounder of 2¾in. hexagonal bore. The Armstrong grooves are deep in proportion to their width, their driving sides are rectangular and radial, and the opposite sides rounded. In the chamber at the bottom of the grooves the bore is enlarged ⅛in. so as to wedge the shot. Mr. Anderson, the superintendent of the Royal Gun Factory, has attached cards to the 12-pounders, stating that one had been fired 391 rounds, with charges finally increased to 3 lb. of powder and 120 lb. of shots, the bore and rifling still remaining uninjured. The ordinary charge of powder is 1¼ lb., or one-eighth the weight of the projectile. Another 12-pounder had withstood 87 proof rounds without injury. With well trained men it is said that these guns (the 12-pounders) can be fired once in 24 seconds with such accuracy as to hit a target at 1,200 yards. Without taking aim the gun may be fired with much greater rapidity.

It would be interesting to have an authenticated statement, not only of the rapidity with which these guns can be trained and fired, but of the greatest number of continuous discharges when the gun is worked at its most rapid rate of firing. No such statement has yet appeared, so far as we are aware.

It is to be regretted that Mr. Whitworth did not send an example of his 12-pounder breech-loader, as it was with a gun of this description that, in an official trial on the 2nd of April, 1861, results very much superior to those afforded by the same class of Armstrong gun were obtained. As we have noticed the construction of the 12-pounder Armstrong, it is as well to give its maximum performance; and, as this was obtained in a trial with the Whitworth gun, the practice with both may properly be given together.

According to the report of the Ordnance Select Committee, the trials took place April 2nd, 1861, the following being the data and results:—

Armstrong breech-loading 12-*pounder. No.* 6, *weight* 8 *cwt.* 2 *qr.* 11 *lb., length* 7*ft.* 6*in.*

No. of rounds.	Charge lb.	Elevation, deg.	Mean range, yards.	Mean observed deflection, yds	Mean time of flight.
Five	1½	2	1,130	4	3·4 sec.
Five	1½	2	1,256	5	3·6 ,,
Five	1½	5	2,146	9	6·3 ,,
Five	1½	5	2,358	11	7·3 ,,
Five	1½	10	3,568	12	9·8 ,,
Five	1½	10	3,908	17	12·9 ,,

Whitworth breech-loading 12-*pounder. No.* 1, *weight* 9 *cwt.* 3 *qr., length* 8*ft.* 8*in., hexagonal bore rifled to make one turn in* 4*ft.* 7*in.*

No. of rounds.	Charge lb.	Elevation, deg.	Mean range, yards.	Mean observed deflection, yds.	Mean time of flight.
Five	1½	2	1,198	1½	3·5 sec.
Five	1½	2	1,289	1⅝	3 4 ,,
Five	1½	5	2,367	1½	6·9 ,,
Five	1½	5	2,471	1⅝	7 0 ,,
Five	1½	10	4,222	3	10·2 ,,
Five	1½	10	4,339	6¾	13·1 ,,

It will thus be seen that Mr. Whitworth's gun gave the best results. This was due to the mechanical fit of his projectiles to the bore of his gun, no forcing or stripping of a lead-coated shot, like Armstrong's, being involved.

The Elswick Ordnance Company exhibit a 40-pounder 32½ cwt. Armstrong gun on a naval slide, the ranges of which, as given by the official tables of ranges, are as follows:—Shot weighing 41 lb. 3 oz., charge of powder 5 lb. Range at 2 deg. 1,040 yards, time of flight 3·2 sec.; at 5 deg. 2,130 yards, time of flight 6·6 sec.; at 10 deg. 3,800 yards, time of flight 12·8 sec.

The display of coils, tubes, &c., illustrating the construction of the Armstrong gun, is very full and interesting. Two large cylinders are exhibited, each coiled from a square bar 100ft. long, and afterwards welded, turned, bored, and squared up. In the gun trophy are a number of coils as laid up by the coiling machine, and before welding. Others are shown welded, but in the rough. Other tubes are shown in the rough, but comprising two or more coils, each first welded separately and afterwards welded together, end to end. Other tubes are shown, made as described, and afterwards turned and bored for their whole length. A wrought iron shaving is shown, just as it came from the gun lathe, 430ft. long as it came off in the coil, its calculated length, if unwound, being 1,462ft. On a printed card suspended below, Mr. John Anderson triumphantly asks if there is a longer shaving in existence. A case of beautifully finished gauges, as used in the construction of the Armstrong gun, is exhibited, as are also a lot of boring bars and rifling tools which, although they have actually been in use for a considerable length of time, present an appearance surpassing that of burnished silver. The original rifling tools, some with four and some with eight cutters, are shown, as is also a new rifling tool by Mr. Anderson, which cuts the whole number of grooves (say forty) in a gun at one operation. A rifle tube, showing the extraordinary powers of the rifling tool, is also exhibited, as is a longitudinal section of one of the large coils, to show how soundly it has been welded. In ordinary practice these tubes are not likely to be turned out as sound as shown, and many of the Armstrong guns have already started in the coils.

The Whitworth Rifle and Ordnance Company, of Sackville-street, Manchester, exhibit a handsome 1-pounder muzzle-loading rifled cannon, mounted on carriage; a 6-pounder muzzle-loading rifled cannon also mounted; a 6-pounder breech-loading rifled cannon without carriage; a 12-pounder brass rifled field-piece; a 32-pounder and a 70-pounder rifled ship's cannon. All these guns have bores hexagonal in cross section, the projectiles being planed to correspond. The pitch of the rifling is, in all cases, 20 diameters of the bore. Mr. Whitworth, we believe, employs mild steel, or "homogeneous metal," for the inner tubes of his larger guns, those of smaller bore being made wholly of "homogeneous iron," so called. In making his larger guns Mr. Whitworth takes a tube of this material, and turns it so as to have an external taper of about an inch. Upon this a series of hoops of fibrous iron, as employed by Mr. P. R. Jackson, are forced on cold by hydrostatic pressure. Each hoop is about 20in. long on the gun. All the hoops are put on with the greatest amount of pressure they will bear without injury. A second series of hoops, breaking joint with the first, is forced on over them, and thus the larger guns are made up. For the hoops next the breech Mr. Whitworth has sometimes used puddled steel. It is Mr. Whitworth's opinion, frequently declared, that large guns may be made wholly of "homogeneous metal," a material which is practically identical in everything, except cheapness, with the mild steel we have so long advocated for guns.

The standard charges of powder in the Whitworth guns are generally one-sixth the weight of the projectile, the Armstrong charges being only one-eighth of the weight of the shot. The average ranges obtained with the Whitworth 12-pounder at 2, 5, and 10 deg. of elevation, have been already given. With a 12 lb. shot, and 1¾lb. of powder, the average range, at 20 deg. elevation, is 7,000 yards, and at 35 deg., 10,000 yards, or nearly six statute miles. Mr. Whitworth also exhibits one of the flat fronted projectiles which were fired through the armour plates and side of the Trusty during official trials at the Nore. Besides these are hexagonal shot and shell, ranging from 1 lb. to 70 lb. weight.

The largest gun in the Exhibition is that made by the Mersey Iron and Steel Company, of Liverpool, and named the Prince Alfred. This is a wrought iron, muzzle-loading rifled gun, forged hollow by a process patented six years ago by Mr. William Clay. The gun is 12ft. long, 35in. in diameter at the breech, 18in. at the muzzle, 10½in. bore, and weighs 10 tons. The rifling consists of twelve shallow grooves, making one turn in 30ft. Before being rifled it was fired with a 140 lb. ball, and 30 lb. powder, against a target of 4½in. iron plates, backed with timber and sand. The plate was indented 6in., but not actually penetrated

and is exhibited along with the gun, as is also (or was for a short time) the 4½in. plate, shattered in 1856 by the 13in. Mersey gun, firing a 280 lb. shot. The Mersey Company also exhibit Col. Clay's 12-pounder breech-loading rifled gun, of 3in. bore, with 15 shallow grooves. This piece, it is stated, has been fired 19 times a minute, with a great escape of gas, we do not doubt, at the breech, which is not such as is likely to give a good fit.

The next largest gun is that of Herr Krupp's, of 9in. bore, and weighing 9 tons, a single mass of cast steel, and by far the largest gun of that material ever made. It is, however, hardly more than a steel forging, bored and rough-turned, for, although open at both ends, no breech-loading arrangement is shown, nor has the bore been rifled. Herr Krupp also exhibits a 100-pounder, a 68-pounder, a 40-pounder, a 25-pounder, and a 25-pounder steel gun, each in the same stage of finish as the 9in. gun. He also sends a 4-pounder muzzle-loading rifled cast steel gun.

Captain Blakely exhibits a 200-pounder cast iron gun, strengthened on his principle, and weighing 7 tons. It is a muzzle-loading gun, with an 8½in. bore, rifled with three grooves on Commander Scott's "centrical system." The makers of the gun are Messrs. Fawcett, Preston, and Company, of Liverpool. The gun is hardly as well strengthened as we should suppose Captain Blakely would have it, if called to a contest with the heavy Armstrong gun, yet there can be no doubt that the wrought iron coiled jacket extending from the trunnions to the base ring affords great additional strength, shrunk on as it is with a considerable degree of tension. Captain Blakely's system, besides its imitation by Sir William Armstrong, has been adopted by the Spanish, and to some extent by the French Governments. The Confederates have also purchased many Blakely guns, and the Federals have employed the same plan for strengthening cast iron guns, which, thus jacketted, are known as "Parrott guns," from the name of the maker, Mr. R. P. Parrott, of West Point. Captain Blakely also exhibits a 9-pounder cast steel gun with 8 grooves.

Mr. Lancaster exhibits an oval-bore cast iron gun of the 95 cwt. class, doubtless a 68-pounder originally. It is stated to have fired 604 rounds at angles of above 12 deg. of elevation. A smaller oval-bore gun is exhibited with it. The initial velocity of the shot from the large Lancaster guns, where the charge is one-fourth the weight of the projectile, is given as 1,650ft. per second.

Commander Scott, R.N., exhibits the muzzle of a 32-pounder, as rifled on his centrical system.

Mr. P. M. Parsons, of Arthur-street East, exhibits a wrought iron gun with a novel arrangement for loading at the breech.

Mr. Bessemer exhibits a 24-pounder gun in the rough, and another of the same rate in the finished state. That in the rough is a solid forging of Bessemer steel, forged from an ingot 18in. square and weighing 28 cwt. Both are examples, on a small scale, of the ordnance which we have so long advocated as the cheapest and strongest for the purposes of modern warfare. The material may be produced actually at a less cost than wrought iron in the same shape, while the former has nearly double the strength of the best Lowmoor iron, and, being completely fusible, may be obtained in perfect soundness and homogeneity. It is to be regretted that Mr. Bessemer has not yet found it convenient to give a demonstration, on the largest scale, of the capabilities of his material for ordnance, but the time when it will be conclusively tested cannot be far distant. He exhibits some improved projectiles, which we have noticed on former occasions.

Altogether the Exhibition is particularly full in respect of ordnance, the examples shown illustrating a wonderful improvement in construction, or, more strictly, in workmanship, over any known eleven years ago.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

KRUPP'S CAST STEEL IN THE EXHIBITION.

SIR,—In your publication of June 22nd, 1860, and some subsequent numbers, a slight discussion took place between Mr. Mushet and myself respecting Mr. Krupp's capability of casting sound ingots, which Mr. Mushet, in his usual manner, asserted was not possible. In my letter of 3rd July, 1860, I stated that the Exhibition of 1862 would perhaps place this contested point at rest, and without fear of the result upon my part the subject was dropped. I should not have opened the question again, but that, as the point was discussed in public, I would wish, through your valuable paper, just to call attention to the complete denial given to Mr. Mushet (notwithstanding his inappropriate allusion to the "Czar," and his boast of perfect acquaintance with all transpiring at Mr. Krupp's works), by the large ingot exhibited by Mr. Krupp. It is 44in. in diameter, and weighed, before breaking, 21 tons. This ingot is broken in half, and presents a fracture perfectly free from those honeycombs which Mr. Mushet so confidently asserted could not be avoided.

In my letter I stated 20,000 lb. as the weight of ingot up to which Mr. Krupp could cast sound, but, in the specimen at the Exhibition, each half of the fracture is of that weight. There are other fractures also, clearly demonstrating that my assertion was correct, and that Mr. Mushet knew nothing of the subject that he was writing upon, viz., Mr. Krupp's metal being of a spongy character in the cast state.

It is unnecessary to discuss the other topics referred to, as it is more to the point to let facts stand for themselves than to fill your paper and weary your readers with a quantity of theoretical matter of not the slightest utility unless put into practice.

9, Chepstow-place, Camberwell New-road, ALFRED LONGSDON.
May 14th, 1862.

THE 10½-IN. GUN.

SIR,—In last week's ENGINEER there was a letter from Captain T. A. Blakely respecting the 10½-in.—so called—Armstrong gun. It appears to me, if I understand his letter, that both he and Sir William Armstrong are making use of a method of constructing guns similar, if not identical, with plans I submitted to the Admiralty in June, 1854. These were as follows:—

I commenced with a tube of steel, brass, cast iron, or wrought iron to form the breech and chase of the gun. I proposed then to turn the outside of this true. I took another tube of wrought iron and turned the inside bore true, but so much less than the diameter of the chase tube that, when made sufficiently hot, its expansion would enable it to be hammered or pressed by other means over the foundation tube or chase. When these became cool I went through the same process again of turning true the outside of the gun and the inside of another tube, and expanding it by heat. This same process went on until the gun was built up of sufficient thickness, when it would be turned to the gun shape required. If the gun was made longer than the tubes used, I made the tubes break joint where required. I sent these plans to be used for the making of guns of large size, and suggested the use of gunboats, and sent plans of them, each gunboat to carry one of these guns only, for the purpose of battering the fortifications in the Baltic, and I have not the slightest doubt, if my plans had been carried out at that time, they would have accomplished their purpose. My aim was to concentrate the power and destructive force of a number of guns in one for battering purposes. Although these plans were sent to the Admiralty for the purpose of making very large guns, still any one could see their applicability in the construction of smaller weapons, where the difference of expense to a cast iron gun was no object. If the method I have described is identical with the method employed by the Admiralty, Sir W. Armstrong, and Captain Blakely, I think I have some right to claim them as my own plans, submitted to the Admiralty at an early period of the Crimean war. JAMES JONES.

32, Stonegate, York, May 13th, 1862.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

3266. FREDERICK TOLHAUSEN, Boulevart Bonne-Nouvelle, "A new method of, and machinery for, covering springs used for petticoats and other articles."—A communication from Antoine Rameau, Boulevart Bonne-Nouvelle, Paris.—*Petition recorded 31st December, 1861.*

281. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improved processes for the recovery of the oleic acid contained in the residual scouring waters of woollen and other textile materials or fabrics."—A communication from Edmond Lepainteur, Gallard, France.—*Petition recorded 1st February, 1862.*

746. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "An improved combination of cooling and filtering apparatus, forming a safe for the preservation of solid and liquid provisions."—A communication from Joseph Weatherby Bartlett, Broadway, New York, U.S.—*Petition recorded 18th March, 1862.*

763. ROBERT HADFIELD and JAREZ SHIPMAN, Attercliffe, Sheffield, Yorkshire, "Improvements in hardening and tempering wire and crinoline steel."—*Petition recorded 19th March, 1862.*

979. BENJAMIN THOMPSON, Walker, near Newcastle-upon-Tyne, "Improvements in steam engines."—*Petition recorded 5th April, 1862.*

988. JOSEPH WATREMEZ and ALOYS KLOTH, Aix-le-Chapelle, "Improved apparatus for indicating a deficiency of water in steam generators."—*Petition recorded 7th April, 1862.*

999. JOHN JAQUES, jun., Hatton-garden, London, "Improvements in the instruments used in the game of croquet."—Partly a communication from William Fowler Mountford Copeland, Madeira.—*Petition recorded 8th April, 1862.*

1052. JAMES HOWARD, EDWARD TENNEY BOUSFIELD, and THOMAS PHILLIPS, "Improved apparatus applicable to steam cultivation."—*Petition recorded 11th April, 1862.*

1077. CHARLES JAMES COXHEAD, Emeis-terrace, Kentish-town, London, "Improvements in pianoforte actions."

1078. GEORGE FELL and WILLIAM HAYNES, Bolton, Lancashire, "Improvements in machinery or apparatus to be used in the manufacture of leather."—*Petitions recorded 15th April, 1862.*

1149. ALEXANDER PARKES, Liverpool-street, Birmingham, "Improvements in surface condensers."—*Petition recorded 19th April, 1862.*

1162. CHARLES CALLEBAUT, South-street, Finsbury, London, "Some improvements in sewing machines."—*Petition recorded 21st April, 1862.*

1168. SILAS SAFFORD PUTNAM, Dorchester, Norfolk, Massachusetts, U.S., "Certain improvements in machines for forging horse shoe nails and other articles."—*Petition recorded 22nd April, 1862.*

1206. SILAS COVELL SALISBURY, Coventry, Warwickshire, "Improvements in the construction of sewing machines."

1210. RICHARD CHRISTOPHER MANSELL, Ashford, Kent, "Improvements in the construction of wheels to be used on railways."

1214. JOHN ELDER, Glasgow, Lanarkshire, N.B., "Improvements in steam engines and boilers."

1216. JAMES ASPINALL, Middlesborough-on-Tees, Yorkshire, "An improved apparatus for the safe conveyance, from sea to land, of ships' papers, documents, money, and other valuables when wrecks or other casualties occur at sea."

1218. ALEXANDER CARNEGIE KIRK, Bathgate, N.B., "Improvements in refrigerating apparatus."

1220. WILLIAM HALE, John-street, Adelphi, London, "Improvements in rockets."

1222. LACHLAN MCLACHLAN, Manchester, "Improvements in governing or regulating light used for taking photographic portraits and other photographic pictures, part of which improvements is also applicable to lighting picture galleries."

1224. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in chimneys for lamps."—A communication from Harvey Brown, New York, U.S.—*Petitions recorded 25th April, 1862.*

1228. JOHN GAY NEWTON ALLEYNE, Buiteriey Ironworks, Alfreton, Derbyshire, "Improvements in machinery and apparatus for the preparation and manufacture of iron and steel."

1232. FRANCIS GYBBON SPILSBURY and FREDERICK WILLIAM EMERSON, Stratford, Essex, "Improvements in the treatment of fusel oil, and for various applications of the same to useful purposes."

1234. HERBERT WILLIAM HART, Higher Broughton, Manchester, "Improvements in the manufacture of reflectors and shades for gas and other lights."

1236. GEORGE HEDGECOMBE SMITH, North Perrott, Somerset, "Improvements in the manufacture of crinoline or elastic hoops for dresses."—*Petitions recorded 26th April, 1862.*

1242. JOHN FLETCHER, Farnham-place, Southwark, Surrey, "Improvements in the apparatuses for treating saccharine liquids.—*Petition recorded 28th April, 1862.*

1250. SAMUEL WILMOTT NEWINGTON, Goudhurst, Kent, "Improved apparatus for letting off and stopping the flow of liquids from casks and vessels, such apparatus forming a tap, and substitute for the ordinary vent peg."

1254. RICHARD BRIGHT, Bruton-street, Westminster, "Improvements in lamps, and in apparatus for lighting Argand and other wicked lamps."

1256. WILLIAM LITTELL TIZARD, Mark-lane, London, "Improvements in heating, cooling, and condensing apparatuses."

1260. EDWARD BROWN WILSON, Parliament-street, Westminster, "An improvement in the machinery or apparatus used in the manufacture of malleable iron and steel."

1262. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in the construction of mowing and reaping machines."—A communication from Louis Adolphe Faure, Rue St. Sébastien, Paris.—*Petitions recorded 29th April, 1862.*

1266. ARTHUR IRWIN MAHON, Leinster-square, Rathmines, Dublin, "Improvements in projectiles."

1272. EVAN LEIGH, Manchester, "Improvements in the construction of ships and floating batteries, in mounting their guns, and in the application of steam power, parts of which improvements are also applicable to land batteries and forts."

1276. GEORGE HENRY BIRKBECK, Southampton-buildings, Chancery-lane, London, "Improvements in the construction of couches or settees for the purpose of sitting, lying, or reclining upon."—A communication from Charles Henry Ferdinand Leroux, Paris.

1280. JAMES LEE NORTON, Belle Sauvage-yard, Ludgate-hill, London, "Improvements in apparatus for drying fibrous materials and yarns."

1284. HENRY WILLIS, Albany-street, Regent's Park, London, "Improvements in valves for the supply and discharge of gaseous bodies."

1286. WILLIAM THOMAS LOY, Rood-lane, London, "Improved machinery or apparatus for carding cotton and other fibrous substances of a similar character."—A communication from Alphonse Ryex, jun., Rue de la Porte de Bruges, Ghent, Belgium.—*Petitions recorded 30th April, 1862.*

1288. WILLIAM BICKFORD SMITH, Camborne, and WILLIAM BENNETTS, Tucking Mill, Cornwall, "Improvements in the method of, and apparatus for, preventing the injurious effects occasioned by smoke, sulphur, and the deleterious gases which escape from stacks, chimneys, calcining houses, chemical and other furnaces."—*Petition recorded 1st May, 1862.*

Inventions Protected for Six Months by the Deposit of Complete Specifications.

1308. JOSEPH TYLER, Kennington-place, Kennington-lane, Surrey, "Improvements in the manufacture of clarionets."—*Deposited and recorded 3rd May, 1862.*

1333. FRANCOIS MARREL, Marseilles, France, "Improvements in forming wrought iron bars for the manufacture of armour plates and other articles of forged iron."—*Deposited and recorded 5th May, 1862.*

Patents on which the Stamp Duty of £50 has been Paid.

1142. THOMAS JONES, Liverpool.—Dated 6th May, 1859.
1149. MICHAEL HENRY, Fleet-street, London.—A communication from Joseph Napoleon Rebour, Paris.—Dated 7th May, 1859.
1153. RICHARD PEARSALL, Smethwick, Staffordshire.—Dated 7th May, 1859.
1275. ALFRED VINCENT NEWTON, Chancery-lane, London.—A communication from David Parker, Shaker Village, New Hampshire, U.S.—Dated 23rd May, 1859.
1160. FREDERICK VERNON HADLOW, Prince Albert-street, Brighton, Sussex.—Dated 9th May, 1859.
1314. LEON FARRENC and BERNARD SUBRA, Paris.—Dated 27th May, 1859.
1229. ROBERT ROMAINE, Chapel-street, Bedford-row, London.—Dated 18th May, 1859.
1316. GEORGE HADFIELD, Carlisle, Cumberland.—Dated 27th May, 1859.
1437. ALFRED VINCENT NEWTON, Chancery-lane, London.—A communication from Thomas J. Mayall, Roxbury, Norfolk, Massachusetts, U.S.—Dated 15th June, 1859.

Patents on which the Stamp Duty of £100 has been paid.

1085. ROBERT MCCONNEL, Glasgow, Lanarkshire, N.B.—Dated 14th May, 1855.
1031. JAMES BOWRON, Tyne and Tees Glass Works, South Shields.—Dated 8th May, 1855.
1091. ROBERT STIRLING NEWALL, Gateshead.—Dated 14th May, 1855.
1030. JOHN ALLIN WILLIAMS, Baydon, Wiltshire.—Dated 8th May, 1855.
1044. DUNCAN MORRISON, Bordesley Works, Birmingham.—Dated 9th May, 1855.
1045. GEORGE TAYLOR, Liverpool.—A communication.—Dated 9th May, 1855.
1057. JOHN HARRIS, Woodside, and THOMAS SUMMERSON, West Auckland, near Darlington.—Dated 10th May, 1855.
1071. JOHN HERDMAN, Belfast, Antrim, Ireland.—Dated 12th May, 1855.

Notices to Proceed.

3266. FREDERICK TOLHAUSEN, Boulevart Bonne-Nouvelle, Paris, "A new method and machinery for covering springs used for petticoats and other articles."—A communication from Antoine Rameau, Boulevart Bonne-Nouvelle, Paris.—*Petition recorded 31st December, 1861.*

2. NICHOLAS CHARLES SYKRELMEY, Park-terrace, Brixton, Surrey, "Improvements in the manufacture of leather cloth or imitation leather, and in rendering certain fabrics waterproof."

3. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in hose pipe joints or couplings."—A communication from Thomas Braisted, New York, U.S.

5. JOHN WALKER, City-road, London, "Improvements in the construction of forts and fortifications, which are applicable to floating batteries."

14. EDMUND FRANCIS DAVIS, Tavistock House, Tavistock-square, London, "Improvements in gas burners."—*Petitions recorded 1st January, 1862.*

25. GILBERT STRACEY, Rackheath Hall, near Norwich, Norfolk, "Improvements in the manufacture of artificial fuel."

26. FRANCOIS SEBASTIEN BELLOCHE and HERMAN BOLLACK, Bridge-street, Blackfriars, London, "An improved parasol."—*Petitions recorded 3rd January, 1862.*

28. JAMES WHITTON ARUNDELL, Gresham House, Old Broad-street, London, "An improved method and improved apparatus for treating and dressing ores and minerals, particularly applicable to tin, lead, copper, zinc, and iron ores."—A communication from Martin Nueburg, Kalk, Rhenish Prussia.

31. CHRISTOPHER CROSS, Stretford, near Manchester, and EDWARD PADMORE Manchester, "Improvements in the manufacture of pile fabrics, and in machinery or apparatus employed therein."

33. GEORGE LEVSHON, Tividale, and DAVID BECKLEY, Brockmore, Staffordshire, "An improvement or improvements in brakes for retarding and stopping carriages on railways."

34. JAMES HOWDEN, Glasgow, Lanarkshire, N.B., "Improvements in steam engines and boilers."—*Petitions recorded 4th January, 1862.*

39. ALFRED VINCENT NEWTON, Chancery-lane, London, "An improved manufacture of cigars."—A communication from William Cheevers Kneeland, New York, U.S.

40. GEORGE BENJEMANN, GEORGE WILLIAM BENJEMANN, and JOHN BENJEMANN, Pentonville, London, "Improvements in dressing cases, applicable to other cases and boxes."

43. FREDERICK BROWN, Luton, Bedfordshire, "Improvements in kitchen ranges and cooking apparatus."—*Petitions recorded 6th January, 1862.*

48. ARTHUR WALLIS and CHARLES HASLAM, Basingstoke, Southampton, "Improvements in rotatory screws."—*Petition recorded 7th January, 1862.*

55. JOHN STENHOUSE, Upper Brunswick-terrace, Barnsbury-road, London, "Improvements in rendering certain substances less pervious to air and liquids."—*Petition recorded 8th January, 1862.*

63. DAVID WILSON, Colombo, Ceylon, "Improvements in machinery for pulping and preparing coffee."

65. DAVID WILSON, Colombo, Ceylon, "Improvements in hydraulic presses."—*Petitions recorded 9th January, 1862.*

72. ROBERT JOHNSON, Liverpool, "An improved composition for coating the bottoms of iron ships, to prevent their fouling, and which composition may be used as a protective coating for wood, iron, or other substances exposed to the action of sea water."—*Petition recorded 10th January, 1862.*

83. JOSEPH WHITE, Trinity-street, Southwark, Surrey, "Improvements in lubricating or oil cans, or oil feeders, and in the mechanical arrangements for regulating the flow of oil therefrom."—*Petition recorded 11th January, 1862.*

94. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in the manufacture of cups, bowls, saucers, and other dished articles and cases."—A communication from Frederic Wilhelm, Marx, Paris.—*Petition recorded 13th January, 1862.*

102. EBENEZER WILLIAM HUGHES, Parliament-street, Westminster, "Improvements in malleable cylinders used in engineering and architectural structures."—*Petition recorded 14th January, 1862.*

118. JOHN ADAMS KNIGHT, Symond's-inn, Chancery-lane, London, "Improvements in machinery for dressing mill-stones by means of a diamond cutter."—A communication from John Dickinson, New York, U.S.—*Petition recorded 16th January, 1862.*

125. JOHN MARTIN ROWAN, Glasgow, Lanarkshire, N.B., "Improvements in the construction of steam hammers."

129. ROBERT ROMAINE, Devizes, Wiltshire, "Improvements in apparatus to be used in cultivating land by steam power, and in steam boilers used for agricultural and traction purposes."—*Petitions recorded 17th January, 1862.*

140. WALTER SANDELL MAFFIN, Birmingham, "A new or improved lock."—*Petition recorded 20th January, 1862.*

150. JOHN STENHOUSE, Upper Brunswick-terrace, Barnsbury-road, London, "Improvements in the protection of metallic surfaces, and in rendering certain substances less pervious to air and moisture."

153. CHRISTOPHER BINKS, Gray's-inn, London, "Improvements in generating steam, in superheating steam, and in apparatuses employed therein."

156. GEORGE TOMLINSON BOUSFIELD, Loughborough Park, Brixton, Surrey, "Improvements in machinery for making nails and spikes."—A communication from Carl Gustaf Helistorp, near Yonkoping, Sweden.—*Petitions recorded 21st January, 1862.*

182. JAMES HIGGIN, Manchester, "Improvements in machinery for retarding and stopping railway carriages."

183. JOHN CORNFORTH and BENJAMIN SMITH, Birmingham, "New or improved machinery for boring or drilling gun barrels and tubes, and other articles having a cylindrical or prismatic figure, which said machinery may also be applied to other like purposes."—*Petitions recorded 24th January, 1862.*

218. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improvements in engines actuated by heated air, or by combinations of air and steam."—A communication from Jacques Belou, Rue St. Georges, Paris.—*Petition recorded 28th January, 1862.*

250. WILLIAM CLARK, Chancery-lane, London, "Improvements in mechanical wrenches."—A communication from Messrs. Pierre Augustin Samuel and Auguste Toussaint Ozou-de-Verric, Boulevart St. Martin, Paris.—*Petition recorded 30th January, 1862.*

276. THOMAS COOK, Cobourg road, Old Kent-road, Surrey, "Improvements in machinery for punching, cutting, and pressing metals and other materials."

279. WILLIAM CLARK, Chancery-lane, London, "Improvements in machinery or apparatus for the manufacture of fastooneet edging or material."—A communication from Jean Joseph Basset, Boulevart St. Martin, Paris.

281. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improved processes for the recovery of the oleic acid contained in the residual scouring waters of woollen and other textile materials or fabrics."—A communication from Edmond Lepainteur, Gallard, Longuon, France.—*Petitions recorded 1st February, 1862.*

291. CHARLES MARIEN ROULLIER, Paris, "Improvements in the manufacture of straps, bands, chains, and other like articles."—*Petition recorded 4th February, 1862.*

361. JAMES JENNINGS MCCOMB, Pump-court, Temple, London, "An improved fastening for securing cotton and other bales or packages."—*Petition recorded 11th February, 1862.*

578. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improvements in the disinfection of animal excretions, and in the extraction therefrom of fertilising elements for agricultural purposes."—A communication from Alfred Marie Celestin Edgard Goussard, Rue d'Eughein, Paris.—*Petition recorded 13th February, 1862.*

403. THOMAS RENISON, Glasgow, Lanarkshire, N.B., "Improvements in water closets."—*Petition recorded 15th February, 1862.*

462. JOHN STANDISH and JOHN GOODEN, Egerton, near Bolton, Lancashire, "Improvements in machinery or apparatus for stripping or cleaning the flats of carding engines."—*Petition recorded 21st February, 1862.*

579. PIERRE REMOND, Rue de l'Echiquier, Paris, "Improvements in double rein bridle bits."—*Petition recorded 3rd March, 1862.*

641. William Parker and George Henry Batman, Copmanthorpe, Yorkshire, "Improvements in steam engines."—*Petition recorded 10th March*, 1862.

755. James Archibald Jaques and John Americus Fanshawe, Tottenham, Middlesex, and Frank Jaques, Droylesdon, Lancashire, "Improvements in the construction of elastic surface rollers."—*Petition recorded 18th March*, 1862.

819. Thomas White, Birmingham, "Improvements in the manufacture and ornamentation of nut crackers and lobster crackers."

818. Marc Antoine Francois Menkons, Rue de l'Echiquier, Paris, "Certain improvements in machinery for the production of ornamental stitching or embroidering."—A communication from Paul Nicolas Legris, Delme, France.—*Petitions recorded 24th March*, 1862.

914. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in machinery or apparatus for spinning cotton and other fibrous substances."—A communication from James Eaton, Boston, Massachusetts, U.S.—*Petition recorded 1st April*, 1862.

1154. John Pickard and Thomas Morris, Preston, Lancashire, "Improvements in furnaces for the prevention or consumption of smoke."—*Petition recorded 21st April*, 1862.

1173. George Scoville, Wood's Hotel, Furnival's-inn, London, "Improvements in pistons for steam engines."—A communication from Augustus James Scoville and Augustus Hervey, De Clercq, Bloomington, Illinois, U.S.—*Petition recorded 22nd April*, 1862.

1308. Joseph Tyler, Kennington-place, Kennington-lane, Surrey, "Improvements in the manufacture of clarionets."—*Petition recorded 3rd May*, 1862.

And notice is hereby further given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days next after the date of the Gazette and of the Journal, in which this notice is issued.

List of Specifications published during the Week ending 10th May, 1862.

2255, 10d. ; 2340, 4s. 5d. ; 2376, 7d. ; 2377, 6d. ; 2378, 6d. ; 2379, 6d. ; 2380, 10d. ; 2381, 9d. ; 2382, 3d. ; 2383, 3d. ; 2384, 3d. ; 2385, 3d. ; 2386, 7d. ; 2387, 10d. ; 2388, 5d. ; 2389, 3d. ; 2390, 10d. ; 2391, 6d. ; 2392, 6d. ; 2393, 3d. ; 2394, 3d. ; 2395, 1s. ; 2396, 3d. ; 2397, 3d. ; 2398, 10d. ; 2399, 3d. ; 2400, 6d. ; 2401, 3d. ; 2402, 9d. ; 2403, 3d. ; 2404, 3d. ; 2405, 7d. ; 2406, 3d. ; 2407, 3d. ; 2408, 3d. ; 2409, 3d. ; 2410, 3d. ; 2411, 3d. ; 2412, 5d. ; 2413, 3d. ; 2414, 5d. ; 2415, 7d. ; 2416, 10d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for The Engineer, *at the office of her Majesty's Commissioners of Patents.*

Class 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2655. J. Marshall, *Great George-street, Westminster*, "*Improvements in traction engines and wheels, and in carriages to be drawn by traction engines, which improvements in wheels are applicable to common road carriages generally.*"—*Dated 23rd October*, 1861.

These improvements in traction engines consist in placing the driving pinion, which gears into the inside toothed rack of the driving wheels, either in a line with and forward, or below and forward, of the axes of the driving wheels. This pinion slides between horn plates, or other suitable guides, in the framing in a vertical direction, to allow of the play of the springs by which the weight of the engine is supported when at work upon the driving pinion. The pinion is connected with the engine by suitable wheels and pinions to produce the requisite changes of speed. The axes of the driving wheels also slide in the framing, by having the axle boxes sliding in horn plates, or other suitable guides, curved with a radius equal to the distance of the driving pinion first mentioned from the centre of the driving wheel. When the engine is standing still, the weight taken by the driving wheels is supported by the springs at their centre ; but so soon as the engine is put in motion, according to the power required to move the engine and its load, so much of the weight of the engine is transferred from the centre of the driving wheels to that point in the circumference where the driving pinion gears into the toothed rack upon the driving wheels, and the amount of weight thrown upon the pinion is taken off the centre of the driving wheels, so that, if the driving wheels were fixed, the whole weight of the engine would be transferred from the centre towards the circumference. By this arrangement of the driving pinion the weight is transferred from the centre of the wheel, or line of direct vertical pressure, towards the circumference, to a distance equal to the horizontal distance between the centre of the driving wheel and the driving pinion, by which the wheel is compelled to roll forward or slip with a power equal to the weight of the engine acting upon a lever whose length is equal to the horizontal distance between the centre of the wheel and the pinion. These improvements in carriages to be drawn by the traction engine are as follows :—The inventor fits a toothed rack inside the felloe or periphery of the hind wheels, or both fore and hind wheels, having a pinion gearing into and fitted in a similar manner to the engine before described, and driven by a horizontal shaft extending along the bottom of the carriage, and connected to the engine by suitable couplings and gearing. The improvements in wheels for traction engines, and other common road carriages, consist in placing within the rim or felloe of the wheel a raised rail, the spokes being placed either within or without the centre of the felloe, or both. He divides the wheel into four quarters by lines drawn horizontally and vertically through the centre. Within the wheel he places a frame with two arms, and this frame is keyed or bolted to the axle ; on the aftermost arm he places a grooved roller, bearing against and embracing the raised rail within the felloe of the wheel at a point either upon or a little below where the horizontal line, separating the upper from the lower aftermost quarter, cuts the felloe. On the other arm he places another grooved roller, bearing upon and embracing the raised rail within the felloe, at or near a point about the middle of the lower foremost quarter. By thus constructing the wheel, a portion of the weight is (by the forward pull in drawing the carriage) thrown in advance of the line of direct pressure of the wheel upon the ground.—*Not proceeded with.*

Class 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2652. G. Davies, *Serle-street, Lincoln's Inn, London*, "*Improvements in railways and in iron pavements and railways combined.*"—*A communication.*—*Dated 23rd October*, 1861.

This invention consists, First, of a railway composed of two or more cast iron girders constructed and bedded duly into the ground in the manner described hereafter, so as to dispense with the usual wooden sleepers or other foundations, as well as with the ordinary chairs and spikes. The cast-iron beams or girders each consists of a longitudinal plate of about twelve inches in width, and have on the under side at each edge longitudinal ribs or flanges. Running along about the centre of each beam or girder is an elevated rib, forming the tread or rail for receiving the flanges of the carriage wheels. The girders are connected together by means of a dovetailed key, driven tightly into the space between two bevelled lugs or projections which are formed at each end of each beam. To maintain the girders in their proper positions laterally, plates are fitted underneath at the joints, and are connected together by transverse rods. In order to make the joint still more secure, other dovetailed keys may be driven longitudinally between ribs raised on each side of the tread on the upper surface at each end of the girders. The improvements consist, Secondly, in combining cast-iron girders as above bedded into the ground with malleable iron rails, for the purpose of readily removing and replacing the rails without displacing the girders, and in confining the said rails to the girders. The improvements consist, Thirdly, of a combined railway and pavement constructed as hereafter described, so that the wheels of ordinary vehicles can freely traverse the pavement without being obstructed by the rails, the said pavement being so arranged that any portion may be readily removed, without disturbing the whole pavement, or raising the adjacent parts.

653. R. Crammond, *Newton, Roxburgh*, "*Self-acting railway signals.*"—*Dated 23rd October*, 1861.

Under one modification of these improvements a lever is arranged at the side of the rail, and nearly upon a level with it, so that the lever may be depressed when the engine passes over the spot. This lever is fast to one extremity of a horizontal rod, which extends outwards in a lateral direction, and has fitted near to its other extremity a vertical lever, which is connected to a wire cord, or chain, and counter weight, or helical or other spring. The counterweight is attached to one end of the cord or chain, and the other end is carried up the signal post, and is made fast to a spring catch. This catch is immediately contiguous to the inner end of the signal arm, and, when the weight is free, it draws back the spring catch out of the way of the signal arm.—*Not proceeded with.*

2660. A. F. Campbell, *Great Plumstead, Norfolk*, "*Railways.*"—*Dated 24th October*, 1861.

This invention consists in applying a central rail along the line of way, adapted to receive or act in suitable wheels between the bearing wheels of the carriages, for the purpose of preventing the carriages running off the line of way, by which wheels with a plain or unflanged surface may be used as the bearing wheels.

2668. W. Wharton, *Birmingham*, "*Springs for railway and other vehicles.*"—*Dated 25th October*, 1861.

The object of this invention is to produce springs which, while capable of the same resisting or supporting power, shall be (considering the weight or traction) much lighter and more secure than those hitherto in use, as buffing, bearing, or other description of springs. For example, the patentee constructs a spring according to these improvements as follows :—He first takes a bed plate of suitable material of the full length of the spring required, its end being turned into a solid or rolled eye or loop, suitable for the ordinary attachments. He takes a second plate, which overlaps or turns downwards, enclosing the edge of the bed or bottom plate, and upwards, to receive and enfold the edges of the upper or third plate, forming a T-edge on both sides of the plate. All the additional plates used in making the spring are fitted consecutively as just explained, or in the same manner ; the length of each of the plates used in making the spring is governed by the ordinary calculations.

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2650. A. Morel, *Roubaix, France*, "*Machine for combing all filamentous materials.*"—*Dated 23rd October*, 1861.

This invention consists in a new application of the nipper or picker (whether double and swinging like a balance beam, or in two separate parts acting alternately) to effect the combing, using a circular comb or an articulated or jointed one. This nipper or picker, which itself deposits in the comb the fibres which it has picked, at once quits them in a suitable manner, and without disturbing their position.

2651. J. Kirkwood, *Paisley*, "*Looms.*"—*Dated 23rd October*, 1861.

These improvements are contrived to permit of the application of steam or similar motive power, and in one modification of loom embodying them are combined with jacquard pattern mechanism of the single lift class. This jacquard mechanism acts on the warps by means of the ordinary harness mounting and a set of heddles ; it is also made to both regulate and effect the changes of the shifting shuttle boxes, and at the same time to both regulate and effect the picking movement.—*Not proceeded with.*

2684. W. Robertson *and* J. M. Hetherington, *Manchester*, "*Mules for spinning and doubling.*"—*Dated 26th October*, 1861.

This invention consists, First, in effecting the removal of the coils of yarn on the spindles between the point of the cop and the point of the spindle, by combining a partial amount of stripping with a partial amount of backing-off. Secondly, in an improved form of cop builder. Thirdly, in a combination of parts by which the rising of the counter faller in backing-off mules, and the position of the stripper at the commencement of the inward rim, are determined by the descent of the building faller. Fourthly, in an arrangement of parts by which the motion of the winding or quadrant is positively regulated by the motion of the carriage. Fifthly, in regulating the catch, by which the cam shaft is detained at or near the determination of the inward run of the carriage by the rise of the building faller or the descent of the faller rack. Sixthly, in a brake regulated by the counter faller acting on one portion of a differential motion, the other portion of which is moved by the carriage or carriage motion.

2685. J. Sidebottom, *Harewood, near Mottram, Chester*, "*Machinery for cleaning and carding cotton, &c.*"—*Dated 26th October*, 1861.

These improvements are applicable to those partial tubes that are made of sheet metal, and of a conical shape, as described in the specification of letters patent granted to the present patentee on the 20th May, 1861, No. 1232, the object being to bend the sheet metal forming the base of the said partial tubes inwards to fit the spindles or skewers on which they are to be placed. In performing this invention the larger end of the cone is provided with notches, and the metal between the notches is first bent partly inwards by a cup-shaped punch ; after this preliminary operation the final bending inwards of the metal is performed by another punch working upon the cup-shaped one, of the size of the spindle or skewer on which the partial tube is to be placed. A die is inserted into the open end of the partial tube for giving the requisite inward bend to the sheet metal.

2689. J. L. Norton, *Belle Sauvage-yard, Ludgate-hill, London*, "*Beating, stretching, and drying of fabrics.*"—*Partly a communication.*—*Dated 26th October*, 1861.

According to this invention the operation is effected by machinery, the fabric being caused to pass between two rows of sticks which are fitted into metal sockets, and in connection with these sockets are short arms or projections which, being acted on by tappets or shafts suitably arranged and driven, give the requisite motion to the sticks to cause them to strike the fabric. The beating the fabric has to be done generally while the fabric is damp, and it is very desirable that after it has been beaten it should be at once dried, so that the pile, when properly raised, may not be again deranged. For this purpose a beating machine is combined with a tentering, stretching, and drying machine, so that the former machine may feed the latter, the fabric passing direct from the beaters on to the tentering points, and being kept extended from the time the beating commences until it is delivered dried at the end of the tentering, stretching, and drying machines.—*Not proceeded with.*

2712. J. S. Jackson, *Pendleton, Lancashire*, "*Treatment of woven fabrics known as cords.*"—*Dated 29th October*, 1861.

This invention consists in submitting the fabric, before or after it has been finished by any usual method, to a rubbing or impressing action, transversely to the direction of the cords, and by means of a surface with indented portions, so as to constitute a tooth similar to a comb.

2717. R. R. Priestley, *Glasgow*, "*Woven fabrics.*"—*Dated 30th October*, 1861.

In carrying out this invention the inventor uses a cotton or silk warp in its natural colour, or bleached or dyed, and the weft of the goods is worsted or worsted and cotton yarn carded or combed, and either bleached, dyed, or in its natural colour, and sprinkled or mixed with one or more colours of dyed or bleached cotton, silk, worsted, or wool. *Not proceeded with.*

Class 4.—AGRICULTURE.—None.

Class 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

2740. E. A. Maling, *Chelsea*, "*Glass cases for the cultivation of plants and flowers.*"—*Dated 1st November*, 1861.

These improved glass cases are constructed of wood, glass, and zinc, or other suitable material. The frame and lower portion of the case are made of wood, the top and sides are by preference made severally of single plates of glass which are let into the wood framing in the ordinary manner. The sides and top are connected together by means of screws or buttons, or other fastenings capable of being readily engaged and disengaged, so that the cases are taken to pieces and put together with facility and dispatch, and are on that account easily moved. The bottom of the case is made of wood lined with sheet zinc, copper, or lead, so as to form a box or tray, which the patentee prefers to be in height about one-third that of the entire frame. The shape usually adopted for these improved cases, and which is found to admit of the requisite volume of air being supplied, is that of a double cube. Other shapes may be used, care being taken to supply a sufficient amount of air. A special feature in these improvements relates to the mode adopted for heating the cases, and providing a suitable circulation of air in the interior, which materially assists in keeping the plants in a healthy condition. In the box or tray forming the bottom of the case is fixed a tank or vessel, which is placed on one side, and by preference is made to extend about half the bottom of the case. The tank is filled with heated water, as often as may be required, according to the season of the year, and the temperature at which it is desired to maintain the case, which may be ascertained by a thermometer placed within the case. It is not necessary to employ any means for heating the water while in the tank, as it will be found to maintain a sufficiently high and equable temperature by replenishing it at intervals, which will not in practice be found inconvenient.

Class 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

2619. H. Bloxam, *Shrewsbury*, "*Sights for rifles and ordnance.*"—*Dated 19th October*, 1861.

This invention consists in the application to the sights of rifles and cannon of a small vibrating pendulum, mounted on a transverse pin, and attached to a suitably shaped piece of metal, which is attached to the sliding bar of the rifle or cannon-sight by means of two small griping springs which hold the vibrating pendulum and piece of metal to which it is attached in position ; and the piece of metal to which the vibrating pendulum is attached is so constructed as not to interfere with the line of sight. The vibrating sight pendulum may be readily fixed to or removed from the rifle or cannon sight, and when in position is pressed down level with the top of the sliding bar, and two small projections at the back of the metal to which the springs are attached are so formed as to just embrace the flap and prevent any lateral movement.

2633. J. Toward, *Newcastle-upon-Tyne*, "*Armour plates for ships.*"—*Dated 21st October*, 1861.

This invention relates to a peculiar construction of the back or inner sides of armour plates for ships, whereby they may be secured to the sides thereof without weakening the plates by having any holes drilled in them, or exposing the heads of the bolts or fastenings on the outer surface of the plates. According to this invention it is proposed to form, either by rolling or forging, a series of ribs or feathers on the backs of the plates, and to plane such ribs or feathers to a dovetail section. In attaching or fixing these plates bolts are used having their outer ends made to fit accurately or grip the dovetailed ribs or feathers, and so hold the plates firmly against the ship's sides without passing through the armour plates. Or dovetailed spaces, grooves, or recesses may be cut out of a plate of the ordinary description, and the bolt secured therein with a key, or by being made in two halves and rivetted together, or put together with screw bolts after each half is put into the dovetail space, groove, or recess.

2703. O. Bayliss, *Birmingham*, "*Double-sighted double rifle guns.*"—*Dated 29th October*, 1861.

This invention consists in fixing a top and bottom sight on each of the barrels of a double rifle or gun, instead of fixing one top and one bottom sight on a rib between the barrels, as is commonly practised. By placing a top and bottom sight on each barrel, the aim of the rifle or gun is made more true, and the crossing of the balls is avoided. The invention consists further of a double top rib for the same purpose, the said rib being double top and bottom sighted. The said rib is fixed on and extends from end to end on the top side of the barrels. The invention consists further in sighting the left hand barrel without sighting the right hand barrel of double rifles or guns, or sighting the right hand barrel without sighting the left hand barrel The invention is applicable to double rifles and guns of any bore and of any length.

2679. J. Lobb, *Dartmoor*, "*Gunpowder suitable for blasting.*" *Dated 25th October*, 1861.

For the purposes of this invention the inventor substitutes sawdust for a portion of the charcoal and sulphur in the powder. He also adds to the powder, lime. The object of the use of sawdust is to render the smoke arising from the explosion of the powder in a confined place less offensive, and to allow of the quantity of sulphur being reduced, and the object of the addition of lime to the powder is to counteract the deliquescent property of the nitrate of soda, or nitrate of potash, employed in the manufacture of the powder, and is more especially useful in the manufacture of powder to be used underground or in damp situations.—*Not proceeded with.*

2681. N. Cox, *Chester*, "*Attaching armour plates.*"—*Dated 26th October*, 1861.

In carrying out this invention, instead of bolting the armour plates directly to the sides of the vessel, the inventor fastens T or angularly shaped pieces to the sides, skin, or sheathing in a vertical position, by means of flanges, in the usual manner. In the armour plates he cuts corresponding grooves coinciding in outline with the T or angularly shaped pieces before mentioned, and then slips or slides the plates on to them. He also rabbets or grooves the sides, or tops, or bottoms of the plates, if required, to give greater firmness and stability to the whole. By this means he avoids the holes, which weaken the sheathing and plates, and facilitates the changing or removal of the plates when damaged.—*Not proceeded with.*

Class 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

2658. G. Davies, *Serle-street, Lincoln's-inn, London*, "*Lamps for burning coal oil, &c.*"—*A communication.*—*Dated 24th October*, 1861.

This invention relates to a peculiar construction of the burners of lamps for consuming coal oil and other like fluids, the burners being so arranged as to direct currents of heated air to support combustion, and to spread the flame, and thus effectually to prevent the smoke which usually accompanies the flame of this class of lamps, so that the usual glass chimney may be dispensed with. The improvements further relate to a mode of attaching the burner to the reservoir of the lamp, without the aid of the usual screw, and to a means of replenishing the reservoir without detaching the burner therefrom.—*Not proceeded with.*

2672. S. Oppenheim, *Paris*, "*Printed shirt fronts.*"—*Dated 25th October*, 1861.

This invention consists in printing on calico, linen, or any other stuff, the middle fold, and also the arrangement of the folds of the front at the same time, so that the whole is and remains of a single piece to avoid tearing, and having to adjust the middle fold, as is the case with the folds printed until now. The design to be printed is disposed so that the stuff which forms the upper part of the fold, that is to say, the part which is seen, should be alone printed ; the stuff under the fold remains plain, and does not receive any impression.—*Not proceeded with.*

2674. E. Alexandre, *Paris*, "*Pedal box.*"—*Dated 25th October*, 1861.

This invention consists in the construction of a box capable of containing in its interior and carrying about a flutina or organ of small size, or other similar instrument, when not in use. This box answers the purpose of a foot or support to the instrument when played upon. It also contains a pedal which is moved with the foot to work a bellows, and the whole may be placed under the key board of a piano to play two instruments at the same time.

2693. G. Hutton, *Manchester*, "*Hats, caps, &c.*"—*Dated 26th October*, 1861.

This invention relates to a method of forming the hat or cap elastic, so as to fit heads of different sizes. For this purpose the patentee employs coiled springs of metal constituting a portion of the circumference of the article.

2676. J. B. Schalkenbach, *Treves, Rhenish Prussia*, "*A new kind of musical instrument of the pianoforte class, including harmoniums and organs.*"—*Dated 25th October*, 1861.

This invention relates to combining several musical instruments in one case, so as to constitute one compound instrument, which the patentee designates an "orchestral piano," and consists, First, in adapting certain instruments, the sound of which is produced by percussion (such as big drums, marching drums, cymbals, tom toms, triangles, and such like instruments), to harmoniums, pianofortes, and other keyed instruments, in such a manner that the performer may play them with the hand or arm without interrupting the execution of the piece of music. Secondly, in a particular construction of the marching drum, for the purposes of this invention, so as to obtain by means of keys the greater part of the effects which a clever drummer could produce with the ordinary drumsticks. Thirdly, in a peculiar contrivance applicable to harmoniums, organs, and other instruments, by which the keys may be temporarily locked or set in order to leave the performer at liberty to play on the percussion instruments, while the cords or tones of the instrument are sustained or prolonged when certain effects are to be produced. Fourthly, in the application of a series of metal funnels or mouthpieces to the sound holes of harmoniums and other instruments, by means of which, and a corresponding action of the tremolo valve, a tone is produced which imitates that of a trumpet, or tabor.

Class 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

2605. H. Macmekikam, *Stratford, Essex*, "*Smelting copper, gold, and other ores.*"—*A communication.*—*Dated 18th October*, 1861.

The patentee claims the reduction of ores by fusion of the metallic portion within the substance of the gangue or stony portion of the ores, and without the fusion of the gangue or stony portions themselves, together with the subsequent operation of the metallic and stony portions, by crushing and washing. The carbonaceous material employed may consist of gases having an affinity for oxygen to serve the purpose of metallising the metallic portions of the ores within their gangue, or bringing such gases or other substances and the ores into contact within closed and heated vessels.

2607. J. Webster, *Birmingham*, "*Manufacturing oxygen gas and obtaining certain other products.*"—*Dated 19th October*, 1861.

This invention consists of a mode of treating a mixture of nitrate of soda or other nitrate with an oxide of iron or burnt oxide of zinc, for the purpose of obtaining oxygen gas, nitrogenous compounds, and the base of the salt employed. For this purpose the patentee submits the mixture to distillation in an iron or other proper retort. He condenses the nitrogenous compounds contained in the gaseous products of the distillation in water, or in any other convenient manner, and thus separates those compounds from the residue of the gaseous products, consisting chiefly of oxygen gas, which he collects in a proper receiver. The residuum in the retort at the end of the process contains the base of the salt employed, which, if it be an alkali or alkaline earth, will be in a caustic state.

2609. R. Mushet, *Coleford*, "*Manufacture of titanic pig metal or alloy of titanium and iron.*"—*Dated 19th October*, 1861.

The essence of this invention consists in smelting that particular variety of titanium ore called ilmenite, and which is a titanite of iron, in conjunction with the red hematite iron ores of Cumberland and Lancashire, or precisely similar red hematite iron ores formed in adjacent districts, in a blast furnace heated with coal, coke, or charcoal fuel, in order thereby to reduce the metals contained in the said ore of titanium called ilmenite, and the said red hematite iron ores to the metallic state, and to produce thereby an improved titanic pig metal, consisting essentially of titanium and iron, and containing also carbon.

2618. F. J. Evans, *Horseferry-road, London*, "*Carburetting gases for the purpose of illumination.*"—*Dated 19th October*, 1861.

The object of this invention is to effect the carburetting of gaseous bodies,

and thus to impart thereto illuminating properties, or to heighten the illuminating properties which they may already possess. This end the patentee proposes to obtain by passing the gaseous body intended to be carburetted through a suitable arrangement of heating apparatus, and while in a heated state leading it off to a vessel containing an easily volatilisable hydrocarbon; as the gas passes through this vessel the hydrocarbon will be vaporised, and combine with the heated gas, whereby the requisite illuminating power will be imparted thereto. The mixed gas may then be led off to a burner to be consumed.

2637. R. MUSHET, *Coleford*, "*Manufacture of a certain metallic alloy.*"—*Dated 22nd October*, 1861.

The patentee claims manufacturing a triple metallic compound or alloy of iron, titanium, and manganese, containing also carbon, by smelting in a blast furnace or cupola furnace heated with coal, coke, or charcoal fuel, a mixture or combination of that variety of titanium ore called ilmenite and spathose iron ore, or other manganesic ore of iron containing much oxide of manganese, so as to reduce the iron, titanium, and manganese in the said ores, or a portion of the said iron, titanium, and manganese to the metallic and alloyed state.

2643. G. H. BIRKBECK, *Southampton-buildings, Chancery-lane, London*, "*Extracting silver from lead.*"—*A communication.—Dated 23rd October*, 1861.

This invention consists in a series of processes for separating or extracting silver from lead by incorporating zinc therewith.

2664. J. CHESTERMAN, *Sheffield*, "*Improvements in heating steel and iron, and in hardening and tempering steel, and in apparatus employed therein.*"—*Dated 24th October*, 1861.

The First part of this invention consists in enclosing the lead or other metal or material to be melted, and in protecting it from the atmosphere, in a suitable bath or vessel, and in forming a passage or passages through the same by means of tubes or otherwise, through which the ribband or other steel or iron article to be heated, hardened, or tempered, may be drawn without coming in contact with the molten metal or material. The Second part of this invention consists in the employment of what is called a flux, instead of molten lead. This flux, consisting of chloride of sodium or common salt, soda ash, sal enixum, chloride of zinc, chloride of potassium, chloride of calcium, alum, borax, either together or separately, or of any other mineral or compound of minerals which will become liquid under heat, and at such temperature as will be suitable for properly heating iron, or for heating steel for hardening and tempering either in open or closed vessels; but the higher the degree of heat required the greater should be the proportion of soda ash or sal enixum. The steel article to be hardened or heated, or both, is passed into and through the flux while in a hot and melted state. The steel being kept from the action of the atmosphere, no scale or oxide results. Those articles requiring to be hardened or tempered, when removed from the melted composition, are immersed in oil or water, or in any other fluid capable of effecting a similar purpose.

2665. J. MCCALL, *Houndswitch, and* B. G. SLOPER, *Walthamstow*, "*Preservation of food.*"—*Dated 24th October*, 1861.

In the preservation of meat and other articles of food it is usual to subject them in tins to heat in order to drive off the air and oxygen contained in the vessels and in the meat or other articles of food themselves. For this purpose, an aperture is made in the tins through which a portion of the air and oxygen is driven off; and in order to decompose the remaining portion of the air it has been necessary to use such an elevated temperature, or to apply heat for so long a time, as to injuriously affect the meat and food. This invention consists in introducing into the tins some material or composition for which oxygen has a greater affinity than for the meat or other article of food under preservation, and which at the same time shall be in no way detrimental to it. The patentees have found in practice that sulphite of soda is the best agent for their purpose; but they do not confine themselves to the use of that substance only.

2695. E. MCCLINTOCK, *New York, U.S.*, "*Manufacture of soda and sulphuric acid.*"—*Dated 28th October*, 1861.

This invention consists partly in the substitution of copper, or any one of its compounds, reducible by coal for carbonate of lime, as used in the ordinary soda manufacture. These improvements consist further, in the reconversion of the original sulphuret of copper, obtained, as before stated, into oxide of copper, or metallic copper, or suboxide, &c., as the case may be; at the same time saving the sulphur for the manufacture of sulphuric acid or sulphate of soda.—*Not proceeded with.*

2707. F. BENNETT, *Bagilt, Flintshire*, "*Manufacture of spelter.*"—*Dated 29th October*, 1861.

This invention consists in mixing or incorporating chloride of sodium, or other substances containing chlorine, to be hereafter named, with the materials now generally used in the manufacture of spelter after their calcination, and then subjecting the materials so mixed to the usual smelting process. The patentee carries his invention into effect as follows:—He first calcines the blende, calamine, or other zinc ore in the usual manner, and next mixes such ore with coal, coke, or other carbonaceous matter, and adds chloride of sodium—common salt. The proportions he has found best in practice are about 4 per cent. by weight of the chloride of sodium to the calcined ore, but this may be varied without injuriously affecting the result. He then subjects these mixed materials to the ordinary smelting or deoxidating process in the retorts or other usual apparatus, the product being condensed and collected in the usual manner. Instead of chloride of sodium he uses other substances containing chlorine, namely, chloride of lime, muriatic acid, or chloride of calcium, in the same proportions, and at the same stages of the process.

CLASS 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

2661. T. MORRIS, R. WEARE, *and* E. H. MONCKTON, *Trafalgar-square, London*, "*Improvements in magnets, induction coils, and in insulating wire and metal for electric and other purposes.*"—*Dated 24th October*, 1861.

In obtaining electricity for carrying out this invention the patentees employ any of the known methods, but prefer those specified in the patent granted to T. Morris, for "Improvements in voltaic batteries, and in vats used in depositing metals by electricity," dated March 10th, 1860, No. 653, and also in accordance with their patent for "Improvements in voltaic batteries for obtaining electric currents, and the products therefrom," dated September 14th, 1861, No. 2298. They make and use permanent magnets cast in suitable forms from cast iron, which are to be decarbonised by any of the known methods, so that they may be rendered sufficiently soft to fill, drill, or be otherwise operated upon; they are then to be recarbonised, hardened, and magnetised, by which means these magnets can be made cheaper and more uniform than those made from steel. With regard to coils for armatures of magneto-electric machines, where great intensity is required, and also in induction coils, the insulation should be effected in the most perfect manner, and the lengths of the wires composing the coil must, of course, be in proportion to the effect required. This novel and special method of insulation is applied as follows:—Suppose, for example, that the patentees use gutta-percha as an insulating medium, a very thin layer is to be introduced to separate the first from the second coil, and also a layer introduced between each of the succeeding coils, but the thickness of the layers of gutta-percha is to be increased as the number of coils is increased, and the intensity of the electric current is exalted. In short, the thickness of the gutta-percha must keep pace with the intensity of the electric current as the coil proceeds in thickness.

CLASS 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

2529. D. S. BROWN, *Ashby-road, Islington, London*, "*Propelling and sustaining balloons and aerial machines in the air.*"—*Dated 10th October*, 1861.

This invention consists in the employment of ammonia and carbonic acid to work engines, similar to steam engines, for the purpose of giving motion to fans like screw propellers, with a view of propelling and sustaining balloons and aerial machines in the air.—*Not proceeded with.*

2531. C. W. FELT, *Salem, Essex, Massachusetts, U.S.*, "*Machine for setting, spacing, justifying, and distributing printers' type.*"—*Dated 10th October*, 1861.

This invention relates to novel arrangements and combinations of mechanism, for the purpose of operating upon printers' type. First, to set them the type being arranged in lines in separate columns in order as they are received from the founder, an end of each column is exposed in such a manner that a pincer mechanism, operating similarly to human fingers, can take one type at a time from any column and place it in the line which is composing, moving for that purpose from column to column to receive the different letters and characters required, the movements of the pincers from one column to another being directed by the intelligence of the operator conveyed to and commanding the machine by details hereinafter referred to; connected and moving with these pincers is a mechanism which moves when commanded by the operator to place at the end of a word separating it from the next by a piece of metal, which the patentee terms a "machine space," the purpose and form of which is to be hereafter described. There being always a practical limit to the length of the line which is composing, a mechanism is employed to indicate when the available space for the type in the said line is nearly filled, so that the setting action of the machine may be seasonably arrested by the operator, and the line transferred by the action of the mechanism commanded by the operator to the spacing mechanism; thus line by line can be successively composed and transferred to the spacing mechanism. The movements of the mechanism in setting the type can form, upon the principle of the jacquard, a register of the set type, and the movements of the mechanism can be best controlled by the operator through the medium of a key board. Secondly, the object of the invention is to automatically space and justify the previously composed lines of type, and this is effected by mechanism which operates substantially as follows:—Ordinary spaces of a certain thickness are inserted at first by the side of the previously mentioned "machine spaces," until the line will contain no more of these ordinary spaces, which fact is indicated by the mechanism. Then the machine spaces are withdrawn one at a time, and ordinary spaces of the same thickness with the machine spaces are inserted in lieu thereof, provided the line is of the exact required length, but if the line is too short the mechanism will insert ordinary spaces, which are slightly thicker than the machine spaces, till the discrepancy in length is filled up, when the spaces left by further withdrawal of machine spaces are filled as before mentioned, the mechanism opening the line at the places where spaces are withdrawn and inserted to prevent wear. The line, being spaced and justified, is fed out upon a galley. Lastly, the object is to distribute the matter set up, which is done by a reverse action of the pincers before referred to, and which are made to operate on the type, removing them from the stick, and placing them in the columns, the mechanism being controlled in its action through manipulation of the key board by the operator, or by the register obtained in setting up the matter.

2534. B. BROWNE, *King William-street, London*, "*Improved spring.*"—*A communication.—Dated 10th October*, 1861.

This invention consists of a combination of steel blades or strips of tempered steel bent in different curves or direction, the said blades being connected together at their extremities so as to act one upon the other, in such a manner as that, when in use, the end portions of such said blades pressing upon each other stiffens the springs, and thus adapts them to the load or pressure they are required to bear or carry. The aforesaid improved spring may either be formed each of a single blade of steel, or each spring may be formed of several blades connected together in the usual manner; in all cases the two innermost or main blades are connected together by their ends. The form or shape of the bend of these plates may either be elliptical or of other form. The uppermost main blade the patentee proposes to form of a regular curve, but the lowermost main blade he makes of a compound curve, that is to say, he forms the centre portion curved in one direction, and the ends curved in an opposite direction, so that, when a spring thus formed is in use, the ends only shall gradually press more or less against the uppermost curved blade, thus shortening the elastic parts of the two blades, or altering the effective length of the spring, and stiffening the spring in proportion to the weight or pressure thereon, and it is this peculiar combination of curved plates that constitutes this invention.

2535. J. DOWNS, *Kingston-upon-Hull*, "*Pumps and stops used for working hydraulic presses.*"—*Dated 10th October*, 1861.

In carrying out this invention the patentee casts two pumps of unequal bore in one casting, so as to form a double pump; two such pumps are fixed at opposite ends of a cistern. Four sets of stops (each set work together in the same box) are arranged on the cistern—two sets on each side, or at any other convenient place—and are connected to the said pumps by means of pipes, and also to each other by the same means. The waterways in the said pumps and stops are so arranged as to cause all the four pumps to work through each set of stops singly, or to work through all four at once, or any portion of them; the said pumps are worked by a lever in the usual manner; the two rams (working the same pumps) are fixed into one cross head, which has only one shank, and is worked from the lever by one pair of slide links, in the usual way. Or he casts two pumps of a small bore and two pumps of a large bore, and places one of each sort at one end of a cistern, and one of each sort at another end thereof, and works all the four from one lever by one pair of slide links to each pump, in the usual way; or by a double ram with one crosshead having one shank, as described, and connects them to the stops in the same way as the double pump. Each set of stops is connected by pipes to what is commonly called a double press; consequently, by these said arrangements of pumps and stops, one, two, three, or four double presses can be worked from one set of pumps at the same time. When it is required to work three double presses only he uses the same pumps with three sets of stops, and he places these stops either on the cistern or on any other convenient place; or if only two double presses are worked he uses the same pumps, and places one set of stops on each side of the cistern, or other convenient place. When only one double press is worked from one set of these pumps the stops will be placed on the cistern in the usual way. These arrangements will permit the pressure to be given in each press much more rapidly than heretofore. He places a valve beneath, or at one side, or behind one or both of the stops in the centre of the stop box, so as to prevent the oil or water returning when the opposite stop is raised. When more than one double press is worked from one set of pumps each of the two centre stops will be provided with a valve. If only one press is worked from one set of pumps then only one valve will be required behind one of the centre stops.

2537. W. PAYNE *and* J. BARGUM, *Birmingham*, "*Packing for engines and machinery.*"—*Dated 10th October*, 1861.

The inventors take sponge and cut it up into very small particles, or almost into dust; they then prepare a mixture of the following ingredients in about the following proportions:—Zinc, melted, two ounces, combined with an equal quantity of mercury; this composition is to be granulated or pulverised when cold. Devonshire lead ore pulverised, four ounces; flour of brimstone, two ounces, the whole to be thoroughly amalgamated. The fine cut sponge is then soaked in grease, and mixed up with the metallic composition powder above named; until it has absorbed as much as it will of the powder. They then squeeze out the grease and ram the remaining compound into cotton or other casing. They find that the above proportions of the metallic powder will require about four ounces of sponge, but all these proportions will admit of some variation.—*Not proceeded with.*

2538. W. CLARK, *Chancery-lane, London*, "*Apparatus for bending iron rails or chairs.*"—*A communication.—Dated 10th October*, 1861.

This invention cannot be described without reference to the drawings.

2551. E. T. HUGHES, *Chancery-lane, London*, "*Compound to prevent the incrustation and sediment of calcareous matters in boilers.*"—*A communication.—Dated 12th October*, 1861.

This invention consists in amalgamating or combining the following articles in about the proportions stated, namely, alum, 25 kilos.; salts of soda at 32 deg., 25 kilos.; red ochre, 2 kilos.; sulphuric acid, 3 kilos. 500 grains; brown fecula of potatoes, 15 kilos.; distilled water, 35 kilos. The alum, salts of soda, and ochre are mixed together after being well pulverised separately. The distilled water is poured into a suitable vessel, adding the brown fecula, so as to make a paste of it, which is then heated to the boiling point; the acid is added, and the boiling continued till the matter becomes perfectly liquid, after which the whole is run into another vessel to cool; the mixture of alum, salts of soda, and ochre is then added and stirred up till the substances are well amalgamated.—*Not proceeded with.*

2554. M. CARTWRIGHT, *Carlisle*, "*Stench traps.*"—*Dated 13th October*, 1861.

This invention consists in covering the closing plate or trap either wholly or partially on its closing side, with vulcanised india-rubber, alone or in combination with other suitable materials; a similar covering being applied to the surface upon which the flap closes, so that a perfectly tight joint is obtained.—*Not proceeded with.*

2560. J. BROWNING, *Minories, London*, "*Barometers.*"—*Dated 14th October*, 1861.

This invention relates to those barometers in which hands or needles are used to indicate the state of the atmosphere, and consists in adding two loose hands or indicators which will yield without offering appreciable resistance to the barometer needle, and be pushed thereby, and remain stationary until reset at the points where so pushed, and thus register the extremes of the barometer needle in both directions since the setting of the instrument.—*Not proceeded with.*

SAILING OF THE NEW STEAMSHIP SCOTIA.—The British and North American Royal Mail steamship Scotia, Captain Judkins, sailed from Liverpool on Saturday for New York. Besides the usual mails she took out a fair amount of cargo, and had 130 passengers. Numerous spectators thronged the piers and quays to witness the departure of the noble vessel, the fine appearance of which was much admired as she steamed majestically down the river.

UPRIGHT BORING MILLS.—In the United States all large cylinders are bored vertically, the four cylinders of the caloric ship Ericsson, each 168in. or 14ft. in diameter, having been bored on a mill which would admit a cylinder 16ft. in diameter. The *American Railway Times* gives a list of new machines in course of erection at an extensive ironwork in Massachusetts, and among these is an upright boring mill with a revolving table 20ft. in diameter, and to admit an object 24ft. in diameter between the side posts. The weight of this machine is to be nearly 65 American tons of 2,000 lb.

THE 10½-IN. ARMSTRONG GUN.—The *Times* of Saturday last, in speaking of the approaching trial of Captain Coles' shield, stated that "the trial had been unavoidably postponed on account of a flaw having been discovered in the interior of the great Armstrong gun intended to have been used on the occasion. The damage, it appears, is of sufficient magnitude to render the gun unsafe for present use, the defect being on the spot where the velocity of the missile commences, slightly beyond the breech." On Monday, however, the *Times* contained the following:—"The 300-pounder Armstrong gun has been officially reported, after proof, as fit for service. The flaw in the bore, to which some allusion has been made, is represented as unimportant. The experiment against Coles' cupolas will take place as soon as the naval preparations are completed."

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

INQUIRIES FOR ARMOUR PLATES FOR FOREIGN GOVERNMENTS—PIG IRON: *Improved Demand*—COAL TRADE: *Unaltered*—HARDWARES: *Condition Unchanged*—TENDERS FOR IRONMONGERY—CONCERNS OF MR. KIMBERLEY—THE TARIFF WITH ITALY: *Remarks on the Wolverhampton Trades*—WOLVERHAMPTON SCHOOL OF ARTS TO BE CLOSED—BOILER INSPECTION ASSOCIATION—MILLFIELD ACCIDENT RELIEF FUND: *Donation from the Earl of Dudley: Temporary Relief to the Sufferers.*

A somewhat better feeling is now pervading the iron trade than was observable last week. The orders on hand are slightly more numerous than at that time, and there are decidedly more inquiries abroad. The most conspicuous feature in the inquiries is, that they relate in numerous instances to heavy plates for the naval purposes of foreign Governments. The fact of such inquiries being made in South Staffordshire is conclusive; that the applicants are engaged in a work in which they have hastily, and for the first time, embarked. Our own Government, who are now no novices in the armour-plate business, would not, of course, apply to South Staffordshire for plates 4½in. thick; nor, making all allowance for the absence by foreigners of much information which is possessed here in regard to the business capabilities of the several parts of our own country, can we suppose any foreign Governments would have applied to this district for the supply of such an article if they had had even the most elementary experience in such matters. The demand which is now springing up may be, therefore, fairly supposed to be only the commencement of demand which will continue to develope itself. It is not a little amusing that some of the firms to whom application has been made for these plates are not producing iron in a shape at all resembling that required of a greater thickness than a quarter of an inch. Holland and America are among the countries who are expressing their wants. But the latter are inquiring for the greater part for plates certainly of considerable thickness, but not of such dimensions as the thickness already mentioned, and most in favour at our own Admiralty. Among the actual work in land there are some good orders from the Continent, which were taken some time ago. These, added to the current necessities of home customers, are enough to keep the houses where the best iron is produced in tolerably active operation throughout a fair proportion of their works.

The pig iron trade is in as good a condition as can be expected. Inferior descriptions of native make are securing high prices considering their quality, and the makers of them are now doing better than has been the case for some time past. The profits of the producers of 50s. pigs are more probably than those of the makers of iron which is now being sold at 60s. or 62s. 6d.

The coal trade is without alteration.

A meeting has been held in Birmingham of the creditors of Mr. John Kimberley, of the Eagle Works and Foundry, Oldbury. The meeting was convened by the trustees under the deed of conveyance which Mr. Kimberley has executed for his creditors' benefit. The total liabilities were £32,817, of which £11,100 were secured, and the deficiency was £17,748. It transpired that Richard Mason and Thomas Kimberley, John Kimberley's late partners in the Parkhall and Cinder Meadow collieries, had recently filled separate petitions for adjudication of bankruptcy in the Birmingham Court; and a discussion ensued as to the right of the respective representatives of the three persons to administer the co-partnership estate, and of the creditors of the late firm to participate in the proceeds of the trust estate under John Kimberley's deed. It was, however, resolved that for the present the trustees should proceed to realise under the deed all that could be most readily disposed of.

The condition of the general hardware trades has not much altered in the past week.

We perceive that the Director-General of the Stores for India is advertising for a supply of ironmongery, tenders to be in by the 2nd of June.

Proceedings of a private nature continue to be conducted by certain ironmasters, with a view to the establishing of a local boiler inspection society; and as a secretary there has been selected the gentleman who is the secretary to the Rolling Stock Company of Wolverhampton.

The authorities of the Board of Trade have requested from the Wolverhampton Chamber of Commerce information as to the effect produced upon the trade of that district by the tariff and customs duties now in force in Italy. As a rule the rates for metal goods are not immoderately high. They are certainly much lower than those chargeable in France under the late treaty. It is, therefore, particularly desirable that England should be placed on as good a footing as in the new commercial treaties between France and Italy will be given to France. In the tariff with Italy, as at present existing, it is a somewhat singular circumstance that the instances which stand out with most prominence as needing attention on behalf of the interests of this district, as well, indeed, as on behalf of the interests of the Italians themselves, are those in which the goods may be regarded as the raw material. For instance, the duty on iron is higher in proportion than the duties upon manufactured goods. It is true that the duty imposed by France on our iron consumed in that country is higher, but that now levied by Italy is equal to 25 per cent. upon the present prices in England. On bars and rods the duty is £2, and on sheets £3 5s. per ton. On springs for carriages the Italian tariff is higher than the French, the latter being 7s., whilst the former is 12s. per cwt., and the impost upon bolts and locks of other metals than iron are very heavy, being for common £1 0s. 10d., and for fine £2 1s. 8d. per cwt. The duty upon plated goods and fine hardwares is also £2 1s. 8d., a rate against which there could be but little complaint in its application to fine goods, but which impedes the trade with Italy in the commoner class of productions under this head. Benefit to Birmingham and South Staffordshire might, therefore, be fairly expected to follow any reduction in the duties here specified. In such an event scarcely any branches would receive greater impetus than those engaged in the brass casting to which the rates last but one quoted are applicable, for the number of articles made in this district is so large, and the goods so varied in their application, that if the duties were lower, the extended application in Italy of brass castings to purposes to which they are not now employed would be sure to follow.

The step which, it will be remembered, we have more than once feared would soon have to be taken, would now seem to be seriously contemplated by the committee of the Wolverhampton School of Practical Art. They have issued an advertisement, calling a special general meeting of the society, "to consider the existing necessity for dissolving the society and winding up the affairs of the school." A few gentlemen have displayed great practical interest in the school, amongst them Mr. Hartley, ironmaster, and Mr. C. B. Mander, japan manufacturer, who has acted as secretary, but their hands have not been held up by the manufacturers or the inhabitants generally; and there seems no alternative but that, however great a disgrace may be thereby reflected upon the town, the handsome building must for a time be devoted to other uses.

The mention of Mr. Hartley's name reminds us of the last of that ironmaster's many acts of liberality towards the town in which he is one of the leading employers of labour. He has just given a very valuable site for a place of public worship and £1,000 towards the cost of the erection.

The fund for the relief of the sufferers by the fearfully destructive boiler explosion at Millfields, now amounts to about £1,900, including £100 received in the past few days from the Earl of Dudley. About £25 a week is now being distributed by the committee in temporary relief. That portion of the works which was destroyed by the explosion is being rebuilt, and the whole of the machinery will soon be again in a working condition.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

THE IRON AND MACHINE TRADES: *Review of the Progress made in the last Nineteen Years*—NORTHERN MATTERS: *State of Trade: The Cleveland District: The Newcastle Monument of George Stephenson: Mr. Abernethy, C.E., and Sunderland Dock Extension: River Tyne Improvement Commission: Launch of the Lombardia (s. s.): Cockermouth, Keswick, and Penrith Railway*—THE NORTHERN BLAST FURNACES: *Present Position of Affairs*—LIVERPOOL: *The Chamber of Commerce and the Rangoon and Singapore Telegraph: Mersey Docks and Harbour Board*—CHESHIRE MIDLAND RAILWAY—STATE OF TRADE: *Sheffield: Derbyshire: Manchester*—HULL DOCK EXTENSIONS—PRINCE OSCAR OF SWEDEN AT CREWE, LIVERPOOL, &c.—NEW RAILWAY STATION AT LONDON ROAD, MANCHESTER—THE ARABIAN (S.S.)—SCOTTISH TOPICS: *Glasgow Association of Assistant Engineers: Scottish Shipbuilders' Association: The Luchana (s.s.): Coltness Iron Company: Fowler's Steam Plough in Ayrshire.*

WE are now in a position to extend, by a year's additional experience, the tabular statements given in May, 1861, with respect to the progress and position of the iron and machine trades, so far as their external outlets are concerned. The value of the exports of iron and steel, wrought and unwrought, and machinery of all kinds, including steam engines, has been as follows during the last nineteen years:—

Year.	Iron and Steel.	Machinery.	Total.
1843	£2,590,833	£713,474	£3,304,307
1844	3,191,541	776,115	3,967,656
1845	3,501,895	905,962	4,406,857
1846	4,178,026	1,116,470	5,295,496
1847	5,265,779	1,263,016	6,528,795
1848	4,777,966	817,656	5,595,622
1849	4,986,508	700,631	5,687,139
1850	5,350,056	1,042,166	6,492,222
1851	5,830,370	1,168,611	6,998,981
1852	6,684,276	1,251,360	7,935,636
1853	10,845,422	1,985,536	12,830,958
1854	11,674,675	1,930,860	13,605,535
1855	9,465,642	2,243,166	11,708,808
1856	12,966,109	2,716,453	15,782,562
1857	13,603 337	3,883,669	17,587,006
1858	11,197,072	3,599.352	14,796 424
1859	12,314,437	3,731,301	16,045,738
1860	12,154,997	3,837,821	15,992,818
1861	10,341,574	4,219,688	14,561,262

From this enumeration it appears that the British iron interest reached the maximum development of its foreign trade in 1857, that in the succeeding year the Indian mutiny gave a shock to operations, from which there was a partial recovery in 1859; that in 1860 matters remained as nearly as possible stationary, and that last year there was a disastrous revulsion, which brought matters even below the level of 1858, although they still remained at a point not attained in any year previous to 1856. Still, comparing 1861 with 1843, it is astonishing to note the amazing strides which have been made in this branch of the business of the empire in nineteen years, which, after all, is but a trifling period in the history of nations.

Notwithstanding the confidence which a review of such striking facts can scarcely fail to inspire in thoughtful minds, the general tone of business advices at present is one of much dulness and depression. A slight improvement is observable in the coke trade of the Tyne which has been long depressed, but a circular issued to the colliery owners of the district calls upon them to continue to curtail their deliveries of coal to the metropolitan market during the next few weeks. The *Newcastle Chronicle* observes with reference to the Cleveland iron district:—"The exports during the past week have again been on the increase, about 3,500 tons having been shipped. Besides this shipment of iron there has also been an increase in the shipment of coke, fire bricks, and calcined ironstone. The business of this district carried on with Continental countries must have a beneficial effect, and be the means of bringing the Cleveland district more prominently before the world as an iron-making district, which will ultimately tell upon the Scotch and Staffordshire makers. In addition to the pipe-making facilities of the two firms mentioned a fortnight since, the Messrs. Cochrane and Co., of the Ormsby Iron Works, situated about a mile from Middlesbro', are also large pipe manufacturers, their foundry establishment being principally adapted to this trade, with which they are very busy. Their principal make at present is from 18-in. pipes downwards, with the exception of a few 30-in. ones for Leeds. This firm have lately built a large addition to their old pipe foundry, with all recent improvements in drying stoves, &c., for the purpose of facilitating their work. It is currently reported that the Madras chair order has come to one of our firms; if such be the case, additional employment will be given to the artificers of this kind of work, for we believe a very large proportion of this order of 14,000 tons has to be delivered this year."—The ground for the reception of the pedestal of the Newcastle monument of the late George Stephenson has been marked out, and the excavations or the foundation have been commenced.—We are now in a position to give the heads of the report delivered by Mr. Abernethy C. E., in regard to dock extension at Sunderland, although we cannot find space for the document *in extenso*. Mr. Abernethy recommends, first, the construction of a pier or breakwater on the southside of the present outlet, 1,600ft. in length from high water mark; secondly the formation of an additional entrance channel from the outlet, to a depth of 27ft. 6in. at high water springs, and 24ft. at neaps; thirdly, an entrance lock, 300ft. of available length, and 60ft. in width, the cills being laid at such a level as to give a depth of 26ft. 6in. over them at springs, and 23ft. at neap tides; fourthly, the construction of an additional dock of 20 acres area, excavated to a depth of 1ft. 6in. below the level of the cills, provided with an entrance between it and the existing docks, with reverse gates and caisson cills, the excavations to be used in forming the quays around its margin, and in embanking to the southward, the slopes of the embankments being protected by a facing of rubble beton blocks of large size from the action of the sea. The total cost of these works Mr. Abernethy estimates at £210,000, and the River Wear Commissioners have resolved to proceed at once with the construction of a breakwater at the south outlet, the cost being calculated at £25,000. With respect to the proposed new dock, however, it was considered that sufficient information had not been obtained, and that question has been referred back to the executive committee. The River Tyne Improvement Commissioners have determined to make the necessary arrangements preliminary to the removal of Whitehall Point. The great difficulty with respect to the Low Lights Dock is the inability to procure the requisite funds and the Blythe and Tyne Railway Company are being sounded as to the extent of the pecuniary assistance they may be prepared to afford, Mr. Ure the engineer being instructed in the mean time to report on the formation of the south or river wall of the proposed dock.—The Lombardia, screw steamer, has just been launched by Messrs. Palmer Brothers, of Jarrow. At her trial trip she averaged a rate of thirteen knots per hour. She is intended to convey mails from Genoa to Sicily and Sardinia, and is also fitted up in a tasteful style for a large number of passengers. Her length is 195ft., and registered tonnage 500 tons. She is propelled by engines, also made by Messrs. Palmer, of 120-horse power, indicating an actual power of 500 horses. The gentleman who was present at the trial, on the part of the owners, was so satisfied with the ship that he has taken possession of her, and placed on board an Italian crew, so that the vessel will at once proceed to her destination.—Messrs. G. Boulton and Son, of Newcastle, have entered into a contract for the construction of the Cockermouth, Keswick, and Penrith Railway. The line, thirty-one miles long, has heavy works on it, including a million cubic yards of earthwork, a short tunnel, four large viaducts, and a number of bowstring bridges of considerable spans over the river Greta. The object of the line is to open up the Lake district, and to connect Whitehaven and district with the iron furnaces on the east coast (Middlesbro', &c.).

The annexed statement illustrates the position of these furnaces at the commencement of this month:—

	In.	Out.	Total.
Eston—Bolckow and Vaughan	9	—	9
„ Clay-lane Company	2	1	3
„ Samuelson and Company	3	—	3
Cargo Fleet—Jones, Dunning and Co.	2	—	2
„ Cochrane and Company	3	1	4
„ Gilkes, Wilson, Pease, and Co.	4	1	5
Middlesborough—Bolckow and Vaughan	2	1	3
„ Hopkins and Co.	2	—	2
Port Clarence—Bell Brothers	5	1	6
Norton—Warner, Lucas, and Barrett	2	1	3
Ferry Hill—Morrison	2	—	2
Stockton—Holdsworth and Co.	3	—	3
Thornaby—Whitwell W. and Co.	2	1	3
Darlington—South Durham Company	2	1	3
Witton Park—Bolckow and Vaughan	3	1	4
Stanhope—Weardale Iron Company	—	1	1
Towlaw—Weardale Iron Company	4	1	5
Consett—Derwent Iron Company	4	14	18
	54	25	79
All furnaces April 1st, 1862	53	26	79
„ February	50	26	76

We turn to Liverpool. The monthly meeting of the Council of the Chamber of Commerce was attended by Mr. Gisborne, telegraphic engineer, who explained his project for establishing telegraphic communication between Rangoon and Singapore. His report enumerated the advantages which trade would derive from the establishment of this telegraph, and further stated that the projectors had applied to Government for an annual subsidy of £14,000, which amount, it was contemplated, would cover the working expenses; and the distance between Rangoon and Singapore being 1,170 miles, it was anticipated that a capital of £450,000 would be sufficient for the undertaking. The council, after deliberation, agreed to petition Government generally in favour of the scheme. A memorial to Government stating that for the proper development of British Columbia and Vancouver Island, and the promotion of their welfare, it was essentially necessary that a regular bi-monthly steam communication between those colonies in British steamers, to and from Panama, should be established, was also approved. At the last sitting of the Mersey Docks and Harbour Board, the Works Committee submitted a report for the graving docks on the Herculaneum estate, the construction of which was ordered on the 3rd inst., and they recommended that the same should be carried out at an estimated cost of £176,586. Mr. Brocklebank stated that the plans differed materially from those originally laid before the board. Previously only a single entrance into the basin was proposed, but it was now contemplated to have two entrances, one 60ft. and the other 80ft. wide, which would be a great improvement. The committee were in expectation that, at a future period, a dock would be made to the north of the present basin, and they proposed that an entrance should be constructed there, as it could be completed at a much cheaper cost than at a future period. The total cost of the works now proposed was £176,586 against £131,000—the expenditure originally contemplated—the augmentation being occasioned by a proposed double entrance and the entrance to the dock, which may be made on some future occasion. After some remarks from Mr. Boult in favour of the new graving docks being supplied with bilge cradles in preference to the system of shoring vessels, the recommendations of the committee were agreed to. A renewed overture was made to the board for the disposal to them of the lease of the Woodside graving docks for £12,000 instead of £15,000, the terms originally named. It was determined, however, by a majority of 12 to 7, that the letter embodying the proposition should lie on the table for the present.

A portion of the Cheshire Midland Railway—6¼ miles from Bowdon to Knutsford—was opened on Saturday. The engineer engaged in the construction of the line has been Mr. T. J. Mawson, of Manchester, who has had only light gradients, cuttings, &c., to deal with. It is intended to continue the line from Knutsford to Northwich, where it will form a connection with the West Cheshire Railway. The London and North-Western Company intend also to extend a branch from their main line at Chelford to Knutsford, a distance of 4½ miles, to run into the Knutsford station of the Cheshire Midland. The Cheshire Midland line will, at present, be a purely local line; but when the Stockport, Timperley, and Altrincham Railway, and the Stockport and Woodley Junction Railway are finished, it will form a link in the Sheffield and Lincolnshire and Great Northern systems, by which the traffic from Birkenhead, &c., can be transferred to the east and south of England, without passing through Manchester.

The general depression of trade at Sheffield still continues. The large iron and steel houses, however, are busy with orders for materials required for railway and other purposes, both for home use and exportation. From Germany average orders are on hand for edge tools and files, and from France the orders for manufactured goods are slightly on the increase. Orders for steel, iron, and other articles required for war purposes continue to arrive from America; but, in other respects, there is only little doing. A better demand has been experienced for rails and plates in Derbyshire, but trade generally is in an uneasy state, and much difficulty is experienced in obtaining remittances. Captain Palin, in his official report on the state of employment in Manchester, returns the position of the machinists and foundries as follows:—Machinists: Working full time with all hands, 11; working full time with a portion of their hands, 27; working short time, 8; stopped altogether, 1. Foundries: Working full time with all hands, 6; working full time with a portion of their hands, 14; working short time, 4. The number of machinists wholly out of employment is estimated by Captain Palin at between 1,100 and 1,200, and the total of unemployed foundry operatives is set down at 600.

Mr. M'Cormick, who has executed extensive dock works in Liverpool and Birkenhead, has just entered into a contract with the directors of the Hull Dock Company for the construction of the proposed west dock and the enlargement of the Victoria dock and timber pond.

Prince Oscar of Sweden visited the extensive works of the London and North-Western Railway Company at Crewe, on Friday, and minutely inspected every department. A new locomotive was christened after him the "Prince Oscar." His Royal Highness afterwards passed on to Holyhead and Bangor, where he visited the Menai and Britannia bridges. Between Colwyn and Conway the Prince rode upon the locomotive, for the purpose of inspecting the action of an appliance near Conway, invented by Mr. Ramsbottom for filling tenders with water while in motion. On Saturday afternoon the Prince and his attendants visited Liverpool, where the extent and character of the vast docks and other features of the town were pointed out to the visitors' discriminating notice. At 8 p.m. the Prince (who seems to be gifted with quite a Napoleonic activity) left for Chester. We may add that there are now thirty new locomotives in progress at the Crewe shops.

The general contract for the building of the new railway station at London-road, Manchester, has been let to Messrs. W. and H. Southern, of Salford, who have already begun to put up their scaffolding. The terms of the contract are that the new building shall be roofed in by the end of June, 1863, so that considerable activity will have to be displayed in carrying out the works. The contract for the masonry has been taken by Messrs. Patteson, of Oxford-street, Manchester; Messrs. E. T. Bellhouse and Co. will supply the ironwork; and the brickwork will be executed by Mr. Rutherford. The station will be a handsome and imposing structure.

Messrs. M'Nab and Co., of Greenock, are now supplying engines to the screw steamship Arabian, of 3,600 tons burthen, built at Belfast by Messrs. Harland for a Liverpool firm, who will employ her in the Liverpool and Mediterranean trade.

The Glasgow Association of Assistant Engineers has closed its session. The papers read at the last meeting were on "Levelling and Surveying," by the President; and on "Girders," by Mr. J. A. Smith: both elicited animated discussions. At the last meeting for the session, also, of the Scottish Shipbuilders' Association, an adjourned discussion on "Steamship Economy" was taken up and sustained for nearly two hours. Considerable diversity of opinion prevailed as to the most advantageous mode of expansion in marine engines; whether economy increases as the amount of admission decreases, at any pressure; whether there is a point, according to every increase of pressure, at which it is most economical to cut off steam, and whether marine engines cannot be worked advantageously, or without loss, when the steam is expanded below the atmospheric pressure; in other words, when the full vacuum or atmospheric pressure is not taken advantage of throughout the whole stroke. At the close of the discussion, votes of thanks were passed to the president and council for the manner in which the affairs of the association had been conducted during the session.—With respect to other Scottish topics, we may note that the Luchana (s.s.), recently built and engined by Messrs. W. Simmons and Co., of Renfrew has made a satisfactory trial trip, accomplishing a speed of a mile per hour beyond that stipulated in the contract. The Luchana has since left for her destination. The Coltness Iron Company have commenced preparations for a new blast furnace. The company's present furnaces, nine in number, are all in full blast, and have been so for some time in spite of drooping markets and dull times. We called attention last week to a trial of Fowler's steam plough at the annual meeting of the Ayrshire Agricultural Society. The judges' report has since been published. It is favourable to the system of steam cultivation, and Mr. Fowler has been awarded the association's gold medal in acknowledgment of his persevering and successful attempts to apply steam power to the cultivation of the soil. The rate of ploughing at Craigie was 6 acres, 2 roods, and 20 poles per day, at an estimated cost of 7s. 3½d. per imperial acre. At a meeting of landed proprietors and farmers it was resolved to purchase Mr. Fowler's cultivator, and retain it in the county. One half of the cost is borne by an Ayr firm, and the other half is subscribed by landed proprietors and tenant farmers. The plough will be hired out to plough whenever it is wanted, and no doubt when the season for ploughing comes round it will be in great request.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£ s. d.	Dis. p. ct.
IRON, English Bar and Bolt:—			
in London	pr tn	5 15 0	3
in Wales	„	5 0 0	„
in Liverpool	„	5 10 0	„
Staffordshire Bars (Deliv. into boats at wks; Nom. rates last qr. day for favourite brands)	„	7 0 0	1
Sheet, Single	„	8 10 0	„
Dbl.	„	10 0 0	„
Hoop	„	8 0 0	„
Rod, round	„	7 0 0	„
Nail Rod, sq	„	7 5 0	„
SHIPPING IRON, (Delivered in Liverpool 10s. per ton less)			
Staffordsh. Bars	„	7 0 0	2
Sheet, Single	„	8 15 0	„
Double	„	10 5 0	„
Hoop	„	8 5 0	„
Rod. Round	„	7 0 0	„
Nail Rod, Square	„	7 5 0	„
IRON, Rails, in Wales, cash	„	5 5 0	nett
„ „ 6 months	„	5 7 6	„
Old, to cut up	„	0 0 0	„
Railway Chairs, in Wales	„	4 0 0	„
„ in Clyde	„	3 15 0	„
Pig No. 1, in Clyde	„	2 13 0	„
3-5ths No. 1 & 2-5ths No. 3		2 13 7	„
No. 1, in Wales	„	3 10 0	„
No. 1, in Tyne and Tees	„	2 12 0	„
Ditto, Forge	„	9 0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	„	3 10 0	„
Welsh Forge Pig (all Mine), at the Port	„	3 5 0	„
Acadian Pig, Charcoal	„	7 10 0	„
Scotch Pig, No. 1, in London	„	0 0 0	„

		£ s. d.	Dis. p. ct.
IRON, Swedish, Indian assortments	pr tn	11 5 0	2
Russian C C N D to arrive	„	16 0 0	„
STEEL, Swedish Keg, ham.	„	15 10 0	2½
Ditto, rolled	„	15 0 0	„
Fagot	„	17 0 0	„
SPELTER, on the spot	„	18 5 0	no
To arrive	„	18 7 6	„
Hard, remelted	„	17 0 0	„
ZINC, in sheets	„	24 0 0	„
COPPER, Tile, 14 to 28 lb.	„	98 0 0	2
Tough Cake	„	98 0 0	„
Sheathing and Bolts	pr lb.	0 0 11	„
Sheet	„	0 0 11	„
Bottoms	„	0 0 11½	„
Old	„	0 0 9	„
Yellow Metal	„	0 0 9	„
Burra	„	96 0 0	„
Russian do.	„	0 0 0	„
LEAD, British Pig	„	20 0 0	„
Spanish	„	19 0 0	„
W. B.	„	21 5 0	„
Sheet	„	20 10 0	„
TIN, English Block, nom.	„	114 0 0	„
Bar „	„	115 0 0	„
Refined „	„	119 0 0	„
Foreign Banca	„	123 0 0	„
Straits	„	113 0 0	„
TIN PLATES, Charcoal, IC	pr bx	1 9 0	„
Ditto IX	„	1 15 0	„
Coke, IC	„	1 2 6	„
Ditto IX	„	1 8 6	„
Do. at Newport, 1s. pr bx less		—	„
Do. at L'pool, 6d.	„	—	
CANADA, Plates	pr tn	12 0 0	
QUICKSILVER	pr bt		

RAILS.—The market has been quiet during the week, and prices remain as last quoted.

SCOTCH PIG IRON.—A considerable amount of business transacted this week, and the tone of the market is stronger; prices also have advanced from 53s. 3d. to 53s. 7½d. per ton, which was the closing quotation in Glasgow, for Mixed Nos. cash.

SPELTER.—But few sales reported prices, however, keep steady.

COPPER without change.

LEAD in good demand.

TIN.—English in fair request this week, but in Foreign there has been but little done. Banca called £122 at £123, and Straits £112 at £113.

TIN PLATES are quiet.

May 15th, 1862. MOATE AND CO., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Teak	15 10	17 0	15 0	16 0
Quebec, red pine	3 10	4 10	3 5	4 0
yellow pine	3 0	4 0	3 0	3 15
St. John, N.B., yel.	5 0	5 10	5 0	5 10
Quebec, oak, white	5 0	5 10	5 0	5 10
birch	3 10	4 0	4 0	0 0
Memel	0 0	0 0	0 0	0 0
elm	3 10	4 15	3 10	4 15
Dantzic, oak	3 10	6 0	3 10	6 0
fir	2 15	3 10	3 0	4 0
Memel, fir	3 10	4 0	3 10	4 0
Riga	3 5	3 10	3 10	3 15
Swedish	2 15	3 0	2 15	3 0
Masts, Queb. rd pine	5 0	6 0	5 0	6 0
yl. pine	5 0	6 0	5 0	6 0
rd pine	0 0	0 0	0 0	0 0
Lathwood, Dantz, fm	6 0	6 10	6 0	7 0
St. Peters.	8 0	8 10	9 0	9 10
Deals, per C., 12 ft. by 3 by 9 in.				
Quebec, wht spruce	13 0	18 0	15 0	19 0
St. John, wht spruce	14 0	16 0	15 0	17 10

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Yel. pine, per reduced C.				
Canada, 1st quality	17 0	18 10	17 10	19 0
2nd do	12 0	12 10	12 0	13 0
Archangel, yellow	13 0	13 10	14 0	15 0
St. Petersbg. yel.	12 0	12 10	12 10	12 10
Finland	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	15 0
Gothenburg, yel.	10 0	11 10	10 0	12 10
white	9 10	10 0	9 10	11 0
Gefle, yellow	10 0	11 0	11 0	12 10
Soderhamn	10 0	10 10	11 0	12 10
Christiania, per C 12 ft. by 3 by 9 in. yellow	22 0	25 0	22 0	24 0
Deck plank, Dntz per 40 ft. 3 in.	0 14	1 4	0 14	1 4
Staves, per standard M				
Quebec, pipe	70 0	75 0	80 0	85 0
puncheon	16 0	18 0	16 0	18 0
Baltic, crown pipe	160 0	170 0	170 0	180 0

SCOTCH PIG IRON REPORT.

		s. d.	
No. 1	Gartsherrie	58 0	f.o.b Glasgow.
„ 1	Coltness	57 6	do.
„ 1	Calder	53 9	do.
„ 1	G.M.B.	53 3	do.
„ 3	Do.	51 6	do.
M. Nos.	Do.	52 6	do.

WARRANTS.

		s. d.	
3-5ths No. 1 and 2-5ths „ 3 .. G.M.B.	Cash prompt	53 9	per ton.
	1 mo. open	54 0	do.
	2 mos. „	54 3	do.
	3 „ „	54 4½	do.

MANUFACTURED IRON.

	£ s. d.	
Bars, Govan	6 0 0	
„ Common	6 10 0	
Drumpeller, Common	6 10 0	
Do. Best	7 10 0	
Cramond Scrap Bars Delivered in London	10 5 0	less 5 per cent.
Plates and Sheets	9 0 0	to £9 10s.
Rails	6 5 0	
Pipes	4 17 6	
Chairs	3 15 0	

GLASGOW, 14th May, 1862.

Scotch pig iron remains remarkably firm, which shows that the recent advance is acknowledged as due.

Consumers are now buying at the current rates, and although makers' iron is plentiful, it is no drug in the market. 53s. 3d. and 53s. 9d. paid this week, and to-day we close sellers 53s. 9d., buyers 53s. 7½d.

Exports last week were 14,127 tons, against 16,045 tons in the corresponding week of last year.

SHAW, THOMSON, and MOORE, Metal Brokers.

SOCIETY OF ENGINEERS.

May, 12th, 1862.

ON THE USE OF COAL IN FURNACES WITHOUT SMOKE.

By CHARLES F. T. YOUNG.

FROM the first employment of coal in open or closed furnaces we find the desirability of abating the nuisance of the smoke arising therefrom, fully admitted, and also that constant attempts were and are being made, to get over this unpleasant and unsightly nuisance.

The immense increase in the use of coal is continually adding to, instead of decreasing, the huge volumes of smoke which meet our eye in nearly every direction, more especially in the manufacturing districts, and, as a rule, it may be said that but little success attends the attempts made to diminish the evil, or at least, if this is not the case, that little employment is given to those methods by which the nuisance might be reduced.

The smoke nuisance, it may be remarked, has even its supporters, for it has been urged by persons of a "smoky" tendency that the healthiness of London is in a great measure due to the large quantity of carbon with which the atmosphere is constantly charged, and which absorbs the poisonous exhalations of the sewers and other fetid matter. No doubt this may have a certain amount of truth in it, because carbon or charcoal is well known to be a powerful disinfectant, but I think that some more pleasant way of getting rid of the effluvia which are said to be destroyed by the carbon might be arranged, so that the perpetuation of this nuisance need not be sought on sanitary grounds.

The influence of the atmosphere of London was felt for miles around, though at present its effects are much diminished, and all who live in the neighbourhood of a smoky manufactory are well aware that the more delicate plants grow with difficulty in such situations, or perish entirely. The effect of a single factory chimney has been traced by the grass in the direction of the prevailing winds being destroyed, and nothing remaining but rank weeds of a few species capable of resisting the smoke.

The nuisance caused by the falling of the soot or blacks, and of which, by the way, we have a tolerable allowance in London, has increased of late years to such an extent in Leeds that many situations used by the inhabitants for drying linen in the air have been obliged to be given up, and the fact that smoke and soot loading the atmosphere, filling the eyes and noses of the passers by, and spoiling their clothes, are intolerable nuisances, are too plain to need any further proof.

Twenty years ago a writer said on this subject "The smoke arising from the furnaces employed at factories has, within the last twenty or thirty years, been felt as a great nuisance in most manufacturing towns, polluting as it does the pure air of Heaven, and begriming every exposed object within the range of its influence. Those employing furnaces have also become generally aware that if either less of it were generated, or if when generated it could be consumed, there would be a great saving in the expense of raising steam."

The worst portion of smoke is the superfluous carbon which is left unburnt, when either sufficient atmospheric air is not present, or the temperature is not sufficiently high for perfect combustion of the varieties of carburetted hydrogen and the vapour of coal tar which are disengaged from heated coal. Under either of these circumstances the hydrogen inflames, while the carbon is left to be carried forward by the draught of the chimney, poured out of its mouth, and ultimately to fall to the ground, and form the nuisance so loudly and so justly complained of.

It is further necessary that the due proportion of atmospheric air should be intimately mixed with the combustible gases before or during exposure to the requisite temperature; otherwise, however much may be introduced, it cannot be said to be present availably for the intended purpose. In ordinary furnaces, at the period when smoke is most abundant, that is soon after the coals are thrown on, both of these conditions are wanting; too little air is present, and the temperature is too low at the surface of the fresh fuel, for perfect combustion, and the entrance of air through the bars, which would to a certain extent assist in promoting combustion, is diminished, by the coals just thrown on having closed, as it were, the apertures through which it could enter.

It should always be remembered that in burning coal it is needful to introduce air in sufficient quantity to maintain a sufficiently high temperature in the furnace, and to so distribute it amongst the solid and the gaseous portions of the fuel as to effect that thorough mixture of the air and the gases whereby alone their perfect combustion can be ensured and the formation of smoke prevented.

At every charge of fresh coal on the fire the first product is not smoke, in the strict sense of the word, but a very large body of crude, impure coal gas, or rather coal in a minute state of diffusion or disintegration; and this in either greater or less quantity, and of longer duration, according as the furnace is more or less free in obtaining the supply of air needed to obtain a perfect combustion.

Theoretically speaking, if a furnace could be so constructed that the proper amount of air could be constantly admitted in its proper place at the various states of the fire, from its green state after a heavy charge of coal to its bright and clear state, and no more than is actually required at each stage, no smoke would ever be seen; but, as in practice this, for various reasons, cannot be carried out, recourse is obliged to be had to various plans as additions, by means of which this perfection is to be attained, and the intolerable nuisance of clouds of black smoke diminished.

It should be borne in mind that there is not much difficulty in getting a large quantity of air into a furnace; leaving the door open, for example, would let in air enough, but then there is the disadvantage of cooling the furnace and lowering the steam from the air introducing itself "in a lump," and not becoming intimately and rapidly mixed with the products of combustion.

The late Dr. Dalton has shown by his interesting experiments that for perfect diffusion of the air amongst the gases time is required, but the construction and working of ordinary furnaces will not admit of this; therefore, in order to get over this difficulty, we have to apply some mechanical arrangement. Dr. Ure says he found by experiments made with Dr. Wollaston's differential barometer, in several factories where both high and low pressure steam were employed, "That the aërial products of combustion from the boiler furnaces flew off with a velocity of fully 36ft. per second, a rate so rapid as to preclude the possibility of the hydrogenated gases from the ignited coals becoming so duly blended with the atmospheric oxygen as to be burned."

It will be evident, therefore, that there is something more needed to prevent smoke, and thereby promote economy in fuel, than the mere admission of air into the furnace. It has just been shown that we may have enough, and too much air, but that from applying it in a wrong manner, though we may to a certain extent diminish the smoke, we also diminish the steam, a process which few of the boilers at present in use can permit without seriously impairing the working of the engine. If we take the open end of a gas pipe, and burn the gas issuing therefrom, we have a great amount of smoke and but little heat; pass the gas through a common Argand burner and we have an intensely hot, smokeless flame. By this we see that the numerous small holes with which the Argand burner is provided affords that more rapid and perfect diffusion of the gas amongst the air required for its combustion than is afforded by the large bore of the tube, which suffers the gas to escape in a lump or solid mass, unmixed with the amount of air required for its perfect combustion.

From this we learn that, instead of admitting the amount of air required for the combustion or complete utilisation of the fuel put into the furnace in a lump, it should be so admitted that it becomes thoroughly and quickly intermixed with the hot gases whilst still in the hotter part of the furnace, and if it be properly managed we evidently obtain thereby the rapid diffusion and complete mixture required for perfect combustion.

It has long been a favourite idea—which is no doubt perfectly correct in theory, only we don't get it in practice—that if we can have sufficient furnace space by the proper setting of the boiler, that if we can secure the proper amount of air during the process of combustion, that if we can keep the engine at work by careful and moderate firing, and that if we can secure proper care and attention on the part of the firemen, no smoke would be produced, and that, therefore, no apparatus for preventing smoke would be needed.

All this I am sure we shall readily admit, but then to do this requires what we have never yet seen, viz., a perfect furnace, perfect attention on the part of the men, and perfection all over; conditions which, in 999 cases of 1,000, it is utterly impossible to fulfil under the circumstances in which most of our steam boilers are employed. The continually increasing demand for increased power from most engines requires them to be worked, and the fires to be urged, beyond their usual or original capabilities; and, consequently, hard firing, increased consumption of fuel, increased smoke, increased wear and tear, and increased neglect of smoke abatement, are the inevitable results of such a system, and must sooner or later lead to some more powerful and increased control being exercised over the owners of steam power.

The late Dr. Ure remarked that nothing places in a clearer light the heedlessness of mankind to the most instructive lessons than their neglecting to perceive the difficulty of duly intermingling air with inflammable vapours for the purpose of their combustion, as exhibited in the every-day occurrence of the flame of a tallow candle or common oil lamp; for though this flame be in contact externally with a current of air created by itself, yet a large portion of the tallow and oil passes off unconsumed, with a great loss of the light and heat which they are capable of producing. It is well known that elastic fluids of different densities, such as air and carburetted hydrogen, intermingle very slowly, but when the air becomes considerably carbonated, as it does in passing through the grate, and consequently heavier, it will not incorporate at all with the lighter combustible gases above it in the short interval of the aërial transit through the furnace and flues. Thus there can be no more combustion amidst these gases and vapours than in the axis of a tallow candle. The first operation which coals undergo when thrown into a furnace is distillation, attended with a great absorption of heat, and may be compared to the distillation of sulphur in the process of refining it, for which purpose much external heat is required; but if the fumes of sulphur or the coals be, after ascension, intermingled with the due quantity of atmospheric oxygen, they will, on the contrary, generate internally from the beginning their respective calorific effects.

Dr. Brett observes, in speaking of the supply of air required in close furnaces, "Every one who observes the volumes of black smoke escaping from the chimneys of manufactories must be struck with the positive waste of fuel thus sustained; yet not only is the black smoke lost for calorific effect, but a further loss may be traced to the passing off of what may be called a smoke, though not visible—I mean unburnt carburetted hydrogen and carbonic oxide. By mingling atmospheric air with the inflammable gases before they can escape unburnt, black smoke may be got rid of, or, in other words, that loss of fuel, and consequent loss of heat, may be avoided. The importance of this supply of good, instead of vitiated air at the proper time and place, the no less important influence which a thorough commingling of the substances to be burnt and the substances burning exerts in facilitating full and complete chemical union, and the injurious effect from a neglect of these precautions, appear to be quite manifest if we look to the nature of the elementary substances which enter into the composition of all ordinary pit coal."

It is constantly urged by those who are owners of smoking furnaces that it is not worth the trouble and cost of preventing smoke, the fuel they use being so "cheap;" but they must admit that, however "cheap" it may be, it still costs something, and it must thence be evident that a "penny saved is a penny got," and that we are all trying both to "save" and "get" pennies (at least I know I am), and which, by the way, soon make pounds; every penny saved from going up the chimney is a penny put in their pockets. If these persons, however, are so rich that they do not require to save "pennies" for their own advantage, let them, at least, learn to leave the atmosphere as clear and as pure as it is given us, and not make their furnaces nuisances to a whole neighbourhood, annoying alike both to rich and poor, without at the same time affording a single benefit.

Another great assistant to smoke-making in the ordinary furnace is the thick, heavy fire-bar with the very limited air-way, which its very thickness causes. Air being needed for combustion, it seems difficult to account for the use of these bars, when a moment's reflection must show that the thicker the bars the more limited becomes the area of opening whereby air can be admitted to support combustion. A great reform has, however, taken place of late years in this direction by the employment of slotted bars, Argand bars, and other contrivances, whereby a strong bar is obtained, and yet a great amount of air-way is secured. Of these varieties the open bar, known as Stratford's, seems to me the best, and one most calculated to obtain the end in view.

One of the members of our society specified a short time since a bar to be made of thin, deep plates of wrought iron rivetted together, with pieces between to give the necessary air-way. This bar has been found to give excellent results in practice, and has been used for a considerable period in the coal-burning locomotives of the Societé Couillet, and may be seen in the fire-box of a locomotive now in the Exhibition. These engines, I am informed, use the dirtiest description of small coal, so dirty that it frequently has to be washed before it can be used, and it is said that without this plan of bar they could not use it. From the description of it I should say the fuel is not better than "breeze."

Now, let us consider a moment what we are "practically" doing when we are letting huge volumes of black smoke curl out of our chimneys, and I think, from what we must find as the results of that consideration, that the first step will have been arrived at towards alleviating the evil.

First, we build round our boilers and furnaces in brickwork, because it is nearly a non-conductor of heat, and that thereby the heat evolved from the coal burnt in the furnaces may be prevented from passing away and be lost. Next, we so arrange the flues or heat passages around and under the boiler or through it, and amongst the water, as the case may be, that the heat may have every opportunity of passing into the water, and forming itself into steam.

Then we sometimes, but not always, carefully cover up with non-conductors of heat our steam pipes and cylinders, which latter we also occasionally envelope in steam jackets (through which we also occasionally pass the exhaust steam) in order to prevent the loss of heat by radiation, all of which proceedings (but one) are highly commendable, and show that, up to a certain point, we are disposed to be careful of our heat after we have extracted it from the coal.

Now, having done all this, taken this trouble, and gone to this expense, the question arises of "What has all this been done for?" The answer is, to save money, or rather steam, for steam is money, and get as much work out of a given quantity as possible. But I say that this is only a partial saving—it is saving at one end and losing at the other; for so long as by improper construction of furnaces, or by want of proper arrangements, we allow a portion of the fuel put into that furnace to pass unconsumed out of the top of the chimney, and without converting a portion of the water into steam, I maintain that we are not working with the full amount of saving to which we are fully entitled, and might easily obtain, were proper attention given to the subject; and then we should find, from being thoroughly awake to its importance, that we had taken the next step towards preventing smoke, as we should quickly adopt those means which would secure this desirable result.

It would seem to be anything but an evidence of the wisdom of "practical" men when we see them first fill a boiler with any amount of small tubes, through which they cause the heat to pass, with the avowed intention of getting out of the fuel all the heat it contains, and then employ that fuel in such a manner that it deposits in all the internal surfaces of these tubes a large amount of non-conducting matter, by means of which a great amount of their "practical" effect is diminished, and yet this is the daily practice with tubular boilers, where coal is burnt without any means being taken to prevent the formation of smoke. It would seem here that a little theory engrafted on this large amount of "practical" knowledge would not be out of place.

In marine boilers little attention has been paid to what is taking place during combustion, and the necessity of making them occupy as little room as possible has led to deficient boiler power, requiring hard firing, which is not by any means conducive to smoke prevention, nor even to obtaining the full practicable duty of the coal burnt, and the proportions between engine and boiler are so restricted that perfect or even decent combustion is not easily attained.

Smoke may, however, be greatly diminished in them if judgment be used in applying the means, and care be taken to see that they are used, and not neglected and suffered to get out of order.

While on the subject of economy in the use of fuel I would make a few remarks in regard to feed-water heating, its desirability and advantages, especially in the case of high-pressure non-condensing engines, where the steam which has done its work in the cylinder is blown into the atmosphere, and not needed for creating a draught in the furnace.

As it would take too long to go into the history, merits, demerits, and description of the various plans which have been patented or used from time to time, and which are of all possible and impossible descriptions, I shall, therefore, proceed to enumerate what a good feed-water heater should be, what it should do, and why it should be employed.

The first grand requirement in anything, especially from a popular point of view, is cheapness, and this is particularly the case in anything relating to steam engine improvement, where it is generally found that, if an engine works at a certain cost, there is not much inclination evinced to adopt even a cheap improvement, by means of which a further economy might be obtained in its working, unless such an improvement be very cheap indeed. From this it will be evident that one great requirement in a feed-water heater is cheapness, and it may be said that after that come efficiency, simplicity, freedom from liability to derangement, ease of management, and the capability of being cheaply and easily applied in those situations where its services may be required.

A good feed-water heater should, in the smallest possible space, with the smallest amount of superintendence, and in the smallest amount of time, do the greatest amount of work, run for the greatest length of time without repair or diminished efficiency, and with as little wear and tear as possible, and heat the cooler feed passing into the boiler to as near the boiling point as possible.

The reasons why a good and simple feed-water heater should be applied to all steam engines are numerous, but the chief and most important is on the score of economy, or saving, as it is rightly termed; and, if we remember that it is said that the very best engines yet made only give from one-twelfth to one-ninth of the theoretic duty contained in the fuel burnt, it must be admitted that there is room for a greater economy than we have yet in practice. Let us take, for example, an engine burning 20 cwt., or 1 ton, of coal per day, doing a certain amount of work, and let this engine, when the steam has done its work in the cylinder, exhaust it into the atmosphere, and thus suffer it to go to waste with a considerable amount of heat in it, which heat is thus dissipated in the atmosphere and lost. Now, it is evident that any portion of this heat saved is a clear gain, and if it be returned to the boiler in the shape of hot feed-water it will be evident that a greater amount of duty will be obtained from that boiler with a given weight of coal than when cold feed is pumped in, and a corresponding saving in coals result.

We will assume, for the sake of argument, that the coal cost 20s. per ton, or 1s. per cwt, or £1 per day; now, if we can save, say, 2 cwt. = 2s. per day from the waste heat passing off in the exhaust steam by the use of a cheap and effective arrangement for this purpose, I think few will say that this is not worth doing, and that more will be found to try it.

The drawings, to be given by and by, show in section and elevation one variety of just such a simple and compact apparatus, in which the steam taken by a short pipe from the exhaust or blast pipe, after it has been used in the cylinders, is projected into a short tube leading into the heater, and is delivered amongst the feed-water, which enters the heater in a thin annular sheet around the steam nozzle. In this short tube or chamber the water is broken into spray by the steam, which is instantly condensed, and the water is raised to a high temperature, at or near the boiling point, and runs into the pump or small cistern by it, and is then pumped into the boiler. In trying the working of this arrangement, on a bitter cold day in the month of February, the feed-water entering the heater was at the temperature of 39 deg., and, after it had gone through the heater, passed out at the temperature of 191 deg., at which it was pumped into the boiler. The engine used 20 cwt. of coal per day without the heater, and when it was put in operation the consumption fell to 18 cwt. It will be seen that this arrangement can be easily applied to locomotive and agricultural engines on wheels, where simplicity, lightness, compactness, and ease of application are of importance, and it is also of easy application to engines of all descriptions, and, from its being free from any liability to get out of order, easily get-at-able for cleaning, and possessing no complication of parts, I have no doubt it will be of very extended application. This arrangement has been patented by D. K. Clark, the inventor, and is the simplest plan I have yet seen for accomplishing this desirable purpose.

It was once proposed that an association or society should be formed to receive and consider propositions for abating the nuisance of smoke, with funds, obtained by subscriptions or otherwise, sufficient to buy up any patent that might be deemed adequate to the purpose, and then, by enforcing the acts of the Legislature, to see it carried into effect; but I do not find that any steps were taken to carry out this very desirable undertaking.

I would remark now that it seems to be the intention of Government, by its Metropolitan Smoke Bill, now before the House of Lords, to enforce more rigidly on the owners of engine and other furnaces the consumption of the smoke arising from them, it will be necessary to see that the circumstance of having put up the proper apparatus for effecting that object shall not be admitted as a sufficient defence in case of an action or indictment, where the continuance of the nuisance proves that the means, though thus admitted to be at hand, are not employed, otherwise any law will produce little effect.

One thing is very evident, that, so far as London is concerned, considerable improvement has taken place in its usually smoky atmosphere, but a great deal still remains to be done towards further diminishing, if not altogether preventing, the clouds of smoke which still appear around us. It is, I believe, practicable to divest our manufacturing operations of a great portion of the evil at present attached to them, namely, their smokiness, by obtaining a more perfect combustion of the coal used, and at the same time a considerable economy by that operation.

In diminishing smoke much no doubt depends upon the determination of the owners of furnaces to set about it and have it done, and, having had the means applied, resolutely to enforce its employment by the firemen or others into whose hands its working may fall. In the majority of cases, where the management of an arrangement for this purpose is left entirely to the superintendance of the stoker, it either only partially fulfils its purpose, or is found to be entirely useless, from the neglect and indifference of this individual, who well knows that any fine or action for non-prevention of smoke will fall on the master, not on himself. It would be a very desirable thing if all those who apply a plan for the prevention of smoke to their furnaces would make themselves acquainted with its operation, see that it acts well, and, having done so, take such precautions or make such arrangements that, in case of any smoke appearing, the party in charge of the engine or furnace should suffer by a fine; this, I think, would strike at the root of the evil, and make the men take an interest in their work, which at present does not seem to be generally the case.

(To be concluded next week)

INTERNATIONAL EXHIBITION OF 1862.

LIST OF JURORS IN CLASSES AND SECTIONS.

(Concluded from page 301.)

Class XIX.—Flax and Hemp.

1. M. Alcan, France, Professor at the Conservatory of Arts and Manufactures, 32, Ovington-square, S.W.; 2. Erskine Beveridge, Dunfermline, Flax Manufacturer, 15, Langham-street, Portland-place, W.; 3. Marquis Luigi Cusani, Italy; 4. Wm. Charley, Belfast, Linen Merchant; 5. Ch. de Brouckere, Belgium, President of the Chamber of Commerce at Roulers, Member of the Upper Council of Industry; 6. G. Mevissen, Chairman, Zollverein, Privy Councillor of Commerce, Cologne, Westminster Palace Hotel, S.W.; 7. J. Moir, Dundee, Flax Spinner; 8. C. Oberleithner, Austria, Manufacturer; 6. Hon. Fred. Smyth, United States, formerly Member of the Senate of New Hampshire.

Class XX.—Silk and Velvet.

1. Henry Brocklehurst, Macclesfield, Velvet Manufacturer, 31, Milk-street, Cheapside, E.C.; 2. Charles Diggelmann, Switzerland, Silk Warehouseman; 3. Arlés-Dufour, Chairman, France, Member of the Chamber of Commerce at Lyons; 4. H. W. Freeland, M.P., Turkey, Athenæum Club, S.W.; 5. Anton Harpke, Austria, Member of the Chamber of Commerce at Vienna; 6. W. S. Leaf, London, Silk Warehouseman, 39, Old-change, E.C.; 7. S. W. Lewis, London, Silk Mercer, 193, Regent-street, W.; 8. Jose Reig, Spain; 9. Filippo Sessa, Italy, Manufacturer, Westminster Palace Hotel, S.W.; 10. Baron Von Diergardt, Zollverein, Privy Councillor of Commerce, Viersen; 11. Thomas Winkworth, London, late Silk Manufacturer, 7, Sussex-place, Canonbury, N.

Class XXI.—Woollen and Worsted, including Mixed Fabrics generally.

1. R. Atkinson, Dublin, late Lord Mayor of Dublin, Poplin Manufacturer, 1, Cambridge-place, Victoria-road, W.; 2. Alex. Boutovsky, Russia, Director of the Department of Manufactures and Inland Trade; 3. Wm. Clabburn, Norwich, Shawl Manufacturer; 4. H. Hudson, Leeds, Woollen Merchant, 7, Harley-street, Cavendish-square; 5. E. Huth, Huddersfield, Foreign Merchant; 6. Larsonnier, France, Member of Chamber of Commerce of Paris; 7. Laoureux, Belgium, Member of the Senate; 8. F. Marback, Saxony, Manufacturer, Chemnitz; 9. Chs. Offermann, Chairman, Austria, Manufacturer, at Brünn, 24, Charles-street, St. James's-square; 10. C. Palmstedt, Sweden, Professor; 11. E. Pratorious, Prussia, Councillor of Commerce, Berlin; 12. J. W. Redhouse, F.R.A.S., Turkey, 18, Garway-road, Bayswater, W.; 13. H. W. Ripley, Bradford, Chairman of the Bradford Chamber of Commerce, 9, St. George's-terrace, Hyde Park; 14. Gregorio Sella, Italy; 15. E. E. Vreede, Netherlands, Woollen Manufacturer; 16 H. S. Way, London, Woollen Warehouseman, 127, Cheapside, E.C.

Class XXII.—Carpets.

1. Badin, France, Director of Imperial Manufactures at Gobelin and Beauvais, 3, George-street, Portman-square; 2. J. Brinton, Kidderminster, Carpet Manufacturer, 90, Newgate-street, E.C.; 3. P. Graham, London, Upholsterer, 33, Oxford-street, W.; 4. H. L. Lapworth, London. Carpet Manufacturer, 22, Old Bond-street, W.; 5. Sylvain van de Weyer, Chairman, Belgium, Envoy Extraordinary and Minister Plenipotentiary, 50, Portland-place, W.; 6. W. Whitwell, Kendal, Carpet Manufacturer, 26, Gloucester-place, Dorset-square, N.W.

Class XXIII.—Woven, Spun, Felted, and Laid Fabrics, when shown as Specimens of Printing and Dyeing.

1. Pompejus Bolley, Ph.D., Chairman, Switzerland, Professor of Chemistry at Zurich; 2. Crace Calvert, F.R.S., Ph.D., Manchester Honorary Professor of Chemistry to the Manchester Royal Institution; 3. R. Dalglish, M.P., Glasgow, Calico Printer, 2, Queen's-gate-terrace, W.; 4. Alexander Harvey, Glasgow, Dyer; 5. F. Leitenberger, Austria, Manufacturer; 6. J. Mercer, F.R.S., F.C.S., Accrington, Calico Printer; 7. A. Neild, Manchester, Calico Printer; 8. Persoz, France, Professor at the Conservatory of Arts and Manufactures; 9. M. Reichenheim, Zollverein, Manufacturer, Berlin; 10. J. S. Stern, Manchester, Merchant, Fenton's Hotel, St. James's-street, S.W.

Class XXIV.—Tapestry, Lace, and Embroidery.

1. Aubry, France, Merchant, late Member of the Tribunal of Commerce; 2. Dan. Biddle, London, Lace Manufacturer, 68, Finchley New-road, Hampstead, N.W.; 3. Richard Birkin, Nottingham, Lace Manufacturer; 4. J. Fisher, London, late Lace Manufacturer, 60, St. James's-street, S.W.; 5. F. Fortamps, Chairman, Belgium, Member of the Senate, 27, Ovington-square, S.W.; 6. Rudolph Laporta, Austria, Manufacturer; 7. Prince St. Guiseppe of Vandolfina, Italy, Senator; 8. Major-Gen. Sir H. Rawlinson, K.C.B., F.R.S., Turkey, 1, Hill-street, Berkeley-square, W.; 9. Richter, Zollverein, Inspector of Industrial Schools, Schneeberg; 20. E. Stadler, Switzerland, Commission Merchant, 2, Lawrence-lane, E.C.; 11. Col. Sykes, M.P., F.R.S., India, Chairman of the East India Company, 47, Albion-street, Hyde-park, W.

Class XXV.—Furs, Feathers, and Hair.

Section A.—*Skins and Furs.*—1. Duke of Casigliano, Italy; 2. E. Ellice, M.P., London, Deputy-Governor of the Hudson's Bay Company, 18, Arlington-street, S.W.; 3. Gabl. Kamensky, Chairman, Russia, Russian Commissioner in London, 33, Victoria-road, Kensington-gore, W.; 4. J. A. Nicholay, London, Furrier, 82, Oxford-street, W.; 5. Guillmo. Petit, France, Manufacturer; 6. E. B. Roberts, London, Furrier to the Hudson's Bay Company, 239, Regent-street, W.

Section B.—*Feathers and Manufactures from Hair*—1. Augustus Altgelt, Zollverein, Government and Architectural Councillor, Berlin; 2. Chas. Duncum, London, Artificial Florist, 16, Wigmore-street, W.; Henri Gillett, France, Manufacturer, President of the Chamber of Commerce of Bar-le-Duc; 4. G. B. Kent, London, Brush Manufacturer, 11, Great Marlborough-street, W.; 5. C. Nightingale, London, Feather and Hair Merchant, 88, Gloucester-place, Portman-square, W.

Class XXVI.—Leather, including Saddlery and Harness.

Section A.—*Leather, and Manufactures generally made of Leather.*—1. M. Blackmore, London, late Leather Dresser, East Moulsey, S.W.; 2. Fauler, France, late Manufacturer, Member of the Chamber of Commerce, Paris; 3. J. George, London, Wholesale Leather Factor, 4, Skinner-street, E.C.; 4. Lang-Gores, Zollverein, Manufacturer, Malmedy; 5. Wm. Linley, London, Leather Factor, 30, West Smithfield, E.C.; 6. Major-Gen. Count E. Martini di Cigala, Italy, Aide-de-Camp to his Majesty; 7. Piret Pauchet, Belgium; 8. Moritz Pollak, Austria, Manufacturer and Merchant; 9. Jean Reymod, Switzerland, late Currier, Morges.

Section B.—*Saddlery and Harness.*—1. Earl of Bessborough, Chairman, London, Master of the Buckhounds, 40, Charles-street, Berkeley-square, W.; 2. Hy. Brace, Walsall, Wholesale Saddler, 3, Norfolk-road, St. John's Wood, N.W.; 3. C. Joyce, Egypt, Merchant, 32, Moorgate-street, E.C.; 4, Leblanc, France, Late Officer of the Imperial Navy; 5. Ben. Long, Manchester, Saddler, Brenthouse, Hendon, N.W.

Class XXVII.—Articles of Clothing.

Section A.—*Hats and Caps.*—1. Cavarè, France, late Merchant; 2. George Christy, London, Hatter, 35, Gracechurch-street, E.C.; 3. S. B. Eveleigh, Manchester, Hat Manufacturer, 4, Hereford-square, S.W.; 4. Aloys Isler, Switzerland, Straw Manufacturer, Wildegg; 5. Wm. Swinscow, London, Furrier, Loman-steeet, Southwark, S.E.

Section B.—*Bonnets and General Millinery.*—1. Thomas Brown, London, Wholesale Milliner, 85, Wood-street, Cheapside, E.C.; 2. Henry Gregory, London, Straw Bonnet Maker, 15, Aldermanbury, E.C.; 3. Alphonse Payen, France, Merchant, Member of the Chamber of Commerce of Paris; 4. Samuel Sugden, London, Warehouseman, 12, Aldermanbury, E.C.

Section C.—*Hosiery, Gloves, and Clothing in General.*—1. J. D. Allcroft, London, Glover, 55, Porchester-terrace, W.; 2. J. R. Allen, Nottingham, Hosier, 8, King Edward-street, E.C.; 3. F. Esche, Zollverein, Manufacturer, Limbach; 4. Gaussen, France, late Manufacturer; 5. Joseph Gunkel, Chairman, Austria, Member of the Chamber of Commerce, Vienna; 6. J. Hunter, London, Robe Maker to the Queen, and Tailor, 34, Maddox-street, W.; 7. Luigi Scalia, Italy, Member of the Italian Parliament; 8. Vanderborght, Belgium, Manufacturer.

Section D.—*Boots and Shoes.*—1. J. K. Bowley, London, Bootmaker, 53, Charing-cross, W.C.; 2. R. D. Box, London, Shoemaker, 187, Regent-street, W.; 3. Gervais (Caen), France, Director of the Upper School of Commerce; 4. Huber, Zollverein, Director of the Chamber of Commerce of Stuttgart; 5. Jas. Medwin, London, Bootmaker, 86, Regent-street, W.; 6. Fred. Sucss, Austria, Manufacturer.

Class XXVIII.—Paper, Stationery, Printing, and Bookbinding.

Section A.—*Paper, Card, and Millboard.*—1. Bart. Cini, Italy, Member of the Italian Parliament; 2. Charles Cowan, F.R.S.E., Edinburgh, Paper Manufacturer, 11, Sussex-place, S. Kensington, W.; 3. E. Hoesch, Zollverein; 4. Wyndham S. Portal, Basingstoke, Paper Manufacturer, 3, Wilton-crescent, Belgrave-square, S.W.; 5. Sainte-Claire-Deville, France, Member of the Institute, Professor at the Normal School, 3, Byng-place, Gordon-square, W.C.; 6. W. R. Spicer, London, Wholesale Stationer, 19, New Bridge-street, E.C.

Section B.—*Stationery.*—1. Warren de la Rue, F.R.S., F.C.S., London, Ornamental Stationer, 110, Bunhill-row, E.C.; 2. List, Zollverein, Manufacturer, Frankfort-on-the-Maine; 3. Victor Masson, France, Judge to the Tribunal of Commerce of the Seine, 21, Pelham-crescent, S.W.; 4. Earl Stanhope, F.R.S., Chairman, London, 31, Grosvenor-place-houses, S.W.; 5. H. Stevens, F.S.A., F.R.G.S., United States, Literary Agent, 4, Trafalgar-square; 6, C. Venables, Bath, late Papermaker, 42, Cambridge-terrace, W.

Section C.—*Plate, Letterpress, and other Modes of Printing.*—1. Adam Black, M.P., London, 24, James-street, Buckingham-gate, S.W.; 2. George Clowes, London, Printer, Duke-street, Stamford-street, S.; 3. Guiseppe La Farina, Italy, Member of the Italian Parliament, Councillor of State, late Minister in Sicily; 4. Ch. Girardet, Austria, Manufacturer; 5. Jamar, Belgium, Member of the Chamber of Representatives, 21, Norfolk-street, W.C.; 6. H. Korn, Zollverein, Bookseller and Printer, Breslau; 7. Laboulaye, France, late Typefounder; 8. W. Spottiswoode, F.R.S., London, her Majesty's Printer, 19, Chester-street, W.

Section D.—*Bookbinding*—1. J. Gibson Craig, W.S., Edinburgh; 2. Ch. Reed, F.S.A., London, Printer, Foundry, Fann-street, E.C.; 2. Jas. Toovey, London, Bookseller and Publisher, 177, Picadilly, W.; 4. L. Wolowski, France, Member of the Institute, Professor to the Conservatory of Arts and Manufactures, 27, Duke-street, St. James's, S.W.

Class XXIX.—Educational Works and Appliances.

Section A.—*Books and Maps.*—1. Hon. and Rev. S. Best, London; 2. Robt. Chambers, F.R.S.E., Edinburgh, Editor and Publisher, 6, Hall-road, St. John's-wood, N.W.; 3. Gottfried Müller, Austria, Professor, Hermanstadt; 4. Antonio Panizzi, D.C.L., Italy, Librarian, British Museum; 5. Robert, France, Master of Appeals to the Council of State; 6. Nassau Senior, London, 13, Hyde Park-gate, W.

Section B.—*School Fittings, Furniture, and Apparatus.*—1. Rt. Hon. C. B. Adderley, M.P., London, 35, Eaton-place, S.W.; 2. Marquis Gustavo Benso di Cavour, Chairman, Member, Italian Parliament, 44, Thurloe-square, S.W.; 3. Hy. Chester, Esq., London, late Secretary to Committee of Council of Education, 63, Rutland-gate, W.; 4. Rev. M. Mitchell, London, one of H.M.'s Inspectors of Schools, Education Department, Council Office, S.W.; 5. Léon Say, France; 6. Sir J. K. Shuttleworth, F.R.G.S., F.G.S., London, 38, Gloucester-square, Hyde Park, W.

Section C.—*Appliances for Physical Training, including Toys and Games.*—1. E. Chadwick, C.B., London, 5, Montague-villas, Richmond, S.W.; 2. Viscount Enfield, M.P., London, 7, Charles-street, Berkeley-square, W.; 3. Flendin, France, Councillor of State; 4. R. Monckton Milnes, M.P., London, 16, Upper Brook-street, W.; 5. Dr. Rud. Wagener, Zollverein, Professor, Würzburg.

Section D.—*Specimens and Illustrations of Natural History and Physical Science*—1. Cloquet, France, Member of the Institute, Professor of Medicine; 2. Rev. B. M. Cowie, B.D., London, one of her Majesty's Inspectors of Schools, 62, Queen's-gardens, W.; 3. J. E. Gray, Ph. D., F.R.S., Keeper of Zoological Collection, British Museum, W.C.; 4. N. S. Maskelyne, London, Keeper of Mineralogy, British Museum, W.C.

Class XXX.—Furniture and Upholstery, including Paper-hangings and Upholstery.

Section A.—*Furniture and Upholstery.*—1. Dr. Begg, Chairman, Zollverein, Principal of the School of Industry and Commerce, Fürth, 48, Brompton-square, S.W.; 2. Lord de l'Isle, London, St. George's Hotel, Albemarle-street, W.; 3. Demanet, Belgium, Member of the Department of Fine Arts of the Royal Academy, Belgium; 4. Count Demetrio Finocchietti, Italy, Vice-Governor of the Royal Palaces at Florence, 44, Thurloe-square; 5. William Holland, Upholsterer, 28, Mount-street, Grosvenor-square, W.; 6. John Jackson, London, Carton Pierre Manufacturer, 49, Rathbone-place, W.; 7. M. Markert, Austria, Manufacturer, Vienna; 8. L. Piglhein, North Germany, Cabinet-maker, 15, Montpellier-street, S.W.; 9. J. H. Pollen, Rome, 11, Pembridge-crescent, W.; 10. Du Sommerard, France, Director of the Museum of Cluny, 3, Ovington-square, S.W.; 11. Sir C. Trevelyan, K.C.B., India, 8, Grosvenor-crescent, Belgrave-square, S.W.; 12. Digby Wyatt, F.S.A., London, Vice-President, Royal Institution of British Architects, 37, Tavistock-place, W.C.

Section B.—*Paperhangings and General Decoration.*—1. Lord Ashburton, F.R.S., London, President of the Royal Geographical Society, 82, Piccadilly, W.; 2. Marquis F. A. Gattinara di Breme, Master of the Ceremonies, Director-General of the Royal Albertine Academy, Senator, &c.; 3. J. G. Crace, London, Decorator, 14, Wigmore-street, W.; 4. Joseph Forguignon, North Germany, Upholsterer, 12, Greek-street, W.; 5. A. J. Beresford Hope, M.A., London, 1, Connaught-terrace, Hyde Park, W.; 6. Owen Jones, London, Architect, 9, Argyll-place, Regent-street, W.; 7. Prosper Mérimée, France, Senator, Member of the Institute.

Class XXXI.—Hardware.

Section A.—*Manufactures in Iron.*—1. J. G. Appold, F.R.S., London, Fur Skin Dyer, 23, Wilson-street, Finsbury, E.C.; 2. William Bird, London, Iron and Tin-plate Merchant, 3, Laurence Pountney-hill, E.C.; 3. Giulio Curioni, Italy, Secretary to the Royal Lombard Institute of Sciences; 4. Danbrée, France, Engineer-in-Chief to the Imperial Corps of Miners, Professor to the Museum of Natural History; 5. Chev. de Fridau, Austria, Proprietor of Iron and Steel Works, Styria; 6. A. Gill, Sweden, Director of Mines; 7. H. E. Hoole, Sheffield, Stove-grate Manufacturer, 14, Percy-street, Rathbone-place, W.; 8. J. Oaks, Alfreton, Ironmaster; 9. Dr. D. S. Price, F.C.S., London, 26, Great George-street, Westminster, S.W.; 10. L. Ravené, jun., Zollverein, Manufacturer, Berlin; 11. George Shaw, Birmingham, Patent Agent, Old Hummums Hotel, W.C.; 12. Trasenster, Belgium, Professor at the University of Liége.

Section B.—*Manufactures in Brass and Copper.*—1. S. Buckley, Birmingham, Merchant; 2. E. Gem, Birmingham, Merchant; 3. P. C. Hardwick, London, Architect, 21, Cavendish-square, W.; 4. De Longpérier, France, Member of the Institute, Conservator of the Museum of the Louvre; 5. Ferdinand Stamm, Ph. D., Austria, Member of the Austrian Parliament; 6. Dr. von Steinbeis, Chairman, Zollverein, Director of the Royal Central Board of Industry and Commerce, Stuttgart; 7. A. Tylor, London, Brass Founder, Warwick-lane, Newgate-street, E.C.

Section C.—*Manufactures in Lead, Tin, and Zinc, and General Hardware.*—1. Robert Fletcher, Birmingham, Merchant; 2. Goldenburg, France, Manufacturer; 3. W. A. Rose, London, Alderman, Lead Merchant, Queenhithe, E.C.; 4. G. Stobwasser, Zollverein, Manufacturer, Berlin; 5. J. S. Wyon, London, Chief Engraver of H.M.'s Seals, 287, Regent-street, W.

Class XXXII.—Steel.

Section A.—*Steel Manufactures.*—1. J. Brown, Sheffield, Mayor of Sheffield, Great Northern Hotel, King's-cross, N.; 2. Frémy, France, Professor at the Museum of Natural History, and at the Polytechnic; 3. Robert Jackson, Sheffield, Steel Manufacturer, 26, Palace-gardens-terrace, W.; 4. Thomas Jessop, Sheffield, Steel Manufacturer, 26, Palace-gardens-terrace, W.; 5. Dr. Karmarsh, Zollverein, Director of the Royal Polytechnic School, Hanover, 26, Palace-gardens-terrace, W.

Section B.—*Cutlery and Edge Tools.*—1. Henry Atkin, Esq., London, Merchant, late Master Cutler, 32, New Broad-street, E.C.; 2. De Hennezel, France, Engineer to the Imperial Corps of Mines; 3. M. Hunter, jun., Sheffield, Cutler, 67, King William-street, E.C.; 4. William Matthews, Sheffield, Past Master Cutler, 46, Salisbury-square, Fleet-street, E.C.; 5. Basil Roshkof, Russia, Colonel of Mining Engineers; 6. F. Wertheim, Austria, Vice-President of the Chamber of Commerce, Vienna; 7. Lord Wharncliffe, Chairman, London, 15, Curzon-street, W.

Class XXXIII.—Works in Precious Metals and their Imitations, and Jewellery.

1. Tommaso Corsi, Italy, Member of the Italian Parliament, late Minister of Agriculture, Industry, and Commerce; 2. C. W. S. Deakin, Birmingham, Merchant; 3. A. M. Dowleans, India, Secretary to the Bengal Central Committee for the Exhibition; 4. Frederick Elkington, Birmingham, Silver Plater, 97, Gloucester-terrace, Hyde Park, W.; 5. Fossin, France, late Judge to the Tribunal of Commerce, 5, Thurloe-square, Brompton, S.W.; 6. Frederick Friedland, Austria, Member of the Chamber of Commerce, Prague; 7. J. Hunt, London, Goldsmith, 156, New Bond-street, W.; 8. A. Kaiser, Zollverein, Manufacturer, Pforzheim; 9. H. J. Lias, London, Prime Warden, Goldsmith's Company, 18, Regent's Park-terrace, Gloucester-gate, N.W.; 10. W. Maskell, M.A., Bristol, 24, Onslow-square, S.W.; 11. Lord Stratford de Redcliffe, G.C.B., Chairman, Turkey, 29a., Grosvenor-square, W.; 12. Rev. Montague Taylor, London, 42, Graven-hill-gardens, W.

Class XXXIV.—Glass.

Section A.—*Stained Glass and Glass for Decoration.*—1. J. R. Clayton, London, Glass Stainer, 331, Regent-street, W.; 2. W. Dyce, R.A., London, Streatham, S.; 3. Sir Philip de M. Grey Egerton, M.P., F.R.S., London, 28B, Albemarle-street, W.; 4. J. R. Herbert, R.A., London, 7, Grove-end-place, N.W.; 5. E. Peligoz, France, Member of the Institute; Professor at the Conservatory of Arts and Manufactures, and at the Central School of Arts and Manufactures.

Section B.—*Glass for Household Use and Fancy Purposes.*—1. R. L. Chance, Birmingham, Glass Manufacturer, 51, Wimpole-street, Cavendish-square, W.; 2. Alfred Copeland, London, Glass Manufacturer, 160, New Bond-street, W; 3. James Hartley, Sunderland, Glass Manufacturer; 4. Jonet, Belgium, Member for the Chamber of Commerce at Charleroi; 5. Apsley Pellatt, London, late Glass Manufacturer, Knowle-green, Staines; 6. Pelouze, Chairman, France, Member of the Institute, President of the Commission of Money and Medals; 7. Frederick Schmitt, Austria, Secretary of the Statistical Department, Board of Trade, Vienna; 8. F. Wisthoff, Zollverein, Manufacturer, Kœnigs-Stelle.

Class XXXV.—Pottery.

1. Marquis D'Azeglio, Italy, Envoy Extraordinary and Minister Plenipotentiary of Italy; 2. Thomas Battam, F.S.A., London, 5, Aubrey-villas, Holland Park, W.; 3. Right Hon. W. E. Gladstone, M.P., Chairman, London, Chancellor of the Exchequer, 11, Carlton-house-terrace, S.W.; 4. Sir Thomas Gresley, Bart., Burton-on-Trent; 5. J. Marryat, London, Banker, 17, Upper Eccleston-place, Pimlico, S.W.; 6. Regnault, France, Member of the Institute, Professor of the College of France, Engineer-in-Chief, Imperial Corps of Mines, Director of the Imperial Manufactory at Sévres, &c.; 7. J. G. Robinson, London Superintendent of Art Collection, Department of Science and Art, South Kensington Museum, W.; 8. Chr. Fischer, Zollverein, China Manufacturer; 9. J. Webb, London, 11, Grafton-street, Berkeley-square, W.

Class XXXVI. — Dressing Cases and Despatch Boxes and Travelling Cases.

1. Charles Bazin, London, Dressing Case Manufacturer, 112, Regent-street, W.; 2. Beriah Botfield, M.P., F.R.S., London, 5, Grosvenor-square, W.; 3. Fink, Zollverein, Councillor of Commerce, Darmstadt; 4. Lord Harris, K.S.I., London, late Governor of Madras, 28, South-street, Grosvenor-square, W.; 5. Sir Thomas Phillips, F.G.S., Chairman, London, Vice-President and Chairman of the Council of the Society of Arts, 11, King's Bench Walk Temple, E.C.; 6. N. Rondot, France, Merchant; 7. F. West, London, Cutler, 1, St. James's-street, S.W.

Iron Targets.—On Tuesday Mr. Samuda's target was tried at Shoeburyness. It is of 5in. plate, with an iron backing equal to 2in. more, or 7in. of iron in all, no wood being used. The 10-in. Armstrong gun, fired with 50 lb. of powder, sent its shot clean through it, and into the bank behind.

A Railroad "Sink."—An American paper says a portion of the track of the Pittsburgh, Fort Wayne, and Chicago Railroad has sunk out of sight three times. The space where this occurred is about 200ft. long. After losing two other tracks, the company inserted piles. These have also sunk out of sight. They are now driving down piles of over 60ft. in length, and yet have not found hard ground. This spot is supposed to have been once occupied by a lake, over which vegetation has spread a thin crust.

A New System of Artillery.—The other night General Vandenburgh, of New York, who has been engaged for some time in this country with experiments in gunnery, made public the results in a lecture before the Royal United Service Institution. This result is a new system of artillery, by which a group or cluster of shot are projected, with the highest attainable range and precision to each, the group being such as to sweep and cover the largest area of space with the destroying force. He exhibited the parts of two guns, one projecting ninety-one 2-oz. shot, the other eighty-five of the regulation weight of 530 grains each. The guns are similar in form, of no greater weight, and discharged in the same manner, and with the same facility and rapidity as any single shotted breech-loading gun projecting the same weight of metal. One is a 12-pounder and one a 6-pounder; each is composed of a cluster of tubes or gun barrels, corresponding to the number of shot. It was demonstrated that less weight of metal was required in one or two hundred tubes, or bores, for projecting a given weight of matter, when subdivided into so many small shot, than in one tube or bore, for projecting this matter in one shot. He also referred to experiments, showing that each of these small shot can attain as great accuracy at long range as the larger mass. The union of these tubes, in a hollow cylinder or outer case, so as to assume the same general form as ordinary artillery, without impairing the independent capacity of each to do its duty, was also explained. One hundred and sixty-three of the Enfield gauge tubes, for projecting 2oz. solid shot or shell each, making a 20 pounder gun, are less than 1ft. in diameter; while 365 of the "small bore" make a gun of no greater dimensions. The breech is extremely simple, each tube or bore has its separate charge chamber, the whole in one block or piece. A powder charger (a small brass case) instantly drops a measured charge of powder into each at the same instant, and a cluster of shot corresponding to these chambers are placed in them with the same ease and facility as if there was but one shot. The ignition is from a common centre, from which the fire is radiated to all the chambers. The group of shot diverge slightly on leaving the muzzle. If the barrels are arranged parallel to each other, the mechanical defects give a good cluster for extreme range, and will disperse the shot something over 100ft. at a mile. If greater divergence is required, the muzzles are slightly separated or set divergent.

THE ACTION OF SEA WATER ON LIME MORTAR.

AT an ordinary general meeting of the Institution of Civil Engineers of Ireland, held in the Museum, Trinity College, Dublin, on Wednesday, May 14th, M. B. Mullins, Esq., C.E., vice-president, in the chair, Mr. B. B. Stoney, B.A. (member), read the following paper "On the Action of Sea Water on Lime Mortar."

Last year several breaches were made by storms in the retaining wall which supports the north side of the causeway between Ringsend and the Pigeon House Fort. The heart of the wall facing the Liffey was then exposed, and proved to be built of Calf rubble stone, with the mortar for the most part washed out from between the stones, so that the wall, which was originally, no doubt, composed of ordinary rubble, was reduced to the condition of a dry wall, and rendered, therefore, quite unfit to resist the impinging action of the waves. The little mortar which still remained was for the greater part reduced to the state of soft putty, which, when dried in the house, became pliable, without having the bond of ordinary mortar. Along with this soft putty was found a smaller quantity of good ordinary mortar, forming in some cases a hard core imbedded in the softer mass, but generally occurring by itself, in consequence of the softer material having been washed away. These effects were confined to that part of the wall below high-water line, the mortar above resembling ordinary mortar. Amongst other valuable information relating to the harbour of Dublin contained in the "Historical Sketch of Engineering in Ireland," by our late president, M. B. Mullins, Esq.,* we find that this wall was commenced in the year 1748. It is therefore about a century old, and a grave consideration arises, namely, how much dependence can be placed in lime mortar in similar positions, that is, when exposed to the action of salt water if its duration is to be limited to a century, or if it depends on conditions of which we have but little knowledge, and which are consequently beyond our control. It is a well-known fact that the purest limes, when in contact with sea-water for a lengthened period, are liable to an alteration of their chemical constituents, the salts of magnesia replacing those of lime. In connection with this subject Mr. J. Burnell states in his "Rudimentary Treatise on Limes," p. 55, that "Vicat studied the causes of these failures (artificial puozzolands), and was led by them to some conclusions which may probably explain, not only the disintegration of the limes, but also the destruction of some of the building stones, by sea water. He found in the sea water a very considerable portion of hydrochloride of magnesia, and he proceeded to experiment upon its action upon the hydrates and imperfect carbonates of lime. He found that, in a simple solution of the hydrochloride, the particles which were already in a state of perfect carbonisation remained intact; but that the particles which were simply in the state of hydrates passed into that of a soluble hydrochloride, and that the magnesia was introduced into the mass, and disseminated throughout the whole tissue. It then quickly passed to the state of a carbonate, with the greater facility when any carbonic acid gas was present. From this Vicat was led to think that the imperfectly carbonated parts of the cements, whose failure led to the investigation, must have taken up the magnesia from the sea water, and passed to hydrocarbonates of lime and magnesia, similar to the dolomites, whose formation may perhaps be accounted for in like manner. This would of course be accompanied by a mode of crystallisation different from that of the ordinary carbonate of lime, leading, doubtlessly, to the disintegration of the whole mass." Mr. Burnell further adds: "The engineer charged with the direction of the works at Rochefort told me that, besides taking up the magnesia, and passing to the state of a carbonate of lime and magnesia, the mortars at Fort Boyard contained crystals of sulphate of lime. Now, as the sea-water does contain a considerable portion of the sulphate of magnesia, it is very probable that the lime may have absorbed the sulphuric acid thus presented, and gives rise to the new combination, which, in its turn, must have contributed to destroy the cohesion of the whole body, for the tendency of the sulphate of lime in crystallising is known to be expansive."

Having mentioned the condition of the Pigeon House-road wall to Professor Apjohn, he very kindly offered to analyse specimens of the mortar, of which two were accordingly selected.

The first, taken between high and low water, was quite disintegrated and damp, and had the consistence of fresh-made putty.

The second specimen was taken from above high-water, and had the usual consistence of good ordinary mortar.

The following are the results of the analysis:—

No. 1.—Taken between high and low water.

Water	18·00
Sand and pebbles (insoluble in muriatic acid)	38·10
Peroxide of iron and alumina, dissolved by the acid	1·15
Sulphate of lime	8·33
Carbonate of lime	8·41
Lime	2·50
Magnesia	10·89
Silicic acid (soluble in dilute muriatic acid)	5·34
Chloride of sodium and trace of chloride of potassium	1·50
Combined water and loss	5·78
	100·00

No. 2.—Taken above high water.

Water	8·40
Sand and small pebbles (insoluble in muriatic acid)	45·50
Peroxide of iron and alumina	1·20
Sulphate of lime	2·68
Carbonate of lime	27·13
Lime	12.02
Magnesia	·78
Silicic acid (soluble in dilute muriatic acid)	4·00
Chloride of sodium	·66
	102·37

On this analysis Dr. Apjohn observes that, "With a view to the hydraulic quality of a lime, what is of most importance is the amount of soluble silicic acid, for the induration of the mortar depends upon the presence of the silicate of lime which it must of necessity form. The quantity of soluble silicic acid in the two mortars is not far from being the same, but in No. 2 there is associated with the silicic acid 12 per cent. of lime, with a little magnesia; whereas in No. 1 the relative proportion of the bases is reversed, and we have 10·89 per cent. of magnesia and but 2·5 of lime. Such being the case, there is no difficulty in understanding the cause of the disintegration which has occurred to No. 1. Sea water abounds in chloride of magnesium, which is, in fact, the salt next in abundance to the chloride of sodium. This chloride of magnesium has, by double decomposition, gradually converted the silicate of lime into chloride of calcium and silicate of magnesia, the former of which has been washed away because of its exceeding solubility in water, while the silicate of magnesia remains in a loose state in the disintegrated mortar. This theory is confirmed by the fact that the ratio of the number of the atoms of silicic acid to the sum of the number of the atoms of the two bases is the same in the two mortars. In No. 2, for example, the empirical formula is $5{\cdot}3\ R\,O \times Si\,O_3$, and in No. 1 it is $5{\cdot}25\ R\,O \times Si\,O_3$." With reference to the sulphate of lime, of which we have 8·33 per cent. in No. 2, and only 2·68 per cent. in No. 1, Dr. Apjohn observes—"The total lime in the two mortars when first made must, I find, have been in

No. 1	25·82
No. 2	29·87

Into this statement the lime of the sulphate of lime is introduced, for there can be no doubt that this salt was produced by the action of the lime of the mortar upon the Epsom salt present in sea-water."

We thus see that Professor Apjohn's analysis of the Dublin mortar corroborates, in a very satisfactory manner, Vicat's theory of the action of sea-water on lime. It will further be interesting to compare the composition of the Pigeon House-road lime with that of the hydraulic limestones of Lyme Regis and Aberthaw (see vol. xvii., p. 411, "Proceedings of Institution of Civil Engineers"), and the natural cement-stone found at Sheppy and Harwich, near London (see Vicat on "Mortars and Cements," translated by Captain Smith, p. 221), from which the well-known Roman cement is made.

	Lyme Regis.		
Lime	44·35	} 79·20	
Carbonic acid	34·15		
Silica and alumina	17·30		
Water	3·50		
	100·00		

	Aberthaw.	London.	
Carbonate of lime	80·00	65·7	
Carbonate of magnesia	2·46	0·5	
Carbonate of iron	2·46	6·0	
Carbonate of manganese		1·9	
Clay: Silica	10·70	18·0	24·6
Clay: Alumina		6·6	
Clay: Oxide of iron			
Carbon, water, &c.	4·38	1·3	
	100·00	100·00	

Owing to the Pigeon House-road lime being mixed up with sand to form mortar we cannot arrive at its original composition with the same accuracy as in the foregoing tables; but if we omit the sand, peroxide of iron, and alumina, the latter two of which were probably introduced into the mortar along with the sand, we may conclude that its composition is nearly as follows:—

Carbonate of lime	93
Silica (soluble in muriatic acid)	7
	100

In the stone from Lyme Regis we have the clay and lime in the proportion of 1 to 4·5; in the Aberthaw 1 to 7·5; in the Roman cement stone 1 to 2·7; and in the Dublin stone 1 to 13·3. Hence we may conclude that the latter is only a moderately hydraulic lime, and the action of salt water on it is an additional fact in confirmation of the statement that none but eminently hydraulic limes are suited for marine masonry, and if, as there is little reason to doubt, the hydraulic properties of the lias and similar limes be due to the formation of the silicates of lime and alumina in the mortar made of them, then Portland cement, of which the silica and alumina form so much larger a proportion, ought *à fortiori* to make a permanent sea mortar. Mortar made of the rich or slightly hydraulic limes may appear, as in Algiers, Cherbourg, Dublin, and elsewhere, to set hard at first, and present the appearance of strong mortar; but so far as our present experience goes, their disintegration in sea water seems merely a process of time, in some cases three or four years, in others, as in the present instance, a much larger period elapsed before failure took place.

* See vol. x., p. 5, "Trans. of Inst. of Civil Engineers of Ireland."

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

Thursday, May 22nd.

ON STEAM BOILER EXPLOSIONS.

By Mr. CHARLES B. KING, M.E.

THE author commenced by observing that a more perfect knowledge of the laws of heat had enabled modern engineers to calculate with tolerable accuracy the probability of steam boiler explosions; and though, perhaps, from mismanagement or undiscovered causes, these catastrophes may never wholly cease, still science may and ought to throw as much light as possible on the subject; and, by comprehending thoroughly the causes, to avoid the effects.

The generally received idea of the cause of explosion, viz., excessive internal pressure, is certainly open to grave objections.

Instances have occurred where explosion of boilers has taken place on the engine being set to work after an interval of rest; this appears on the face of it mysterious; that a boiler being relieved from the steam should be followed by an increase, such increase being so great as to cause a violent rupture of the fabric.

It is evident a theory of excessive internal pressure will not hold good in these cases. Some writers, in explanation of this anomaly, have ingeniously supposed that, upon the opening of the valve, an undue agitation of the water is produced, by which it is dashed against the hotter portion of the furnace plate; and more particularly should any part of it have been left uncovered through a deficiency in the supply of feed water, resulting in a largely increased quantity of steam, and a corresponding increase of pressure.

So here explosion might be attributed to an undercharge of water if we did not also know that an overcharged boiler has frequently exploded, and it is contrary to mechanical logic to ascribe a maximum of effect from a minimum of power.

Still there does not seem ground for the supposition of some violent internal action at the instant preceding the actual rupture, the rupture being regarded as the consequence of such action, and not of a mere pressure which, until the ruptured parts are in motion, can only act statically. This hypothesis has derived a certain probability from frequent instances of the quick rupture of steam boilers. The first abstract cause of explosion that obviously suggests itself is overheating.

Now, though boilers may be exploded by the formation of a great quantity of steam from water dashed on red-hot plates, yet overheating is not the general cause of explosions.

There have been explosions where the water gauges only a moment before indicated a full supply of water, and in such cases the furnace plates have been found in a perfectly sound condition and not at all burnt.

It is also doubtful whether the pressure already in the boiler would be greatly increased by the quantity of steam disengaged, supposing extensive overheating to have taken place, and water to be suddenly thrown on the heated plates.

According to the best authorities, the quantity of heat that would be required to raise the temperature of 112 lb. of iron would impart the same temperature to only 12 lb. of water. This deduction from the accepted laws of heat is borne out experimentally by plunging any weight of highly heated metal into an equal weight of cold water.

It is a favourite opinion of many engineers that the presence of highly heated iron in a boiler is sufficient of itself to account for the most violent explosion.

This, however, is incapable of proof; although any one may blow up a boiler, no one can definitely prove that superheated steam, decomposed steam, or electricity, is the active cause. A most cursory glance at the properties of steam, as elaborately defined in Professor Miller's work on Chemistry will show that the hypothesis is decidedly erroneous. It is evident no heat can be generated within the steam or water chambers of a boiler. All the heat that may exist, then, must have been externally communicated, *i.e.*, from the fuel in the furnace. Heat acts by its quantity the same as ponderable matter, and in its effects is quite as measurable as a solid body. The quantity of heat which will raise a pound of water to a temperature of 1 deg. is as definite and invariable as the quantity which will fill a given space, or as the weight of the air we breathe.

Steam superheated cannot lose any part of its heat without being more or less condensed.

The author then touched on electricity as a cause of boiler explosions, and showed, from various experiments and other causes the inferences which would be derived, ending mostly in obscurity and mystery.

With regard to over-pressure as a cause of explosions, the author said that the increase of pressure in a boiler must be comparatively gradual, and, if over-pressure were a sole cause of explosion, they would of course rupture in the weakest part.

Care ought, therefore, to be taken that the materials used be of a kind capable of resisting pressure. In this matter a knowledge of metallurgy is decidedly useful to discriminate between the varied species of metals and their peculiar fitness for certain specific uses.

Even when excellent material has been used it is subject, of course, to the same casualties as inferior materials.

Corrosion, which frequently goes on unsuspected, will render the most admirably constructed boiler dangerous. Thus we find that in an explosion of a boiler at the Clyde Grain Mills at Glasgow (in 1856) extensive breadths of iron were said to be reduced to the thickness of a sixpence. In the same year at an explosion which took place at Messrs. Warburton and Holker's, at Bury, the bottom plates had been reduced to one-sixteenth of an inch in thickness.

It may be reasonably inferred, from instances too numerous to quote, that it is extremely probable that explosions occur at nearly the ordinary working pressure, and that such explosions would not have occurred had the boiler not contained some hidden defect.

Supposing, however, that well-constructed boilers, both as regards workmanship and material, have burst by over-pressure, it is by no means difficult to suggest a remedy. If one or two safety-valves are sufficient, under ordinary circumstances, to liberate steam as fast as it is generated in the boiler, an addition of others, working independently of each other, would effectually prevent all chance of over-pressure. For while it is quite possible for a boiler unprovided with safety-valves, or with such as are inoperative, to produce an explosion by over-pressure, it would be equally impossible to do so when these outlets from the boiler were equal in discharging capacity to its evaporating powers.

The fact of explosion by over-pressure, therefore, is a proof simply that the safety-valves were either inoperative or too small.

Having now endeavoured to set before you the causes of boiler explosions, and investigated how far they are admissible, it only remains for me briefly to sum up the argument by a few practical observations.

The synopsis of my argument you will observe to be as to the occurrence of ruptures without explosion. I have seen and known of many, and they are well known to others. As to their occurrence above the water line the escape of the free steam is easily enough understood, and it is, furthermore, calculable that the steam in the water, or the steam ready to form in the water, must rush to fill the void, although, as the resistance to the rise of the steam in the water is to some extent greater than that to the escape of the free stream through the already opened rent, the rising steam and water will have hardly had time to gain headway until nearly all the free steam above the water has escaped. Thus, the rising volley of steam and water will have free scope.

The impact on striking is to some extent inferential. We know that a leaden bullet is flattened when fired from a gun into water. Therefore, if water, moving at the same velocity as a bullet, should strike a plate of iron at rest, the concussion would be the same as with the gun. Jacob Perkins was enabled to project leaden bullets 10½ times heavier than their own bulk of water with steam of 900 lb., and even 500 lb. to the inch, and with a force and velocity equal to that of bullets fired in the ordinary manner.

In the case of a boiler during the moment when the water is rising in the act of explosion, we may consider that the urging pressure is almost all below the water, *i.e.*, that there is little pressure above it. It is evident, then, that the water must rise with great violence. I think that engine drivers and stokers are in some instances the cause of boiler explosions; they rarely possess anything more than the ability to perform their duties in a most automaton-like manner. Some may say that this is all that may be required. If a man knows that when he turns a cock on the water will run, and when he turns it off it will stop, he will be a very good engine driver.

Results prove the contrary between two men—one performing his duty mechanically, the other systematically and rationally, and you will find the latter will do them best. If the former deviates from the beaten track he knows not how to remedy his *faux pas*; the mind of the latter comes to his aid and extricates him.

It is, therefore, a matter of reasonable inquiry whether, in these days of increasing enlightenment, those who have such a responsible office as that of conducting a locomotive, on whose safe regulation depends the lives and safety of numbers of their fellow-citizens, should not be better instructed in the scientific details of their duty, that they should be able, from their own reason and common sense, to avoid the dangers they now only see in a hazy, vague mist, and of whose cause they are wholly ignorant, and can produce only the reason it is because it is. I do not design sweepingly to set down the bulk of engine drivers as ignorant and illiterate; but from considerable experience I have come to the conclusion that there are too many such, and events have shown that their ignorance has too often resulted in disastrous consequences.

It may seem a very common-place observation that engine drivers in their ignorance risk the most terrible consequences, which a little knowledge of mechanical science would enable them to foresee and calculate. An experienced engine driver would be able, by the aid of science, to ascertain whether the boiler he proposed to govern was in all its parts capable of its functions. No later than March the 6th a verdict of manslaughter was entered against an engine driver, whose neglect had caused an explosion at Dudley, in which six persons were killed.

It is well known that when an engineer receives an order he tries either to add to his reputation by the excellence of its fulfilment, or he tries to get as much money out of it as possible. It will be found that the passion for gain—that monster which, like Saturn, devours its own offspring to appease its insatiable cravings—is the main cause of half the miseries of life. I believe it to be of boiler explosions.

I can conceive nothing baser than a man who, to get a few pounds extra in the fabrication of a boiler, uses such materials as he knows must speedily wear out, and risk the destruction of his fellow-men merely because it is cheaper. I admit that many may, and doubtless do, use bad material from inability to judge of its quality. But this surely ought not to be the case with any one desirous of excelling in his profession. The connecting link between all sciences as relatively dependent in some degree on one another is clearly seen in the intimate relations between geology, mineralogy, and engineering. A very little investigation will suffice to give the student a sufficient knowledge of these very interesting sciences, which will be found, in instances too numerous to mention, most important adjuncts to mechanical science. In the foregoing remarks it will be seen that I have adopted, in a great measure, the reasoning of Mr. Colburn, whose excellent treatise on this subject should be carefully read by all interested in this matter, and I must here tender my thanks to that gentleman, and also to Mr. Charles Wye Williams, for very important hints and suggestions connected with steam boiler explosions.

IRON IN THE EXHIBITION.—Messrs. Moore and Manby, of Dudley and Billiter-square, London, exhibit a large case, containing a great variety of sections of rolled iron, numbering upwards of 1,000 pieces, all of different sizes, shapes, and forms, suitable for engineering, ship-building, and almost every other purpose for which iron can be used. Iron made into chains, and proved by hydraulic power, 7-16th, ½, ¾, 1, and 1¼in., bearing respectively a tensile strain of 16½, 26, 39½, and 53¾ tons without breaking. Boiler plates, tested by the same process, requiring a power equal to 21 tons per square inch longway, and 22 tons per square inch crossway of the fibre, ere they can be broken; also boiler plates and sheets flanged, and bent hot and cold every way of the grain; 2-in. round iron, and several smaller sizes tied cold into double knots, with ram's-horn test at one end, and drawn down fine at the other to form a corkscrew. Deep stamped iron made from a flat sheet, and in each case worked cold into various shapes. Iron in the bloom, and made specially for rifle and gunbarrels, broken by a very heavy steam-hammer, in order to show the fracture, and ground on the side to show the clearness and cleaness of texture; also a portion of a 3-in. armour-plate which was tested at Shoeburyness, receiving the blow of a 40-lb. shot from a distance of 100 yards without showing any signs of cracking.

LUSH'S MASHING ATTEMPERATORS.

The object of this invention, by Joseph Lush, of St. George's-square, Portsea, is to avoid the injurious effects of what are known in brewings as "raw worts," by which much of the useful portion of the malt is lost, and the quality of the beer is deteriorated.

For the purpose of carrying out the improvements there is fixed in the mash tun an upright shaft, which is carried at the top by suitable bearings, and at the bottom by a shoe or step fixed in the bottom of the mash tun; this shaft is caused to revolve by gearing driven by steam or other motive power, and it is made hollow for a portion of its length to carry the steam and water required in using the attemperator. On to this shaft are bolted or otherwise secured one or more arms, which are placed at right angles to the upright shaft close to the false bottom of the mash tun, and are carried nearly to the length of the inside diameter of the mash tun. On to

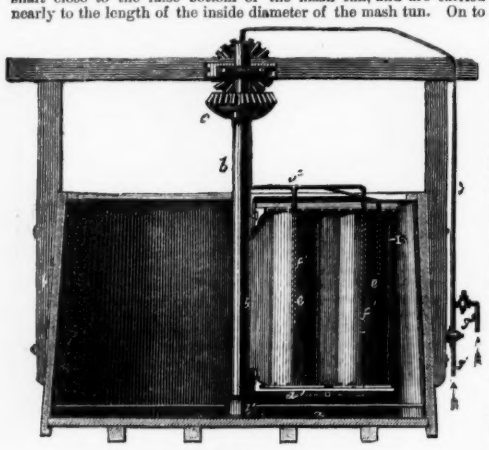
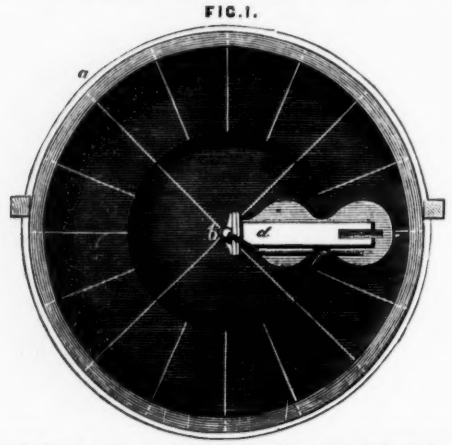


FIG. 1.



each of these arms are cast one or more flanges, and to these flanges are fixed by bolts or otherwise vessels of copper or other material of suitable shape (which may be either round or oval, parallel, coned, or otherwise), which stand upright on the arm or arms, and which are therefore parallel with the upright shaft; these copper vessels are connected at the top to an arm which is fixed above them on the upright shaft, and which is perfectly parallel with the lower arm; and where more than one copper vessel is used on each arm they are formed hollow, so that the copper vessels may be in communication with one another; these vessels are filled with heated water up to a point indicated by a gauge cock fixed in the side of the vessel.

Fig. 1 shows a plan, and Fig. 2 a vertical section of a mash tun, having apparatus applied thereto, according to the invention. *a*, *a*, is the mash tun, in which the upright shaft *b* is supported in bearings, as shown, and resting on the bottom of the vessel *a* in the shoe or step b^1. Rotary motion is communicated to the shaft *b* from a steam engine or other motive power, by means of the bevil toothed wheels *c* and c^1. The shaft *b* is formed hollow or tubular down a portion of its length, in order to admit steam or water, as required while using the attemperator. *d*, d^1, are arms fixed at right angles on to the shaft *b*. The arms *d* and d^1 have plates or flanges cast or formed thereon, to which the upright hollow copper or other metal vessels *e*, *e*, are secured by bolts or otherwise; *f* is a pipe, connected with the hollow shaft *b*, and having branch pipes f^1, which descend into the vessels *e*, *e*, and by which they can be supplied with water or steam from time to time, as required, by means of the supply pipe *g*. This pipe has branches g^1, g^2, leading to the liquor tank and steam boiler. The vessels *e*, *e*, are when in use filled with heated water to a point indicated by the gauge cock *h*, and suitable safety valves and thermometers may be applied to the vessels to regulate the pressure of steam and temperature of the water contained therein.

LEE'S STEAM PUMPING ENGINES.

This invention, by Wellington Lee, of New York, U.S., of "An Improvement in Steam Pumping Engines," relates to a novel or improved mode of arranging and working the valve gear of the steam cylinders of engines for pumping or forcing water. In New York these pumps are known as "Worthington's Duplex."

In carrying out the invention two or more steam cylinders are arranged side by side, or in any other convenient position, and the valve gear for working the valve of one cylinder is actuated or opened and closed by the movement of the piston of the other or contiguous cylinder. It will be found convenient in practice to arrange the working of the pistons in such a manner that when one piston is at mid or half stroke the other piston shall be at the end of the stroke. The operation of the valves and the arrangement of the ports for the induction and eduction steam is also so contrived (as will be hereafter explained) that the exhaust of the steam from the cylinder may be arrested at such a point of the stroke as will prevent the piston from overreaching or striking against the heads of the cylinders. By this means the cranks, eccentrics, and fly-wheels usually employed in steam engines may be dispensed with; and, when the invention is applied to pumping engines, a more uniform and equal flow of water or other liquid at all points of the stroke is effected. The pistons will also be allowed to pause at the end of each stroke, thereby permitting the valves of the pumping cylinders to close more gently, and with less shock, than they otherwise would.

Fig. 1 is a longitudinal vertical section taken through one of the steam cylinders and valve chest, and one of the pumping cylinders, and the valves belonging thereto; Fig. 2 is a plan view of the engine complete, the covers of the valve chest being removed to show the interior arrangement of the same; Fig. 3 is a transverse vertical section taken in the line 1, 2, of Figs. 1 and 2, and looking towards the left-hand end, or towards the steam cylinders; Fig. 4 is a similar sectional view taken in the same line 1, 2, but looking

LEE'S STEAM PUMPING ENGINES.

FIG. 1

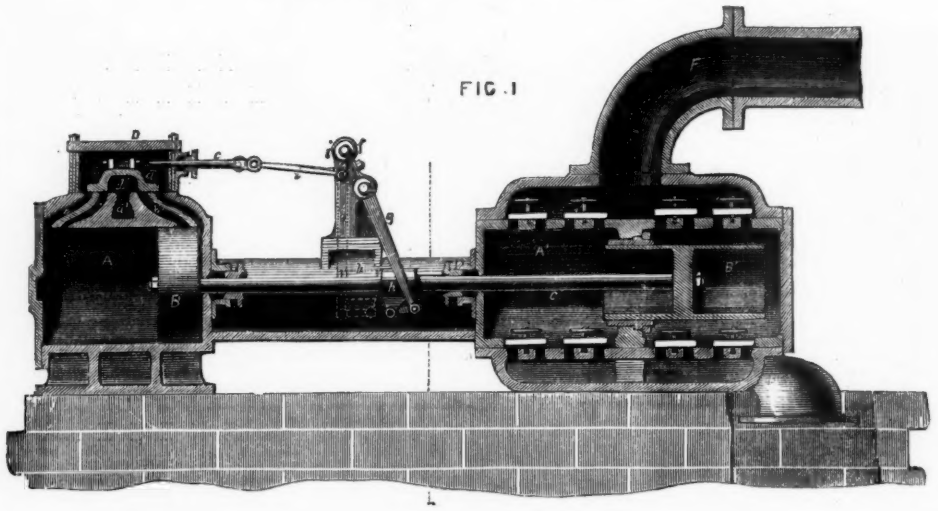


FIG. 2

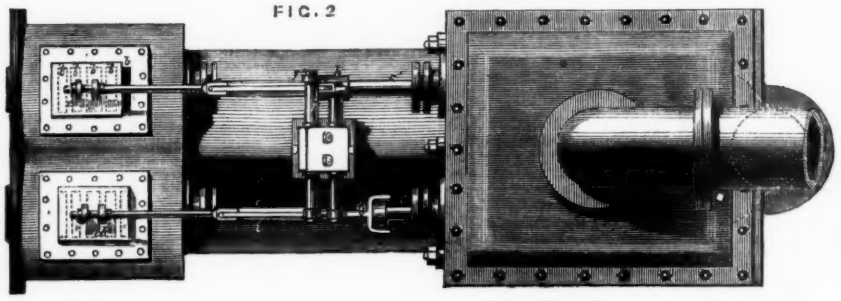


FIG. 4.

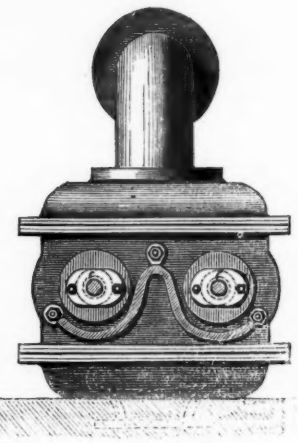
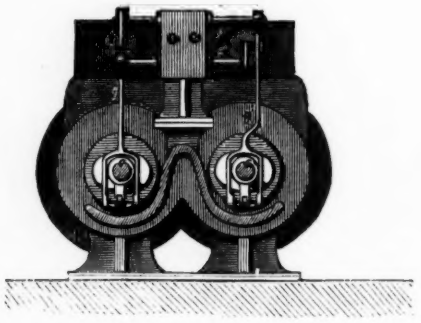


FIG. 3



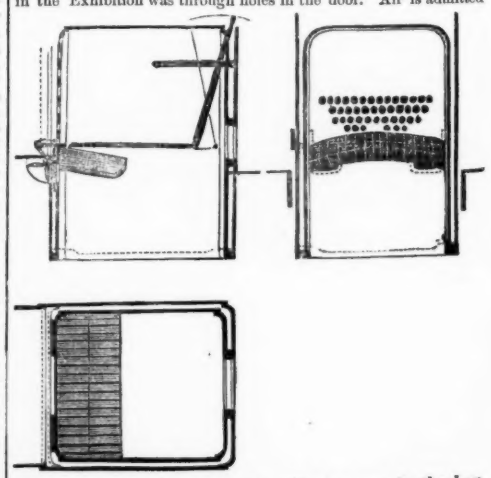
towards the right or the forward ends of the pumping cylinders. A, A, are the steam cylinders, and A^1, A^1, the pumping cylinders; B, B, are pistons fitted one on end of the piston rods C, C^1, and one of these pistons works in each of the steam cylinders; and B^1 is a trunk piston fitted on the other end of the piston rod, and working in one of the pumping cylinders; D is the valve box of the steam cylinder, and *d* the valve which is worked therein over the steam ports *b*, b^1, by means of the valve stem *c*, which passes through a suitable stuffing box in the end plate of the valve chest, and is connected at its outer end by means of a link *i* to a vibrating lever *e* on the rocking shaft *f*. In connection with the other steam cylinder there is a similar rocking shaft f^1, carrying at one end a vibrating lever e^1, which, through a link i^1, communicates motion to the stem c^1, and the valve d^1 of the other cylinder. On the opposite ends of the rocking shaft *f*, f^1, are keyed two levers, *g* and g^1, which are connected at their lower extremities, by means of links, to the pendent arms of blocks *h*, h^1, which are keyed or otherwise secured near the middle of the piston rods C, C^1. On referring to the illustration it will be seen that on the advance of the piston B in the steam cylinder A, the block *h* on the piston rod C of that cylinder will, through the intervention of the vibrating lever *g*, cause the shaft f^1 to rock in its bearings, and push forward the valve stem c^1 of the other cylinder, and thereby open the valve of that cylinder, and, on the other hand, the block h^1 on the piston rod C^1, and shown by dots in Fig. 1, will, through the intervention of the other vibrating lever g^1 (also shown by dots in the Figure), cause the shaft *f* to rock in its bearings, and thereby communicate motion to the valve stem *c* and valve *d* of the first-mentioned cylinder. Of course, on the return stroke, the reverse action of the valves takes place. It will thus be understood that the piston rod of steam cylinder No. 1 will actuate the valve gear of the cylinder No. 2, and the piston rod of the latter will actuate the valve gear of the cylinder No. 1.

It is, of course, necessary that the pistons of the two cylinders and the valve gear should be so arranged that the pistons are never at the same part of the stroke at the same moment of time. By this means the engine will be made to act smoothly, and a continuous flow of water from the pumping cylinders through the exit pipe F will be insured.

In order to form a cushion of steam in front of the piston at the end of the stroke, the exhaust ports are closed before the piston reaches the end of the cylinder. An arrangement for effecting this object is shown in the illustration, in which it will be seen that there are five steam ports, *b*, *b*, b^1, b^1, and b^2. The ports *b*, *b*, are the induction ports for admitting steam to the ends of the cylinders. The steam is supplied to the valve chest D in the ordinary manner, but the supply pipe is not indicated in the illustration, in order to avoid complexity of parts; b^1, b^1, are the eduction passages, which, by means of the hollow space d^1 in the valve *d*, communicate with the central eduction passage b^2, which is common to both the passages b^1, b^1. It will, therefore, be understood that, instead of using the same port alternately as an induction and eduction passage as heretofore, the ports *b*, *b*, are never used except as induction passages, and the ports b^1, b^1, are always used as eduction passages. By this arrangement of ports the piston, as it arrives near the end of its stroke, is made to close the eduction passage b^1 as shown in Fig. 1, and thereby confine a cushion of steam between the face of the piston and the end of the cylinder, as the induction passage *b* will not be opened until the piston has rested for a second of time, so as to give time for the valves to be charged. The induction passage *b* will then be opened by the piston of the other cylinder moving the valve, and on the admission of steam the piston B will be driven back.

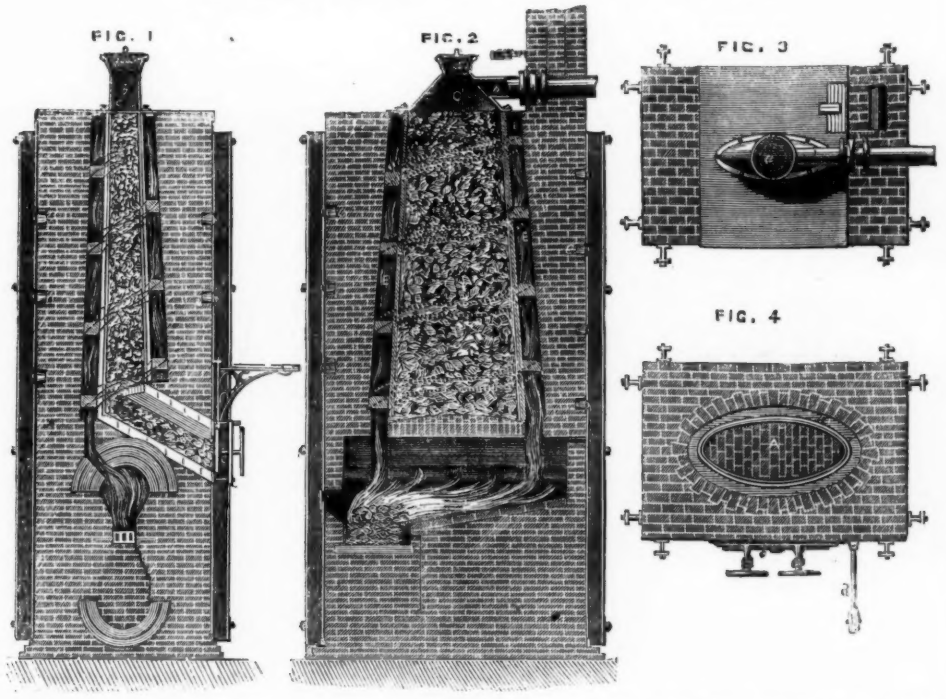
THE LOCOMOTIVE, LADY OF THE LAKE.

In The Engineer of the 2nd inst. we erroneously stated that the admission of air to the fire-box of Mr. Ramsbottom's engine in the Exhibition was through holes in the door. Air is admitted



through an opening in the side of the fire-box opposite the door and is thence deflected backward and upward by a fire-brick arch, thereby mixing with the gases, which are thus ignited and burnt before reaching the tubes. The amount of air-opening is controlled by a damper. See sketch.

EVANS' APPARATUS FOR GENERATING GAS.

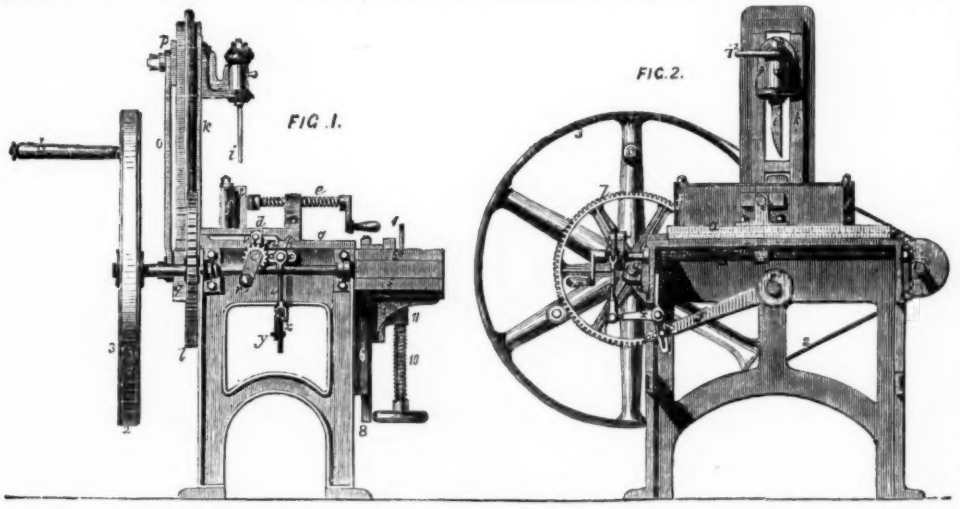


THE object of this invention, by F. J. Evans, of the Chartered Gasworks, Horsferry-road, Westminster, is to expedite the manufacture of gas, and effect an important economy both in the manipulation of the process, and in the construction of the gas-generating apparatus. To this end, instead of using, as heretofore, a series of horizontal retorts, set side by side in a furnace, for generating a given amount of gas, Mr. Evans employs in lieu thereof a vertical retort of large capacity and of peculiar construction enclosed within a furnace or oven, and surrounded by a heating flue, which leads from the fireplace and rises spirally around the retort until it reaches the exit opening to the chimney. Fig. 1 shows the gas-generating apparatus in vertical section; Fig. 2 is a vertical section, taken at right angles thereto; Fig. 3 is a top or plan view; and Fig. 4 is a sectional plan, taken in the line 1, 2, of Figs. 1 and 2.

A, A, is the retort, which may be constructed of fire-clay or of iron, protected by a fire-clay covering on its outside, as shown. This retort is enclosed in a furnace, and it is made, by preference, of an oval form in cross section, as shown at Fig. 4, and corrugated vertically on its inner surface. A slight taper towards the top is also given to the retort, in order that it may the better discharge the coke when the illuminating gases are distilled therefrom. The retort is closed at top with a cast-iron cover C, which is formed with a valve seat for receiving a drop valve or plug *a*, and projecting from the side of the cover is a pipe *b*, leading to the hydraulic main. The drop valve *a* is used for covering the opening by which access is gained to the interior of the retort for supplying coal thereto, which may be discharged into the retort (until it is nearly full) from wagons run upon a level with the top of the furnace. The lower end of the retort inclines downwards, as shown at Fig. 1, and extends to the outside of the furnace. It is closed by a door *c*, like the ordinary horizontal retorts, and similar means to that ordinarily adopted are used for securing the door in position, and making it air-tight. A small crane *d* mounted in front of the furnace serves to facilitate the operation of applying and removing the door *c*; D is the fireplace of the furnace, the heat from which is caused to circulate by means of a spiral flue E around the retort and heat it equably. The gases of combustion make their exit near the top part of the retort into the main flue, and thence to the chimney; *e*, *e*, *e*, are sight holes, made in the walls of the furnace to enable the attendant to observe the degree of heat of the retort, and to give access to the flue for the purpose of cleaning out the same. The discharge of the coke when the coal has been carbonised is effected at the outlet *f*.

The operation of the apparatus is as follows:—A quantity of coke is put into the retort (it having first been got up to the proper heat), sufficient to fill the bottom up to a level with the commencement of the vertical sides. Upon this bed of coke a charge of coal is discharged from a wagon running on rails fixed over or on a level with the top of the furnace or oven, or by any other quick and easy method, the drop valve *a* being first raised from its seat. When the retort is charged the valve is lowered into its seat and the heat of the furnace being kept up the gas will be quickly caused to distil off, and escape by means of the exit pipe *b* to the hydraulic main (which may be fixed in any convenient position), and from thence to the condensers. When the coal is sufficiently carbonised the door *c* is withdrawn from the retort, and swung aside by means of the small crane. The coke is then allowed to run out of the retort by its own specific gravity, either on to the ground or into wagons placed ready to receive it; a quantity sufficient to fill the sloping part or bottom of the retort being, however, retained therein by replacing the lid, which is then screwed in place and luted as before. The retort is then ready to receive another charge of coal. Should it be thought desirable, before this part of the process is performed, steam from a steam boiler may be admitted into the retort near the bottom. While passing through the red-hot coke it will be decomposed, and form gases valuable for mixing with the gas previously distilled from the coal. This decomposition of steam in the retort will have a two-fold effect; first, it will afford an additional quantity of gas at a cheap rate; and, secondly, when using coals which swell on being carbonised, the steam by decomposing or destroying part of the coke will facilitate its subsequent discharge from the retort. In addition to using steam, any of the hydrocarbon oils, tar, or such like substances may be economically converted into gas by injecting them into the bottom part of the retort by any well-known means. This part of the process may be carried on as long as may be considered desirable; but as the principal object in view is to make gas from coal it must only be continued so long as experience may prove it to be profitable so to do; the design of this supplementary distillatory process being to utilise the heat of the red-hot coke before discharging it from the retort, and which heat has been obtained in the first instance in converting the coal into gas by means of the fuel used in the furnace.

KIMBERLEY'S MACHINE FOR MORTICING, TENONING, AND SAWING.



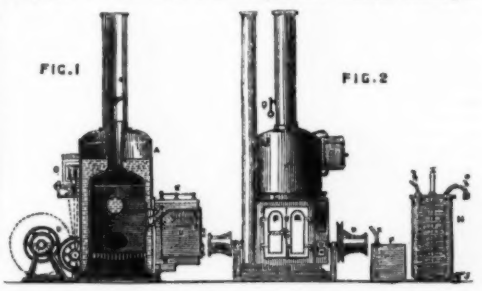
THIS invention, by James Kimberley, of Birmingham, consists of a machine for morticing or tenoning, and which may also be used for sawing, boring, or drilling and grooving wood. That part of the machine by which the morticing is effected may be made to work simultaneously with that part by which the other operations enumerated are effected; or either part of the machine may be made to work separately.

Fig. 1 represents an end elevation of a machine constructed according to the invention, and Fig. 2 is a longitudinal vertical section.

The motions of the several parts of the machine are taken from the driving shaft *a*, which may either be worked by hand by means of the winch *b*, or by steam or other power. The block of wood *c* to be morticed is fixed upon the table *d* by the screw clamp *e*, the said clamp *e* holding the block of wood firmly between its end and the plate *f*. The table *d* during the action of the machine is made slowly to traverse the base *g* of the machine in the manner hereinafter explained, the table *d* working on the dovetail *h* on the base *g*; *i* is the morticing chisel, which has a reciprocating motion in a vertical line in the upright *k*. The morticing chisel *i* is worked by the train of toothed wheels *l*, *m*, *n*, the first toothed wheel *l* being fixed on and receiving its motion from the driving shaft *a* *o* is a connecting rod jointed at one end to the slide *p* carrying the morticing chisel *i*, and at the other end to the crank *q* fixed on the toothed wheel *n*. By the motion of the shaft *a*, toothed wheels *l*, *m*, *n*, and the crank and connecting rod *q*, *o*, the required reciprocating rectilinear motion is given to the morticing chisel *i*. The position of the chisel *i* in its holder can be adjusted by the arm i^2. After each descent of the morticing chisel *i*, the table *d* carrying the wood block *c* is made to advance with an intermittent motion in the following manner:—*r* is a screw underneath the base of the machine, upon which screw a screw box *s* connected to the table *d* works. On one end of the screw *r* a ratchet-wheel *t* is fixed. *u* is a pall or click turning on one end of the bell crank lever *v*, the lever turning on the axis of the screw *r*. The lever *v* is connected through the connecting rod *w* and bell-crank lever *x* with the arm *y* of the eccentric y^2, the eccentric being situated on the axis of the toothed wheel *n*. By the motion of the eccentric y^2 transmitted through the arm *y*, lever *x*, connecting rod *w*, and lever *v*, the pall or click *u* is made to push forward the teeth of the ratchet-wheel *t*, and thereby to give a slow intermittent motion to the screw *r*. The screw *r* working in the screw box *s* connected with the table *d* thus communicates a slow intermittent motion to the table. By turning the pall or click *u* on its centre, so as to make it engage on the opposite side of the ratchet-wheel *t* to that represented, motion in an opposite direction may be given to the screw *r*. The return motion of the table *d* is effected by lifting the pall or click *u* from the ratchet-wheel *t*, and turning the winch r^2 on the axis of the screw *r* in the required direction. Or the winch r^2 may be used for giving the advancing motion to the table *d*, instead of using the self-acting mechanism just described. At the side of the machine opposite to that at which the driving-shaft *a* is situated is another shaft *z*, carrying at its end a saw 1. A band 2 from a pulley 3 on the driving-shaft *a* passes over a pulley 4 on the shaft *z*, and gives a rapid rotatory motion to the shaft and saw. The upper part of the rotating saw 1 passes through the top 5^a of a table or bench 5, 5^a, the said table or bench being carried by the frame of the machine. The matter to be sawn is placed on the bench or table 5^a, and advanced against the rotating saw 1 by hand, or by a screw. The table or bench 5, 5^a, is capable of being raised or lowered, in order to accommodate its height to the different sized saws employed in the following manner:—On the frame of the machine are fixed two dovetails 6, 7, in which dovetails the slides 8, 8, secured to the bench or table 5, 5^a, work. 10 is a screw working in a bracket 11, the said bracket being fixed to the frame of the machine, the top of the screw bearing against the under side of the table or bench 5, 5^a. By turning the screw 10 in one or other direction, the table or bench 5, 5^a, can be raised or lowered at pleasure, the table or bench being guided in its motion by the dovetails 6, 7, and slides 8, 8. The dovetail slides may after the adjustment of the table be fixed in the dovetails by the screws 12. The tenoning is effected by the circular saw 1, and a movable table or bench. By substituting a saw with broad teeth for the saw 1, or two or more saws or cutters, of the ordinary kind, at the option of the workman, the machine may be used for grooving.

CHAPLIN'S COMBINED WINDING ENGINE, BOILER, AND COOKING APPARATUS.

THIS invention, by Alexander Chaplin, of Glasgow, relates principally to a combination of apparatus specially designed for ships' use, but also applicable otherwise. Fig. 1 is a vertical section, and Fig. 2 is an elevation, partly in section, the two figures representing the apparatus as viewed from sides at right angles to each other. The improved combination comprises in the first place a steam boiler, by preference of the vertical class, such, for example, as is represented at A, with its furnace B, and having attached to it an inverted direct-acting cylinder C (or two such cylinders), driving, winding, or hoisting gear, such, for example, as is shown at D, and which is applicable for a great variety of purposes on board ship, such as hoisting cargo, anchors, yards, or sails, or for working the ships' pumps, this last operation being conveniently effected by means of an endless pitch chain, which transmits the requisite power from the engines to the pumps. The ordinary ship's windlass may also be worked by this apparatus in a similar manner. In the next place there is fitted up in immediate connection with the boiler A a cooking range E, and a cooking vessel F, contrived so that cooking may be effected by introducing therein steam from the boiler by means of a pipe *f*. A steam oven G is also provided, wherein cooking is



effected by introducing high-pressure steam into a jacket or casing *g*, enclosing the oven. There is also provision for introducing steam into boilers for heating water, and into apparatus for distilling fresh from salt water for ships' use. A simple and convenient arrangement for effecting such distillation is shown at H, Fig. 2. The steam enters by a pipe *h* into a spirally coiled pipe or worm H, enclosed in a vessel, into which sea water is introduced by a pipe I, which descending to the bottom, where it is perforated for the water to issue, causes the current of water to pass upwards to the outlet *i*, in a direction opposite to that of the steam being condensed. The fresh or condensed water is drawn off by the tap J, and is passed through a suitable filter to render it fit for use. The condenser H, as also the boiler or cooking vessel F, are shown detached for convenience of illustration, but they may in practice be placed in any convenient positions close to or removed a moderate distance from the boiler A. One or more condensing tanks or vessels also may be used. In the case of the distilling apparatus, the steam pipe before entering it may be passed through the cabins and other parts of the vessel for the purpose of warming them. Arrangements are made for directing the fire gases, or a portion of them, from the steam boiler furnace B into flues (M N), contrived in the cooking range E, in order that the radiant heat of such gases may be used in cooking, whilst suitable valves or dampers P, Q, R, are fitted in the several flues to regulate the action of the gases. The flames first acting upon the hot plate *e*, which is provided with suitable openings and lids for boiling pans, &c., by direct action of the flame. The steam boiler A is fitted with the usual funnel S, a separate funnel T being provided for the fire gases passing through the cooking range E. When the fire gases, or a part of them, are wanted to pass through the range, the damper Q is more or less closed, and the damper P fitted to the communication between the boiler A and range E opened. The fire gases have then access by the flue M to the hot plate *e*, and round the oven U, finally passing by the flue N to the funnel T. The range E is fitted with a separate grate at V, which, by opening a slide or door, can be made to present an open face for roasting at the side, being provided with an ash-pan W, whilst a damper, the handle of which is shown at R, is provided for shutting or opening the communication with the flue M. This grate V may be employed for cooking when the steam boiler A is not in use, or its furnace not available. It may, however, be entirely closed up, when the fire gases from the boiler furnace B are passed through the range. The draught through the range E and its funnel T is assisted by a steam jet pipe *t* introduced into the latter.

LONDON FIRES IN 1861.

THIRTY-FIRST ANNUAL REPORT.

By William Baddeley, C.E.

(Concluded from p. 296.)

Captain Shaw very properly remarks, "It appears absolutely necessary to caution owners of property, particularly in wharves and warehouses, as to the position and protection of gas lights. In many of the most valuable buildings in the metropolis movable gas brackets are placed within 20in. of the ceiling without any protection whatever. It may be laid down as a rule that the jet should never be less than 3ft. from the ceiling, covered by a hanging shade, with stops to prevent the bracket moving beyond a safe distance." The very common practice of nailing tin or iron plates to the ceiling is justly reprobated as affording no protection, and often concealing incipient mischief. The returns of the fire brigade distinguish between houses in which gas is or is not used; but for any practical purpose these returns are valueless. In a large number of instances it has so happened that the gas, having been turned off at the main, it could not by any possibility either cause or increase the extent of the fire. To be of any use the returns should distinguish between the presence or absence of gas, and not the use or non-use. It is greatly in favour of the prevention of accidents from the escape of gas that its presence, even in very small quantities, is palpable to the olfactory organs; a warning that can never be disregarded with impunity. If gas has a bad pre-eminence in shops, candles are in the ascendant in private dwellings, where nearly two hundred and fifty fires have been traced to their mis-use, the greater number of them, however, having been of trifling extent. The defective construction of flues contribute about their usual proportion to the chapter of accidents. Linen drying or airing before the fire has led to nearly sixty fires; in two cases cats are known to have been (unintentionally) guilty of incendiarism by their gymnastic exercises upon clothes-horses. It would be well if this offence was limited to the feline race, and always unintentional. The most painful fact presented by an investigation into the causes of fires is the large number that are known to have been wilfully occasioned, as well as those that are strongly suspected to have been so. Some of our most destructive fires have been the result of incendiarism—the act itself well known, but the incendiary undiscovered. A vicious spirit of revenge, for real or fancied grievances, on the part of domestic servants; from rivalry in trade; pecuniary gain; or mere wanton mischief, are often the moving causes to incendiarism. Fires are often wilfully occasioned late on Saturday night, or early on Sunday morning, for the sake of reopening public houses, and the saturnalia arising therefrom. It is often said that coming events cast their shadows before, but it is rarely the case that fires do so. It is frequently found, however, that subsequent proceedings in the bankruptcy, insolvent, or law courts throw a "great light" upon what have previously been very "mysterious" fires. A new cause of fires has been introduced in the so-called paraffin oil; seven fires were put down to the account of this villanous fluid last year, two of them attended with loss of life. Other fatal accidents have also occurred, but not having been attended by the firemen do not appear in their report. Now paraffin oil is, *par excellence*, the gas light for the million. The lamps are sold at fabulously low prices, and the oil, even when pure and unadulterated, is so cheap as to possess advantages not afforded by any other light-producing material. Paraffin oil has been well described as a carburetted hydrogen gas, in a condensed and convenient form, and cannot fairly be described as a "dangerous" light; although, like gas, it requires to be used with reasonable care. The volatile and highly explosive mineral oils so extensively sold as paraffin is about one of the most dangerous articles (gunpowder excepted), that a man can bring into his house. Nor is its dangerous character the only objection to the spurious article; its light-producing powers are of a lower order—it gives off much smoke, and speedily places the lamps in which it used, *hors de combat*. Many oilmen are selling the spurious article through ignorance, but a larger number of tradesmen sell the fictitious oil from a hankering after extra profits, or in order to compete with, or undersell their neighbours.

Fortunately for the public, they have it in their power to protect themselves against imposition as regards the character of paraffin. A safety gauge is supplied by the Asphaltum Company, which, by showing the specific gravity, at once determines the true character of the fluid.

Lucifer matches are known to have caused a number of fires, but there is good reason to believe that many more are attributable to these mischievous agents. Dropped about a house they become ignited in many curious ways; a slight abrasion by a passing footstep, or the shutting of a door, is sufficient to cause ignition, and cupboards have, in several cases, been unsuspectingly set on fire in this way.

Among the fires of the past year, the following merit a brief notice:—

Wednesday, January 30th, 4.30 p.m.—A fire occurred in the house of Mr. Peak, sack-maker, Forster-street, Bethnal-green, from a sack falling on to a stove in the back kitchen, used as a drying room. Mr. Peak attempted to extinguish the fire, but was unable to do so, and endeavoured to escape, but was prevented by a police constable who was "keeping the door," with a view to getting the reward given by the fire brigade for that service. The firemen having arrived, and extinguished the fire, they entered the house and found Mr. Peak a corpse. At the coroner's inquest a great deal of evidence was taken, the principal fact elicited being the refusal of the constable to open the door for the escape of Mr. Peak. The jury returned a verdict "That the deceased was found dead from suffocation; and that, in the opinion of the jury, the police constable, from mistaken judgment, was wrong in not allowing persons who had entered the house from the back to leave it at the front door, and for not exerting himself to endeavour to ascertain if the inmates of the house had escaped; and that it is wrong in principle, and vicious in practice, for the insurances offices to offer fees to police officers."

Tuesday, February 14th, 5.45 a.m.—A fire broke out in the Railway Tavern, opposite the Eastern Counties Railway Station, in High-street, Shoreditch, kept by Mr. Benns. The fire was seen raging at the back part of the house by a police constable, who raised an alarm. The fire escape from Shoreditch Church was instantly brought to the spot, when Conductor Shaw was told that all the inmates had escaped, except two children, who were in the third-floor back room. On attempting to enter that room Shaw found it in flames; he tried twice to enter the room, but found it impossible, and was well assured no living person could be therein. The parish and brigade engines having arrived, and been set to work, the fire was extinguished, but not until the building and contents had been all but destroyed. On entering the third floor the two missing children (Emma and John Benns, aged respectively 13 years and 3½ years) were found lying suffocated in the front room, to which they appeared to have escaped, and must have fallen, overpowered by the smoke, before the fire-escape man entered it. At an inquest held upon the bodies by Mr. Humphreys, the coroner, the jury returned a verdict—"That the two children met their death by suffocation and burning, but how the fire occurred there was no evidence to show." The jury returned a vote of thanks to the fire-escape man and the police for their praiseworthy conduct upon this occasion.

Friday, April 12th, 2.45 a.m.—A fire broke out in the premises of Mr. Stanborough, miller, Isleworth. The premises were well known as Brazil Mill, and were of considerable extent, consisting of a double water mill, three storeys high, and 80ft. long by 60ft. wide. At the time stated the mill was at work grinding the husks of rice, the fine dust from which is highly inflammable, and floating in the atmosphere is supposed to have been ignited by contact with a gas-light. The fire spread rapidly, the flames ascending so high as to be distinctly visible at great distances around, which led to the firemen turning out under an impression that the fire was in a much nearer locality. Engines from Isleworth, Brentford, Richmond, and London arrived in quick succession, and were vigorously worked, an unlimited supply of water being obtained from the river Colne. Notwithstanding the exertions made, the mill, with all its valuable machinery, was entirely destroyed. The adjacent properties were, however, saved from the threatened destruction.

Sunday, April 21st, 1.15 a.m.—The light of a serious conflagration, in the south-eastern suburbs of the metropolis, called for the firemen's services. This proved to be the steam flour mills of Messrs. Rose and Scrivener, New-road, Woolwich; a brick building three storeys high, 80ft. long by 30ft. wide. The engines from Woolwich Dockyard and the Arsenal were promptly in attendance, but for three-quarters of an hour no water could be obtained from the mains, and the flames raged uncontrolled. Before the fire could be extinguished the mills were all but destroyed, and four other buildings much damaged.

Thursday, April 25th, 3.15 a.m.—A most alarming conflagration broke out suddenly in the spacious and well-filled timber yard of Mr. King, Nos. 138 to 140, Saffron-hill. The flames spread rapidly to the houses on either side, and in the rear to the premises of Messrs. Abbott and Hopwood, builders, in Bleeding-heart-yard. The heat evolved from the piles of timber for a time rendered approach next to impossible; but the new steam fire engine having been brought to bear upon the principal mass of the fire, and the branches of the other engines at various points around, the fire was mastered, but not until a very serious amount of damage had been done.

Sunday, April 28th, 1.15 a.m.—A most destructive fire broke out in the extensive works of Messrs. Todd, builders, Milner-street, Old Brompton. The premises were of great extent, comprising saw mills, workshops, and timber stores, running parallel with the backs of the houses in Halsey-street and Princes-street. A police constable perceiving smoke issuing from the mill, gave an immediate alarm, but before any engines could arrive the flames had spread throughout the works, and were attacking the houses in Princes-street. A plentiful supply of water was obtained from the Chelsea mains, and a number of engines brought to bear upon the burning buildings, but it was nearly five hours before the fire was mastered; Messrs. Todd's saw mills and workshops being destroyed, and the stock of timber nearly so. Twelve houses in Princes-street, and three in Halsey-street, were more or less severely injured.

Friday, May 13th, ½ a.m.—The light of a tremendous conflagration in an easterly direction, caused a general turn out of the fire-brigade, some of the engines travelling on the Middlesex, others on the Surrey side of the Thames, and both, singularly enough, being turned back by the police telling them they were wrong. After considerable delay thus occasioned, the correct locality was ascertained to be East Greenwich, and the premises the Thames Soap Works, and steam saw mills, belonging to Messrs. Wilkie and Soames; comprising a brick building of three floors, upwards of 200ft. long, by 40ft. wide, used as carpenters' workshops, saw mills, melting houses, copper rooms, soapery, frame rooms, &c. The fire began in the carpenters' shop, and, on being discovered by the watchman, an alarm was given and assistance sent for. For three-quarters of an hour no water could be obtained, and the fire spread rapidly in all directions. The land and floating fire engines from the dock-yard, the parish, and seven of the brigade having been brought to the spot, were set to work as fast as water could be obtained; but it was several hours before the fire could be got under, by which time damage to the amount of many thousand pounds had been done.

Sunday, May 26th, 3.30 a.m.—A fire broke out in the first floor of a lofty building in Dock-street, East Smithfield, occupied by Mr. Yearsley, as steam rice mills, comprising ten floors, expensively fitted up with the most improved machinery. On discovery of the fire by the police, messengers were sent for the needful assistance; when the first engine arrived, from Wellclose-square, the premises were enveloped in smoke so as to be almost invisible. The two floating engines, the land steam engine, and ten hand worked brigade engines were brought to bear upon the building, but without any perceptible effect, the flames travelling upward from floor to floor, until the whole was destroyed.

Tuesday, June 11th, 2 p.m.—Some plumbers who had been employed upon the roof of the Royal Surrey Gardens Music Hall, left a fire burning in a brazier, the heat of which ignited the roof. In consequence of the great difficulty of access to the seat of mischief, no timely steps could be taken to arrest the progress of the flames. Numerous engines from the brigade stations and several private establishments were brought to the spot, and found an unlimited supply of water in the lake, which was poured in torrents upon the burning building, and every possible exertion was made, but with very little success; the building, which was 140ft. long by 90ft. wide, being all but destroyed. So intense was the heat that the cast iron columns were bent, and, giving way, caused the roof and galleries one after the other to fall to the ground.

Friday, June 21st, 0.30 a.m.—A fire broke out in a very small house in the occupation of Mr. Goldsmid, greengrocer and fruiterer, in Newington-causeway. The fire spread with such rapidity that the inmates were in the greatest danger, but were rescued by the fire-escape conductor. Before an engine could be brought to bear, the flames communicated to the adjoining premises of Mr. Hayward, floorcloth manufacturer, a brick and timber building of great extent, containing a large stock of oils, turpentine, and varnish. A terrific conflagration ensued, which for four hours taxed the utmost powers of the firemen, and was not extinguished until both the above-named premises had been destroyed, and twenty-nine other buildings more or less damaged.

Saturday, June 22nd, 4.15.—Just as the business of the day was being closed at Cotton's Wharf, Tooley-street, smoke was perceived issuing from the stores of hemp and jute in the first floor of the warehouse; some buckets of water were immediately obtained, but the smoke prevented their application. A hose was then attached to the fire main, but alas! the pressure was not on, and no jet could be obtained; more hose was then got out and attached to a force-pump, but before this could be brought to bear, the smoke and flames had got to an unapproachable head. The alarm having been given, engines kept arriving from all parts, but a lamentable deficiency in the water supply greatly crippled their powers. The two steam floating engines of the brigade, as well as those from the London and St Katharine's Docks were got to work as soon as possible, but in spite of the powerful force eventually brought to bear, the flames raged with uncontrollable fury. By half-past seven o'clock the warehouse in which the fire commenced had been completely gutted, and all the adjacent buildings were burning furiously. Mr. Superintendent Braidwood was standing in front of the second warehouse, giving his firemen some brandy, when the wall fell outwards and caused his instantaneous death; a gentleman named Scott was also overwhelmed and killed at the same time. The calamity which had occurred to the Fire Brigade, in the loss of their respected chief, for a time completely paralysed their efforts, but additional assistance having arrived, the most determined efforts were made to prevent the further spread of the fire, the burning piles of warehouses being necessarily left to their fate. The churchyard of St. Olave's on the west, and Hay's dock on the east, broke the continuity of the buildings, and gave an opportunity of limiting the spread of the fire in those directions. The fire had seized upon a large number of houses in Tooley-street and it was here that the skill of the firemen was severely tested, and came off victorious, and by four o'clock on Sunday morning the extent of the mischief was defined. Upwards of a month elapsed before the fire was wholly extinguished, in consequence of the large stock of oil and tallow burning in the vaults, which bid defiance to all the means of suppression that could be brought to bear upon them. No such conflagration as this has visited the metropolis since the "Fire of London" in 1666.

Thursday, August 1st, 8 a.m.—A most alarming fire broke out in the extensive warehouses of Messrs. Curling and Co., known as Davis's Wharf. These and the adjoining premises were filled with an immense stock of the most inflammable character; the fire commenced in a pile of jute and hemp consisting of upwards of 8,000 bales. A good supply of water having been obtained, a number of brigade and private engines were soon in full operation, and for several hours kept pouring volumes of water upon the burning mass, and it was not until the afternoon that the fire was got under.

Friday, August 30th, 4.45 p.m.—A destructive fire broke out in the extensive sugar refinery of Messrs. Harrison and Wilson, in Dock-street, East Smithfield, through the carelessness of a workman, who threw some waste paper from an upper floor down through a loop-hole, which, coming in contact with a gas light, took fire and ignited the premises. The building was very lofty and of great extent, and full of food for flames. Numerous engines were soon in attendance, and a good supply of water from the East London mains was obtained. The flames, however, spread rapidly in all directions, and soon got out of reach of the water, and it was not until the contents of the building had been consumed or fallen to the ground that the power of the engines had any perceptible effect upon the fire. Several persons were much injured in escaping from the premises, one of whom, attempting to slide down by a heated steam pipe, fell and was fatally injured.

Wednesday, September 4th, 12 p.m.—A fire broke out in the premises of Mr. Knight, tallow melter, in Paternoster-row, which was not extinguished until a very serious amount of damage had been done; and, considering the confined character of the locality, it is greatly to the credit of the brigade that the damage done was not greater. Four large houses were destroyed, and a dozen others more or less damaged. The tallow-melting factory had for years past been a most intolerable nuisance to the locality, and its removal, even in this violent manner, caused no regret.

Thursday, November 28th, 1 p.m.—A most disastrous fire broke out in the extensive factory of Messrs. Holland and Son, cabinet-makers and upholsterers, Upper Ranelagh-street, Pimlico. The fire was first seen in one of four brick and timber buildings of two storeys. A strong force of firemen and engines arrived as quickly as the distance from their stations would permit, but the water did not. Twenty minutes elapsed before a drop of water issued from the Chelsea mains, by which time the fire had extended throughout the premises, seized upon the large stock of timber in the yard, and was attacking the adjoining houses. In about four hours the fire was mastered, Messrs. Holland's workshops having been destroyed, and thirteen adjacent houses more or less damaged.

In addition to the great number and serious extent of London fires the provincial towns and the sister kingdom have been the *locale* of serious conflagrations, which want of space precludes the possibility of noticing here. The following, however, from their importance, may be briefly noticed:—

On the morning of Tuesday, Feb. 5th, a fire broke out in the palace at Blenheim, the residence of the Duke of Marlborough, about half-past five o'clock. The porter was roused by the smell of burning, and saw that the roof of the bakehouse was in flames, and immediately gave an alarm. As soon as assistance could be obtained, the Titian gallery was found to be hopelessly on fire. The palace and Woodstock fire engines were got to work, but the whole of the north-east wing, with the exception of a fire-proof room, was destroyed, the fire having burnt itself out, the engines being of no further use than to extinguish the embers.

The paintings, which represented the Loves of the Gods, were nine in number, of large size, and were considered choice productions of the great master. The Duke of Marlborough was in London, and, singularly enough, when the telegram reached him, was in consultation with Mr. Merryweather, with a view to improving the fire-extinguishing apparatus of the palace.

Saturday, March 7th.—Savernake House, near Marlborough, one of the seats of the Marquis of Aylesbury, was entirely destroyed by fire. So rapid was the progress of the flames that a small portion only of the furniture could be rescued. The destruction of this mansion, like the preceding, is attributed to an overheated flue.

Saturday, April 6th.—Burhil Park, one of the finest mansions in the county of Surrey, the seat of F. T. Bircham, Esq., fell a victim to the flames. The fire broke out in the butler's pantry about three o'clock, when the family were aroused, and a mounted messenger despatched to Kingston, distant seven miles, for engines. These arrived in about an hour, when the mansion was enveloped in flames. A plentiful supply of water being obtained from a pond, the engines were got to work, but so rapid was the progress of the fire that the main building, with its valuable contents, was utterly destroyed.

Saturday, September 28th.—The stately mansion of Capesthorne Hall, Cheshire, the seat of A. H. Davenport, Esq., fell a victim to the devouring element. The fire was first seen in the staircase leading to the bell turret, from whence it rapidly spread to the roof and upper floor of the building. Engines from Macclesfield and Congleton were brought to bear upon the burning pile, but with no avail, and the building was completely gutted. There were four flues converging to a point near the bell-turret, one of which is supposed to have caused the calamity.

Thursday, December 19th.—A fire broke out in the north bedroom of Wynyard Hall, Stockton, the seat of the Marchioness of Londonderry. The flames assumed a serious aspect, being seen at a great distance. By dint of great exertions on the part of those present the mansion was preserved, but the bedroom and the chapel were destroyed.

It is matter of continual regret that, notwithstanding the large number of fires that are known to have been wilfully occasioned, the instances in which the incendiary has been brought to justice are lamentably few. If the incendiarism has been cleverly done, the necessary legal proof is very difficult to obtain, all traces thereof being entirely destroyed by the fire. But even where the guilt is manifest, for want of a prosecutor, the offender too often escapes. Juries always look with suspicion upon prosecutions instituted by insurance companies, as being interested parties; parishes are rarely found patriotic enough to prosecute cases of incendiarism; and individuals shrink from the trouble and expense. Hence the immunity of this class of offenders.

Upon one occasion last year, however, the Globe Insurance Company felt it to be their duty to institute a prosecution, and obtained a conviction. On the evening of Friday, August 2nd, between nine and ten o'clock, a fire broke out in, and entirely destroyed, a house occupied by two brothers named George and Frederick Clift, known as No. 2, Lansdowne-villas, Peckham. On the 20th of July previous the brothers went to the Globe Fire-office, and effected an insurance for £2,500 upon their stock-in-trade as quill merchants, and £200 upon household furniture. When the outbreak took place, it was found that the stock-in-trade had been removed, that the inmates left the house shortly before, and that immediately the fire broke out George Clift was seen surreptitiously running from the premises, which had been fired in two places. The brothers, after the fire, sent in a claim, stating their loss to be £4,000; this was resisted, and they were given into custody. At the October sessions of the Central Criminal Court George and Frederick Clift were indicted for feloniously setting fire to the house with intent to defraud the insurance company. The foregoing facts having been clearly proved by the evidence, a verdict of "Guilty" was returned, and Mr. Baron Wilde said they had been convicted of a most serious offence, for which, a few years back, their lives would have paid the forfeit. They had been found guilty, most properly, he would say, of one of the most heinous offences that could be committed in a civilised country. By this act they jeopardised the lives and property of others for mere filthy gain, and no one who had heard the case could have the slightest doubt of their guilt. The jury had recommended them to mercy on account of their respectability and youth, but against that the Court could not but consider that their education and position placed them above those who had not enjoyed similar advantages. He therefore thought, notwithstanding the recommendation of the jury, that public justice demanded that he should not pass a less sentence than that they each be kept in penal servitude for the term of ten years.

In the month of November, 1849, a fire occurred in the house of Mr. Pizey, a marine store dealer, in the Lower-road, Islington. When the premises were entered it was found that some rags and hay had been set fire to in the front cellar, over which some thin deal boards had been placed, so as to direct the flames towards the partition, from which some plaster had been removed, to expose the laths, and also to make a passage for the flames to a quantity of old

furniture on the other side. Early discovery of the fire led to its early extinction. The premises were afterwards converted into a beer-shop, but did not answer, and Mr. Pizey eventually left the neighbourhood. After three insolvencies he again commenced business as a marine store dealer at Tottenham, insuring his stock and furniture for £400 in the Sun Fire-office. On the 1st of April, 1860, Mr. Pizey's premises, as well as two adjoining houses, were burnt to the ground. Suspicion being rife, the inhabitants requested Mr. Humphrey, the coroner, to hold a court of inquiry. After three sittings, and the examination of numerous witnesses, the jury found that "there was not sufficient evidence to prove how the fire occurred, but that it arose under circumstances of great suspicion; and that, in their opinion, the fire might have been extinguished, but that Mr. Pizey refused to allow the means at hand to be used for that purpose."

Other facts having come to the knowledge of the Sun Fire-office, they refused to pay the claim, and Mr. Pizey brought an action in the Court of Queen's Bench, which commenced on Saturday, February 23rd, and lasted until midnight of the Thursday following. Mr. M. Chambers, in opening the plaintiff's case, said there was a very serious charge placed upon the record by the defendants—first, that the plaintiff had made a fraudulent claim; secondly, that he set fire to his house. The plaintiff, when examined, contradicted the evidence he had previously given on oath before the coroner. Mr. Pizey's wife had left him, and he was cohabiting with a young girl named Gibbons, who, like her paramour, contradicted her former evidence. Numerous witnesses were called to prove the character and extent of plaintiff's stock, but they could only speak in very general terms, and when they went into particulars contradicted each other. To account for the funds with which he had rebuilt his house, and purchased goods to the value of between £500 and £600, the plaintiff proved the borrowing of £210. For the defence it was clearly shown that no such amount of property was ever on the premises as was stated by the plaintiff; that there was every probability of the fire having been wilfully occasioned; and that it might have been easily extinguished at the outset, but that the plaintiff prevented it. The jury, after five hours' deliberation, acquitted the plaintiff of setting fire to his premises, but found a verdict for the defendant upon the ground that the claim was fraudulent.

The general increase in the number and extent of metropolitan fires, culminating in the disastrous conflagration in Tooley-street, in June last, drew universal attention to the lamentable insufficiency of the existing arrangements for extinguishing fire. The insurance companies, smarting under their heavy losses, in a moment of unreasoning panic issued a new tariff of rates, on the 6th of July, applicable to dock and warehouse property. These charges were of such an extravagant character as to give great and universal dissatisfaction to the mercantile community. Upon a requisition to the Lord Mayor he permitted a public meeting to be held in the Mansion-house, at which resolutions were passed deprecating the new tariff as unjustifiable, and calling upon the insurance companies to reconsider the matter. There is no doubt that, as stated by the insurance companies, the mercantile risks had for a long time been an unprofitable business, and that a readjustment of the rates was really necessary.

The insurance companies felt that the position they had so hastily taken was untenable, and on the 1st of August they issued a revised and slightly reduced tariff, to which they have since adhered. As a result of the dissatisfaction which the hasty and ill-judged proceedings of the insurance companies had created, two new fire offices were started with highly respectable and influential directories, which entered into competition for the mercantile risks independent of the tariff, and both appear to have secured a considerable amount of business. It was thought that, by improvements in the construction of warehouses, and in the stowage of goods, as well as by an improved system of fire extinction, the risks may hereafter be so diminished as to justify a reduction in the premium.*

The heavy losses arising out of the Tooley-street fire, the great expense incurred in its extinction, the publicly expressed dissatisfaction with the insufficiency of the existing fire establishment, whether with the yearly increasing expenses of the Fire Brigade, and the loss of its superintendent, induced the managers thereof to appoint a committee on the 15th of July, "to consider what changes, if any, have become necessary in the constitution of the fire engine service of the metropolis, in consequence of the death of Mr. Braidwood, and other circumstances." On the 20th of July they resolved that early means should be taken to transfer to the public authorities the fire engine service of London, "always provided that means be taken to enable the fire insurance companies to obtain, under such transfer, efficient protection of their interests.

On the 5th of November the committee wrote to Sir George Grey, inquiring whether her Majesty's Government were prepared to make any communication on the fire-extinguishing service of the metropolis. In reply, Sir George Grey said they had been collecting information, but were not at present prepared to make any communication. On the 10th of February last a deputation was appointed to wait upon the Home Secretary, officially informing him that the associated companies feel the necessity of relinquishing, at an early date, the maintenance of the London Fire Brigade; with an intimation that the companies were prepared to furnish the Government with every information respecting the Fire Brigade, and to transfer the entire establishment, on liberal terms, to any authority, the constitution of which shall be approved by the Government and the companies. On the meeting of Parliament Mr. Thomson Hankey obtained the appointment of a committee to inquire into the existing state of legislation, and of any existing arrangements for the protection of life and property against fires in the metropolis. The evidence taken before the committee shows that the existing law is obsolete and useless; that the parochial fire establishments, with a few exceptions, are wholly inefficient; that the Fire Brigade is efficient within a limited district, but that a very large portion of the metropolis is altogether unprotected.

Among the remedies proposed Sir Richard Mayne thought the protection of life and property from fire should not be left to irresponsible bodies supported by voluntary contributions, but should be the duty of the police. Mr. Brown, the secretary to the Westminster Fire-office, did not see why the protection of life and property from fire should be placed on a different footing from protection against burglary and other offences. Mr. Drummond, chairman of the committee for managing the Fire Brigade, said they would not be willing to bear any increased expenditure; they were willing to turn their apparatus over to any authority that would work it efficiently, and to contribute towards its support. Instead of transferring it to the police, he should prefer a department in which the offices had some interest, and a contribution from Government towards its support. Or the insurance companies would continue to carry on the establishment, if they had a subsidy; £10,000 a year would enable them to provide ten additional stations. Major Greig gave evidence as to the efficient and economical working of the fire-police in Liverpool. Several wharfingers, warehousemen, and mill-owners advocated the employment of a fire-police in the metropolis. The Lord Mayor was of opinion that the fire-extinguishing force ought to be at least four times as large as that which now exists; that it should be an independent body, managed by a commission; the estimated cost, £100,000 per annum, to be met by a contribution of £25,000 from the insurance companies, and an allowance from Government of 15 per cent. off the tax on fire insurance. Mr. Biggs, a director of the Law Fire-office, was of opinion that Government ought to protect the public from fire, by means of the police, to which the offices would willingly contribute. Mr. Baddeley, C.E., said he had, for the last forty years, devoted much time and attention to the protection of life and property from fire. He thought the present arrangements were altogether inadequate for the protection of the metropolis, and would place the whole system under the police. He estimated that, by means of this organisation, efficient protection could be provided for about £60,000; of this sum the insurance companies should contribute £25,000; a halfpenny in the pound added to the police rate would produce £30,000; and Government should pay £5,000 on account of protecting the public buildings. The parishes being relieved from their present payments for fire-engines, fire-escapes, and fire-rewards,* would have scarcely any additional burden thrown upon them, while greatly increased protection would be afforded.

P. S.—Since the foregoing was in type the "Report of the Select Committee of the House of Commons" has been issued. They state that:—"Every witness, including the managers of the brigade, has admitted that the present state of the staff, engines, and stations is totally inadequate for the protection of London from fire. The committee express an opinion that the existing staff of the London Fire Brigade ought to be made available in connection with any new system. After eulogising the Society for the Protection of Life from Fire, and reviewing the various points brought under consideration by the evidence, they recommend—'That a fire brigade be formed under the superintendence of the Commissioners of Police, on a scheme to be approved by the Secretary of State for the Home Department, to form part of the general establishment of the metropolitan police, and that the acts requiring parishes to maintain engines be repealed; that an account of the expenditure of the new police fire brigade be annually laid before Parliament, together with the general police accounts, in such a manner that the special cost of the brigade may be ascertained; and that the area of the new fire brigade arrangements be confined within the limits of the jurisdiction of the Metropolitan Board of Works, with the option to other parishes to be included, if within the area of the metropolitan police.'"

* A Parliamentary return just issued shows the amounts paid out of poor rates by the parishes within the bills of mortality (exclusive of the city of London) for the year ending Lady-day 1861, for the maintenance of fire engines was £906; for fire ladders, £1,358; and for fire rewards £2,992. To this has to be added the expenses incurred in the City, and also of the large metropolitan parishes without the bills, not paid out of poor rates; as also the large sum annually raised by voluntary contributions for the maintenance of fire-escape stations.

* At the beginning of the month of March last the tariff was again slightly reduced; the insurances on the docks, which had been raised from 3s. 6d. to 10s., and afterwards reduced to 7s., being now taken at 4s. 6d.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

THE DELUGE IN NORFOLK.

SIR,—As the German Ocean covers more than ten thousand acres of the richest land of Norfolk, and the decision come to by the Middle Level Commissioners is to have barges laden with clay bags to be sunk in the current, and the engineers are employing hundreds of men in filling bags with clay, and twisting lengths of willow, all of which are swept away, and all their efforts to arrest the rush of water through the gap appear to be in vain, I beg to suggest an expeditious and inexpensive method, by which the gap or breach can be repaired, and which consists of spreading on the bottom of the sea, near the breach or gap, a sheet of strong naval canvas, which can be made in sections and laced to any size, and the end towards the sea to be held securely to the bottom by weights or anchors, and the shore end surrounding the gap or breach to be raised sufficiently high and secured to suitable vessels, anchored across the gap or breach, forming an efficient abutment, which will effectually prevent the entrance of water. As steamers and canvas can be prepared at once, I would undertake to prevent the inroad of water through the gap or breach in a very short time. When such a disaster occurs publicity puts the public in a position to know the right thing to be done. J. MACINTOSH.

May 21st, 1862.

ON THE CORROSION IN LOCOMOTIVE BOILERS.

SIR,—Your observations in the leading article of THE ENGINEER of the 9th inst., on the "furrowing" of locomotive boilers, where you state, "This, however, only brings the phenomenon back again into the region of mystery," induces me to send you a few remarks on the subject, and to point out a prevention to the corrosion in a boiler I once had. About thirty years ago I bought a superannuated locomotive as scrap iron; it was a very primitive one, having a 5in. or 6in. cylinder on the top of the boiler, a three-way cock, instead of a slide valve, and a cog-wheel on the axle to carry an endless chain, instead of side connecting rods. As the boiler shell was good I had it lengthened, and a 12in. or 14in. tube placed in it, and the whole set in brickwork like a Cornish boiler, to generate steam for purposes for which it was required, and the engine was used to work a small force pump in a well to supply water. After it had been at work for some time I found that the tube and angle iron were so much corroded in holes nearly through the plate as to lead me to fear that a new tube would soon be required. As I could attribute the cause to none other than galvanic action, I placed an ingot of zinc, about 20 lb. weight, 1½in. thick, on the tube where the action appeared to have been the strongest, and after a month or two again examined the tube, when, to my satisfaction, I found the holes in it covered with a thin scale, and no further corrosion had taken place. After several months I again examined with the same result, but the ingot of zinc had increased in bulk, and on breaking it found only a thin stratum of metallic zinc in the middle; the rest had become a black oxide, which could be crumbled between the finger and thumb.

For many years after we continued to use this anti-corrosive remedy, renewing the zinc when it required, and the boiler tube by this treatment continued sound.

Query, might not this method be used with advantage in locomotives of the present day, when they are found to corrode inside?

JOHN PLAYER, M.I.M.E.

Norton Ironworks, Stockton-on-Tees, May 15, 1862.

JAMES' PACKED ELONGATED SHOT AND SHELL.

SIR,—I find in *Frank Leslie's Illustrated Newspaper*, New York, 10th inst., an account of James' packed rifle shot and shell for rifle cannon. It appears to be the best method for causing the shot to follow the spiral grooves of a rifle. I have tried something of the kind and was satisfied with the results. All that is now wanted is to have a packing cap to fit on the front of the shot, so as to hold the forepart of the shot central, and not to allow it to rest on the lower part of the bore before being projected by the explosion of the cartridge, the cap to be so formed as to part company on the shot leaving the gun.

Howard's Hotel, Kingstown, Dublin, May 19. J. NORTON.

THE PRIZE SYSTEM.

SIR,—Mr. Sidney may have won the good graces of a certain party by his paper "On the Effect of Prizes on Manufactures," but I cannot admit the soundness of his views, but rather differ from him in the assumptions upon which he bases his arguments. His paper is more particularly directed to the long disputed point of the prizes offered by the Royal Agricultural Society, and on close investigation it will be found that it is not the giving of prizes which is objected to, but the partial trials by which the results are supposed to be obtained, and the prizes awarded. I do not see that the prize system assumes that a customer is not competent to select what he requires, but, on the contrary, a trial shows whether the plough which may have successfully opposed all others in one district, can hold the same position in another where the soil is of a very different character. It is not fair to suppose that the best plough for the county of Kent will be found to be the best for the strong clay of Scotland, and a Scotch customer will at once reject a wheel plough as unsuitable, even though on trial it should prove to be only about half the draught; indeed, will even assert that it would take far more power than the common short rest ploughs to be found there. Again, he will reject the cast iron body as being altogether unsuitable whereas it is well known that there are many doing good work there.

Next, I will own that the system does assume, and of which Mr. Sidney seems to doubt the truth, that there are tests by which the qualities of implements can be fairly ascertained—though only in relative and not marketable value. A mere inspection of a well finished and neatly painted article will not satisfy any one of its intrinsic value or utility, even though backed by a profusion of statements to superiority of workmanship and patronage; and I must also admit that there are judges to be found "free from natural or local prejudice," though, when self-registering tests are applied, prejudice or favour will have less opportunity than at present.

For the security that only the usual manufactures are exhibited for competition, we ought to look to the conditions of competition; and the remarks on the racing engines show that Mr. Sidney is well aware of the means used to carry off prizes, while evading the intention of the society to secure an improved make. It follows, therefore, that the administration of the rules, or the rules themselves, must be lax.

Mr. Sidney was answered in his objections as to woollen, &c., fabrics; now for his instances of the brougham and easy chair. In competition of broughams, I would weigh each, so as to ascertain the total weight and the distribution of it; then try the power required to draw each empty, and with a certain load. The area allowed for the occupants on, and between seats, would assist the above results in giving a tolerable idea of the comparative value of each.

Arm-chairs or easy chairs are made some too high for an ordinary person to sit in comfortably with his feet on the ground; others too low to rise from readily, or to sit down upon without losing one's balance; some too small, others too large—thus size and height of seat, angle of back and weight, are self-giving points without being led away by a gaudy cover to a flock padding, from a hair stuffing in a neat cover. And so on through all departments of manufacture, tests would benefit the honest maker and expose the fraudulent; but if a man, to save his pocket, prefers shoddy to wool let him have it—that is his affair.

Established trade reputations! Whence come these? Extensively advertising in every known way by newspapers, and by agents whether in the trade or not, would tend to make a reputation; but who would think of a prize given to such? Who are the individuals, who are the large manufacturers, who wish to do away with the prize system? Are they not those who have most benefited by it under the auspices of this very society? And more, are not all these parties directly in contradiction to Mr. Sidney's assertions now arrayed in competition at South Kensington? And is there one firm there that would seriously object to receive a prize if awarded to them? This is a self-answering argument, worth a hundred such semi-ludicrous statements as those about Sir E. Landseer's coat and the prize boots and shoes; and, to quote a remark which I believe emanated from Mr. Sidney, "the small blacksmiths now become large engineers" have much to thank the prize system for their present position, and it might well suit them to have a snug monopoly by doing away with competition lest some of their neighbours should trench upon their solid advantages, or a new generation be permitted to eclipse them.

The prize system has been injured by maladministration. Let Mr. Sidney look to this, and earn the thanks of all parties concerned, instead of becoming the organ of a party who have placed themselves in opposition to the Royal Agricultural Society. It is not the first time that Mr. Sidney has expressed the same views; but when agricultural prizes are diverted to a room stove, and commendations given to articles not exhibited, there certainly is an opening for reform, and there have been objections made to brick-making machinery being considered as implements of agriculture, and so on; but, above all, there should be a guard against partial trials, partial results, partial judges, and partial reports, if we would serve the farmer and IMPLEMENT MAKER.

8th May, 1862.

STEEL IN THE EXHIBITION.

SIR,—I had quite forgotten my controversy with Mr. Longsdon respecting Krupp's steel, and I think Mr. Longsdon might wisely have abstained from again broaching the subject, for the arguments he uses are most unhappily chosen. There is exhibited by Mr. Krupp an immense ingot, 21 tons in weight and 44in. in diameter, broken into two pieces, to demonstrate that an enormous mass of steel may be made by emptying a sufficient number of pots of melted steel into a mould, and likewise to prove that the mass thus made is free from cells or honeycombs. Now, every practical steelmaker knows that when steel is made of sufficient hardness the ingots into which it is cast are free from honeycombs, no matter whether the steel is Sheffield steel, Bessemer steel, or Krupp's steel. But steel thus made is perfectly useless for the manufacture of guns, shafts, boiler plates, tyres, and other articles of a similar nature, as it does not possess the requisite degree of toughness. The large ingot, therefore, merely shows that a large quantity of hard, and consequently of easily melted steel, can be cast into a solid ingot, and the ingot can then be broken; but to suppose that a mass of steel 44in. in diameter, tough enough to be twisted cold like a corkscrew, or doubled flat in a 5-in. square bar without cracking, can be broken to show its solidity and freedom from honeycomb, Mr. Longsdon may get the uninitiated to believe, but to a practical man he only demonstrates the untenable nature of his own proofs and arguments.

Grant for one moment that this immense solid ingot is also as tough as Krupp's gun metal and tyre metal is well known to be, why does he, then, still persist in forging his guns and tyres when he can cast them free from honeycomb? Is it an idiosyncrasy on the part of Mr. Krupp that he will forge his steel when it does not require it; or is it, as I say it is, that his steel, when made soft enough for guns and tyres, is so full of honeycombs that it must be forged in order to close up these imperfections? Having a high opinion of Mr. Krupp as an inventor and practical man, I conclude that he is not the victim of the strange idiosyncrasy I have described, and therefore his steel is honeycombed and requires forging. If Mr. Longsdon would do as the Czar did, go to work with his own hands and learn as a workman, he would find that matters are as I represent them to be, not as he would wish them to be.

The remarks I have made respecting Krupp's monster ingot apply equally to the 14-in. Bessemer ingot. Are the public to be asked to believe that metal which in a rail can be twisted, cold, like a ribbon, can in an ingot, 14in. diameter, be broken off as short as a carrot; and does the fact of one hard ingot of cast steel being free from honeycombs disprove the statement of "W. S. P." that six other Bessemer ingots of soft cast steel were mere sponges from excess of honeycomb?

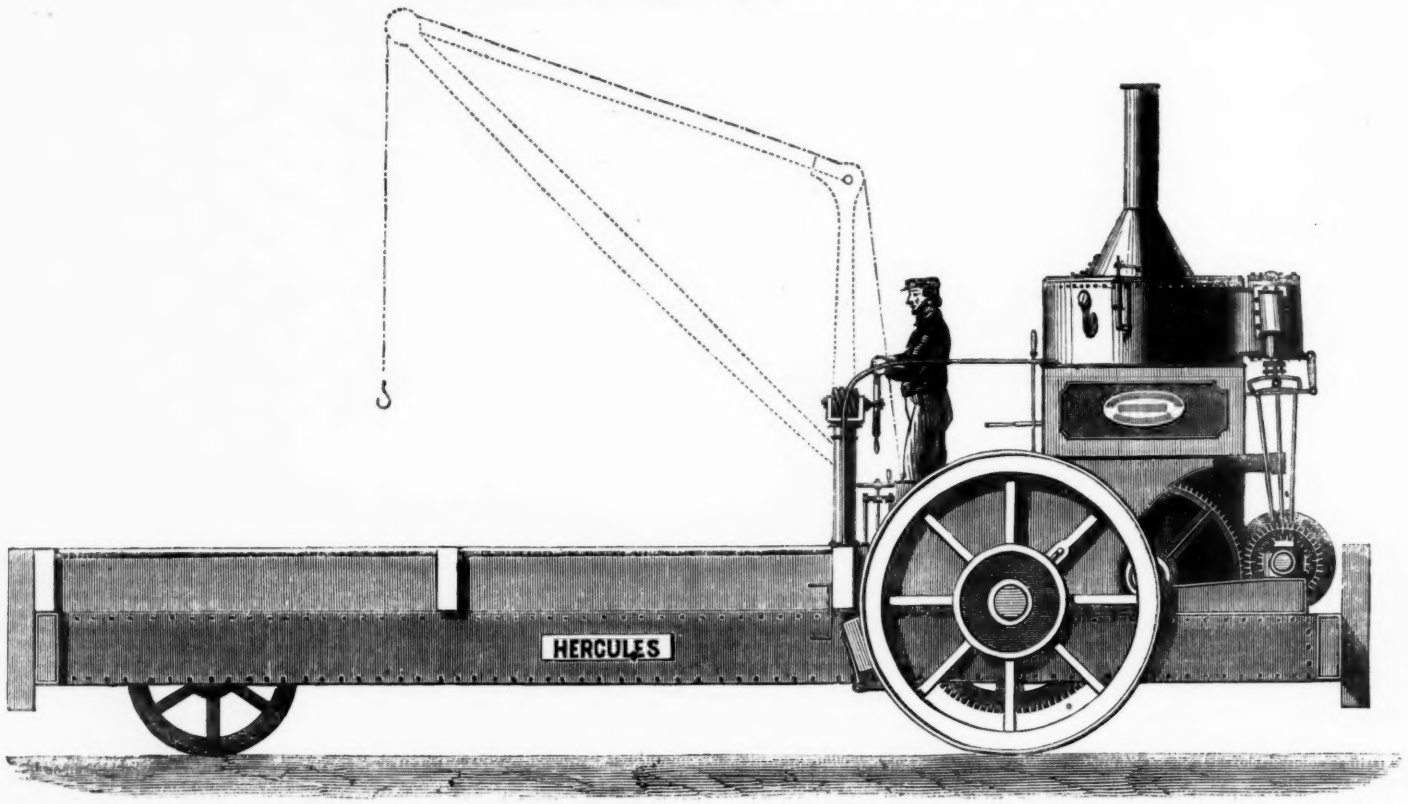
Had these stupendous ingots been bent at one end and broken at the other there would have been something to admire, and it must be admitted that any bendable substance can be bent easier than it can be broken, but these perverse ingots, though "tough as copper," will not bend but will only break.

There is a tyre shown in Mr. Bessemer's "trophy" made, as I candidly admit, without the aid or intervention of my manganesic process, and very pretty this tyre is to look at, and very well suited is it to be placed where things are only to be looked at, not used. But what is the worth of this tyre as a tyre? Why, a stout blacksmith could break it with a heavy hand hammer. In comparison with one of Krupp's tyres it is like a sixpenny lead watch compared with a finished gold repeater.

In conclusion, referring to my former controversy with Mr. Longsdon, the matter remains now precisely as it did then. I can cast guns of steel free from honeycombs, which will stand 48 tons tensile per square inch without any forging, while Mr. Krupp's steel guns all require to be forged after they are cast, a fact which the presence of his immense broken solid ingot at the Exhibition only serves to demonstrate. Had it been bent, and not broken, then the affair would have assumed a widely different complexion.

Coleford, 19th May, 1862. ROBERT MUSHET.

CHAPLIN'S TRACTION CARRYING AND WINDING ENGINE.



This engine, the first of the class, manufactured by Messrs. Alexander Chaplin and Co., of Glasgow, was intended for the International Exhibition, but owing to the demand for it in Glasgow, it was decided to send only a drawing of it, which is exhibited along with the steam crane sent by the above firm. It has a pair of cylinders 7in. diameter × 14in. stroke. The wheels are about 6ft. diameter × 1½ft. broad, and connected with the engines by a double set of very strong spur gearing, giving a variable speed of from 1½ to 4 miles an hour. The large platform is for carrying loads of from 15 to 20 tons. The crane (shown by dotted lines) is for loading and unloading itself on separate trucks, and can be worked by the engines, the main driving gear being at rest.

This engine has also the power of winding itself slowly up steep inclines, or of winding its load towards itself. It is steered by one man, while another attends to the engines, and it is under the most perfect control at all times.

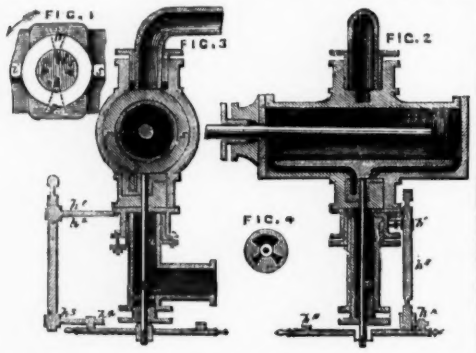
The boiler is of the upright tubular kind, known as Chaplin's patent, with tapered and expanded tubes, and supplies steam up to 100 lb. pressure. The nominal power of this engine is 15 horse; its performances during the last two months show it capable of work equal to 40 or 50 horses, while from the easy control over it, and the power of instantly reducing the travelling speed, it is found much safer and less obstructive to the ordinary traffic than a number of horses.

This engine differs from all others yet introduced in carrying, as well as drawing, loads (the load being found to increase its traction power), and has a self-winding engine.

DAVIS AND EVANS' STEAM ENGINES.

These improvements, by James Davis and Thomas Evans, of Ulverstone, relate to the construction of those engines where the admission of the steam is regulated by the oscillation of the cylinder, and consist in the peculiar form and arrangement of the valve which opens and closes the steam and exhaust ports, and also in the peculiar mechanism by which the motion of the valve is regulated.

Referring to Figs. 1 and 2, r, s, are the steam passages; r^1, s^1, the nozzles of the passages; i, i^1, the exhaust ports leading to the



exhaust passages in the belt p; r^2, s^2, (Fig. 2), are the two corresponding ports in the valve; v, the recessed hollow which covers the exhaust and isolates it from each steam port at the alternate strokes. Suppose now the cylinder at the end of the stroke and about to describe an arc in the direction of the arrow (Fig. 1), the port or nozzle r^1, will now begin to take steam, which it receives through the oscillation of the cylinder, which causes the nozzle to gradually cover the port r^2 of the valve; at the same time the nozzle s^1, which had been previously taking steam from s^2, will now, owing to the oscillation, gradually leave that port and come under the recess of the valve, and allow the steam to escape from it into the exhaust passage i, which is kept from the other port by the sides of the recess; when the cylinder oscillates back again the reverse is the action of the ports.

The steam ports on the valve seating are so arranged as to form an angle equal to that made by the axis of the cylinder and the arc of oscillation; as the steam ports on the seat are at right angles with the exhaust ports, it will be seen that by turning the spindle and valve round half a circle, the functions of the ports and motion of the engine will be reversed.

Figs. 3 and 4 show the valve in section, and steam passages and ports; they also show the valve spindle u and its junction with the valve; it will be seen that this spindle is jointed on two planes u^1, u^2. In the application of the valve as above described it will be seen that the valve remains fixed, the cylinder moving; in order, however, to actuate the motion of covering and uncovering the ports more quickly, we apply the rocking shaft arrangement before referred; a stud h is fixed upon the trunnion of the cylinder, hence moving with it; to this is attached the lever h^1, which actuates through a link the rocking shaft h^2, and in its turn gives motion to the gab h^3, which working on a stud h^4 in the wheel i, fixed to the valve spindle, causes it to move in a direction opposite to that of the moving cylinder, and thus accelerates the opening and shutting of the ports.

THE MARSHLAND DELUGE.

(From the *Times*.)

The Bedford Level is a tract of low land, containing about 400,000 acres, situate in Northamptonshire, Huntingdonshire, Cambridgeshire, Suffolk, Norfolk, and Lincolnshire. Its natural drainage is by the rivers Nene and Ouse into the great estuary of the Wash, and so to the German Ocean; but much of it, lying below the level of the sea, remained for ages a series of lakes and swamps. Its name is derived from the ducal family of Bedford, which possesses large property in it, and two of the heads of which—Francis, fourth earl, and his son and successor William, fifth earl and first duke—successively undertook (with the assistance of Sir Cornelius Vermuyden, a Dutch engineer) its drainage and reclamation.

In 1695 the Bedford Level was divided into the North, Middle, and South Levels, all under the management of the Bedford Level Corporation. In 1753 the North Level finally separated from the others, and having its own drainage by the Nene (the Peterborough and Wisbech river), it is no longer considered part of the Bedford Level. The Middle and South Levels each drain into the Ouse or Lynn River; but, as will be seen hereafter, the Middle Level has now no connection with that river until shortly before it reaches Lynn.

One of the earliest and chief works of the Bedford Level Corporation was the erection of a sluice across the Ouse at Denver, about twelve miles above Lynn. This was advised by Vermuyden, but opposed by Westerdyck, another Dutch engineer employed by the corporation. A sluice consists of folding doors set in strong brickwork, and constructed so as to be opened by the fresh water when the tide runs out, and shut by the salt water when it comes in—the retreating fresh water thus making way for its own egress, and the advancing salt water opposing a barrier to its own progress. The advantages of a sluice are that the banks above it need not be made strong enough to bear the weight and violence of the sea water, nor high enough to avoid being overtopped by an unusually high tide, and that the retreating fresh water is not impeded in its course by the advancing salt water.

Denver sluice was, of course, constructed solely with a view to drainage, and its erection was thought to have a bad effect on the navigation, particularly in ckoking Lynn harbour. In fact, drainage and navigation are, and always must be, conflicting interests, the former requiring the channel to contain as little, the latter as much water as possible.

In 1713 the controversy was for a time settled by the tidal waters undermining and "blowing up" Denver sluice, and in that condition it remained until 1750, when, in spite of strong opposition from Lynn, it was rebuilt, and has remained ever since, the recent statement of its destruction being altogether a mistake.

Notwithstanding numerous and expensive works for the drainage of the Middle and South Levels, it remained very imperfect, while the navigation of the Ouse became worse daily. An opinion gradually prevailed that the bad state of both drainage and navigation proceeded from the width, shallowness, and circuitous course of the Ouse from Eau Brink to Lynn, and in 1795 an Act was passed for making a straight cut between these points, which, however, was not completed until 1821. The Act was the first of a series, called Eau Brink Acts, by which the drainage of the Bedford Level is in effect placed under the control of a body lately called the Eau Brink Drainage Commissioners, but now the Conservators of the Ouse Outfall, leaving the Bedford Level Corporation but the shadow of authority. It has recently been proposed to dissolve that corporation, and finally separate the Middle and South Levels.

The proprietors of the Middle Level have already taken a great step in that direction. Their existing drainage being very incomplete, and particularly a large lake, called Whittlesea Mere, being altogether incapable of drainage, they obtained an Act for making a new drain from their level to the Eau Brink Cut, which had answered the expectations of its promoters and the objections of its opponents by greatly improving both drainage and navigation. This "Middle Level drain" was completed in 1852, at a cost of over £400,000, and it has been a complete success, having given the whole Middle Level, including Whittlesea Mere, an efficient natural drainage.

The drain is about eleven miles long, perfectly straight, and devoted exclusively to drainage, there being no navigation. Its outfall into the Eau Brink Cut (about three miles above Lynn) was secured by a sluice which cost £30,000, and by which it is said the contractor lost £10,000.

The drain, although made for the sole benefit of the middle level, runs through a district called Marshland, lying between Lynn and Wisbech, and forming no part of the Bedford Level. A great part of Marshland consists of fens, the largest of which is called Marshland Fen. These fens were drained about half a century ago, under local acts, entirely distinct from those affecting the levels, and through them runs the Middle Level drain, carrying through the Marshland fens the waters of the Middle Level on their way to the sea.

The Marshland fens, from reedy swamps, have been converted by drainage and cultivation into good corn land, almost equal in value to that of the rest of Marshland, which is one of the most fertile districts in England.

On Sunday, the 4th instant, the Middle Level sluice blew up, as that at Denver had done in 1713, the cause in both cases being probably the same, viz., that the tidal waters had gradually undermined the brickwork and formed a hole in the bed of the river, in which the structure was engulfed. Whether this took place without warning is a controverted point, which may result in litigation.

It was now evident that unless some means could immediately be adopted for excluding the waters of the Ouse from the Middle Level drain, the banks of the latter (constructed only to resist the fresh water from above) must give way. Attempts were made to make a dam across the drain, but they failed, and on Monday morning, the 12th instant, under the weight of a high spring tide, the west bank of the drain broke, and the roaring tide, which had previously nearly overtopped the bank, poured into the adjoining fens, carrying away the bank for about seventy yards, and making, it is said, a hole 10ft. deep where it had stood. And at every tide since the water has poured over the defenceless country, until it is supposed that nearly 10,000 acres are now submerged, all a few days since verdant with luxuriant crops.

The case of the sufferers is hard indeed. They are injured by the failure of works which were not intended to benefit them, and from which they neither derived nor acquired any advantage.

As soon as the breech in the bank can be repaired it will not, it is thought, be a work of great difficulty to get the water off the fens, which possess a complete system of drainage. But it is useless to attempt this until the Middle Level Commissioners have secured their banks, so as to relieve the unfortunate fenmen from fear of further inroads.

This, it may be hoped, is now in a fair way of being done. The commissioners are said to have given *carte blanche* to Mr. Hawkshaw, and it is understood that the local works will be much under the direction of Mr. Muller, a Dutch engineer, who has been much employed in works of embankment in connection with the Norfolk Estuary Cut, a work designed to effect a similar alteration below Lynn to that caused by the Eau Brink Cut above it, but on a much larger scale.

Boiler Explosion.—A large boiler exploded on Tuesday morning in the extensive iron ship building works of Messrs. Scott and Co., of Greenock. Three men were killed and eight others more or less seriously injured. The boiler was 7ft. in diameter and 25ft. long. It exploded from the middle of one of the internal flues. As the explosion happened at a few minutes before six o'clock in the morning the boiler had probably just been fired up for the day's work.

The Japanese Ambassadors at Messrs. Penns'.—On Monday morning the Japanese ambassadors, accompanied by Mr. Macdonald, attached to the English Legation in Japan, and a numerous suite, proceeded down the Thames in a steamer placed at their disposal by the Admiralty, to visit the great boiler and engine factories of Messrs. John Penn and Son. They seemed particularly struck with the immense steam hammers of Nasmyth's patent, which were in full operation. A wish having been expressed to witness the process of melting iron and running it in its liquid state, this was speedily accomplished. Having spent about two hours at these works, they re-entered the carriages, and proceeded to the private residence of Mr. J. Penn, at Lee, near Blackheath, where they partook of luncheon. They afterwards visited the lower works of the firm at Deptford Green, where they appeared much impressed with the operations of the planing machines, and also with the machinery for punching rivets, &c. There are now on hand at this establishment two pairs of engines of 1,350-horse power, the largest ever made, besides the engines of the Achilles, of 1,250-horse power. The various processes carried on in different works were eagerly and closely examined by the Japanese visitors, and they made copious notes and drawings of all that particularly struck them.

TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

A NOVICE.—*We see no merit in the plan of Merritt.*

AN UNKNOWN QUANTITY.—*The whole plan will be fully explained in our next.*

A SUBSCRIBER'S *letter would serve no purpose without his name were attached to it.*

R. F.—*Such plans and elevations are advertised every week on the last page of* THE ENGINEER.

W. D.—*There is no work, that we know of, exclusively devoted to the Fan or the Governor. Almost every work on the steam engine gives more or less information as to the latter.*

J. E. E. G.—*There is a company which offers to take mortgages on what they may consider good patents, as security for advancing money to procure the patents. We know nothing of their standing.*

J. S.—*We know of no packing other than metallic rings upon which you can depend in using steam superheated to 500 deg. This packing could not, however, be kept lubricated at that temperature.*

T. N.—*Mr. Hoskyns once wrote a work called "Talpa, or the Chronicles of a Clay Farm," which is, we presume, the one to which you refer. We do not know how you can obtain it except by ordering it through a bookseller.*

J. H.—*The only remedy that we know of against the incrustation of clay retorts is to exhaust the gas by exhausters, so that the pressure in the retorts shall not exceed 1in. or 2in. of water. Clift's enamelled retorts are said to be less likely than ordinary retorts to crust or "fur."*

F. H.—*There is no real difference in the meaning of the words "bridge" and "viaduct," the latter, from the Latin, literally meaning a way-carrier. The term "viaduct" is generally understood, however, to apply to bridges, the larger part if not the whole of which are over dry land.*

A. I. (Maybole).—*We doubt if any advantage would be gained by linen knives and fingers in reaping machines. You have touched upon an analogous case – that of cutting iron. It is generally held that it takes four times as much power to cut or shear a 1-in. plate as is required for a ½-in. plate.*

A SUBSCRIBER.—*Whoever receives a patent, except for a communication from abroad, must declare that he believes himself to be the true and first inventor. If any one, aiding an inventor, chooses to make such a declaration, it might be difficult to prove that he had declared what was not true, and in any case we believe his claim would hold good as long as his partner's the real inventor.*

ROTARY ENGINES.

(To the Editor of The Engineer.)

SIR,—I observed in THE ENGINEER of the 9th inst. that your correspondent, "J. S.," in his letter on expansive and rotatory steam engines, gives an illustration of what he considers to be an improved valvular arrangement.

As your correspondent may not be aware that the valve he recommends has already been successfully applied both to steam engines and to steam hammers, I inclose a sketch of the same, which I patented and applied in 1859. JOHN PATON.

Govan Ironworks, Glasgow, 14th May, 1862.

HYDRAULIC PRESS PACKING.

(To the Editor of The Engineer.)

SIR,—We have an hydraulic press, the ram of which works up into a cylinder heated by steam, at a pressure of say 30 lb. per square inch, and pressure on ram say 1,200 lb. per square inch, and the leather ring, which is usually put into these hydraulics to resist the pressure, is destroyed by the heat of the steam, and consequently renders it useless by once using; and, being too expensive, I thought perhaps you or some of your numerous correspondents would be able to inform me of a cheaper mode of working the same. Hoping to see something in your columns to throw a light on this subject, I will anxiously await your next issue. N.

May 19, 1862.

SHELLS TO EXPLODE BY PERCUSSION ON WATER.

(To the Editor of The Engineer.)

SIR,—I this day witnessed, in company with two scientific gentlemen, an experiment by Captain J. Norton, by which a wooden shell, fixed to the point of an arrow, and shot vertically from a bow, exploded by its fall on the water, in the Archery Grounds at Monkstown Castle.

This elongated wooden shell was constructed on the same principle as that which he fired from his heavy three groove rifle against a ship's sail some weeks ago on the open ground in front of the Anglesey Arms, Kingstown, when the shell ignited by percussion against the canvas, and exploded immediately beyond it. ZOUAVE.

Monkstown, Dublin, May 13th, 1862.

THE CUPOLA SHIPS.

(To the Editor of The Engineer.)

SIR,—The *Times*, in a leader on the 14th inst., strongly advocates the use of cupola ships, and makes some not very complimentary remarks on the conduct of the Admiralty. Now, sir, I wish you to allow me to say in your paper that to build cupola ships is a wanton waste of the public money. No ships ever built offered such facilities for capture. It would be a folly to waste good powder and shot on them, so as to injure good material. Jump on to her deck, wedge the cupola fast, put a hand shield before her loop-holes, pass a hook chain round her cupolas, then to your vessel, and tow her away to where you like. A few hand-grenades thrown in at the top, or through the poop, might be used, if thought necessary. The locking of the cupolas can never be prevented. Then what comes of their revolving merits?

The *Times* is of opinion that Captain Coles ought to be employed to superintend the building of the ships, as if the conception of an idea, that a revolving tower in the middle of a ship's deck might be good in warfare, would at once constitute a sailor to be an experienced shipwright and engineer. If Captain Coles has told all he has to tell, and kept nothing back, then the best course for him and the Admiralty is to let shipwrights and engineers stick to their parts, and sailors to theirs.

There is a statement in the same article which shows the writer to be ignorant of the history of screw propulsion. It is as follows (speaking of the Admiralty):—"It kept to the paddle-wheels until every one adopted the screw." Now, nothing can be farther from the truth. The screw-propeller may be said to be the child of the Admiralty. The Admiralty took it in a crude form, and made it what it is now. The Admiralty led the way, and cleared the ground for the merchant service. If the writer knew nothing about the matter, he should have said nothing about it. The Admiralty may deserve blame, but do not lay it on when they deserve praise. If they deserve blame lately, it is for allowing literary politicians and bucolic members of Parliament to usurp their places. A free press is a good thing, and so is a House of Commons; but ability to write a leader or make a speech does not imply judgment founded on years of experience in naval, military, and constructive science. A BOMBARDIER.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, May 27th, at 9 p.m., "President's Conversazione."

SOCIETY OF ARTS.—Wednesday, 8 p.m., "On the International Exhibition of 1862." By William Hawes. On this evening the Right Hon. the Earl Granville, K.G., will preside.

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THE ENGINEER *is registered for transmission abroad.*

Letters relating to the advertisement and publishing department of this paper are to be addressed to the publisher, MR. BERNARD LUXTON; *all other letters and communications to be addressed to the Editor of* THE ENGINEER, *163, Strand, London, W.C.*

THE ENGINEER.

FRIDAY, MAY 23, 1862.

THE ARMSTRONG GUN.

AT the United Service Institution on Monday evening, the Duke of Somerset in the chair, Captain Fishbourne, R.N., fired some heavy shots, in the shape of facts and arguments, against the Armstrong gun. The principal point of attack was that which, so many months ago, we pointed out to the attention of our readers, to wit:—the low initial velocity of the projectiles fired from rifled guns. The initial velocity (or velocity on leaving the gun) of a 68 lb. round shot, fired with 16 lb. of powder from a 95-cwt. gun, has been ascertained to be about 2,000ft. per second, although Sir William Armstrong has lately thought fit to state in the *Times*, for the information of the public, that it is but 1,580ft. The initial velocity of the 110-lb. rifled shot, fired with 14 lb. of powder from an 86-cwt. Armstrong gun, is under 1,300ft. per second, as admitted by Sir William himself. Now, the force of a shot is in proportion to the square of its velocity, and in the case now under consideration a shot at 2,000ft. per second would have more than twice the force of one of the same weight moving at only 1,300ft. Allowing for the difference in the weight of the shot, the difference of force and consequent destructive effect would be at least as great as that between 2,720 and 1,859, these numbers being proportional to the weights of the shot multiplied into the squares of their respective velocities. But this is not all. As Captain Fishbourne observed, the shot which flies a given distance in one second will in that time have dropped, if free to do so, 16ft. below the plane of projection. But a shot which occupies two seconds in going the same distance will, in that time, have dropped 64ft. below the plane of projection, and upon this inevitable natural principle slow-moving rifled projectiles can never attain other than very short ranges at point blank, while for long ranges the angle of elevation must be so great that there can be but very little chance of hitting the object. Those who have heard so much of the long ranges attained at Shoeburyness and Southport may not be aware that, at point blank, or with the axis of the gun exactly levelled, the rifled projectiles have very much less range than round shot. Such, however, is the case, well known to all practical artillerists. The ranges of 10,000 yards, or nearly 6 miles, attained both by the Whitworth and Armstrong guns, were attained only when the piece was laid at an angle of 35 deg., which is the angle at which a fire engine man holds his branch to obtain the greatest horizontal discharge of water. Of course, the chance of hitting an object at long ranges depends on an almost exact knowledge of the distance. This, generally, can only be obtained by repeated trials by firing shot until it is discovered that the object is hit. Even at a few hundred yards, the exact distance must be discovered by trial, and the gun laid with great accuracy to the proper angle of elevation. In no case can a rifle shot be made, at the first hit, to strike an object a few hundred yards off, if the gun be pointed directly at the object, for the shot will invariably fall to the ground before it reaches the object, and the *ricochet* of a long spinning shot cannot be depended upon to carry it to its mark.

Every competent authority now appears to admit that naval actions are not likely to be fought out of the range of ordinary guns, and it is natural, therefore, that experienced naval men, like Captain Fishbourne, cannot see the advantage of employing a costly complicated weapon, which, at ranges under 600 yards, neither hits so hard as the 68-pounder, and which, at that range, is absolutely less likely to hit its mark at all.

In the course of the discussion which followed the reading of Captain Fishbourne's paper, Captain Blakely read an almost exact description of the so-called Armstrong gun, as made by Daniel Treadwell, in the United States, previous to 1845. In a pamphlet now lying before us that gentleman, writing in 1845, says, "Having been aware of "the fact here stated (that of the superiority of twist "barrels for fowling pieces), and, I trust, in a manner "which can be easily understood and appreciated, for "many years I determined, between four and five years "ago, to attempt to apply it practically to the fabrication "of cannon. My first attempt was to make a four-pounder "cannon by the best means then at my command, of rings, "or short hollow cylinders, joined together, end to end, by "welding. Each ring was made of several thinner rings "placed one over the other and welded. * * * I may re-"mark here that this method was subsequently changed in "some degree by first making a single thin ring of steel, "and upon the outside of this winding a bar of iron "spirally, as a ribbon is wound upon a block. This gun, "although imperfectly made, withstood the action of enor-"mous charges of powder, and was only burst by using "very superior powder and shot without windage." Mr. Treadwell then proceeded to describe how he constructed a number of 6-lb. field cannon and four 32-lb. cannon (equal to 90-pounders according to the present rating of rifled guns) for the United States' Government. These guns had steel tubes in the bore, with iron wound around them, and the whole welded together in one solid mass. One of the 6-pounders, weighing 800 lb., was fired with 1,500 service charges, and afterwards 20 rounds with 3 lb. powder, 1 shot, and 1 wad; 20 rounds with 3 lb. powder, 2 shots, and 2 wads; 10 rounds with 3 lb. powder, 3 shots, and 2 wads; and, at last, 10 rounds with 6 lb. of powder, 7 shots, and 2 wads, and remained entirely uninjured. Mr. Treadwell practically proved the inferiority of wrought iron in comparison with steel as a material for the inner tube or lining of 32-pounder guns. In 1856 Mr. Treadwell published a pamphlet, a copy of which is also before us, in which he proposed to strengthen cast iron guns by shrinking upon them successive hoops of wrought iron, not welded, however, as in his earlier guns, but applied exactly as Sir William Armstrong applies them to wrought iron internal tubes.

The Whitworth Ordnance Company, we learn, are now making heavy guns, of which the principal part if not the whole is of Bessemer steel, the internal portion being bored out of the solid, and having twice the strength and hardness of a wrought iron tube. If jackets are required over a gun so formed they could not be better made, we should suppose, than from the same metal, rolled direct from the ingot into the required form, and shrunk on with a calculated tension due to the distance from the bore. Such guns can ultimately be made so as to be cheaper as well as stronger than anything now made at Woolwich or Elswick.

THE INTERNATIONAL EXHIBITION.

THE western annexe is still standing, the Commissioners having caused props to be put up against the western sides of the posts supporting the roof. Without this additional support the whole affair, as we have several times pointed out, was liable to tumble in at any moment. The props put up make a great variety of angles with the perpendicular, and thus are anything but ornamental, while they are most unquestionably in the way. The roof, furthermore, is, or lately was, so leaky that some of the owners of the £500,000 worth of machinery—most of it polished and oxidisable—placed beneath, have been compelled to petition the Commissioners to have something done forthwith. Until the props, peculiar to the Fowkean style of construction, were added, however, the roof could hardly have borne the weight of a shower in addition to that of its own unsound carpentry. As for ventilation, that is, we suppose, quite a minor consideration, one indeed to which the Commissioners, or at least their constructing genius, appear to have given no consideration at all. The roofs would doubtless prove a most valuable acquisition to a market gardener largely engaged in the cultivation of cucumbers, but, as they are, the solar heat from above and the radiation from somewhere about 18,000 square feet of steam and exhaust pipes beneath the floor, are likely, when the dog days set in, to impress visitors with a tolerable idea of that process of distillation known as the Turkish bath. In respect of light there is nothing to complain of. In the important provision of steam power the calculations of the Commissioners have fallen ridiculously short. Their able superintendent, Mr. Clark, was, we believe, from the first fully sensible of the probable extent of the requisitions for steam, but instead of allowing him to set up a dozen large boilers he was restricted to half that number. As was to have been expected, therefore, there is only half a supply of steam. The boilers are estimated to afford steam equal to 500 indicated horse-power, whereas Messrs. Gwynne and Co.'s centrifugal pump alone is estimated to require, when in full work, nearly 200 horse-power. The large Appold pump would require about 100 more—two machines alone, therefore, requiring at least one half of all the steam provided for the whole Exhibition, to say nothing of the condensation in upwards of half a mile in length of steam pipes varying in diameter from 15in. to 8in. At last, we understand, three more boilers are to be provided (not the three, close at hand, so long known as the "Brompton boilers"), and late in June therefore the shilling visitors may find the machinery enlivened by a corresponding additional horse-power. On account of the refusal of the Commissioners to grant season tickets to exhibitors, there are very few persons in attendance upon the machinery, which, therefore, has to speak for itself. Unlike objects which appeal only to the eye, mechanism, even to the most practised engineers and machinists, requires explanation, and the very persons who, as a casual observer might suppose, would be already familiar with everything, in their own profession, in the annexe, are those who have occasion to ask the most questions. It is they who most wish to know the form and arrangement of parts not in full view, the dimensions of important members which they are not at liberty to measure, and the general action and practical value of everything put forward as an improvement. But there are few to give any such information in the western annexe. We could, with a certain amount of industry, get together a tolerably full list of the objects exhibited, but our readers, we fear, would hardly thank us for this unless we could, at the same time, point out the peculiarities and general scope of the objects themselves. This, where there is seldom any one on the spot, even to receive the orders of intending purchasers, is not so easy a task.

But with all these drawbacks, the exhibition of machinery is the finest ever made, and a large proportion of the whole number of visitors make the circuit of the western annexe, and examine its varied contents with an interest apparently no less than that bestowed upon the chief points of attraction in the main building. The jurors have an arduous task before them, provided they are really making anything like a thorough examination of the multitude of objects upon which they are expected to bring in just verdicts. That they can do this is most unlikely if indeed it be not impossible. With the larger number of objects they can judge only from externals and from the reputation of the exhibitor. Mr. Sidney's able paper on the effect of prizes on manufactures, lately read before the Society of Arts, will have led many to reflect upon the extent to which prizes enter into the inducements to exhibitors to come forward with their goods. If prizes are to be given it is natural that every exhibitor should feel anxious not to be overlooked, for not to receive a prize is held to be equivalent to want of prize-worthy merit. But let it be given out that, while a full display is required, no prizes are to be awarded, and what difference would it make in the minds of exhibitors? We know that, on a small scale, the shows of the Smithfield Club, who have never awarded prizes to machinery, are crowded with the production of our agricultural engineers. At the meeting, too, of the Royal Agricultural Society, the implements are taken up in classes one or more of which are examined and be-prized one year, leaving others for subsequent meetings. Thus last summer, at Leeds, neither portable engines, horse-ploughs, nor many other machines and implements were made the subject of examination for prizes, yet there were upwards of one hundred steam engines in the yard, and no end of other objects competing commercially only. We believe that the presumption of injustice in the award of prizes actually deters many manufacturers from entering upon competitive displays where prizes are offered. In no place, we believe, will prizes be awarded more at random than in the western annexe. The jurors have not enough to guide them to much more than a general opinion, short of what an authoritative decision upon the merits of the machinery ought to be. In the case of a large part of the machinery anything like a test is totally out of the question. Who is to test Messrs.

Penn's marine engines? All that can be said of them is that they exemplify an objectionable plan, and light proportions, ameliorated by unusual excellence of workmanship. And, after all, fine workmanship oftener serves as proof of what may be rather than what is produced in the general practice of the maker. Then, again, from another point of view, great excellence of workmanship, if not a disadvantage, practically occupies such an equivocal position that inferior workmanship may be absolutely preferred by the purchaser. If there be anything paradoxical in this we will try to explain it, by saying that, although superlative workmanship is desirable enough, *per se*, yet it is not always worth while to purchase it at the prices of the great constructors whose practice is such that they are independent of the competition under which anything beyond useful workmanship must be dispensed with. Good workmanship, now-a-days, is not exactly dependent upon good workmen, but upon good self-acting tools, and give any one of many obscure mechanical engineers a monopoly of Admiralty orders at £60 per Admiralty horse power (about two thirds of a nominal horse power by Watts' rule) and we feel assured that he could both produce and afford as good "workmanship" as is to be found anywhere in the western annexe. Marine engines are constructed chiefly of cast iron, worth £3 per ton in the pig, some of the wrought iron forgings, it is true, cost £200 and upwards per ton, in "the rough," and the gun metal, what there is of it, is worth £125 per ton as it leaves the foundry. Yet, taking into account the great preponderance of cast iron, it is remarkable that the price of the best marine engines in the Exhibition should be £200 and upwards per ton, as they stand. Such is the case, while locomotive engines and tenders are well paid for at £70 per ton, or say £2,800 for an engine and tender weighing 40 tons "empty." We wish the jurors could explain the anomaly of these prices, and show how it is that the ponderous marine engine, with all its cast iron, costs nearly or quite three times as much per ton as the locomotive engine and tender, one-seventh of the total weight of which is commonly made up of materials costing £100 and upwards per ton in the rough. We believe that, in the consideration of jurors, excellence of workmanship and constructive reputation should be taken into account together with what the purchaser has to pay for them, and the prizes awarded accordingly.

This may have been a digression from the subject before us, but we believe that, so far as mechanical engineers are concerned, better satisfaction would have been given, and quite as good a response made, had there been no prizes at all. As it is, if the jurors properly consider their real position they will, as far as prudent, give every exhibitor a prize, and thus open the way for the ultimate abolition of unconsidered prizes generally.

In the valve gear of hammers there is considerable variety, some being made to work by hand, while others are for making the hammer self acting: some are slide and others are equilibrium valves, and many other modifications are made, which it would be difficult to describe without drawings.

In the Exhibition, Messrs. J. Nasmyth and Co., as the firm is still styled since Mr. Nasmyth's retirement, exhibit three steam hammers, the largest of which is intended to be worked by hand, while the smaller ones are self acting. There are very few points of difference between these and the hammers so long made by the same firm. The large hammer is, however, the first we have seen, by these makers, in which the guides of the hammer are recessed within the side standards or frames, instead of projecting therefrom. With the old guides, cast as they were upon the standards, their fracture from any cause involved the loss of half of the framing—sometimes of a casting weighing many tons. With recessed guides, receiving projecting ribs on the hammer itself, the risk of fracture is diminished. One of the smaller hammers, by the same exhibitors, has the single-standard frame behind the anvil, a form well known in the practice of other makers, but, so far as we are aware, only lately adopted by the house in question.

Mr. Allan C. Wylie, of No. 8, Cannon-street, City, and who is the successor to the business of the late Mr. John Condie, exhibits a 10-cwt. and a 3-cwt. Condie's steam hammer, with moving cylinder. By this arrangement the cylinder, which, upon any other plan, is so much dead weight, is made to serve as the hammer itself, the piston remaining fixed in one position. There is thus not only a saving of weight, but, to some extent, a simplification of parts. The piston rod is formed of two tubes, one within another, so as to admit steam alternately to both sides of the piston, and the piston rod, thus formed, is attached, at its upper end, by a ball and socket joint to the top of the framing. Thus, with any little lateral movement of the cylinder, there is no danger of breaking the piston rod, which swings freely so as to adjust itself to any possible variation from its proper perpendicular position. The 10-cwt. hammer, which is both double-acting and self-acting, has side standards, bent back a few inches, however, at a little above the level of the anvil, so that, if desired, a long bar may be welded when laid across in front of the frames. The 3-cwt. hammer, which is double-acting, but not self-acting, has a single-standard frame behind the anvil, but a large opening is made through this frame, so that a long bar may be welded as well when placed across the anvil in one position as in another. In this hammer the anvil block and sole plate are cast together. The steam valves to both hammers are of the equilibrium kind, and require the least possible effort of the hand or of the hammer itself to work them. There are but two handles for all purposes to each hammer. In all the Condie hammers, supplied by Mr. Wylie, the guides are made separate from the framing, and so as to be readily adjustable when worn. Whatever may be the plan of a steam hammer, the fracture of the guides is not an unfrequent occurrence. In the case of the former Nasmyth hammers, as already mentioned, to break a guide was to destroy a main standard. With recessed guides there may be less danger of fracture, but as made in the later Nasmyth hammers the consequences in case of breaking would be the same as before. With recessed guides, however, as made in the Condie hammers, the adjustable pieces, even if broken, could easily be renewed. The Condie hammers are intended to work at a steam pressure of from 25 lb. to 45 lb., the latter being preferred. In America, where this kind of hammer is much in favour, a pressure of 90 lb. is employed. The smaller hammers can make 200 short strokes per minute, the full stroke being about 18in. for the 3 cwt. hammer. Both hammers were made for Mr. Wylie by Messrs. John Musgrave and Sons, of the Globe Ironworks, Bolton.

The intermediate shaft of the Great Eastern, weighing, before being turned and finished, 31 tons 2 cwt., was forged, in 1857, under a 6-ton Condie hammer, at the Lancefield Forge, Glasgow. This great and difficult forging was 21ft. 6in. long over all, the throw for working the air pump was 5ft. 1in. long, and 2ft. 9in. thick, while the greatest and least diameter of the shaft were respectively 2ft. 7in. and 2ft. 3in.

Messrs. R. Morrison and Co., of Newcastle-on-Tyne, send a 20-cwt. double acting hammer, with the hammer bar and piston forged solid together. The cylinder is bolted to the top of a single-standard frame, very stoutly ribbed at the back so as to approach a box form in section, and in this frame are contained the steam chest, steam passages, and steam and exhaust pipes. The hammer bar, which serves also as a piston rod, is forged solid with the piston, and works through stuffing boxes in both the top and bottom cylinder covers, the bar, above the piston, being flattened on one side to serve as a guide for keeping the hammer always square with the anvil. The piston is of Mr. Ramsbottom's form, having two small steel rings. The framing is not so made that a long bar could be welded when projecting behind the anvil, and from the position of the working handles in the sentry-box framing it would be difficult, if not impossible, for the man at the handles to see the hammer. The hammer has a noble sole plate, and is very well proportioned for strength.

The Kirkstall Forge Company exhibit Naylor's double action steam hammers. As already stated Mr. Naylor was the first to make the steam hammer double acting; but the valve gear which he employs for the purpose might be greatly simplified, as a glance at other double acting hammers, close by, will disclose. One of the hammers shown has a single-standard frame, which, however, is not so made as to permit of welding a long bar both along and across the anvil. This is a point which most makers of steam hammers neglect, but it is one which is of considerable consequence to the forgeman.

Messrs. Glen and Ross, of Glasgow, exhibit a 2-cwt. and a 5-cwt. Rigby's hammer. The frame and cylinder are like those of Morrison's hammer, but the hammer bar is not continued above the piston. It comes out at the bottom of the cylinder through a very deep stuffing box and gland, which, together with the piston itself, is all there is to guide the hammer. The hammer bar is a round bar planed flat on two opposite sides, and as the gland is formed to a corresponding shape, this keeps the hammer square on the anvil. By not continuing the hammer bar above the piston the whole area of the latter is preserved for the action of steam on the down stroke, and thus a sharper blow may be given than with Morrison's hammer. Nevertheless, except when forging work of great thickness, the hammer bar is guided only near its upper end, although it certainly has the unerring guidance of its own gravity throughout its whole stroke. The 5-cwt. hammer has a single standard frame not made to permit of welding a long bar both along and across the anvil. In the 2-cwt. hammer the single-standard frame is so formed that long bars can be welded when laid in either direction. In the smaller hammer the anvil block is cast with the frame. The late Mr. Condie was the first to cast the two in one, although, several years afterwards, Mr. Naylor patented the same thing. Messrs. Glen and Ross' hammers are very simple and excellent tools.

Messrs. Thwaites and Carbutt, of Bradford, exhibit a 7-cwt. double-action, self-acting hammer, and a 4-cwt. double-action, single-standard hammer. The first of these hammers appears to be made upon the patent of Mr. Thomas Fearnley, which was illustrated in The Engineer of August 17th, 1860 (vol. x., p. 108). There are inclined slides or cams upon one side of the hammer block, and intended to act upon rollers on the ends of arms connected with the steam valves. There are no less than five handles altogether, and perhaps a little more work than usual about the valves. The frames or double standards are cast hollow, as originally practised by Mr. Condie. In all other respects, so far as we can see, the hammer is like Nasmyth's, which, as will have been seen, we look upon as less preferable than some others. We mention, *en passant*, that we understand Messrs. Thwaites and Carbutt are making a 15-ton hammer for the Rhymney Iron Company, South Wales.

Messrs. Carrett, Marshall, and Co., of Leeds, exhibit a 2 cwt. steam hammer, without levers, valve motion or stuffing box; and for a variable stroke or intensity of blow. The valve gear is upon the patent of Mr. Joy, of Manchester, an abstract of whose invention appeared in The Engineer of May 31st, 1861 (vol. xi., p. 341). Instead of levers, tappets, cams, &c., Mr. Joy employs the direct action of the steam itself in moving the valve. This is done by permitting the steam, when the piston is near the end of its stroke, to escape through a hole—opened by the piston in the side of the cylinder—into the valve box of a piston valve, which is thus moved in the proper direction to reverse the steam for the succeeding stroke.

Messrs. Imray and Copeland, of the Bridge-road, Lambeth, send one of their hammers with a water reservoir under the anvil and a water lining within the hammer head, as already described.

Messrs. Hudswell and Clark, of Leeds, exhibit a 4 cwt. double-action, self-acting hammer, which appears to be upon the patent of Messrs. Hewitson and Walker, illustrated in The Engineer of October 12th, 1860 (vol. x., p. 239). It is a Rigby hammer, with an unsubstantial looking frame, and having self-acting gear worked from the hammer head itself, and likely, we should say, to get knocked off. The price of this hammer is catalogued as £75.

Mr. J. S. Hulse, of Manchester, exhibits a steam hammer of the antiquated Nasmyth pattern, with all its faults.

Mr. J. Rhodes, of Wakefield, sends a small Condie hammer, in which, however, the cast iron piston rod is cast whole with the top bar of the framing. Not only, therefore, has it no chance to adjust itself to any slight variation of the cylinder from the perpendicular, but being of cast iron, the piston rod breaks easily under a very slight shock. We believe that the piston rod of this very hammer was broken in getting it into the annexe, and that another had to be sent for from Wakefield. Mr. Rhodes would do well, we think, to take a look at the attachment of the piston rods in the hammers made by Messrs. Musgraves, of Bolton. We do not quite understand, we may remark, why Mr. Rhodes went to the trouble and cost of re-patenting the Condie hammer on the 14th December, 1859.

Mr. J. Eastwood, of Derby, exhibits a small hammer upon a plan which he thought fit to patent some time since, and which was illustrated in The Engineer of July 6th, 1860 (vol. x., p. 8). One claim of the patent is for wrought iron standards, and here they are. We do not see that the length of stroke of this hammer could be adjusted while working. There is but one lever, which is no disadvantage.

There are two or three steam hammers in the foreign department, and these we have already mentioned. There is not, in the whole building, a really full size hammer, Messrs. Morrison and Co.'s, of 20 cwt., being the largest. The smaller hammers, no doubt, serve to illustrate the principle of construction even better than those of great bulk, but among 800-horse marine engines and 32-ton locomotives, it would have been in keeping to have shown a 10-ton or 12-ton hammer, and although there is no great profit on steam hammers, and it is costly moving them when they weigh, altogether, from 50 tons to 100 tons, yet it was to have been expected that some one would have taken the lead. A steam hammer, simple as it is, is an object of much popular interest, as is evidenced by the crowd collected by the quick, nervous palpitations of Naylor's miniature hammer, when it is engaged in the task of cracking nuts for the lady visitors.

Leaving steam hammers, we have Cowan's air compressed machine hammer, Ryder's cam hammer (exhibited by Messrs. Joseph Whitworth and Co.), and a drawing of Mr. Haswell's machine for compressing hot iron, as illustrated in The Engineer of August 16th last (vol. xii., p. 94).

Altogether, no such display of steam hammers could have been made in 1851, and it is not easy to understand how a better display can be made in 1872.

STEAM HAMMERS IN THE EXHIBITION.

Those classes of steam hammers having moving pistons, and those also having moving cylinders, have been considerably varied of late years, and of nearly all their present varieties there are representatives in the western annexe of the Exhibition. Before noticing them, it may be as well to say a word upon the history of the steam hammer, which was invented by Watt, re-invented in 1806 by Deverill, and again by Mr. Nasmyth, who patented it in 1842. Until the publication, within the last few years, of the patents issued during the last two centuries, it was very difficult to obtain the history of some of the most important inventions. The patents of James Watt were, however, well known, and in his fifth patent, dated 28th April, 1784, he describes a direct acting steam hammer. Without converting the alternating motion of a steam piston into a rotary movement to be re-converted into the alternating motion of a hammer, he proposed to drive the latter by—we will quote one of his own long sentences—"applying the power of steam or fire engines to the moving of heavy hammers or stampers for forging, or stamping iron, copper, and other metals or matters, without the intervention of rotative motion of wheels, by fixing the hammer or stamper to be so worked either directly to the piston or piston rod of the engine, or upon or to the working beam of the engine, or by fixing the hammer or stamper upon a secondary lever or helve, and connecting the said lever or helve by means of a strap or of a strong rod to or with the working beam of the engine, or to or with its piston rod." On 6th June, 1806, a patent issued to William Deverill, of London, who described his direct acting steam hammer as follows:—"First, I raise steam in a boiler or steam vessel, as in the common way. I have a steam cylinder with a piston and a rod in it; at the end of the rod that comes out of the steam cylinder is a hammer, either made fast to the rod by welding or in any other proper way. The steam from the boiler or steam vessel, as aforesaid, is let in underneath the piston by means of opening a cock or valve, or cocks or valves; the air at the top of the piston will be then compressed by the superior pressure of the steam underneath the piston. After the piston had been raised to a given height, there will be an opening made from the under side of the piston to a vacuum formed as in the common way, or otherwise the steam may be let out into the common air; the compressed air on the top of the piston will then drive down the hammer with a velocity equal to what it may be compressed." In Deverill's hammer, the compression of the air was resorted to in addition to the weight of the hammer itself, and this feature of his invention has appeared among the most "recent improvements" on power hammers.

It was too early, however, both in 1784, and in 1806, for steam hammers. The time was not ripe. It was not until 1838 or 1839 that James Nasmyth revived the subject, by which time, it is understood, he had prepared plans of his hammers, and had made arrangements for their construction. At this time, 1839, Francis Bourdon, the manager of the extensive ironworks at Creusot, in France, visited Mr. Nasmyth, who exhibited all his plans. M. Bourdon returned immediately to Creusot, and in May, 1842, Mr. Nasmyth went there on a visit. To his surprise, no doubt, he found a large steam hammer in operation. It was seen

a hammer as is now known everywhere, except in France, as the "Nasmyth hammer." No sooner did Mr. Nasmyth return to England than, on the 9th of June, 1842, he patented the hammer in his own name. He had possibly never seen Watt's patent, and had very likely never heard of Deverell's, and by the patent laws he had a right to patent an invention in use abroad. In this case he doubtless felt he was doing no more than asserting his title to his own property, so far as M. Bourdon was concerned, for no steam hammer had yet been made in England. M. Bourdon afterwards went to America, and resided two years in New Orleans. He then returned to France, and is now, or very recently was, living at Marseilles. MM. Schneider et Cie., the well-known proprietors of the Creusot Works, have now in operation one of M. Bourdon's largest hammers, one having a head of 12 tons, falling 3 mètres, or nearly 10ft.

The only thing in the Nasmyth patent, not already described by Watt and Deverell, was the provision for regulating the lift of the hammer, so as to graduate the blow. This is very important, no doubt, yet the force of Nasmyth's specification was directed mainly upon the distinction between the direct acting and the common trip hammer. He gave a drawing, and described at considerable length the construction of the latter hammer, and his only claim read as follows:—"Having thus described the nature of my said invention, and in what manner the same is to be or may be performed, I desire it to be particularly understood that I do not claim the exclusive use of any of the several parts and arrangements of apparatus and machinery hereinbefore described. Except when the said parts and arrangements are used in connection with and furtherance of my said invention, whereby the elastic force of steam is made directly applicable to raise the hammer or striking block for forging, stamping, or cutting iron, or other substances, as above described."

On the 15th October, 1846, the late Mr. John Condie, then of the Govan Bar Ironworks, patented the moving cylinder hammer, an improvement of much importance, as it greatly simplified the construction and diminished the weight and cost of the steam hammer.

On the 30th October, 1855, Mr. William Naylor, of Norwich, patented the application of gear for rendering the steam hammer double acting. From the manner in which this feature has been adopted by other makers, there is every probability that the £100 stamp, due on Mr. Naylor's patent in October next, will be punctually paid, when his claim will remain in force almost up to the beginning of 1870.

Messrs. Condie's and Naylor's improvements are the most important of those which have been made upon the steam hammer originally constructed by Bourdon, at Creusot. A great number of modifications have been contrived by others, and one would suppose that all the possible changes had been rung. Thus Mr. Morrison, by so forming the piston rod that its own weight should be sufficient to enable it to act as a hammer, and by guiding it in the cylinder by means of long stuffing boxes in both the top and bottom covers, dispensed with the ordinary guides, and, at the same time, overcame a great difficulty attaching to the Nasmyth hammer, that of breaking the piston rod. Mr. Morrison planes off one side of that part of his thickened piston-rod above the piston, so that the flat surface thus formed may, in connection with a stuffing box and gland of corresponding shape, keep the hammer always in the same relative position with the anvil block. Without some means for attaining this end the hammer could not be employed for swaging to shape. Mr. Rigby took up Mr. Morrison's plan, dispensing with the prolongation of the piston-rod above the piston, and planing the lower portion of the rod (which, as in Morrison's, is made sufficiently heavy to serve as the hammer) so as to present two flat surfaces on opposite sides of the rod, the object of this being the same as that of the flat side of the upper part of the piston-rod in Morrison's hammer. Other makers have failed to respect Mr. Rigby's patent, which, possibly, would fail in law upon the probable right of everyone to employ any form of piston-rod he chose under Watts' patent of 1784. MM. Farcot et fils, of Pont St. Ouen, near Paris, exhibit, in the western annexe, a steam hammer with a square piston rod, heavy enough to serve as the hammer, and one or two British makers besides Messrs. Glen and Ross show hammers of which the sliding portion is formed as in the Rigby hammer.

Watt proposed to apply steam to work helve hammers, and steam helve hammers have been extensively used in the United States. Watt also proposed a sort of beam engine hammer, and a lady in the north not long since applied for a patent for the same arrangement, as a "communication" from her deceased husband! Mr. Nielson, of Glasgow, has patented a steam hammer which may be moved radially, like a radial drill, to act upon two or more anvils successively. In Schwatzkopf's arrangement, which, we believe, is that adopted by Herr Krupp in the construction of his monster hammer of 40 tons head, the cylinder is so made as to be adjustible upon the standard, so that the hammer may be raised or lowered bodily, and independent of the lift given by the steam, to adapt it to work of greater or less thickness. This arrangement was illustrated in THE ENGINEER of February 24th, 1860 (vol. ix., p. 124). Messrs. Imray and Copeland, of the Bridge-road, Lambeth, some time ago patented means by which the anvil block may be raised or lowered, according to the height of the work. This plan was illustrated in THE ENGINEER of October 26th, 1860 (vol. x., p. 270). The anvil block is placed in a close reservoir filled with a liquid, as water, and according to the height of water in the reservoir will be the position of the anvil block. The patentees claim for this arrangement an important advantage, that of distributing the shock (occasioned by the blows of the hammer) over an extensive surface, and with this view they have introduced a water chamber into the hammer head. A hammer of this kind is exhibited in the Exhibition; and a Belgian also sends a hammer in which a reservoir is used in much the same manner for adjusting the anvil block.

HIGH PRESSURE MARINE BOILERS.—The screw steamer Amalia, fitted with Ramsden's boilers, by Messrs Horton and Son, of Liverpool, has been running 12 months, and working at a steam pressure of 100lb. per square inch. The vessel is 277ft. long, 37ft. 4in. beam, 25ft. hold, and has direct acting engines with four 43-in. cylinders, 2ft. 6in. stroke, provided with surface condensers. The indicated horse power is about 900.

IRON-CASED FRIGATES.—Messrs. G. and A. Harvey, tool makers, Glasgow, have received orders from the Admiralty to construct a cross-cutting machine for armour plate, for Portsmouth Dockyard, similar to those made by the same firm for C. J. Mare and Co., London, and the Parkhead Forge Company, Glasgow. This tool cuts armour plates 4ft 6in. broad, of any thickness up to 6¼in. at any part of their length, and is fitted with self-acting feed motion, quick return motion, and lateral motion for feathering and grooving.

AMERICAN AND ENGLISH PATENT DRESS FOR MILLSTONES.—THE ENGINEER, of April 11, contains an illustration of what it calls "Improvements in setting millstones, by A. B. Childs, of New Oxford-street." This millstone dress is the same exactly as that illustrated on page 328, vol. xiii. (old series) of the *Scientific American*, for which a patent was granted to Gabriel Natcher, of Indianapolis, Ind., April, 27, 1858. Upon the same day he also obtained a patent for the tool (a diamond) for putting his dress upon the stone. Both the diamond tool and the dress of the stone figure in THE ENGINEER are improvements invented by Mr. Childs, who appears to be "no child" in the appropriation and application of other people's improvements.—*Scientific American.*—[Mr. Childs is an American, and, we believe, patented his plan as "a communication" from some person in the United States. Under our patent law any one can patent any foreign invention not previously published here, doing so either with or without the consent of the original inventor. Mr. Lee, of New York, has just patented the Worthington "duplex pump," not as "a communication," but as his own. In both cases those who have "appropriated and applied other people's improvements" are Americans.—ED. E.]

NAVAL ENGINEERS.—The following appointments have been made during the last fortnight:—W. Rumble, inspector of machinery, to the Cumberland; Hugh R. Gair, engineer, to the Cormorant; W. Hardie, engineer, to the Racehorse; W. Skeen, acting engineer, to the Asia, for the Earnest; W. G. Hughes, first-class assistant-engineer, to the Fisgard; George F. Williams, first-class assistant-engineer, to the Cormorant; William Birks, first-class assistant-engineer, to the Racehorse; J. Baptist, first-class assistant-engineer, to the Asia, for the Cracker; A. Martell, first-class assistant-engineer, to the Asia, as supernumerary; W. Crow, acting first-class assistant-engineer, to the Fisgard, as supernumerary; James Templeton, second-class assistant-engineer, to the Racehorse; Robert Findlay and T. W. Dearden, second-class assistant-engineers, to the Cormorant; J. S. Fidgeon, acting second-class assistant-engineer, to the Racehorse; R. Ditchburn, first-class assistant engineer, to the Asia, as supernumerary; W. Town and John Dunlop, acting second-class assistant-engineers, to the Adventurer as supernumeraries; J. Fox, confirmed as engineer in the Tribune; and E. J. Humphreys and J. A. Raven, acting second-class assistant-engineers to the Indus; Thomas S. Gissing, first-class assistant engineer, to the Asia, for the Fancy; Charles F. Gregory, second-class assistant-engineer, to the Indus, for the Princess Alice; R. J. Wemyss, confirmed as chief engineer; W. Smilay, promoted to acting chief engineer in the Wrangler; R. Phillips, confirmed as second-class assistant-engineer in the Bacchante; C. W. Wakeman, C. A. Vogwell, and T. J. Richard, acting second-class assistant-engineer, to the Asia; Henry Brown, promoted to chief engineer; W. H. Wivil, first-class assistant-engineer, to the Royal Adelaide, for the Princess Alice; George Thompson and J. H. Bradshaw, in the Donegal, confirmed as second-class assistant-engineers; J. H. Ferguson, confirmed as second-class assistant-engineer in the Galatea; A. M'Farlane, chief engineer, to the Fisgard, for the Vesuvius; R. W. Hulford, first-class assistant-engineer, to the Fisgard, as supernumerary; John Ferguson (B), second-class assistant-engineer, to the Forte; and W. R. Trenwith, second-class assistant-engineer, to the Russell; A. M'Farlane, chief engineer, to the Vesuvius; John Sear, chief engineer, to the Galatea; Richard Taplin, engineer, to the Galatea; H. Harrison, first-class assistant-engineer, to the Vesuvius; John Turner (B) and W. E. Presgrave, first-class assistant-engineers, to the Galatea; James Ambler, first-class assistant-engineer, to the Indus, for the Gleaner; E. Miles, acting first-class assistant-engineer, to the Vesuvius; Alexander Brown, second-class assistant-engineer, to the Galatea; J. W. Smart, Charles F. Hulford, William A. Betts, and James Mitchell, acting second-class assistant-engineers, to the Cumberland, as supernumeraries; C. S. Jordan and J. H. Ferguson, acting second-class assistant-engineers, to the Galatea; G. G. Smith, acting second-class assistant-engineer, to the Vesuvius; R. G. Foster, acting second-class assistant-engineer, to the Edinburgh.

SOCIETY OF ENGINEERS.—The committee of this society have lately made arrangements whereby the members might visit the various engineering works in progress in the metropolis. Accordingly, on Thursday last, the 15th inst., about thirty of the members visited the works of the Southern Outfall of the Main Drainage, for which permission had been cheerfully given by Mr. Bazalgette; and Mr. Grant, the engineer in charge of this portion of the work, very kindly offered to accompany the visitors. The members met at 10 o'clock at the New-street, in the Borough, where they proceeded to visit the subway now in course of erection by Mr. Downs. It was lighted throughout, and every point in connection with it, as to its uses, were explained, and the cost given by Mr. Grant. From this street they went to London Bridge, and took the train to Charlton station, on the North Kent line, and walked to the sewer in course of construction in the Greenwich-road. Here they descended to the works, and proceeded for about 1½ miles through the finished sewer towards Deptford (every arrangement as to lights, &c., for the proper viewing of the works being very kindly provided), leaving the sewer at an outlet at the bottom of South-street, Greenwich, and then walked to the pumping station at Deptford, which is being erected by Messrs. Aird and Son. The first point visited here was the chimney shaft, from which could be seen the general plan of the works. They then descended into the sewer, and viewed the general arrangements for the various works, pumps, &c., required for raising the sewerage to the upper level, every point here being minutely pointed out and explained by Mr. Grant and the Messrs. Aird and Son, who accompanied the members over the whole of these works. From this point they went to the dam in the creek, being constructed for carrying the sewer under Deptford Creek, and then examining the coal sheds, engine house, and the various bricks used for the works. They then proceeded to the cement testing room, where the mode of testing was explained, and several moulds of cement of various ages were put to the test, resulting in the proof that the cement used in the works was the best that could possibly be obtained. This concluded the visit. The members then returned to the office on the works, and the chairman called upon them to vote their cordial thanks to Mr. Grant, for his extreme kindness in accompanying them over the works, and in a few words expressed the opinion of the members, by stating that the work they had seen was a credit to those who planned it and overlooked it, and also to the contractor who performed it, for better work it was impossible to find. He was sorry that it had unfortunately been a very wet day, as it perhaps would have afforded more pleasure, but he thought he might venture to say that it could not have been more profitable, nor could it have made any difference in the very kind manner in which Mr. Grant had conveyed every item of interest to the members. Mr. Grant, in reply, stated that the visit had given him a very great deal of pleasure, and he trusted that he had given all the information that was required, and that, at a future day, when the works were further advanced, he should be most happy to see them again, so that they might see the progress made.—A vote of thanks was also passed to Messrs. Aird and Son, for the very kind manner they had received the members, and for having accompanied them on the works.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

46. JOHN TATHAM, Rochdale, Lancashire, "Improvements in machinery or apparatus for preparing, spinning, doubling, and winding cotton and other fibrous materials."—*Petition recorded 7th January, 1862.*

50. LOUIS WUNDER, Leignitz, Prussia, "Improvements in the manufacture and composition of soap, applicable especially for shaving."—*Petition recorded 8th January, 1862.*

139. THOMAS ROBERTS and JOHN DALE, Manchester, "Improvements in the manufacture of gunpowder."—*Petition recorded 18th January, 1862.*

219. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris, "Improvements in the construction of looms for weaving."—A communication from Claude Crozet, Rue de Lyon, St. Etienne, Loire, France.—*Petition recorded 28th January, 1862.*

335. FREDERICK TOLHAUSEN, Boulevart Bonne Nouvelle, Paris, "Improvements in the manufacture of tyres of railway wheels, and in apparatus for such purpose."—A communication from Antoine Duplay, Rue du Faubourg Montmartre, Paris.—*Petition recorded 8th February, 1862.*

365. FREDERICK TOLHAUSEN, Rue du Faubourg Montmartre, Paris, "Improvements in the construction of vertical steam boilers."—A communication from Jean Larmanjat, Rue du Mail, Paris.—*Petition recorded 12th February, 1862.*

426. HENRY EBENEZER QUANT and GEORGE HENRY FISK, High-street, Manchester, and WILLIAM DAWES, Bolton, Lancashire, "Improvements in the method of, and apparatus for, securing the ends of steel or other materials used for crinolines."—*Petition recorded 18th February, 1862.*

909. WILLIAM CLARK, Chancery-lane, London, "Improvements in kneading machines."—A communication from Mr. Ovide Isidore Boland, Boulevart St. Martin, Paris.—*Petition recorded 1st April, 1862.*

971. MOWBRAY WALKER, 8t. Benet's-place, Gracechurch-street, London, "Improvements in breech-loading rifles and other fire-arms, and in ordnance."—*Petition recorded 4th April, 1862.*

1026. JOHN LILLYWHITE, Seymour-street, Euston-square, London, and THOMAS NIXON, Chelford, Cheshire, "An improved bowling apparatus for cricket balls."—*Petition recorded 10th April, 1862.*

1157. ABRAHAM MARKS, Cannon-street-road, Middlesex, "Improvements in artificial feathers, applicable to certain ornaments of dress."—*Petition recorded 21st April, 1862.*

1166. THOMAS LEA and SAMUEL SMITH, Smethwick, Staffordshire, "Improvements in burglary alarms or indicators."—*Petition recorded 22nd April, 1862.*

1175. RICHARD JIKES, Upper King-street, Bloomsbury, London, "Improvements in apparatus for suspending, raising, and lowering Venetian blinds, and for retaining them and other blinds, and also curtains and sunshades, at any required height."

1177. WILLIAM MOIR, Manchester, "An improved instrument for ascertaining the specific gravity of liquids."

1178. GEORGE NORTON BATES, New Basford, Nottingham, "Improvements in dressing lace and other fabrics."

1179. GEORGE HENRY BIRKBECK, Southampton-buildings, Chancery-lane, London, "Improvements in lubricating apparatus."—A communication from M. Leon Amene, Paris.

1181. JAMES PRICE, Dundalk, Ireland, "Improvements in spikes for railways and other purposes, and in the mode of manufacturing and securing the same."

1183. WILLIAM FEAR, jun., Bristol, "Improved arrangements for joining the saw plates of veneer and other saws constructed in segments."

1185. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in apparatus for taking deep sea soundings, and for recording the speed of ships."—A communication from William Trowbridge, Bowling Green, New York, U.S.

1189. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in the manufacture of imitation lace, net, or openwork fabrics."—A communication from Lucien Henry L'heureux, Eugene Victor L'heureux, and Charles Alphonse L'heureux, Rue St. Sebastien, Paris.—*Petitions recorded 23rd April, 1862.*

1191. JOHN ENDEAN, Locksfields, Walworth, "Improvements in cocks, taps, and valves."

1192. WILLIAM HAGGETT, Sherborne, Dorsetshire, "Improvements in locomotive engines and carriages for railways, part of which improvements are applicable to carriages and vehicles for tram and common roads."

1193. HENRY WHEATLEY, Hopton Mills, Mirfield, Yorkshire, "Improvements in or applicable to the employment of steam for heating or drying purposes."

1195. WILLIAM DENNY RUCK, Duke-street, London Bridge, "The manufacture of grease from coal, tar, coal oil, creosote, or dead oil."

1197. GEORGE DAVIES, Bellevue-terrace, Seven Sisters'-road, Holloway, Middlesex, "Improvements in the manufacture of matting, and in apparatus for the same."

1199. JOHN FRANKLIN ALLEN, New York, U.S., "Improvements in slide valves and valve gear for steam engines."

1201. FREDERICK DANGERFIELD, Bedford-street, Westminster, "Improvements in lithographic or zincographic presses."

1203. JOSEPH OFFORD, Wells-street, Oxford-street, London, "Improvements in carriages."—*Petitions recorded 24th April, 1862.*

1207. FREDERICK BARNETT, Paris, "Improved electric danger signals for railways and other cognate surfaces."

1208. GEORGE RICHARDS, Caroline-street, Bedford-square, London, "Improvements in ordnance, and the manner of loading such with the charges and projectiles suitable thereto."

1213. RICHARD PERCY ROBERTS, Exeter-villas, Kennington Oval, Surrey, "Improvements in the preparation of paper for copying letters and other documents, and in the preparation of copying ink."

1215. JOHN SHAW, Liverpool, "Improvements in steam and other power engines and indicators."—A communication from John Shaw, jun., Ferrol, Spain.

1217. CHARLES REED, Kintbury, Berkshire, "A new method of treating the sorghum saccharatum or holcus saccharatus in order to obtain saccharine liquor and pulp therefrom."

1219. AUGUSTUS APPLEYARTH, Dartford, Kent, "Improvements in printing in colours and in apparatus to be employed for this purpose."

1221. WILLIAM FISKEN, Stamfordham, Northumberland, "Improved apparatus for cultivating land by means of steam power."—*Petitions recorded 25th April, 1862.*

1225. DUDLEY CHARLES LE SOUEF, Twickenham, Middlesex, "An improvement in the manufacture of nails, bolts, rivets, screws, eyes, and split keys or pins."—A communication from John Schubert, Vienna, Austria.

1227. GEORGE HENRY LAW, Rochester-road, Camden New Town, Middlesex, "Improved means for draining flower pots and other articles or things which require draining in the same or a similar manner."

1229. EMILE ALCAN, Coleman-street-buildings, London, "An improvement in or addition to carding engines."—A communication from Celestin Martin, Pepinster, Belgium.

1230. WILLIAM CLARK, Chancery-lane, London, "Improvements in collars, wristbands, and cuffs."—A communication from Jules Hippolyte Jean Baptiste Delosme, Boulevart St. Martin, Paris.

1231. SQUIER CHEAVIN and GEORGE CHEAVIN, Boston, Lincolnshire, "Improvements in filtering and purifying water, and in apparatus employed therein."

1233. ARTHUR BOYLE and THOMAS WARWICK, Birmingham, "New or improved machinery for manufacturing hair pins and cotter pins, a part of which machinery may also be used for cutting off and pointing wires for various purposes."

1235. GUSTAV BISCHOF, Jun., Swansea, "Improvements in treating solutions containing copper and silver, or either of them, to obtain metallic copper and silver."

1237. AARON LESTER, Coventry, Warwickshire, "Improvements in the manufacture of the fronts or uppers of slippers, shoes, boots, and gaiters, and of mats, bags, fire screens, and various other articles which are usually made of ornamental or Berlin needlework."

1239. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improvements in lamps for burning coal oil and other hydrocarbons."—A communication from Bradford Ripley Alden, New York, U.S.—*Petitions recorded 26th April, 1862.*

1240. GEORGE BARRY GOODMAN, Baker-street, Portman-square, London, "Improvements in machinery or apparatus for preventing accidents in or at mine shafts."

1241. JOHN BURNIE, Castle-Douglas, Kirkcudbright, N.B., "Improvements in tobacco pipes."

1243. ROBERT VAILE, Auckland, New Zealand, "Improvements in propellers for ships and boats."—*Petitions recorded 28th April, 1862.*

1245. GEORGE ROBERT SAMSON, Old Chapel-row, Kentish Town, Middlesex, "Improvements in valves or cylinders for wind musical instruments."

1246. HENRY FOX WELLS, Woodland House, Prospect-row, Woolwich, Kent, "Improvements in screw clamps or cramps for joiners' and other work."

1248. JAMES EGLINTON ANDERSON GWYNNE, Essex-street Wharves, Strand, London, "Improvements in the construction of centrifugal pumps, and in the application thereof, parts of which improvements are also applicable to other pumps."

1253. JOHN ROSS, Chancery-lane, London, "Improvements in grinding stones or surfaces for grinding grain and other substances."—A communication from Charles Ross, Stapleton, New York, U.S.

1255. JOHN CLIFF, Lambeth, Surrey, "Improvements in insulators for supporting telegraph wires."

1261. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in machinery for picking, burring, and cleaning wool and other fibrous

substances."—A communication from Calvin Luther Goddard, New York, U.S.—*Petitions recorded 29th April*, 1862.

1270. Achille Tranquille Mercier, Louviers, Eure, France, "Improvements in weaving looms."

1274. Henry Hickman, Miller-place, Park-road, Dalston, Middlesex, "An improvement in the method of fastening ladies' crinoline skirts and other articles of wearing apparel, and elastic and other bands."—*Petitions recorded 30th April*, 1862.

1290. Thomas Holmes, John-street, Edgware-road, London, "Improvements in the manufacture of military cartouches, portmonnaies, courier bags, letter bags, knapsacks, and other articles of a like nature."—*Petition recorded 1st May*, 1862

1291. Thomas Foxall Griffiths, Birmingham, "An improvement or improvements in raising or shaping sheet iron"

1296. Ormrod Coffeen Evans, Church-street, Old Kent-road, Surrey, "A reversible attachment to a shaft or arbor for converting reciprocating rectilinear into rotary motion."

1298. Charles Ashwell, Albany-road, Barnsbury Park, Islington, "An improved safety fastening applicable to the locks of doors."

1302. James Waller Gill, Woolfardisworthy, Crediton, Devonshire, "Improved apparatus for turning up and pulverising the soil of land for cultivation."

1304. Alfred Vincent Newton, Chancery-lane, London, "Improved electrical apparatus applicable to the lighting of gas."—A communication from Robert Cornelius, Philadelphia, U.S.—*Petitions recorded 2nd May*, 1862.

1306. Joseph Brierley, Blackburn, Lancashire, "Improvements in the construction of fire-plugs or valves to be used in extinguishing fires, or for other purposes where water is required to be drawn from mains under pressure."

1310. Henry George Moffatt, Dalston, Middlesex, "An improved advertising medium."

1312. Thomas Snowdon, Stockton-on-Tees, Durham, "Improvements in the manufacture of steel tyres, hoops, and cylinders, and in furnaces employed therein, and applicable to the melting of steel generally."—A communication from Pierre Mourrier, Bona, Algeria.

1314. John Herdman, Belfast, Antrim, Ireland, "Improvements in the manufacture of wrought iron, steel, or combined wrought iron and steel plates, adapted for shipbuilding and other purposes for which strength and lightness are required."

1318. John Fowler, Leeds, "Improvements in engines for hauling agricultural implements."

1320. William Edward Newton, Chancery-lane, London, "An improved method of joining boxes."—A communication from Wright Duryea, New York, U.S.

1322. Charles Schlickeysen, Berlin, Prussia, "Improvements in machinery for moulding bricks, tiles, pipes, and turf."

1324. Pierre Victrice Lefevre, Boulevart St Martin, Paris, "Improvements in fountain pens."—*Petitions recorded 3rd May*, 1862.

1326. Thomas Parkinson, John Norman, jun., and Richard Cottam, Blackburn, Lancashire, "Certain improvements in the construction of furnaces for steam boilers."

1330. Samson Barnett, Forston-street, Hoxton, Middlesex, "Improvements in helmets for divers."

1332. Christopher Bikes, Parliament-street, Westminster, "Improved methods of obtaining hydrogen gas and certain gaseous compounds of hydrogen and of carbon."

1340. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in steam generators."—A communication from Joseph Harrison, Philadelphia, U.S.

1342. Benjamin Cooke, Frathy House, Anthony, Devonport, "An improved construction of implement for cutting turf."—*Petitions recorded 5th May*, 1862.

1344. Richard Mills, Bury, Lancashire, "Improvements in washing, wringing, drying, and mangling machines."

1348. John Clark and John Richmond, Chilvers Coton, Warwickshire, "Improvements in looms for weaving."

1350. John Henry Johnson, Lincoln's-inn fields, London, "Improvements in the manufacture and production of minium or red lead."—A communication from Charles Louis Pierre Burton, Rue St. Sébastien, Paris.

1352. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in the manufacture of soda and potash, and of their carbonates."—A communication from Charles Louis Pierre Burton, Rue St. Sébastien, Paris."

1351. William Clark, Chancery-lane, London, "Improvements in cylinder printing apparatus."—A communication from Messrs. Felix Marie Baudouin and Henry Jérémie Christen, Boulevart St. Martin, Paris.—*Petitions recorded 6th May*, 1862.

1358. Eugene Bourdon, Paris, "Improvements in the construction of blowing fans, which improvements are also applicable to centrifugal pumps for raising water and other liquids or gases, or for exhausting the same."

1366. Richard Archibald Brooman, Fleet-street, London, "An improved box and apparatus for containing and igniting matches."—A communication from Louis Leonard Poulain, Presles, France.

1368. John Combe, Leeds, Yorkshire, "An improved machine for spreading and drawing into slivers flax, hemp, jute, and other fibrous substances."

1372. Desire Marchal and Adrien Carton de Wiart, Brussels, Belgium, "An improved method of preventing the destructive effects of vibration or jar on the permanent way of railways, and on the wheels, axletrees, and other parts of carriages, and the working and other parts of machinery liable to shocks."—*Petitions recorded 7th May*, 1862.

1374. John Hay, Troon, Ayrshire, N.B., "Improved arrangements to facilitate the cleaning and repairing of ships' bottoms."

1378. William Southwood, Kensington, Middlesex, "Improvements in machinery for pulverising ores and extracting metals therefrom, part of which is applicable to breaking stones."

1380. Peter Tate, Park-terrace, South-street, Kennington, Surrey, "Improvements in smelting furnaces."—A communication from Wlademer Raschette, St. Petersburg, Russia.

1384. Arthur Kinder, Cannon-street, London, "Improvements in the manufacture of sheet metal."

1386. Nathaniel Thompson, Birmingham, "Improvements in barometers."—A communication from Jedediah Hubbell Dorwin, Montreal, Canada.—*Petitions recorded 8th May*, 1862.

Erratum.

48. For "rotary screws" read "rotary screens."

Patents on which the Stamp Duty of £50 has been Paid.

1200. Robert Gourlay, Glasgow, Lanarkshire, N.B.—Dated 13th May, 1859.

1201. Thomas Vicars, sen., Thomas Vicars, jun., Thomas Ashmore, and James Smith, Liverpool.—Dated 13th May, 1859.

1204. William Sparks Thomson, St. Martin's-le-Grand, London.—Partly a communication.—Dated 13th May, 1859.

1213. John Chatterton, Devonshire-street, Islington.—Dated 14th May, 1859.

1250. James Palmer Budd, Ystalyfera, near Swansea.—Dated 20th May, 1859.

1258. Thomas Stokes Cressy, Burton-upon-Trent.—Dated 21st May, 1859.

1318. Thomas Wilson, Birmingham.—Dated 28th May, 1859.

1219. George Allcraft, Upper Thames-street, London.—A communication.—Dated 16th May, 1859.

1214. Schofield Crowther Sheard, Smethwick, Staffordshire.—Dated 16th May, 1859.

1231. Edward Charlesworth, King William-street, Strand, London.—Dated 18th May, 1859.

1242. Robert Wilson, Patricroft, near Manchester.—Dated 20th May, 1859.

Patents on which the Stamp Duty of £100 has been paid.

1099. George Tomlinson Bousfield, Loughborough Park, Brixton, Surrey.—A communication.—Dated 15th May, 1855.

1133. Frederick William Mowbray, Shipley, near Leeds.—Dated 21st May, 1855.

1153. George Collier, Halifax, Yorkshire.—Dated 22nd May, 1855.

1134. Thomas Piggott, Birmingham.—Dated 21st May, 1855.

1157. Johan Jacob Meyer, Rochdale, Lancashire.—Dated 23rd May, 1855.

1127. Walter Henry Tucker, Fleet-street, London.—Dated 21st May, 1855.

Notices to Proceed.

45. James Higgins and Thomas Whitworth, Salford, Lancashire, "Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous materials."

46 John Tatham, Rochdale, Lancashire, "Improvements in machinery or apparatus for preparing, spinning, doubling, and winding cotton and other fibrous materials."—*Petitions recorded 7th January*, 1862.

56. Henry Bessemer, Queen-street-place, New Cannon-street, London, "Improvements in the machinery and apparatus employed in the manufacture of malleable iron and steel."

58. Henry Cook, Manchester, "An improved mode of, and apparatus for, transmitting despatches and small articles by the agency of electricity."—A communication from Gaetano Bonelli, Milan, Italy.—*Petitions recorded 8th January*, 1862.

59. Charles William Siemens, Great George-street, Westminster, "Improvements in the means and apparatus employed for insulating and protecting telegraph conducting wires, and in apparatus for working the same."—Partly a communication from Dr. Werner Siemens, Berlin, Prussia.—*Petition recorded 9th January*, 1862.

75. James Oates, Mirfield, Yorkshire, "Improvements in washing machines."

79. John Kenyon, Ivy-cottage, Lower Heath, Hampstead, and Archibald Horn, Great James's-street, Bedford-row, Middlesex, "Improvements in railway signalling by electricity, and in the arrangement of apparatus for that purpose."—*Petitions recorded 10th January*, 1862.

85. Thomas Scott, Nelson-square, Surrey, "Improvements in steam engines."

86. William Wilkinson, Charlotte-street, Fitzroy-square, London, "Improvements in ornamenting and decorating metals, glass, porcelain, parchment, and other skins, and in the materials and ingredients employed therefor; also in protecting silver and gold on said materials, and on surfaces or plates of glass or metal, or plates of glass and metal combined, applicable to works of art, furniture, jewellery, and other articles of a useful and ornamental character."—*Petitions recorded 11th January*, 1862.

87. Anthony Gapper Southby, Bulford, Wiltshire, "Improvements in the preparation of pulp for paper making."

89. Thomas Gilbert, Charles Gilbert, and Thomas Haddon, Birmingham, "An improvement or improvements in the manufacture of swivels for guns, and in machinery to be employed for the said manufacture."

93. William Edward Gedge, Wellington-street, Strand, London, "Improved means or apparatus for gaining or acquiring motive power."—A communication from Hughes Serrazin, Passage des Petites Ecuries, Paris.

96. George Hewitt, Ipswich, "Improvements in apparatus used in the manufacture of drain tiles."—*Petitions recorded 13th January*, 1862.

105. Matthew Chadwick, Radcliffe, Lancashire, "Improvements in machinery for folding or plaiting cloth, and for measuring the same."

109. Christopher Hill, Ferryside, Kidwelly, Carmarthenshire, "Improvements in the manufacture of lubricating compounds."—*Petitions recorded 14th January*, 1862.

115. Joseph Ridsdale, Minories, London, "Improvements in preparing sheet lead for covering floors, stairs, and other like purposes."—*Petition recorded 15th January*, 1862.

123. Thomas Myers, Bloomsbury-square, London, and Edward Myers, Millbank-street, Westminster, "An improved composition for preventing rust on bright steel, iron, brass, or metal."—*Petition recorded 17th January*, 1862.

131. Thomas Emmott and Joseph Travis, Vale Mills, Oldham, Lancashire, "Improvements in the manufacture of velvets, velveteens, and other similar piled fabrics."

136. William Tice, Downham-road, Islington, "Improvements in gas regulators and meters, part of which invention is also applicable for covering various descriptions of metal spindles."

137. Samuel Dreyfous, Paris, "An improved throstle spinning frame."—A communication from Monsieur Charles Layheer, Laval, France.—*Petitions recorded 18th January*, 1862.

141. Leonard Barbat, South-street, Finsbury, London, "A new and improved fabric applicable to the manufacture of hats, bonnets, and other like articles."

144. William Boaler, Manchester, "Certain improvements in the method of sizeing paper, yarns, and woven fabrics, and in machinery or apparatus connected therewith."—A communication from John Adams Rhodes, Providence, Rhode Island, U.S.

147. Edward Chambers Nicholson, Atlas Works, Lockfields, Surrey, "Improvements in the preparation of colours suitable for dyeing and printing."—*Petitions recorded 20th January*, 1862.

155. Henri Bernoulli Barlow, Manchester, "Improvements in machinery or apparatus for counting and indicating the number of revolutions of shafts or other articles, and for exerting power."—A communication from Arnold Caffish, Winterthur, Switzerland.—*Petition recorded 21st January*, 1862.

220. Arthur Herbert Church, Great Portland-street, St. Marylebone, Middlesex, "Improvements in the means of preserving stone, brick, slate, wood, cement, stucco, plaster, whitewash, and colour-wash from the injurious action of atmospheric and other influences, also in the application of colours to the surfaces of stone, brick, slate, wood, cement, stucco, mortar, clay, plaster of Paris, whitewash, and colour-wash, and in the retention of such colours thereon."—*Petition recorded 28th January*, 1862.

235. William Clark, Chancery-lane, London, "Improvements in the disintegration and bleaching of textile materials for the manufacture of paper."—A communication from Jean Baptiste Michel Auguste Siry, Boulevart St. Martin, Paris.

239. William Edward Newton, Chancery-lane, London, "Improvements in printing machinery."—A communication from Richard March Hoe, New York, U.S.—*Petitions recorded 29th January*, 1862.

246. Edward Alexander Rippingille, Staple Hill, near Bristol, "Improvements in engines worked by steam or other fluid, and in pumps."—*Petition recorded 30th February*, 1862.

259. William Walton, Manchester, and Frederick Walton, British Grove Works, Chiswick, "Improvements in the manufacture of wire cards."—*Petition recorded 31st January*, 1862.

310. Charles Calow Newton Heath, near Manchester, and John William Hirst, Manchester, "Improvements in slide valves for steam engines and other similar purposes."—*Petition recorded 6th February*, 1862.

338. Marc Antoine Francois Mennons, Rue de l'Echiquier, Paris, "Improvements in the treatment of coprolites, and other fossil phosphates of lime."—A communication from Guillaume Louis Edouard Buran, and Louis Goupy, Rue du Grand St. Michel, Paris.—*Petition recorded 10th February*, 1862.

485. William Johnston, Glasgow, Lanarkshire, N.B., "Improvements in gas and other lamps and stoves."—*Petition recorded 24th February*, 1862.

689. Edward Thomas Hughes, Chancery-lane, London, "Improvements in furnaces for consuming smoke." A communication from Napoleon Felix Boruko de Chodzko and Jean Louis Lebeaux, Paris.—*Petition recorded 13th March*, 1862.

719. John Grant, Albion-place, Maidstone, Kent, "Improvements in the construction of portable railways, and in the trucks or carriages to be used thereon."—*Petition recorded 15th March*, 1862.

856. William Edward Gedge, Wellington-street, Strand, London, "Improvements in apparatus for extinguishing fire."—A communication from Gabriel Brasseur, Passage des Petites Ecuries, Paris.—*Petition recorded 27th March*, 1862.

1040. James Thomas Grice, Birmingham, "Improvements in the manufacture of twisted metallic tubes."—*Petition recorded 11th April*, 1862.

1145. Edward Loysel, Cannon-street, London, "Improvements in locks and fastenings."—*Petition recorded 19th April*, 1862.

1190. Charles Edwin Heinke, Great Portland-street, Middlesex, "Improvements in diving helmets, dresses, and apparatus, parts of which improvements may also be employed for extinguishing fires in ships and other confined places."—*Petition recorded 23rd April*, 1862.

1214. John Elder, Glasgow, Lanarkshire, N.B., "Improvements in steam engines and boilers."—*Petition recorded 25th April*, 1862.

304. Alfred Vincent Newton, Chancery-lane, London, "Improved electrical apparatus applicable to the lighting of gas."—A communication from Robert Cornelius, Philadelphia, U.S.—*Petition recorded 2nd May*, 1862.

1378. William Southwood, Kensington, London, "Improvements in machinery for pulverising ores and extracting metals therefrom, part of of which is applicable to breaking stones."—*Petition recorded 8th May*, 1862.

And notice is hereby further given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days next after the date of the Gazette (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 17th May, 1862.

2417, 7d.; 2418, 6d.; 2419, 3d.; 2420, 3d.; 2421, 9d.; 2422, 10d.; 2423, 11d.; 2424, 5d.; 2425, 1s. 1d.; 2426, 1s. 9d.; 2427, 3d.; 2428, 3d.; 2429, 11d.; 2430, 3d.; 24 1, 3d.; 2432, 6 i.; 2433, 3d.; 2434, 3d.; 2435, 7d.; 2436, 3d.; 2437, 3d.; 2438, 3d.; 2439, 6d.; 2440, 4d.; 2441, 4d.; 2442, 9d.; 2443, 3d.; 2444, 7d.; 2445, 3 i.; 2446, 3d.; 2447, 6d.; 2448, 7d.; 2449, 7d.; 245 , 3d.; 2451, 3d.; 2452, 3d.; 2453, 1s. 11d.; 2454, 3d.; 2455, 7d.; 2456, 3d.; 2457, 3d.; 2458, 1s. 3d.; 2459, 8d.; 2460, 7d.; 2461, 6d.; 2462, 1s. 5d.; 2463, 1s. 3d.; 2464, 2s. 9d.; 2465, 3d.; 2466, 1s. 2d.; 2467, 1s. 6d.; 2468, 3d.; 2469, 3d.; 2470, 10d.; 2471, 3d.; 2472, 3d.; 2473, 10d.; 2474, 3d.; 2475, 1s. 1d.; 2476, 6d.; 2477 7d.; 2478, 3d.; 2479, 3d.; 2480, 9d.; 2481, 3d.; 2482, 4d.; 2483, 3d.; 2484, 3d.; 2485, 3d.; 2486, 7d.; 2487, 7d.; 2488, 3d.; 2489 3d.; 2490, 6d.; 2491, 3d.; 2492, 10d.; 2493, 3d.; 2494, 6d.; 2495, 3d.; 2496, 6d.; 2497, 10d.; 2498, 3d.; 2499, 7d.; 2500, 10d.; 2501, 3d.; 2502, 9d.; 2503, 3d.; 2504, 10d.; 413*, 7d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

Traffic Receipts.—The traffic returns of railways in the United Kingdom, published for the week ending the 10th of May, amounted on 10,165 miles to £520,328, and for the corresponding week of 1861 on 9,936 miles to £519,715, showing an increase of 229 miles, and of £613 in the receipts.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for The Engineer, *at the office of her Majesty's Commissioners of Patents.*

Class 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2671. E. Green and E. Green, jun., *Wakefield*, "*Apparatuses for generating superheating, and condensing steam.*"—*Dated 25th October*, 1861.

This invention, in apparatuses for generating and superheating steam, consists in constructing them of a series of vertical or inclined tubes let into or attached to horizontal tubes or boxes at top and bottom, for the purpose of getting at the tubes for cleansing, and for removing sediment, also for blowing off, and in enclosing the tubes and furnace in a wall or casing composed of other tubes, the sides of which are planed, or cemented, or otherwise formed, so as to fit closely together and form a tight joint. Instead of all the tubes in the generator being horizontal and vertical, those forming or enclosing the furnace may be circular or curved. When the apparatuses are to be used as condensers the furnace is dispensed with, and a water reservoir is placed over the horizontal tubes, with apertures in the bottom through which a film of water is allowed to trickle down the outside of all the pipes. The patentees cause a strong draught, by means of a fan or otherwise, to draw away the steam generated by the water coming in contact with the heated pipes or heated air, and at the same time to cause a continuous indraught of air through and among the pipes. Under some circumstances they condense with air alone, and sometimes with air and water, and in some cases also they apply the water inside the tubes. The condensed steam is employed for feeding the boilers with water. They keep the exterior of the pipes, whether for generating or condensing purposes, clean by means of scrapers made to run up and down the tubes. When generating and superheating steam they maintain the water level at some distance from the top of some of the vertical tubes, in order that the steam occupying that space may be dried or superheated. Although they have described the outer case or wall as being formed of tubes, yet it may be made of brickwork, or other suitable material. The invention, lastly, consists in the employment for the vertical tubes of pipes corrugated or indented longitudinally, or of a hexagonal, octagonal, or many-sided form in section, in order thereby to obtain increased surface and greater facility for scraping the same.

2696. B. J. Predavalle, *Fleet-street, London*, "*Obtaining a hydro-pneumatic motive power.*"—*Dated 28th October*, 1861.

This invention consists of an atmospheric pressure, imparting its gravitation on a column of liquid communicating alternately with a cylinder under the piston, the rod of which fits air-tight into the upper part of the cylinder in which the vacuum is produced.—*Not proceeded with.*

2703. W. H. Furlonge, *Mark-lane, London*, "*The condensation of steam by surface contact.*"—*Dated 29th October*, 1861.

In carrying this invention into effect, the patentee causes the steam which has performed its duty in the cylinder to pass into a condenser, in which condensation is effected by cold water being brought into contact with tubes or vessels in which the steam is contained, and the invention consists in bringing water into contact with, and carrying it off rapidly from, such surfaces by means of a centrifugal pump, or some analogous form of rotary disc. The patentee applies the invention to what are known as condensing engines, and to the working of non-condensing or high pressure steam engines, in order that the steam, after having performed its duty in the cylinder, may be passed into the surface condenser, and be reconverted into water, which is returned to the boiler. The invention is more especially designed for marine purposes, as permitting the adoption of non-condensing steam engines by steam vessels, whereby a large saving is effected in boiler and engine-room space, first cost and working of machinery, and in the quantity of fuel consumed.

2732. J. A. Fanshawe and J. A. Jacques, *Tottenham*, "*Steam generators.*"—*Dated 30th October*, 1861.

The patentees claim constructing steam boilers with a series of distinct narrow water spaces or compartments combined together, and having convolute, curved, or serpentine flues or passages between them, for the purpose of increasing the length of flues, and thereby retaining the heating gases in contact with the sides of the water spaces for a longer time than heretofore, so as to enable the water in the boiler to absorb as much as possible of the heat from the gases from the furnace before allowing them to pass away into the atmosphere.

2741. J. B. Whitehead, *Manchester*, "*Steam boilers.*"—*Dated 1st November*, 1861.

This invention consists in an arrangement whereby the inventor is enabled to inspect the interior of a boiler or other vessel or chamber containing steam during its working condition, and thus to ascertain the level of the water, or to make other observations. To this end he causes light, natural or artificial, to pass through an opening covered with glass, and he adapts another similar opening by which the interior of the boiler or other chamber may be inspected; and in order to increase the amount of light he uses reflectors and condensers. The lighting apparatus he at present proposes to enclose by a casing to convey away the steam should a fracture of the glass take place, and also he proposes using a stop-cock for providing air for the combustion of the illuminating material.—*Not proceeded with.*

2749. M. Henry, *Fleet-street, London*, "*Steam engines and boilers.*"—*A communication.*—*Dated 1st November*, 1861.

The object of this invention is the construction of boilers and engines for the purpose of employing steam at very high pressures, namely, at least five times that of ordinary boilers. For this purpose, according to this invention, an improved boiler is constructed having a reservoir or reservoirs for containing steam and water at about the same temperature, of sufficient volume to constitute a reserve of heat and motive power, intended to keep up the pressure of the steam, and to keep the work of the engine regular, notwithstanding the reduction of pressure and irregularities consequent on the incidents of feed and combustion, and on the power expended. Also an improved arrangement of engine is herein proposed to be constructed for working steam expansively at very high pressures.

Class 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2680. B. J. La Mothe, *New York*, "*Metallic railroad cars.*"—*Dated 25th October*, 1861.

This invention cannot be described without reference to the drawings.

2682. F. Barnett, *St. Mary Axe, London*, "*Electric danger signals for railways.*"—*Dated 28th October*, 1861.

In arranging these signals the inventor proposes that between all stations on railways there shall be on each side of the line (for up and down trains) tall posts erected, surrounded by round balls, or other shaped signals of sufficient size to be seen afar. These signals are to work in grooves, and be sustained in their places each by a catch connected with a galvanic pile or battery. The communication between the said galvanic pile or battery and the movable ball or other shaped signal shall be at the stations on either side of the said post or posts, supporting each a suitable ball or other suitable signal of whatever shape, by means of which connection the person at the station or elsewhere in charge will be able, by completing the circuit of electricity, to cause those movable signals to fall (at the distance of many miles) from the upper to the lower part of the groove on the signal post.—*Not proceeded with.*

2697. G. W. Watson, *Rotherhithe, Surrey*, "*Reefing fore and aft sails.*"—*Dated 28th October*, 1861.

For the purposes of this invention the sail must be of the ordinary kind, the only difference being, that it is made to turn round a boom placed on the top of the ordinary boom, and turned by means of a wheel fixed to the boom, which wheel will by no means interfere with the arrangement of any of the running gear, and can be used at any time, one or two men being sufficient for the purpose of reefing, according to the strength of wind and size of sail.—*Not proceeded with.*

2720. G. Leigh, *Manchester*, "*Sailing ships and other vessels.*"—*Dated 30th October*, 1861.

This invention cannot be described without reference to the drawings.

2687. F. Wrighley, *Manchester*, "*Railway wheels and wheel tyres.*"—*Dated 26th October*, 1861.

This invention consists in the following construction and combination of parts applicable to new wheels. The tyre is made with under cut recesses, one on each edge of its inner periphery forming a "dovetail;" and the rim or sole plate of the wheel has a flange formed on one side, which is under cut to correspond to the dovetail on one side of the tyre, and an annular ring is provided for the other side, which is shaped to fit the under cut recess in the tyre, and also to take hold of the under side of the rim or sole plate. When the tyre is placed on the wheel, the annular ring is then put on and secured by rivets or bolts passing through it and the rim or sole plate of the wheel breadthwise.—*Not proceeded with.*

2734. J. A. Fanshawe and J. A. Jacques, *Tottenham*, "*Means of securing the doors of railway carriages.*"—*Dated 31st October*, 1861.

The object of this invention of "improvements of railway carriages" is to prevent the doors of railway carriages from being opened while the train is in motion, and yet to allow the door to be opened when the train or carriages stop. This two-fold object is effected by self-acting machinery placed beneath the carriage, and set in motion by the running wheels. When the train is in motion all the doors are secured by bolts, which are pushed forward from the jambs, sills, or other convenient parts of the

framing, into sockets made in the doors. These locking bolts are connected by means of rods to a vibrating lever or shaft, which is connected by a lever and rod to the machinery below the carriage, whereby these parts are operated.—*Not proceeded with.*

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2728. A. T. J. *and* J. TOPHAM, *St. Pierre-les-Calais, France,* "*Lace.*"—*Dated 30th October,* 1861.

The patentees claim allowing the gimp or embroidery threads to pass up and down in the fabric as the pattern may require, by so arranging the working of the machine that portions of the fabric may for a time be left unmade, and then afterwards, when the gimp or embroidery threads are ready to return, may be separately produced and raised into the spaces previously left for them. They also claim the employment of lifting threads, for raising meshes requiring to be so treated, to positions higher than the points can take them, viz., the lower edge of the line of work across the machine, such lifting threads being crossed under the mesh to lift it, and afterwards being uncrossed to again free them from the fabric, as described. They also claim the arranging points in such a manner as to take meshes requiring to be raised higher than the lower edge of the line of work across the machine to the extra height required, be it one, two, three, or more meshes, as the case may be.

2742. J. HIGGINS *and* T. S. WHITWORTH, *Salford,* "*Apparatus for preparing cotton and other fibrous materials for spinning.*"—*Dated 1st November,* 1861.

This invention refers, First, to those carding engines which are provided with a roller or rollers furnished with cards beneath the "licker-in," and has for its object facility of adjustment. To this end the patentees mount the "licker in" in bearings capable of being altered in position, so that the said licker-in may be removed, and subsequently properly adjusted, after the under rollers have been fixed in correct positions. Another part of the invention consists in a method of adapting the ends and axes to cylinders or rollers of carding engines. For this purpose they screw the one part to the other, and so as to bring a shoulder upon the one into contact with the other. Another part of the invention relates to the slubbing or roving frame, and is applicable to those machines in which one of the cones is caused to swing upon a centre, or is otherwise shifted, and has for its object the gaining a correct position of the cones for a proper tension of the strap. This they effect by adapting adjustable stops to the screw rack or other mechanism which moves the cone bodily, so that its working position may be required after doffing, or altered according to the condition of the strap. Also, they adapt a click to the mechauism which supports the cone, which, by arriving in contact with a ratchet wheel, retains the differential motion, so as to cause the bobbin and spindle to turn at one speed when an accumulation of material is required for attachment on the commencement of a fresh bobbin.

2747. R. R. PRIESTLY, *Glasgow,* "*Production of cotton, worsted, or composite yarns.*"—*Dated 1st November,* 1861.

This invention relates to the manufacture of yarn from worsted or cotton, in which an ornamental or parti-coloured appearance is obtained, and consists in mixing or sprinkling small portions of fibrous materials of another colour or another material upon the lap or fleecy web of worsted or cotton during the carding or other operation prior to its being spun into yarn.—*Not proceeded with.*

2757. J. FRENCH, *Bradford,* "*Apparatus for doubling or twisting yarns.*"—*Dated 2nd November,* 1861.

The object of this invention is to prevent the present waste of yarn, and the production of bad or imperfect yarn, which is now the case when one or more of the ends or threads break in the series that are being twisted together. To accomplish this the patentee applies a series of catches, so arranged as to act upon and stop the rotation of the whole series of bobbins immediately on the breakage of any one of the ends or threads, and thus break the whole number of ends which are being twisted together at nearly the same time. Each end or thread passes over and acts respectively upon one of the catches, so as to keep it out of contact with its bobbin, but when any one of the ends break the catch, being liberated, acts upon the next bobbin, and prevents rotation thereof, causing that end to break also which allows its catch to act upon and stop the next bobbin, and so on, to any number of bobbins.

2758. B. BROWN *and* R. HACKING, *Bury,* "*Openers, scutchers, and carding engines.*"—*Dated 2nd November,* 1861.

One of these improvements consists in placing between the roller known as the doffer and the cylinder in carding engines other two rollers, containing teeth on their circumferences, for the purpose of stripping the cylinder more effectually. The roller next to the cylinder has a circumferential motion greater than the circumferential motion of the cylinder, which enables it to strip the cotton from the said cylinder, and the teeth of the roller, having their points bent in the direction of the roller's motion, also facilitate the stripping. Another roller, having a circumferential motion greater than that of the roller before named, and revolving in an opposite direction, its teeth being bent in a similar manner to the one before named, strips off the cotton from the first roller and conveys it to the doffer, the revolutions of which are regulated as may be required. The patentees also place fluted rollers underneath the rollers lying between the cylinder and doffer, for the purpose of acting on the cotton to remove sand, seeds, leaf, or any other superfluous matter contained therein. They also place under the said fluted rollers a band of cloth, or other pliable material, which passes over the rollers, the object being to clean the fluted rollers. A revolving brush, cleaned by a comb fixed near it, is used to keep the band of cloth, or other pliable material, free from any matter that may adhere to it.

2767. J. STEWART, *Glasgow,* "*Cards for jacquard weaving.*"—*A communication.—Dated 4th November,* 1861.

This invention relates to a system or mode of renewing the cards in jacquard weaving mechanism, so as to avoid waste of material. Under one modification two cards representing different colours are taken, and the layers of paper which form the card are slightly separated at the corner to a small extent, by means of a knife or other suitable instrument. The layers of paper are then completely separated, and the layer or half of one card is glued or otherwise cemented to the half of the other card. The two remaining halves of the cards are in like manner glued or cemented together, so that the four parts again form two perfect cards, as the perforations in each half are covered by the solid parts of the other half, and the parts when joined in this manner are again ready for being punched. As the moistening of the cardboard has the effect of altering its length, to some extent, the barrel or guide holes at one end are made to correspond, and at the other they are filled up by interposing a piece of paper between the layers of the card, and the barrel hole is afterwards punched out. The cards thus prepared are subsequently submitted to pressure in any convenient manner, so as to cause the layers of cardboard to blend or adhere firmly together.—*Not proceeded with.*

2775. W. HALL, *Calais,* "*The production of curved and other forms in articles of lace.*"—*Dated 5th November,* 1861.

In carrying out these improvements the lace fabric desired to produce the required forms is woven in a straight line, as the most convenient for the purpose, though the patentee does not confine himself thereto, and there are angular or other spaces in the figures or ornamentation thereof, such that, when the parts within such spaces are cut away, and the other parts of the remaining edges sewn together, the required form will be obtained.

2777. R. FETHNEY, *Manchester,* "*Apparatus for preparing, spinning, or doubling cotton, silk, &c.*"—*Dated 5th November,* 1861.

This invention relates, First, to an improved novel bolster to be used in machinery for preparing, spinning, doubling, and winding fibrous materials. Part of the bolster is made of a globular or partly globular form, and fits a recess of a similar shape in the copping or spindle rail, there being a pin or projection to prevent it revolving with the spindle, this pin or projection may either stand out of the bolster, and fit into a slot or notch in the rail, or it may project from the rail and fit a slot or recess in the bolster. There is also fitted on the upper or lower side of the rail, or other convenient part, a cap or other appliance to hold the bolster in its place; or the same effect is produced by entering a pin into a circular recess in the bolster. This arrangement enables the bolster to accommodate itself to any displacement or deviation of the copping or movable rail, so that it can never bind the spindle, but will always allow it to rotate freely, and thereby prevent much friction, and effect a saving of oil, especially in those bolsters or spindle rails that slide up and down, as this form of bolster does not skim the oil off by pressing more on one side than the other. Any length of tube or bolster can be used in order to give great steadiness to the spindle when it runs at a high velocity. Secondly, this invention relates to a self-acting lubricator for lubricating the spindles, which consists of a horizontal tube of any convenient length, fitted to and parallel with the lifting or movable rail. To this tube are attached branch tubes opposite to each spindle, each branch tube having a piece of cloth or other substance attached to it, and fed with oil or other lubricating matter from the horizontal tube, which tube is fitted with an apparatus to bring the cloth or other saturated substance in contact with the spindle, so as to place upon it a small quantity of oil, after which the horizontal tube will revolve until the branch tube shall point upwards, in which position it will remain until again required to be brought in contact with the spindles. The oil or other lubricating matter is spread over that part of the spindle where most required, as the bolster passes that part of the spindle that has been in contact with the lubricating cloth.

2799. J. HANCOCK, *Nottingham,* "*Improvements in the manufacture of looped fabrics, and in machinery to be employed therein.*"—*Dated 7th November,* 1861.

This invention has reference to the ordinary straight frame now used for producing hosiery work. The improvements enable the patentee to make two or more courses of work in one complete motion of the frame, instead of only one course, as is ordinarily done. The invention consists, First, in an improved arrangement of instruments carrying needles for working the needles backward and forward (the needles being operated upon for forming the loops by the jack and lead sinkers), and which arrangement he uses for producing the results now usually effected in the ordinary frame by the use of jack and lead sinkers; these instruments are formed of plates of iron, one to each sinker of the frame, with two needles cast into each plate (one needle only may be employed when it is so desired), and are moved backward and forward by an inclined plane or planes. Secondly, in an arrangement of machinery for working the instruments and needles first referred to, when it is desired either to narrow, widen, or figure by these instruments, and whereby no time is lost in performing these operations. The instruments before referred to are, when used for the purpose of narrowing or widening, raised up or drawn out at the back to throw the needles out of work, and thus the width of the material may be regulated. Any of the needles may be operated upon in the same way for producing false loops when figuring of the work is required, these instruments being raised or drawn out by levers. Thirdly, in the use of two or more bars carrying feeders for laying the threads under the sinker nibs, or on hooks, or on needles, and carrying one, two, or more inclined planes, by means of which combination two or more courses of the fabric can be made at one time. This working of more than one course at one time causes a double loop to be formed on the selvage of the fabric. Lastly, in the combination of the parts described to form an improved frame for making looped hosiery goods, whereby the whole work may be twice (or oftener, as may be required) commenced and completed in the space of less than six inches, thus leaving the rest of the frame at liberty for narrowing, figuring, or widening, without losing time in the manufacture of the fabric.

2803. B. DOBSON *and* J. CLOUGH, *Bolton-le-Moors,* "*Combing, preparing, and spinning cotton, &c.*"—*Dated 8th November,* 1861.

These improvements in machines for combing consist in the application thereto of self-acting stop motions, whereby the machinery may be stopped when a sliver breaks between the feeding cans and the spouts, or between the taking-off rollers and the funnels, or between the funnels and the coiler. In performing this invention the slivers, in passing between the feed rollers and the conducting spouts, are taken over suitable instruments, corresponding to and acting in the same manner as the spoons used in the stop motions of drawing frames for preparing cotton. These spoons or other equivalents are connected by levers, shafts, and gearing to the driving strap, so that, when a sliver breaks, the said strap is moved from the driving to the loose pulley. Other stop motions of a similar construction are or may be placed between the taking-off rollers and the rotary funnels, and when requisite another stop motion may be applied between the rotary funnels and the coiler. The above description refers to a circular combing machine, but these improvements are a so applicable to other combing machines. The improvements in machinery for preparing and spinning consist in an improved mode of constructing the cap bars, by which the top rollers of the drawing rollers employed in such machinery are held in their places. It has been heretofore customary to cast the cap bars with the fingers on which the adjustable slides fit in one piece of cast iron; these fingers are very liable to break, and when one is broken the whole cap bar is useless, and has to be replaced. Now this invention consists in making the fingers of round steel rods fastened on the top; these fingers fit in holes in the cast iron back piece of the cap bar, and are held therein by set screws acting on the flattened part of the rods; the adjustable slides for the top rollers are also connected to the rods by set screws.

2809. J. BURNE, *Whitehouse, Antrim,* "*Apparatus for scutching and refining flax, hemp, jute, &c.*"—*Dated 4th November,* 1861.

This invention is carried out in the following manner:—In the circumference of a wheel revolving about a fixed axis the patentee forms, at convenient distances from one another, transverse grooves or slots, and into each of the said grooves or slots he fixes an arm or projection from the end of a blade of peculiar construction, formed of wood, metal, or other suitable material. That edge of the said blade which first comes in contact with the material to be operated upon is formed sharp, and upon the side of the blade which is presented to the said material, and towards the back of said blade, he forms a row of projecting scrapers of a semicircular form, resembling finger nails, and above the said scrapers and upon the back of the said blade he fixes a projecting plate or scraper of a plane rectangular form. The substance to be operated upon is placed in an opening in front of a carriage, whereupon it is brought into contact with the said blades, and is held firm and fast in the said opening by means of two plates attached to the front of the said carriage, and acting like a vice, one of the said plates being made movable for the admission and removal of said substances. Diametrically opposite that part of the said wheel to which the substance to be operated upon is presented, he fixes a revolving brush of a circular form; the said brush, pressing against the said blades, removes from them the tow or waste, while a fixed scraper, pressing against the brush, keeps the said brush clear and clean.

2779. E. BROWN, *Upper Norwood, Surrey,* "*Elastic fabrics.*"—*Dated 5th November,* 1861.

The patentee claims, First, the manufacture of elastic fabrics composed of india-rubber, gutta-percha, or other elastic gums, combined with chloride of sulphur and dry hydrochlorate of lime, and the covering of linen, woollen, silken, or other fabrics. Secondly, the combination or covering of elastic cloth with the refuse or cuttings of leather or other fibrous material, and the waste vulcanised india-rubber, gutta-percha, or other elastic gums and chloride of sulphur and hypochlorite of lime.

2791. S. COCKET, *Blackburn,* "*Cop-tubes.*"—*Dated 7th November,* 1861.

This invention relates to that destription of cop-tubes which are made of sheet steel, and which have hitherto required rings and buttons on the spindles to prevent the tubes from slipping down. These improvements consist in bending inwards the bottom of the tube, so as to obtain increased strength, at that part, and clip the spindle at the bottom of the tube as well as at the top, and thereby dispense with the rings and buttons on the spindles. The inventor also causes the exterior of the tubes to be rough, either with small points, or stamped with any desired pattern, in order to obtain a greater hold upon the cop.—*Not proceeded with.*

2792. J. WALMSLEY, *New Accrington, Lancashire,* "*Looms.*"—*Dated 7th November,* 1861.

This invention consists in an improved arrangement of the working parts of the loom, so as to be able to weave two pieces of fabric at the same time, in such a manner that each piece will have a proper selvage, and may be woven as wide as the reed space will admit. For this purpose the patentee employs two warp beams, two cloth beams, two taking up motions, two shuttles, one or two sets of healds, two temples, and two weft detectors. The pieces of fabric are one above the other, the two warp threads passing through the same reed, and the other ordinary parts of the loom are arranged to suit the requirements.

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

2753. A. F. YARROW, *Arundel-square, Barnsbury, and* J. B. HILDITCH, *Barnsbury-villas,* "*Machinery used when ploughing, tilling, or cultivating land by steam power.*"—*Dated 2nd November,* 1861.

This invention consists in improved methods of combining winding barrels or drums with portable steam engines. In carrying out the First part of this invention the patentees mount two winding barrels or drums on a horizontal shaft or axis, which is situated on one side of a portable engine. Upon one side of each of these drums are bevel teeth, which are made to gear alternately with two bevel wheels which are driven by a bevel shaft, and at the upper extremity of this bevel shaft is attached a bevel wheel, which gears into a bevel wheel which is fixed on the engine shaft. In the Second part of the invention they key a large bevel wheel upon the horizontal shaft which is situated on one side of the engine; they also place a barrel or drum upon each side of this wheel, to which they may be alternately connected. The large bevel wheel is driven by means of a smaller bevel wheel which is fixed on a bevel or vertical shaft, which itself is driven from the engine shaft by a pair of bevel wheels. The horizontal shaft upon which the large bevel wheel is keyed is continued on towards the hinder part of the engine, where a bevel wheel is attached to it, which wheel may be thrown into gear with another wheel which is connected either to the driving wheel or axle of the engine, for the purpose of propelling the engine. In the Third part of the invention, upon the horizontal shaft, which is situated on one side of the engine, they fix a large bevel wheel, which is driven by means of a smaller bevel wheel, which is fixed on a bevel or vertical shaft, which itself is driven from the engine shaft by a pair of bevel wheels. Upon the horizontal shaft is a clutch, and on each side of the clutch are the drums, which may be alternately thrown in and out of gear in the usual manner. The horizontal shaft may be continued back towards the back of the engine, and arranged to render the engine locomotive in a similar manner to the former case. By these arrangements either of the drums may be rendered the hauling drum, while the rope is uncoiling from the other.

2798. H. G. GIBSON, *Mark-lane, London,* "*Apparatus for drying hops, malt, grain, &c.*"—*A communication.—Dated 7th November,* 1861.

This invention consists, First, of a box or case surrounded with single or double jackets or enveiopes, and containing inside, at different levels, two, three, or more shelves or tables, either formed of perforated louvre plates, which are acted upon by a rod or lever, or they are formed of perforated or open work plates. These shelves or tables run upon slides inside the case, to allow of their being withdrawn through doors fitted for the purpose. At the lower part of the case a funnel or shoot is fixed, through which the article can be withdrawn. At the upper part and side of the case a hopper may be fixed, through which the articles may be fed on to the upper shelf, and from it to those below it. Secondly, of a fan or blower placed at the upper part of the case. This part of the invention cannot be described without reference to the drawings.

2802. T. C. DARBY, *Little Waltham,* "*Horse hoes.*"—*Dated 8th November,* 1861.

This invention cannot be described without reference to the drawings.

CLASS 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

2763. T. SPENCER, *Prescot, Lancashire, and* T. ROBINSON, *St. Helen's,* "*Apparatus for making pipes and other articles of earthenware.*"—*Partly a communication.—Dated 2nd November,* 1861.

This invention refers, First, to those machines in which the direct action of steam or other fluid is employed for forcing the plastic material through or into dies, and consists in the employment of an additional power, whereby the patentees are enabled to maintain the pressure after the moulding has been effected, and to work with a less pressure of the fluid. To this end they weight the ram or piston direct, or through the agency of racks or pinions or equivalent apparatus, and they effect this weighting by using a cistern which may be charged with water or other heavy matter, so that a portion may be drawn off or otherwise removed as required. Another part of the invention relates to making articles of earthenware by a plunger which is forced into a mould, and consists, First, in covering the said plunger or mould with cloth, leather, or other such material, which may be peeled off; and, Secondly, in giving the said plunger or mould a roughened surface. Another part of the invention relates to making pipes or other articles with a socket or other design at each end, and consists in forcing the plastic material into a mould for forming one end, which mould is then removed, so as to allow the pressure to force forward the material for the barrel or analogous part, the second socket or end being formed in an upper mould. Another part of the invention relates to a particular form of pipe for gas, sewage, and other purposes, and consists in forming the said pipe at one end with an enlarged part, within which there is a recess, and at the other end with a part capable of fitting into a similar recess upon another pipe, and they prefer so forming the said ends that the interior diameter shall not be interrupted with projections.

2796. S. LEPARD, *Cloak-lane, London,* "*Apparatus for heating and warming conservatories, greenhouses, ferneries, orchard houses, &c.*"—*Dated 7th November,* 1861.

This invention is carried into effect as follows:—Over a gas furnace, or over a series of gas-burners or jets, the inventor places a small metal boiler, within which he introduces water. He connects this boiler by means of pipes with another vessel of any convenient form. The communicating pipes pass from the upper and under part of the boiler to the upper and under part of the other vessel, in which also water is placed; both the boiler and vessel have the requisite pipes for admitting water, and safety-valves for letting off steam. The gas being lighted, the water in the boiler becomes heated, and a current is established between the water in it and that in the other vessel; the heat radiating from the latter raises the temperature of the building or compartment wherein it is placed. The apparatus may be fixed upon a stand, or mounted on a frame, or suspended from the ceiling, or in any other way.—*Not proceeded with.*

CREAMER'S RAILWAY BRAKES.—The mode of applying railway brakes, invented by William G. Creamer, of New York, has been tried with the best results on the South-Eastern Railway, where it has been finally adopted to a considerable extent. The brakes are applied by the force with which stout springs, previously coiled, unwind themselves when a catch is disengaged. In some recent experiments, with an engine tender and 16 carriages, weighing 143 tons in all, the train when running at the rate of 50 miles an hour down an incline of 1 in 100, was stopped in 30 seconds, and in a distance of 373 yards. When ascending a gradient of 1 in 664, at the rate of 36 miles an hour, the train was stopped in 133 yards, and in 16 seconds.

CANADIAN RAILWAYS.—There were sixteen different railways in operation in 1861, making 1,881 miles in Canada, and 227 miles of extension into the United States—to Portland and Detroit; in all, 2,108 miles of railway. There is no double track, but 249 miles of sidings, or 10½ per cent. of the main lines. There were 112 miles in course of construction. The Great Western has 445 miles, the Grand Trunk 1,092, the Buffalo and Lake Huron 162, the Northern 95, Montreal and Champlain 72, Port Hope, 56½, Cobourg 28, Ottawa and Prescott 54, Brockville and Ottawa 63½. There are 840 bridges, of which 672 are wooden, 147 of iron, 11 of brick or stone, and 10 swing bridges—making 94,361ft. of bridges, or about 48 miles in all. The total amount expended upon Canadian railways up to the end of 1860 was, in round numbers, 97,000,000 dols., and the average cost per mile 19,218 dols. The amount of capital stock paid in on all the railways is over 38,000,000 dols. The total earnings of all the roads were 6,722,666 dols. for the year—total expenses, 5,675,500. The average cost of repairing engines and cars per mile was nearly 8 cents—average cost of repairing the permanent way and works was nearly 17 cents per mile—and the average cost of fuel was 6 cents per mile. The average speed of express trains was 24 miles per hour, and of freight trains 13 miles per hour. There were 6,606 persons employed on all the railways. There were 394 engines on all the roads, 57 of which were built in Canada, 229 in the United States, and 109 in Great Britain. There were 250 passenger cars, 418 baggage cars, 3,281 freight cars, and 2,593 platform cars. The Great Western has cost over 25,000,000 dols. The total expenditure of the Grand Trunk up to December 31st, 1860, was 69,998,950 dols. The cost of the Victoria Bridge was 6,599,300 dols. The bridge was tested by drawing over it eighteen platform cars loaded with stone, and drawn by two engines. The train was long enough to reach over two spans, and weighed one ton to each lineal foot. Under this weight the deflection of the bridge was only from five to seven-eighths of an inch.

DIRECT STEAM SERVICE TO AUSTRALIA.—We read in the Melbourne correspondence of the *Glasgow Herald*:—"As you are aware the Peninsular and Oriental Company are entrusted with the contract for the Australian postal service, and for the mere conveyance of our letters and newspapers the colony pays them the annual sum of £60,000. Some considerable dissatisfaction prevails among the mercantile community with regard to its costliness and the uninviting nature of the arrangements for passenger traffic by the overland route; besides, the company are supremely indifferent as to whether the Government be satisfied or not. The sum of £150 for a first-class passage by that route might appear reasonable if there existed any disposition to insure the comfort of those who choose to travel overland; but when it is considered that much inconvenience, and even discomfort, are entailed on the passengers by being huddled together on board of small steamers on some stages of the journey, it becomes a public duty to endeavour to devise some other superior mode of transit, whereby the convenience of travellers will be attended to, and the indifference of monopolists avenged. For this purpose a movement has been recently made with the view of establishing an ocean postal system, which, if carried out as intended, will bring about direct steam communication with England, *vid* the Cape of Good Hope. No doubt many obstacles will present themselves to such an undertaking, as it must, of necessity, be one of great magnitude. It is proposed to construct six steamers of 8,000 tons, capable of carrying sufficient fuel for both the outward and homeward voyages. These vessels are to have accommodation for 1,200 passengers, the fares ranging from £10 per head for steerage up to £75 for cabin passages. It is calculated that the passage will be made in forty-four days; but this is very questionable, as the Great Britain never made her journey under fifty-five, and she is not to be despised for sailing qualities. However, be that as it may, a few days are not of much moment, if there were once established a regular monthly communication by means of powerful steamers. The Government have had the scheme submitted to them, and they have looked upon it favourably, and only require to be assured that the matter can be carried out as contemplated, in order to give it that substantial support which has been asked by the promoters. The capital required for the undertaking is estimated at £1,500,000. The Government have been asked to guarantee 4 per cent. per annum on the subscribed amount, and, besides, to grant a subsidy of £4,000 a trip, and, in the meantime, they have taken the matter into favourable consideration. Should they see it to be their duty to give a guarantee on the subscribed capital, and a sufficient subsidy, there will then, it is thought, be no difficulty in inducing English capitalists to enter into the scheme, for it is to London that we must look for the sinews of war.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

Continued Improvement in Iron Trade:—*More Inquiries from America*—Pig Iron Trade: *Advance in Prices*—Coal Trade: *Active: Low Rates*—Proposed Reduction of Miners' Wages—National Association for the Relief of British Miners: *Open Air Meeting*—General Hardware Trades: *Condition unimproved: Less Satisfactory Reports: Brisk Demand for Good Locks: Scarcity of Clever Artisans*—Steam Boiler Inspection, &c., Company—Waterworks at Bridgnorth: *Dead-Lock: Exportation of "Brown Paper" Pipes.*

We have still to report an improving tone as pervading the iron trade of South Staffordshire. There are quite as many inquiries afloat this week as there were at the date of our last; and as large a proportion of them are equally likely to lead to business. Some of the inquiries come in a more attractive form than they assumed at the former period. For instance, among the inquiries is one on account of the Federal Government for 3,000 tons of plates for the naval yards of America, the dimensions of which are 4ft. and 5ft. square by 1in. thick. The thickness is the same as that of the plates required last week, but the size is less. In consequence of the sizes being nearer those of plates that are not unfrequently rolled in this district, makers are more disposed to tender for this order—if, indeed, it should prove an order—than they were to quote for the plates in the market on the same account a week ago. It is proposed that the total quantity required should be taken by three several firms, so that the iron may be supplied with as much dispatch as possible. By houses having agents in the States orders are also being received of more value than have for some time characterised the advices by the American mails. Most of the foreign markets for which iron is made at this season of the year are requiring iron from this district. But for such orders the trade would be in a depressed condition, and its prospects would be other than cheering, for the home trade is becoming worse week by week. In an endeavour to obtain orders in this country, some makers known to be in a good financial position are offering to take instructions at rates which are much below those at which alone other makers will consent to manufacture. The last-named firms maintain, however, that the difference in price, in each case, fully represents the difference in quality; and that the customers who leave them for a time attracted by the offers which have a more advantageous appearance soon return.

The pig iron department—judging from the reports that are made to us by the respective divisions of the trade—is in a better condition than the finished. But inasmuch as the orders for pig iron depend upon the demand for finished, this cannot be so unless the makers of finished iron had been ordering in anticipation of their wants at a future period. It is nevertheless a fact that most of the leading makers of pig iron have their books well filled with orders, the execution of which will occupy in some cases two, in others three, and in a few as many, we are assured, as four months. In consequence such firms are now asking higher prices. On Wednesday and yesterday (Thursday) the agents of the Kirkless Hall Company and of the Parkfield Company were all asking half-a-crown a ton more than they would have taken last week, when, it will be remembered, the latter company were requiring in open market an advance upon the rates of the previous corresponding period of 1s. 3d. a ton. So confident are certain of the producers of pigs that the trade is improving, that they assert that by October next prices will have advanced upon the present list no less than £1 a ton! A demand that would justify such a rise would, indeed, be "a consummation most devoutly to be wished;" but it cannot be realised. So large is the number of furnaces now out of blast, that before such a rise could be obtained the make would be increased to an extent that would meet every probable demand with a facility that such a rise as that named does not contemplate.

The coal trade continues tolerably active; but the prices remain unimproved. Some inquiries were commenced on 'Change in Wolverhampton, on Wednesday, with a view to ascertain how far a movement to reduce the wages of miners would be approved by the majority of the employers of that description of labour. The suggestion was not generally received with favour; and we do not shink that any such step would, at this period, be either judicious or successful.

The promoters of the National Association for the Relief of British Miners are endeavouring to bring the advantages of the scheme which they contemplate prominently before the notice of the mining population of South Staffordshire. On Monday evening an open-air meeting in advocacy of the movement was held in a central position, between Wednesbury and Darlaston. At present the workmen here know very little of what the association designs, and they don't care to be informed; for although about 2,000 bills were circulated, calling the meeting, few over 200 persons assembled, including the usual proportion of women and children. The speaker was Mr. W. H. Miller, a tradesman of Dudley, who has taken much interest in the condition of the miners, and who practically illustrated that interest by spending five months in London at a cost to himself of £4 a week in securing, in the last Mines' Inspection Act, certain clauses beneficial to the operatives about coal and stone pits. In his address Mr. Miller did not deal out "taffata phrases and silken words precise," but roundly scolded his hearers for their drinking and other degrading habits whereby their wives were but partially fed, and their children uneducated. No section of the mining population of the United Kingdom require more instruction than do those of South Staffordshire, as well as to what are their real interests as to the best mode of securing them. The association will therefore do well in the interest of the mining operatives to take the necessary measures to make the many advantages that they offer fully known to the lethargic masses in this district. The general manager of the National Association (Mr. J. Towers) is familiar with the necessities of the collier and stone getter. For some time he held a prominent position at the well-known Woodside Works, and was the private secretary of one of the Messrs. Cochrane, the principal proprietor of those works.

The producers of general hardware goods are supplying less favourable reports than we have been receiving from them during the greater part of the month. The Birmingham trades are not as a whole doing so much, especially in the fancy goods; and the tin-plate workers and japanners of Wolverhampton are not well employed. In both towns there is much unemployed labour, and more depression than might be inferred from the pauper list, large as it is. The proportion, however, of unemployed labour is decreasing weekly, and if it continues there will be less pauperism this than there was last summer. Some tolerably good orders for miscellaneous ironmongers—principally for builders' purposes—were delivered here by the last mail from India. A fair proportion of these find their way to Willenhall. Here also window frames of an artistic shape and of large dimensions are being stamped in malleable iron for Spain. The makers of the best locks—both cabinet and mortice—are well employed. So great is the demand that one of the first-class houses are unable to procure all the workmen for whom they could find employment. To keep some of their best hands some employers have to advance them money; and magisterial proceedings consequent upon a workman leaving one employer to go to another are now of frequent occurrence in Wolverhampton. Not a few clever young artizans in the lock trade have lately left Wolverhampton to go to the Government works at Enfield, where their wages are higher and their work less intermittent.

A Steam-Boiler Inspection and Assurance Company has been started in Wolverhampton. It is denominated the Midland Association. The directors are certain of the leading ironmasters of the district, headed by the chairman of the Ironmasters' Association (Mr. Phillip Williams), who, it will be remembered, called a meeting of the trade shortly after the fearful explosion at the Millfields Works, with a view to the establishment of such a company. The scheme is in nearly all its features similar to the Manchester Association. The company looks to find its assurers in Staffordshire, Warwickshire, East Worcestershire, and Shropshire. An engineer is now being advertised for by the directors.

The corporation of Bridgnorth are at a dead lock with their waterworks: their pipes are alleged to be so leaky as to be dubbed "brown paper" pipes, although they are made of iron; and the engine could not be made to do its duty. At the last meeting of the Town Council of Bridgnorth the ex-mayor, in entering into some explanation with reference to the waterworks, said he had visited them the day before, and found that the contemplated alterations were being done. A vast quantity of coal had been consumed in working the engine during the experiments that had been made, and he considered that they had been put to a vast deal of expense. It was a certain fact that a vast quantity of coal had been wasted in making mere experiments. He (the ex-mayor) had heard that Mr. Coultheart had been up to London to see Mr. Rawlinson—as wise a thing as he could have done—and that while there another engineer—he believed an eminent one—had been consulted with reference to the present dead lock in which they were placed at the waterworks He (the ex-mayor) understood that that engineer had made a suggestion to cure the evil. It was an alteration of the main which was connected with the air vessel. The engineer who had been consulted in London considered that if this main were removed the air vessel would act much better; and it had consequently been ordered by Mr. Rawlinson that the main pipe be taken from within the air vessel, and brought up outside of it. It was believed that this alteration would cause the air vessel to act much better. He (the ex-mayor) hoped it would be so; for they had gone on now for three months experimentalising. The engine had never yet done that which the person who entered into the contract had undertaken it should do. He had undertaken that it should lift 240,000 gallons of water a day.

The speaker added, it was the opinion of practical men that all the evil had arisen because the water did not flow continuously. He himself had been at the works the other day, when he had counted "six" between each action of the pump. Now the weight of the water itself was several tons, but there was in addition the weight of atmospheric air, and every time the pump went down it had to raise this enormous weight. He considered that the damage which had already taken place would not be permanently obviated till the water was allowed to flow more equably. The subject then dropped.

The so-styled "brown paper" pipes at Bridgnorth should not be confounded with pipes made by a respectable firm of a material of the paper class.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

Northern Matters: *State of Trade: The Cleveland Iron District: North-Eastern Railway*—Liverpool: *Mersey Docks and Harbour Board: New Ferry Boats: The "Galway Line" Steamer Hibernia.*

To commence with the north There has been a more cheerful feeling on Tyneside during the last few days, and the coke and iron trades have improved, the demand for iron plates for shipbuilding having, as was to be expected, exerted a beneficial influence. Steam coal has also been in increased demand, and the chainmakers have been doing more business. The *Newcastle Chronicle* speaks in the following cheerful terms of the present state of affairs in the Cleveland district:—"The number of furnaces in blast at present is greater than at any previous period of iron making in this locality, and activity prevails in all the works; the demand for pig iron is increasing every week, and it becomes difficult to supply the quantity required. This, no doubt, will be obviated if prices would improve a little. Better prices would stimulate makers to increase their plant, with a view to meet the demand. But with the dulness there has been in the iron trade of late no maker would have been justified in increasing his works, with no other prospect in view than of having so much capital lying dead. For with the prices obtained lately it has only been by dint of great economy that they have succeeded in carrying on their works without a loss. In fact there is every reason to believe that had it not been for the French treaty one half of our furnaces would, at the present time, have been blown out. But, as we reported a few weeks since, things have changed, and, with the small advance iron has got in price, a corresponding result has been felt. For buyers are more numerous, wishing, no doubt, to take advantage of the still low price of iron. The exports for the past week have been about 7,000 tons, and besides this export trade there has been a considerable inland business carried on." The North-Eastern Railway Company has been very successful in its present parliamentary campaign, having carried the proposed amalgamation with the Newcastle and Carlisle through the Commons' committee, besides obtaining, so far as the Lower House is concerned, powers to construct several branch lines. The branch from Battersby to Nunthorpe, which opens a direct communication between the North Yorkshire and Cleveland Branch and the Middlesborough district, is now ready for traffic, and merely waits the fiat of the North-Eastern directors for trains to pass over it. There will be a ready transit for the Rosedale ironstone to the works on the banks of the Tees, and at much lower rates than hitherto.

We will next pass on to Liverpool. The proceedings at the last meeting of the Mersey Docks and Harbour Board did not present much interest, but towards the close of the public business the chairman stated that the Birkenhead Commissioners had sent for the inspection of the board a beautiful model of a ferry boat for which they had contracted. The engineer to the board has also been preparing a model of the proposed improved approaches on the Liverpool side, which has, we believe, been submitted for inspection this week. The length of the ferry boat will be 150ft., breadth between paddle boxes 30ft., outside paddle boxes 48ft., and the deck will be 6ft. above water and level with the landing stage. The boat will have a house on deck 100ft. long and 16ft. broad, with seat room for 300 people; and 20ft. of the saloon will be set apart for the exclusive use of ladies. The engines (four diagonal) work in pairs and quite independently of each other, each pair being attached to one paddle wheel. All the machinery and boilers will be under the deck. The vessel will be on the Woodside station in about six months. A fine iron steamer, intended to ply between the Seacombe, Egremont, and New Brighton ferries, has been launched from the ship-building yard of Messrs. H. M. Lawrence and Co., of Sefton-street. The "Galway line" steamer Hibernia, which was built by Messrs. Palmer, of Yarrow, and has been rebuilt by Messrs. Laird, of Birkenhead, has just made a trial trip. She is now a noble looking ship, and is capable of performing efficiently any service in which the Atlantic Steam Navigation Company may employ her. A hurricane deck has been built, sheltering the vessel from the paddle-boxes forward. The steering wheel is placed on the bridge. During the trial she drew 16ft. 4in. forward and 18ft. 7in. aft, and she ran the measured distance (4¾ miles) at the rate of 14½ knots. She answered her helm quickly, turning at full speed in 6½ minutes.

American Ordnance Matters.—Our Parrott gun, with a newly-invented shot, which we are not at liberty to describe, has sent it completely through a target formed of twelve 1-in. iron plates and a backing of 24-in. thickness of oak, at a distance of 300 yards. At the same distance, another target, sloped to an angle of 25 deg. representing the side of the Merrimac, backed by 24in. of oak and covered with six 1in. iron plates, was completely perforated by every shot. In the Washington Navy-yard targets are now in the course of construction, representing the sides of the Warrior, the Monitor, and the Merrimac, which will be tested by Captain Dahlgren's ordnance. Thus it will be seen that our Navy Department is determined to act in the construction and armament of the new ships of war from experiments made under its own direction.—*Boston, U.S., Traveller*, 29th ult.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

	£ s. d.	Dis. p. cts.
IRON, English Bar and Bolt:—		
in London ..... pr tn	5 15 0	3
in Wales ..... „	5 0 0	„
in Liverpool ..... „	5 10 0	„
Staffordshire Bars .. „	7 0 0	1
Sheet, single „	8 10 0	„
Double „	10 0 0	„
Hoop ..... „	8 0 0	„
Rod, round „	7 0 0	„
Nail Rod, sq „	7 5 0	„
SHIPPING IRON ..... „	5 0 0	2
Staffordsh. Bars „	7 0 0	2
Sheet, Single .... „	8 15 0	„
Double..... „	10 5 0	„
Hoop..... „	8 5 0	„
Rod, Round..... „	7 10 0	„
Nail Rod, Square.. „	7 5 0	„
IRON, Rails, in Wales, cash „	5 5 0	nett
„ 6 months „	5 7 6	„
Old, to cut up .. „	0 0 0	„
Railway Chairs, in Wales „	4 0 0	„
„ in Clyde „	3 15 0	„
Pig No. 1, in Clyde .... „	2 15 0	„
3-5ths No. 1 & 2-5ths No. 3 „	2 13 7	„
No. 3. ..... „		
No. 1, in Wales..... „	3 10 0	„
No. 1, in Tyne and Tees „	2 19 0	„
Ditto, Forge ..... „	9 0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom. „	3 10 0	„
Welsh Forge Pig (all Mine), at the Port .. „	3 5 0	„
Acadian Pig, Charcoal.. „	7 10 0	„
Scotch Pig, No. 1, in London ..... „	0 0 0	„

	£ s. d.	Dis. p. ct.
IRON, Swedish, Indian assortments ..... pr tn	11 5 0	2
Russian C C N D to arrive „	16 0 0	„
STEEL, Swedish Keg, ham. „	15 10 0	2½
Ditto, rolled..... „	15 0 0	„
Faggot.....	17 0 0	„
SPELTER, on the spot .. „	18 0 0	nett
To arrive ..... „	18 7 6	„
Hard, remelted ..... „	17 0 0	„
ZINC, in sheets ..... „	24 0 0	„
COPPER, Tile, 14 to 28 lb. „	93 0 0	2
Tough Cake..... „	98 0 0	„
Sheathing and Bolts ..pr lb.	0 0 11	„
Sheet..... „	0 0 11	„
Bottoms..... „	0 0 11½	„
Old ..... „	0 0 9	„
Yellow Metal ..... „	0 0 9	„
Burra..... „	90 0 0	„
Russian..... do. .. „	0 0 0	„
LEAD, British Pig ..... „	20 15 0	„
Spanish ..... „	19 15 0	„
W. B. .. .. „	21 10 0	„
Sheet..... „	21 0 0	„
TIN, English Block, nom.. „	114 0 0	„
Bar ..... „	115 0 0	„
Refined „ .. „	119 0 0	„
Foreign Banca ..... „	123 0 0	„
Straits ..... „	115 0 0	„
TIN PLATES, Charcoal, IC..... pr bx	1 9 0	„
Ditto IX ..... „	1 15 0	„
Coke, IC ..... „	1 2 6	„
Ditto IX ..... „	1 8 0	„
Do. at Newport, 1s. pr bx less	—	„
Do. at L'pool, 6d. „	—	„
CANADA, Plates.... pr tn	12 0 0	
QUICKSILVER ..... pr bt		

Rails have been more inquired for this week, and prices are quoted firmly.

Scotch Pig Iron.—The market has been less excited this week, but price has been moderately steady, closing about 3d. lower than our last report, viz, 53s. 3d. for mixed Nos. cash in Glasgow.

Spelter may be had 5s. lower, the price on the spot being now £18 per ton.

Copper in moderate request.

Lead has been in good demand, and the price has advanced a little.

Tin.—In English a moderate demand. In Straits there has been more activity lately, and it cannot now be had under £115. Banca quoted £123.

Tin Plates unaltered.

May 22nd, 1862. Moate and Co., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Teak.....	15 10	17 0	15 0	16 0
Quebec, red pine ..	3 10	4 10	3 5	4 0
yellow pine..	3 0	4 0	3 0	3 15
St. John, N.B., yel.	3 0	5 10	3 0	5 10
Quebec, oak, white	3 5	3 10	3 5	3 10
birch	3 10	4 0	4 0	0 0
Memel..	0 0	0 0	0 0	0 0
elm.....	3 10	4 15	3 10	4 15
Dantzic, oak	3 10	6 0	3 10	6 0
fir.....	3 15	3 10	3 15	3 10
Memel, fir	3 10	4 0	3 10	4 0
Riga.....	3 5	3 10	3 10	3 15
Swedish	2 15	3 0	2 15	3 0
Masts, Queb. red pine	5 0	6 0	5 0	6 0
yl. pine	5 0	6 0	5 0	6 0
rd pine	0 0	0 0	0 0	0 0
Lathwood, Dantz, fm	6 0	6 10	6 0	7 0
St. Peters.	8 0	8 10	9 0	9 10
Deals, per C., 12 ft. by 3 by 9 in.				
Quebec, wht. spruce	13 0	18 0	15 0	19 0
St. John, wht. spruce	13 0	16 0	15 0	17 10

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Yel. pine, per reduced C.				
Canada. 1st quality	17 0	18 10	17 10	19 0
2nd do ..	12 0	12 10	12 0	13 0
Archangel, yellow.	13 0	13 10	14 0	15 0
St. Petersbg, yel...	13 0	13 10	13 10	14 10
Finland.....	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	15 0
Gothenburg, yel...	10 0	11 10	10 0	12 10
white	9 10	10 0	9 10	11 0
Gefle, yellow	10 0	11 0	11 0	13 10
Soderhamn	10 0	10 10	11 0	13 10
Christiania, per C 12 ft by 3 by 9 in.....yellow	22 0	25 0	22 0	24 0
Deck plank, Dntz per 40 ft. 3 in.	0 14	1 4	0 14	1 4
Staves, per standard M				
Quebec, pipe	70 0	75 0	50 0	55 0
puncheon	16 0	18 0	16 0	18 0
Baltic, crown pipe	160 0	170 0	170 0	180 0

SCOTCH PIG IRON REPORT.

		s.	d.	
No. 1	Gartsherrie	57	6	f.o.b Glasgow.
„ 1	Coltness	57	6	do.
„ 1	Calder	53	6	do.
„ 1	G.M.B.	52	9	do.
„ 3	Do.	51	3	do.
M. Nos.	Do.	52	3	do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths „ 3 .. G.M.B.	Cash prompt	53	4½	per ton.
	1 mo. open	53	7½	do.
	2 mos. „	53	10½	do.
	3 „ „	54	1½	do.

MANUFACTURED IRON.

	£ s. d.	
Bars, Govan	6 0 0	
„ Common	6 10 0	
Drumpeller, Common	6 10 0	
Do. Best	7 10 0	
Cramond Scrap Bars Delivered in London	10 5 0	less 5 per cent.
Plates and Sheets	9 0 0	to £9 10s.
Rails	6 5 0	
Pipes	4 17 6	
Chairs	3 15 0	

Glasgow, 21st May, 1862.

The iron market continues very firm, and although the business during the past eight days has been a good deal curtailed, prices have yielded very little.

To day the tone is quiet but steady, at 53s. 4½d. cash nominally.

Exports last week were 14,121 tons, against 18,110 tons in the corresponding week of last year.

Shaw, Thomson, and Moore, Metal Brokers.

Artificial Stone.—The *Suffolk Chronicle* contains a notice of the manufacture of artificial stone in large masses, upon a plan lately discovered by Mr. Frederick Ransome, of Ipswich. The composition of the stone is not given, but it appears that the principal binding material is the indestructible silicate of lime. Blocks weighing a ton and a half may, it is stated, be completely solidified and hardened in the brief space of two hours, whereas Mr. Ransome's original process, only small blocks could be made, after a long period for drying and hardening in the kiln. The *Chronicle* quotes a report by Dr. E. Frankland, F.R.S., of the Chemical Theatre, St. Bartholomew Hospital, who says the "Patent concrete will be found equal to the best of Portland, Whitby, Hare Hill, and Park Spring stones in its power of resisting atmospheric degradation, and if the newness of Ransome's stone (the specimen experimented upon not having been made a fortnight) be taken into consideration, together with the well-known fact that its binding material, silicate of lime, becomes harder and more crystalline by age, I am induced to believe that Mr. Ransome has invented a material which, with the exception of the primary rocks, is better capable of giving permanency to external architectural decorations than any stone hitherto used." We are informed, moreover, that such is the confidence entertained in the imperishable properties of this material, it has been selected by Mr. Fowler, the eminent engineer, for the facing of the stations of the Metropolitan Railway now in progress. We may also state that its capabilities of resisting strain and sustaining pressure have been found to be nearly three times that of Portland stone; thus, it may be fairly assumed that these qualities, combined with facility of production and the inexpensive nature of the materials used, must insure for it general adoption in the construction, as well as in the embellishment, of buildings generally, and in works of art. Mr. Ransome has made enlargements and introduced fresh machinery at his works to carry on an extensive manufacture, but it should be observed that the process is so simple that the stone can be manufactured on the spot where the demand arises. The new patent is already making way, for we find some enterprising men at Norwich have secured a license from Mr. Ransome for manufacturing, and are now erecting suitable works.

SOCIETY OF ENGINEERS.

May 12th, 1862.

ON THE USE OF COAL IN FURNACES WITHOUT SMOKE.

By CHARLES F. T. YOUNG.

(Concluded from p. 309.)

THERE can be little reason to doubt that, if the public were once satisfied that smoke might be prevented by cheap and simple means, that its prevention would be at once carried out. Nothing can be more detrimental to the carrying out of any desirable work than the idea that it "can't be done," an idea that, once fostered, is almost ineradicable. There seems to me to be a good opening for an "association to prevent smoke and promote economy in the use of steam," which, if properly and judiciously worked, and resolutely carried out, would be the means of conferring a great benefit on the dwellers in neighbourhoods where steam is employed, and at the same time beneficial to the users of steam power. We have seen the success attending the Manchester Steam Boiler Assurance Company, which supplies a want long felt, whose operations are extended over nearly the whole kingdom, and with such success that it has completely extinguished an undertaking, recently promoted, which had no such advantages to offer, although backed by a strong array of science, and is shaking to its very foundations another affair similar to the one it has already extinguished.

Fig. 1.



Fig. 1 represents the usual amounts of smoke to be seen on the chimney tops of ordinary factories where no apparatus is used.

On railways the use of coal is rapidly extending, and, in fact, may almost be said to have superseded the use of coke, but its employment is unfortunately not free from the great drawback and nuisance of smoke. Numerous attempts have been made to prevent or burn the smoke evolved from coal during its combustion in the fire-boxes of locomotives, and with what amount of success we have only to watch any of the engines on the lines leading out of the metropolis to see; and that there is great room for improvements no one can doubt. When the Act empowering railways to use steam engines was passed, it was rendered compulsory on all railway companies, by that Act, not to produce any smoke. The Railway Act of the 7th Geo. IV. especially provides that each engine shall "effectually consume its own smoke." How well the Act works a journey on any coal-burning line will afford ample and unanswerable proof. Some of the systems of smokeless coal-burning require an entire reconstruction of the fire-box, others require engines to be specially constructed for them, and the remaining portion are easily applied to the coke-burning engines at present in use. They may be classed as follows:—Those with large spacious fire-boxes, containing one large grate, or else divided by a mid feather into two, with a fire-door for each, with long runs, such as those of McConnell, Beattie, and Cudworth; these are further divided into long tube, short tube; combustion chamber projecting into the barrel of the boiler, and other varieties, in which use of fire bricks, and other materials for keeping up a high degree of heat and splitting the hot products of the fire-box into as divided a state as possible, are employed. Then those with deflectors or baffle-plates, to deflect the air down upon the fire, admitted either from the fire-door or elsewhere; these are generally applicable to existing locomotives; and, lastly, the plan of introducing currents of air uniformly distributed over the surface of the fuel, through tubular or other openings in the sides of the fire-box; this last plan is easily and cheaply applied to any existing engine as constructed with the ordinary square fire-box.

Fig. 2.

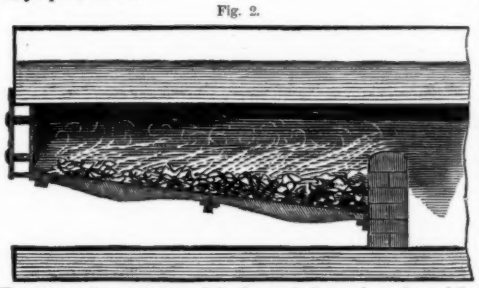


Fig. 2 shows the appearance of the fire producing such smoke, and the imperfect combustion arising from want of air.

Fig. 3.

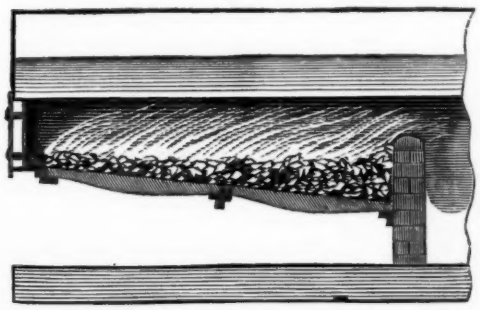


Fig. 3 shows the state of the fire in a well-proportioned furnace, where the air is properly and sufficiently admitted, and combustion is nearly perfect. In this furnace no more smoke would ever be seen than is shown in the least amount in Fig. 1.

Fig. 4.

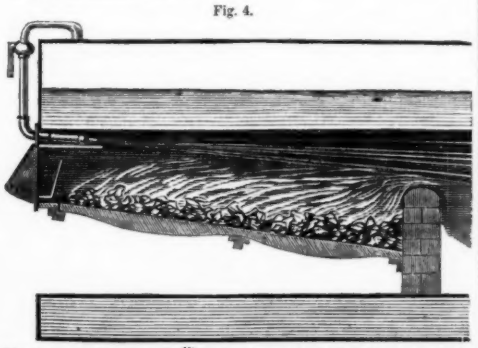


Fig. 4 shows the appearance of such a fire as Fig. 2 when the steam inducted air currents are applied, the smoke being at its worst reduced to No. 2, Fig. 1.

The same remarks that apply to the thorough mixture of a proper quantity of air with the products of combustion in ordinary furnaces are equally applicable here; and it is found in all those plans in which the air is admitted in bulk that a large quantity of that air escapes unconsumed through the tubes, and at high speed, tends to diminish the production or keeping up of steam; another objection to the use of the "baffle," "deflector," or "shovel," to say nothing of their requiring rapid renewal, is their causing the suction, as it were, of particles of coal through the tubes, and the burning of the smoke-box in consequence, unless this were counteracted by the use of the brick arch in the fire-box. If any one examine the smoke-box of an engine fitted on this plan, just as she comes off her journey, they will find this the case, and also that there will be a large deposit of ashes therein.

Fig 5.

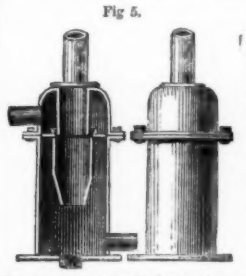


Fig. 5 represents the feed-water heater before described. The steam pipe is shown at the top, the feed entrance at the side, and the pipe to the pump may be at the bottom, or on one side as shown.

Theory shows us, and experience has proved, that the thorough intermixture of the air with the combustible gases at or near the surface of the fuel is best attained when the air is distributed amongst them through numerous small openings, rather than through one or two large ones; and this can be perfectly done without baffles, shovels, deflectors, brick circles, long fire-boxes, or combustion chambers, by the simple employment of air tubes of small diameter passing through the water space either in the front and back or at the sides of the fire-box, open externally to the atmosphere, and internally to the gases and heated matter, just above the surface of the fuel. Now this arrangement, originally patented by S. Hall, in 1841, which, where properly applied, is more efficient in destroying smoke when the engine is running, is not capable of doing it when the steam is short, and the powerful suction and resisting action of the blast is lost, and this is the same in all places acting by the force of the blast. To overcome this difficulty the steam jet in the funnel has been added to all of the ordinary plans in use, but with a very small amount of success. The use of this jet or blower is objectionable, first, because so long as it is in use the steam is continually rising, the fire kept bright, and fuel and steam wasted; and next, because it does not fulfil the end to which it is applied, from its strongest action being in no way equal to the blast of the engine when running, and thus not capable of maintaining that rapid and thorough mixture of air required for prevention of smoke, nor is it capable of uniting itself to the quiet state of the fire when the engine is standing, or the ever varying conditions of a locomotive furnace. The means of overcoming these difficulties, and of adjusting them to the wants of the furnaces, has been admirably obtained by Mr. D. K. Clark (who has patented it a few years since), and consists in inducting, accelerating, and thoroughly intermixing the currents of air within the box, by the instrumentality of minute jets of steam. By this arrangement (as shown in Figs. 13 and 14) the steam nozzles, with the air tubes to which they are pointed, are like so many miniature blast pipes and chimneys turned into the fire-box, possessing relatively the same power of urging and creating the draught, and the air currents are by their means delivered with such precision and velocity as to sweep over the whole surface of the fuel, and forcibly distribute and mix the air amongst the gases, whereby a complete and entire prevention of smoke is obtained.

In practice it is found only necessary to use the jets occasionally when the engine is at work, say, just as a charge of coal is being thrown on, so as to make the fire rather green, the blast, as before shown, introducing nearly air enough; but the time when their use is in demand, and by which smoke is entirely prevented, is immediately on shutting off the steam when coming into a station or otherwise. Then the heat in the fire-box is fierce, and a great distillation of combustible gases will be taking place, all of which, if not met and consumed by the steam-inducted air currents above the fuel, must escape at the chimney in the shape of clouds of smoke. The intensity of heat will now rapidly subside, and the jets may be moderated as desired, and continued in action until the engine again starts off. The indraught of air into the fire-box can be easily regulated by the use of slides or dampers over the air openings, but by so proportioning the area of the hole, to prevent any great excess of air supply, the dampers may be dispensed with altogether.

The following statements of the working of this plan, in comparison with others, will be a satisfactory proof of the economy of it. The gross weight of engine tenders were nearly equal, and the trains of 100 to 116 tons speed, nearly the same, and coal consumption as follows:—

Mr. McConnell's plans, 35½ lb. Hawksbury coal per mile = ·31 lb. per ton gross.

Mr. Beattie's (with cold water), 24 lb. Griff and Stavely coal per mile = ·235 per ton gross.

Mr. Cudworth's, 26 lb. coking coal per mile = ·225 lb. per ton gross, when tried (as used by Mr. Cowan on the G. N. S. R.) in competition with those plans adapted to the ordinary fire-box (with passenger trains), such as Mr. Douglas, of the Birkenhead line, with a door deflector; Mr. Yarrow's, of the Scottish North-Eastern Railway, with a brick arch and air-bars; Mr. Connor's, of the Caledonian Railway, with a brick arch and door deflector; Mr. Frodsham's, of the Eastern Counties Railway, with a door deflector and steam roses in the fire-box, as used by Mr. Sinclair, the following results were obtained:—

	Gross weight. Tons.	Gross coal. Per mile.	Per ton gross.
Mr. Douglas	90	28·4	or ·32 (Welsh)
Mr. Yarrow	86	25·7	,, ·32 (Fifeshire)
Mr. Connor	88	22·2	,, ·26 (Lanarkshire)
Mr. Frodsham	83	23·3	,, ·25 (Stavely)
Mr. Clark	110	21·0	,, ·19 (Fifeshire)

Fig. 6.

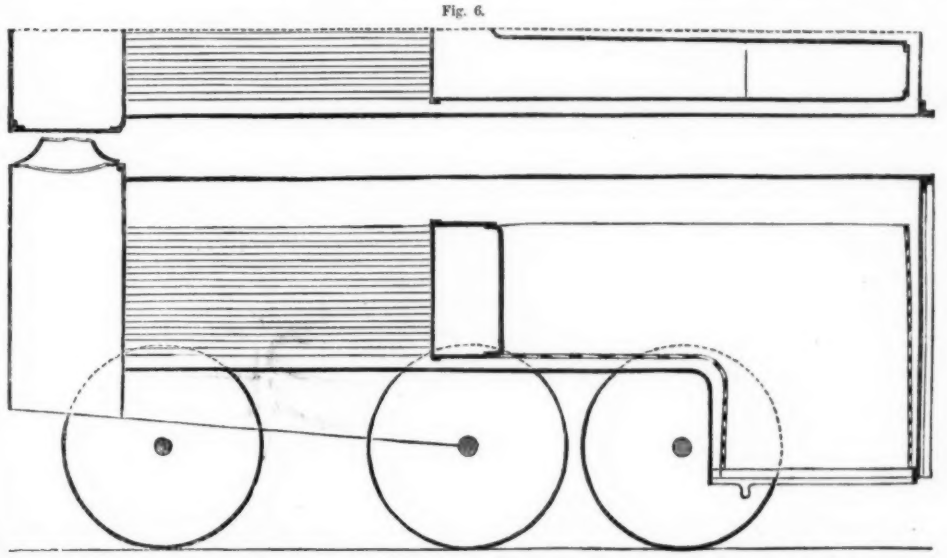


Fig. 6 is a section and half plan of a coal-burning locomotive on Mr. M'Connell's patented principle for using coal without smoke. I may here remark that the best test of the efficiency of the plans named is either a journey behind one of the engines, or else a residence close by the line.

Fig. 7.

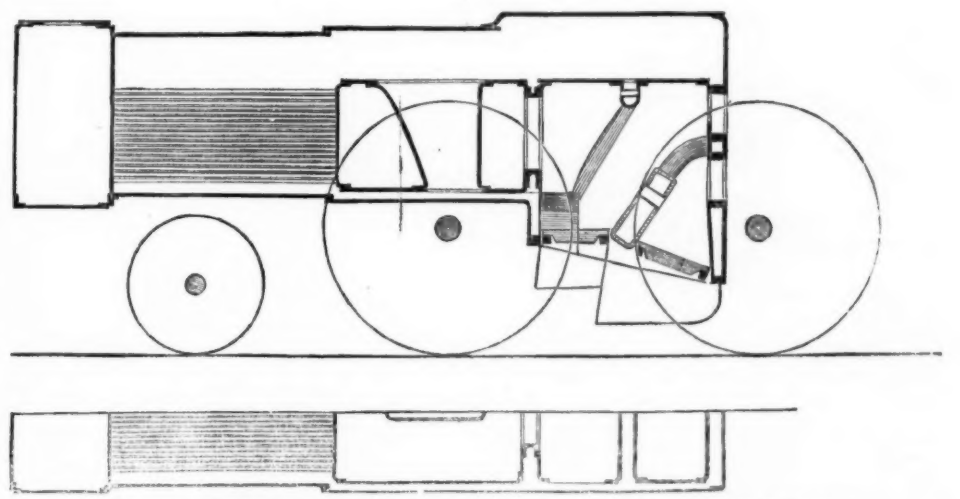


Fig. 7 is a longitudinal section and half-plan of Mr. Beattie's patent, as used on the London and South-Western.

Showing that, with the system of steam-inducted air currents forcibly mixed with the gases, better combustion was obtained and less coal used with a heavier train than by any of the others.

In the working of goods trains similar results followed, as will be seen by the following tables:—

	Gross weight. Tons.	Per mile.	Per ton gross.
Mr. Douglas	445	60·3	or ·135
Mr. Connor	255	37·3	,, ·147
Mr. Frodsham	228	41·5	,, ·182
Mr. Clark	305	39·6	,, ·130

The Great North of Scotland line, on which Mr. Clark's system of smokeless coal-burning is in full operation, all the engines being fitted with it has long gradients, several varying from 1 in 100 to 1 in 150, with frequent curves; and the goods engines could take up these inclines 35 full loaded wagons = 460 tons gross weight, at ten miles per hour. Mr. Cowan, the locomotive superintendent, in speaking of the plan, says, "Should any person wish to see it working they may travel on the engine for a week, and satisfy themselves that smoke consumption is a fact accomplished really and true, and by simple means. Its application as a damper whilst standing is a feature peculiar to this system alone, and of the utmost importance in practice. It is used here daily for that purpose. By the use of it

properly an engine could be kept standing twelve or more hours, and the steam not vary a pound up or down, and yet in three minutes the engine would be in readiness for any train. By its use an engine with a full fire unexpectedly stopped on the road can be easily managed." It may be remarked that Mr. Cowan had personally examined and tried all the systems of locomotive smoke prevention in use, and unhesitatingly adopted this in preference to all the others, it being so simple and efficient. I have had numerous opportunities of examining and travelling on engines fitted with most of the plans for smokeless coal-burning, but I must say that none of them in my opinion come up to that of D. K. Clark, which system is distinguished above all others by its simplicity, durability, efficiency, and simple management.

Fig. 8.

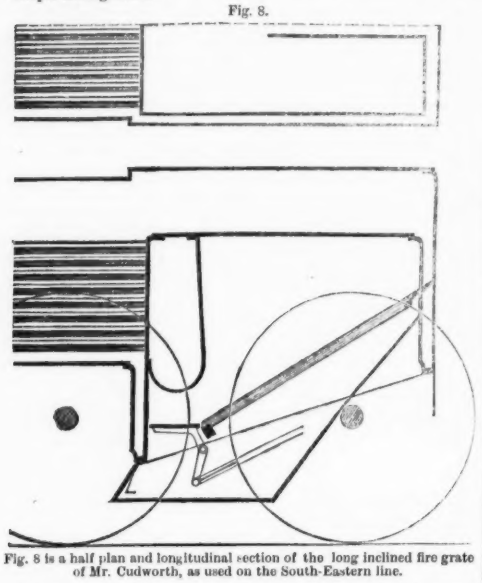


Fig. 8 is a half plan and longitudinal section of the long inclined fire grate of Mr. Cudworth, as used on the South-Eastern line.

It has no construction of any description within the fire-box, and is not therefore subject to wear and tear from exposure to intense heat; and although it commands the entire range of the fire-box, it does not in any way interfere with or cause extra labour in the management of the fire. The whole business of smoke prevention by its use consists in occasionally causing the induction jets (which are placed sufficiently above the fire to command it at all times) to operate by means of a tap or cock near the hand of the engine driver, and an occasional help from the ring jet in the chimney to carry off the products of combustion. By the proper use of this system the fire may be "damped" or kept dull when desired. When, for example, an engine has to wait at a station, without raising the pressure of the steam, as the forcible indraught above the fire is made to prevent a draught through the fire, and thus check or suspend the combustion of the fuel, conducing both to safety and economy, and contrasting favourably with the other systems, in all of which, as before remarked, a powerful blower is needed when standing, incurring thereby dangerous pressure and a waste of steam. It only needs trying, or to be seen in operation by unprejudiced persons, to secure its use wherever it is really desired to burn coal without smoke.

Fig. 11.

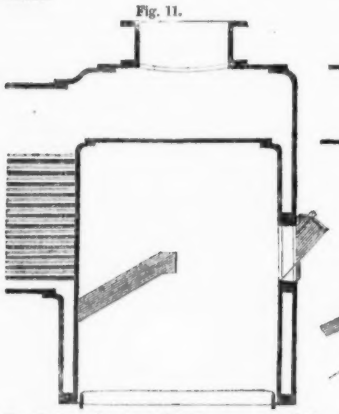


Fig. 11 shows the plan of Mr. Connor, as used on the Caledonian line.

Fig. 9.



Fig. 9 shows the plan of Mr. Douglas, as used on the Birkenhead line.

In conclusion, I would strongly recommend that, whatever plan the owner of a furnace may choose to adopt, he should feel it incumbent on him, especially for his own pocket's sake, to apply either to the patentee or owner of such plan, or else to the agent, in order that the proper carrying out of the erection or alteration may be secured, and that the necessary instructions given may be precisely followed. This is due, in common fairness, to the party whose plan may be followed, because it is found that, either from want of thoroughly understanding the principle, or else from the idea that an improvement may be introduced, many good and simple arrangements have utterly failed, and the interests of the inventor or proprietor have been thereby seriously damaged.

Fig. 10.

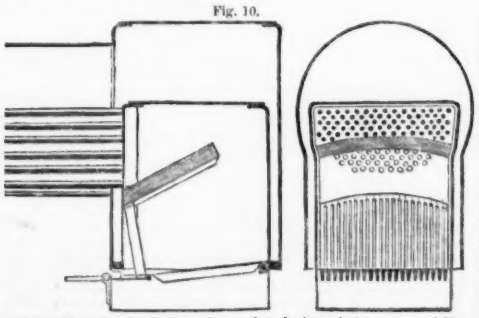


Fig. 10 is a longitudinal section and end view of the system of Mr. Yarrow, on the Scottish North-Eastern.

It has been usual to consider Watt as the first or earliest inventor of a furnace to consume its own smoke, and possibly this may be correct in so far as it relates to steam engine furnaces. In the seventeenth century, however, it appears that apparatus for this purpose was employed in many manufactories in France. In the volume of the Academy of Sciences for 1699 some experiments are given of a M. de la Hire, which have reference to an invention made many years previous by M. Delasme, a French engineer. This latter gentleman, we are there told, exhibited his furnace for consuming its own smoke at the fair of St. Germain, in the year 1685.

"1772, John Aysel, London, 'Improved furnace.'

"1785, R. Cameron, 'Furnaces for consuming smoke.'"

Fig. 12.

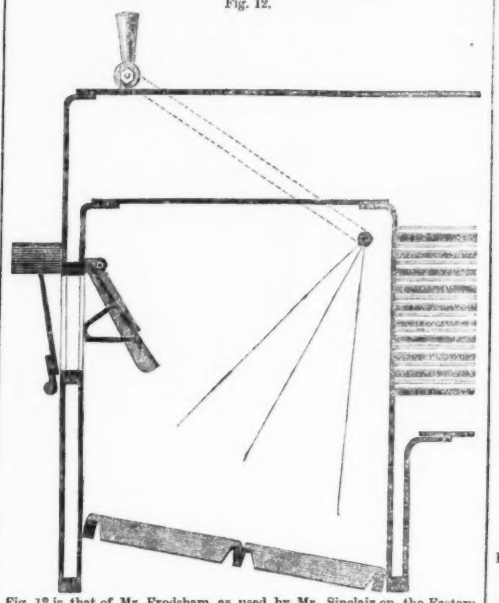


Fig. 12 is that of Mr. Frodsham, as used by Mr. Sinclair on the Eastern Counties.

In June, 1785, Watt patented several modes of consuming smoke in furnaces, many of which have been repatented of late years, such, for example, as passing the smoke and gases from one fire over the bright coals in another, causing the gases and smoke from the fresh fuel to pass through very hot funnels or pipes, or among, through, or near fuel which is intensely hot and has ceased to smoke, and by mixing it with fresh air under these circumstances.

Fig. 13.

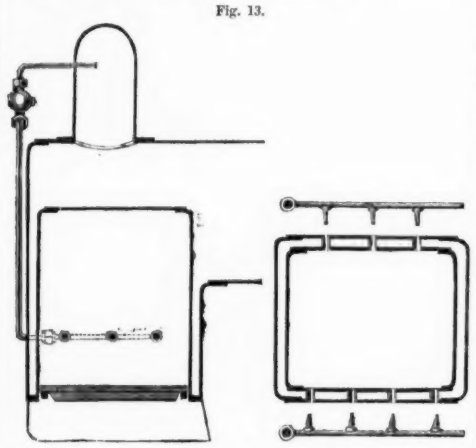
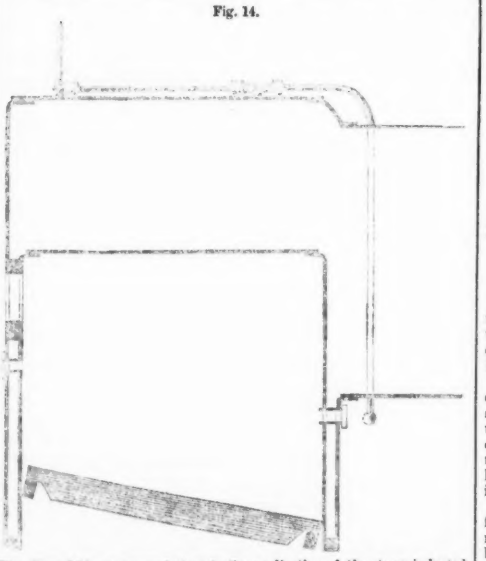


Fig. 14.



Figs. 13 and 14 are two variations in the application of the steam inducted air currents, as patented by Mr. D. K. Clark, Fig. 13 resembling that on the Great North of Scotland line, as used by Mr. Cowan.

In 1796 a Mr. Thomson, of London, patented the hanging bridge or brick arch, and the admission of air through a slit or opening behind the bars, regulated by dampers, nearly similar to Park's split bridge.

"1796, J. Pepper, Newcastle, 'Saving fuel.'

"1796, F. Lloyd, Woolstanton, 'Furnace.'

"1797, J. Grover, Chesham, and T. Rountree, London, 'Furnaces.'

"1798, W. Rayley, York, 'Furnace.'"

In 1813 Benjamin M. Coombs, of London, patented, and in 1819 described, "Plans for saving fuel and suppressing smoke," in which a feed hopper and crushing rollers were used, the grate raised or lowered by means of rackwork, and air admitted to the fire by flues at the front and sides.

In July, 1815, William Losh, of Newcastle-on-Tyne, obtained a patent in which he proposed dividing the furnaces into two: in one case they are placed side by side, and the smoke from the fresh fire in one turned by means of dampers over the other bright one; and in the second they were placed end to end, and by means of doors fitted to the ash-pits and dampers the smoke is driven into the ash-pit, and out through the coals in the clear fire.

In 1816 Joseph Gregson obtained a patent for improvements in furnaces, and preventing smoke, which consisted of an opening in the fire bridge, through which a current of air was admitted.

In 1816 W. Brunton, of Birmingham, patented his well-known circular revolving grate, with feed rollers for crushing the coal on its way to the fire. This plan was brought up again in 1819 by John Steel, of Dartford.

In 1819 John Walker, of Kennington, described to a committee of the House of Commons his plan of burning coke alone in fires with additional flues.

In May, 1820, Josiah Parkes, of Warwick, patented his plan of admitting air from the ash-pit into a hollow bridge, thereby projecting it in a sheet upon the gases and smoke at the back of the fire.

In December, 1820, John Wakefield, of Manchester, patented his particular mode of placing checks or stops in the flues of the furnaces, and also placing the bars "radiantly," or closer together in the front than in the hinder part.

Fig. 15.

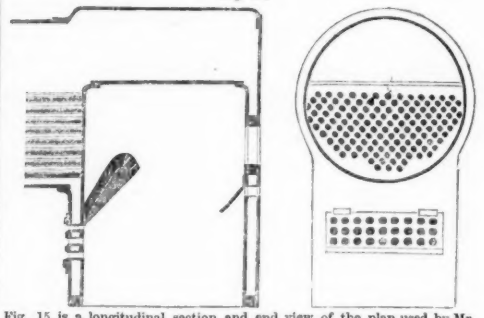


Fig. 15 is a longitudinal section and end view of the plan used by Mr. Jenkins on the Lancashire and Yorkshire; the curved slab shown inside the fire-box was originally made of cast iron, but I believe, from their rapid destruction, they are now made of clay.

In February, 1821, William Prichard, of Leeds, patented the use of a cylinder and piston, with a branch pipe between the two ends of the cylinder, allowing a quick or slow passage of the air according to the adjustment of a stop-cock. A chain from the piston-rod passed over a pulley, and was connected with the fire-door, which, by the sinking of the piston as the air escaped, shut the door gradually without the aid of the fireman. Here we have a self-regulating door as nearly as possible that of T. S. Prideaux's, patented many years after.

In March, 1822, George Stratton, of London, patented a plan for heating a boiler by means of two fires—one in front, and the other under the middle of the long boiler, both being fed with coal by feeding pipes passing downwards through the boiler.

In July, 1822, John Stanley, of Manchester, patented his self-feeding apparatus, consisting of a hopper containing the coals, at the bottom of which were placed two grooved rollers to crush them, a plate on which they fell, and revolving fans to scatter them over the fire, the whole being moved by the engine or other power. This plan it will be seen is very similar to Steel's, Brunton's, and others.

In September, 1823, James Neville, of London, patented the use of a fan placed in a recess in the furnace flue, to be turned at a rapid rate by the engine or other power, and force the smoke and hot air up the chimney, fresh air being drawn in through perforated plates in the cross flues, and thus consume the smoke.

In 1824 Mr. Jeffrey, of Bristol, patented a plan for preventing smoke by causing a down draught through a shaft in which a constant shower of water was falling, so that he condensed it.

Fig. 16.

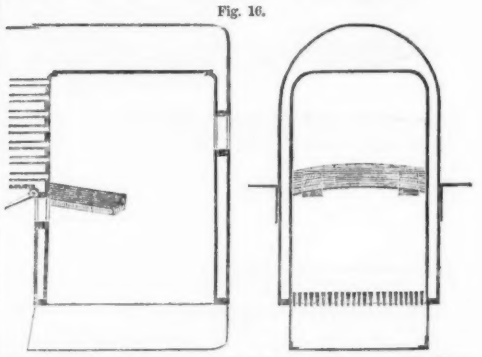


Fig. 16 is a longitudinal section and end view of the plan of Mr. Ramsbottom, of the London and North-Western Railway, in which air enters the fire through two large square apertures in the front of the box under a brick arch fitted with dampers to regulate the quantity.

In the same year George Chapman, of Whitby, introduced hollow fire-bars, open at the front ends to the atmosphere, and opening at the back end into a slit about an inch wide in the fire bridge, which opening inclined slightly forward, so as to reverberate the air back in the fire. (This plan of bridge is similar to Park's split bridge.)

In the same year R. Evans, of London, used a tube perforated at one end with small holes, and at the other connected with the waste steam pipe of the engine. He placed the end with the small holes under the fire-bars in the furnace, and by means of the jets of steam endeavoured to kill the smoke. He eventually found, however, that with the use of coke and strong steam he succeeded better, as he maintained an active combustion. I may here remark that blowing a jet of steam under the fire is now used in several gasworks.

In 1826 James Barron, of Birmingham, patented a plan of feeding furnaces without opening the fire-door, and causing all the air required for combustion to pass through the bars. This was done by means of a large vertical tube nearly over the furnace, through which, by a self-acting arrangement, the fuel dropped on the fire at stated intervals.

In the same year Mr. Jacomb, of London, patented a revolving grate, or cage, in which the coal was burnt, and this was applicable for domestic purposes also.

In 1828 James Gilbertson, of Hertford, patented a furnace to consume its own smoke, in which the air was heated by passing between hollow plates fixed at the side of the fire, and thence into a cavity at the back of the fire, where it ascended through a grating above, and came in contact with the smoke, thus causing it to ignite.

In June, 1831, Samuel Hall, of Moorgate-street, obtained a patent for the use of heated air supplied to furnaces for the purpose of consuming the smoke, which air he heated by causing it to pass through a number of cast iron pipes placed in the flue leading to the chimney, so that it might employ that portion of the heat which had not been used in raising steam.

In September, 1834, John Chanter, of Blackfriars, London, obtained a patent for various improvements in boilers and furnaces, which consisted in gradually drying and preparing the coal in the furnace, so that the liberated gases were burnt in the hottest part, air being supplied by means of a tube under the first fire-grate in the centre of the furnace, two grates being used in this plan.

In June, 1836, John Hopkins, of Clerkenwell, obtained a patent, in which he set forth the use of a fire bridge of a curved form, intended to arrest the heat and flame, together with the smoke, and throw them back from the end of the furnace, and cause them to pass again over the surface of the burning fuel. In marine engines, and others where desirable, it was proposed to construct the bridge of metal, and hollow, and also connected with the main boiler.

In February, 1838, a patent was granted to Michael Wheelwright Ivison, the principle of which consisted in the discharge of a very small quantity of steam, not through the fuel or down upon it, but above the fuel in the furnace, and through the products of the fire.

In August, 1838, Richard Rodda, of St. Austle, Cornwall, patented the employment of fire-brick passages strongly heated, through which the smoke, having passed through the fire, was made to pass. The smoke was previously mixed with a due proportion of atmospheric air, admitted through a valve or box over or near the fire-door, which valve was opened or shut as the gases required.

In the same month of the same year David Cheetham, jun., of Stalybridge, patented the use of a fan placed in such a position as to catch the most inflammable portion of the gases, and propel them with a certain proportion of atmospheric air into a close ash-pit, so as to cause it to pass through the fire.

In October, 1838, Paul Chappé, of Manchester, patented the injecting of a sheet or numerous small jets of boiling water over the fire in front of the bridge, by which he intended to effect the combustion of the smoke (and possibly the extinction of the fire). He also proposed a similar jet to be projected at either end of the flues, or in the chimney, the water to be supplied by means of pipes from the boiler.

In November, 1838, James Drew, of Manchester, patented the use of fire-bars in two sets, the front half being laid on fixed bearers in the usual manner, and those at the back on a frame capable of being raised or lowered by means of rackwork or otherwise. The front bars received the fresh fuel, which, as soon as red-hot and charred, was to be pushed into the second or movable set of fire-bars, and raised as near as might be desired to the bottom, the smoke from the fresh fuel being burnt in passing over the fire on the back grate.

In February, 1839, Thomas Hall, of Leeds, patented the division of furnaces and alternate firing precisely as Losh had done in 1815.

In June, 1839, Charles Wye Williams, of Liverpool, patented his Argand furnace, which consisted in the use of pipes or plates perforated with numerous small holes, and placed either in the furnace, or so near it that the air entering in a finely divided state amongst the gaseous products of the furnace would, by commingling with them, produce more complete combustion, and thus prevent smoke. This plan was originally introduced by a Mr. Stoddart, of Glasgow, in the year 1827, but abandoned in consequence of its having been found to damage the boiler.

In August, 1839, Richard Prosser, of Birmingham, patented a plan in which he used a hanging bridge (similar to those of Chanter and Rodda several years before), placed some distance from the ends of the fire-bars; the gases were thus obliged to pass through flues or openings in the bridge to a chamber beyond, and thence to the chimney; the space between the end of the bars and the bridge was fire-brick, forming an inclined plane on which the hot fuel was to be pushed, keeping them hot and burning the smoke.

In November, 1840, André Kurtz patented a plan for consuming smoke by placing the bars in a peculiar position in the furnace, using three sets, and inclining those at each end towards the middle set, which were horizontal and lower than the two ends of the furnace. He placed these bars on hollow bearers open to the ash-pit, and connected with apertures in the furnace. There were air passages closed by doors, and only opened occasionally to clean the flues, the fire-doors being shut, and the ash-pit also closed, except a slight opening for air, which, rushing through the hollow bearers and becoming heated, was expected on entering the furnace to prevent the formation of smoke.

In January, 1841, Edward Foard, of Islington, patented a plan in which the furnace was supplied from below, the bed or frame carrying the bars being lowered while the red hot fuel in the furnace was supported by a sliding plate or false bottom; the plate was then withdrawn, and the smoke mixed with air rising through the bright fuel was, it was thought, consumed.

In February, 1841, the Baron von Rathen, of Hull, patented his undulating fire grate, in which the bars were double or hollow, resting on bearers, with steps, thus ascending or descending, forming two sides of a triangle, including spaces or hollows in which the fuel was placed. He thus enlarged the area of the contact of the air with the coals. He also proposed to use a coal feeder placed over the dead plate having a movable door, with a lever projecting outside by which the fireman could shake the coals forward, so as not to open the fire-doors; air bars on the side of the fire-grate, so as to let a small portion of the air outside enter the close fire-box; and two ash grates with small round bars one over the other, on which the ashes and hot cinders from the upper grate were to fall, so as to prevent the cold air rushing up in a mass to the large fire, and thus warm on its passage.

In November, 1842, John Cooper Douglas, of London, patented a plan by which the gases were to pass over a bridge under another bridge into the space beneath another set of fire-bars, whence they were to pass off, burning the smoke by passing through the second fire. This was before done by Losh in 1815, and others since.

IRON SHIPS AS TRANSPORTS TO INDIA. — A correspondence has taken place between Mr. John Laird, M.P., and Mr. T. G. Baring, relative to a prohibition laid by the Government authorities in India, on sanitary grounds, against employing iron vessels as troopships within the tropics when wooden ones can be had. In this correspondence Mr. Laird urged that iron steamers have been extensively used as transport ships by Government, with the most satisfactory results, and also that Government has several iron troop ships of their own, and are now building two of large size. He therefore requested that the prohibition should be removed, and that the owners of iron ships be permitted to tender for conveying troops the same as the owners of wooden ships, class for class. The result has been an expression on the part of the Commander-in-Chief that his Royal Highness is of opinion that the owners of first-class iron ships should have the opportunity of tendering for the conveyance of troops equally with the owners of wooden vessels, the object being to procure the best ship, in every particular, for the accommodation of troops.

WANTED A PEN.—What a pen is to be made of is still unsettled. The quill, the steel pen, and the hard nibbed gold pen have their several advocates, and are largely used; but still every one complains that he is not suited; nothing that is good and cheap lasts. Various contrivances have been adopted for keeping steel and corrosion apart. Pens have been galvanised on Davy's plan for protecting the ship's copper, but not with good effect. Washes of all kinds have been applied; the latest we have seen being of gutta-percha, with the very improper name of the "gutta-percha pen." Glass has been tried, but has not come into use. A correspondent informs us that he strongly suspects that simple gold, without any hard nib, is the true material. When his nibs have come off, whether by wear or accident, he grinds the gold ends in an unskilful way into something like a practical form. He thus produces a rough pen, which is so durable that he thinks the manufacturers would do well to turn their attention to the imitation of a quill in gold. The metal is to be excessively thin, and our correspondent suspects that the best imitation of a quill would require so little gold that a pen might be sold for 1s. This pen, he thinks, would last for six months at least, even in the hands of a reviewer. At any rate, it is worth while to repeat from time to time the complaint that the world in this prodigiously-puffed and loudly applauded 19th century is still without a pen.—*Athenæum.*

INSTITUTION OF CIVIL ENGINEERS.

May 13 and 20, 1862.

JOHN HAWKSHAW, Esq., President, in the chair.

THE first paper read was "The Malta and Alexandria Submarine Telegraph Cable," by Mr. H. C. Forde, M.I.C.E.

It appeared that in May, 1859, her Majesty's Government determined that a telegraph cable should be laid between Falmouth and Gibraltar, and the late Mr. Lionel Gisborne and the author were appointed joint engineers. Subsequently, and after some progress had been made with the construction of the core and the outer covering, it was proposed to use the cable to join Rangoon and Singapore. This idea was, however, abandoned, and in January, 1861, it was decided that it should be laid between Malta and Alexandria, an operation which was carried out in the summer of that year, the communication having been successfully completed on the 28th October, 1861.

The recommendations of the late Mr. R. Stephenson and Sir Charles Bright, as to the form and size of the cable to be used between Falmouth and Gibraltar, were then referred to; and it was stated that iron covered cables, of three sizes, were designed for the varying depths up to 600 fathoms, and for the greater depths across the Bay of Biscay, a cable covered with twelve steel wires, each enveloped in a hempen strand, laid in a spiral form. The latter was abandoned when the destination of the cable was changed; but the other forms of outer covering were retained, as considerable progress had been made with their manufacture. If it had been known at first that the cable would be laid in comparatively shallow water a different design would have been adopted. The outer wires were much larger than those of the Atlantic, the Red Sea, and the other Mediterranean cables containing a single conductor, and the conductor was nearly four times the size of the Atlantic cable, and twice that of the Red Sea cable.

The contract for the manufacture of the core was entrusted to the Gutta Percha Company; the contracts for the outer covering, and for laying and maintaining the cable for thirty days after completion, were let to Messrs. Glass, Elliot, and Co. The conditions of the contracts were then given in detail, the main features being that the core and the cable were to be kept continually under water, during the manufacture and the laying, and that the electrical tests were to extend from the commencement of the manufacture until thirty days after submersion of the whole line. The different processes involved were next described, and it was stated that under a pressure of from 600 lb. to 800 lb. the electrical condition of the core improved about 10 per cent. The relative resistance per knot, both as to conduction and insulation, of the Atlantic, the Red Sea, and the Malta-Alexandria Cables, was represented by the numbers 1, 4, and 37. It was requisite that great care should be observed in making the joints of the core, of which there were four thousand two hundred in the Malta-Alexandria line, as the slightest imperfection in any one would be attended with danger.

A difficulty having arisen in keeping the cable permanently under water, one portion became exposed to the air, and was allowed to dry. When tested a loss of insulation with increased resistance in the conductor was observed. An investigation by Dr. W. A. Miller, F.R.S., showed that this deterioration was due to heating, from the effects of oxidation. It was consequently resolved that the original idea of fitting the two ships with water-tight tanks should be carried out. The way in which this was accomplished, and the manner of coiling the cable on board, were then alluded to. The eye of each coil was fitted with an open framework of timber, by which arrangement a fault was cut out of the centre of a large coil, without its being necessary to uncoil the whole cable, as would have been the case with a solid eye.

Previous to commencing the operation of laying the route was most carefully surveyed by ships of the Royal Navy, when it was ascertained that the Admiralty charts were in parts incorrect in latitude, and were deceptive as to the soundings, the general depth and the conformation of the sea bottom being very different to what they were represented to be on the official charts.

Each ship was fitted in the following manner:—A large V sheave, furnished with a small friction band, was suspended above the centre of the hold, and over this the cable was led. The paying-out apparatus, placed on one side of the stern, consisted of three V sheaves, in one vertical plane, and parallel to the centre line of the vessel, each sheave being provided with a friction strap. The cable was passed over these sheaves under three weighted jockey pulleys, to the brake drum, round which it took three or four turns; then over a fixed sheave, and under a movable weighted pulley, into the sea over a fixed stern-wheel at the level of the last sheave. The dynamometer employed was similar to that used on the occasion of the successful laying of the Atlantic cable.

The first portion of this line was laid between Malta and Tripoli, the greatest depth being 420 fathoms. The cable was paid out at an average rate of 4·94 knots per hour. The maximum strain to which the heavy shore-end was subjected was 20 cwt., but with the main cable this did not exceed 12 cwt. The estimated slack paid out in the deep water was not quite five per cent. No difficulties of any kind occurred until attempts were made to splice the main cable to the Tripoli shore-end, which had been laid by another ship. Nine unsuccessful attempts were made, owing to bubbles forming under the fresh gutta-percha, but by cutting off a length of 25 fathoms of the shore-end a perfect junction was effected. The remaining cable on board this ship was laid in the direction of Benghazi, the maximum depth attained being 150 fathoms, the average speed of paying-out 5·3 knots per hour, and the greatest strain 9 cwt. The cable next laid was part of the third section, commencing at Alexandria, and extending nearly 300 miles to the westward, towards Benghazi. The roughness and irregularity of the bottom rendered this operation very critical; but by carefully selecting and laying out the route to be pursued, after accurate soundings had been made, and by only paying out in daylight, it was successfully completed. Six days were occupied in laying 128·8 knots of heavy cable and 153·32 knots of main cable, or a total length of 282·12 knots. Thirty-two buoys were laid down to mark the route, and upwards of sixty different courses were run. The maximum depth of water was 102 fathoms, the minimum, for a short length, was 13 fathoms, and the average 33 fathoms. Subsequently the second part of the third section between Alexandria and Benghazi, and the second part of the second section between Benghazi and Tripoli were laid, and the communication was established. No accurate estimate could be made of the actual slack paid out, but, as a general rule in depths under 100 fathoms, from 2 to 2½ per cent. was the utmost that could be got out of the ship when the cable was running quite free. The angle at which the cable was paid out ranged from 40 deg. to 45 deg. The maximum speed was 7·15 knots, the minimum 4·5 knots, and the mean 5·25 knots per hour.

Respecting the tests during and after the laying, it was observed that as the cable was paid out, its electrical condition invariably improved; the highest resistance being found in the deepest and coldest water, and the lowest in the shallowest and warmest water. Experiments as to the rate of working showed that the speed attained agreed very nearly with that which had been anticipated, namely, five words per minute through a length of 1,100 knots, except through the short sections, where the limit of the speed depended simply upon the skill of the clerk.

The communication was accompanied by a map, showing the general course of the cable, by a longitudinal section of the sea bottom, and by diagrams of the electrical tests. Specimens of different cables were also exhibited.

THE second paper read was "On the Electrical Tests Employed during the Construction of the Malta and Alexandria Telegraph, and on Insulating and Protecting Submarine Cables," by Mr. C. W. Siemens, M.I.C.E.

Having been employed by her Majesty's Government as the electrician to superintend the manufacture and shipment of the Malta and Alexandria Telegraph Cable, the author was in a position to speak as to its actual state of insulation, at different stages of its progress, and as to its general superiority compared with former lines. The methods of testing differed essentially from those previously resorted to. This was the first line that had been tested systematically throughout; and the importance of a uniform and well-devised system of electrical tests being carried on during the manufacture, shipment, laying, and subsequent working of submarine cables, had been fully proved.

The covered strand of conducting wire, in lengths of one nautical mile, was placed for twenty-four hours in tanks filled with water maintained at 75 deg. Fah. It was afterwards removed into a pressure tank, containing water at the same temperature, and when uniformly heated it was tested for conductivity and insulation, and the result, expressed in units of resistance, noted. A pressure of 600 lb. per square inch was then applied, and the electrical tests were repeated. Before any coil was approved it was required that the copper resistance should not exceed 3·5 (Siemens) units, or possess 80 per cent. of the conductivity of chemically pure copper; that the gutta-percha resistance per knot at 75 deg. should amount, at least, to 90 million units, corresponding to about 80 per cent. of the highest insulation that could be obtained with the best gutta-percha of commerce; and further, that the insulation should improve when the pressure was applied, which was invariably the case when the covering was sound. The coils were then transferred to Messrs. Glass, Elliot, and Co.'s works at Greenwich, where they were submerged in tanks until required for the sheathing machine. The sheathed cable was coiled into large tanks, and was always intended to be covered with water, but owing to a defect in the construction of the tanks, this regulation could only be partially carried into effect. It was also intended, in the first instance, that the ships should be provided with water-tight tanks to receive the cable during the outward voyage; but owing to the passive resistance with which every deviation from previous routine was usually met, this plan was not carried out, until the heating of the cable on board the S. S. Queen Victoria had proved, at great cost, that tanks were essentially necessary. There were other important advantages obtained through the adoption of the water tanks by which the causes of failure in paying out were avoided, and the operation was rendered comparatively safe and easy.

In conducting the electrical tests of the Malta and Alexandria cable in the course of its manufacture the chief object was to obtain throughout strictly comparative results. For this purpose it was necessary to adopt a standard measure of resistance, by which to express both the conductivity of the copper conductor and of the insulating covering, This standard measure had been supplied by Dr. Werner Siemens. The unit of resistance was that of a column of pure mercury, contained in a glass tube, one metre in length between the contact cups, and of one square millimetre sectional area, taken at the temperature of melting ice. As the testing apparatus had been already described in the Blue Book "On the Construction of Submarine Cables," it was not necessary to repeat it. In the appendix to this paper tables were given of the results of observations upon two sections of the cable, at various stages of their progress, between Malta and Tripoli, and between Tripoli and Benghazi; and diagrams were exhibited representing graphically these results. On comparing the insulation of the cables after being laid down, with the insulation observed shortly before on board ship, there was a decided improvement after submersion. This was partly due to the pressure upon the cables, the insulation improving 2 per cent. on an average for every 100 lb. of pressure upon the square inch, and partly to the lower temperature at the bottom of the sea.

For working the line Messrs. Siemens, Halske, and Co. had supplied ink-recording instruments, fitted with peculiar arrangements for discharging the residuary charge of the cable, and capable of being worked by exceedingly feeble battery power. Although the line was divided into three electrical circuits, messages were transmitted mechanically and instantaneously, at the intermediate station, by a system of double relay, or translation. By this plan messages could be sent instantaneously from London to Omsk, in Siberia, and there would be no electrical difficulty in establishing the same direct intercommunication between London and Calcutta.

Respecting the construction of a cable of a more permanent character than any hitherto made, to which the author had given much consideration for many years, it was observed that with regard to the insulating covering nature seemed to have provided only two suitable substances, india-rubber and gutta-percha, combining permanent pliability at all ordinary temperatures, with high insulating property. India-rubber had a higher insulating power, a lower specific induction, and was capable of resisting higher temperatures than gutta-percha; but the latter could be put upon the wire in a plastic state by a dye process, and gave greater security against faults than the lapped india-rubber covering. It was also less liable to receive accidental injuries, to become sticky or semi-fluid when exposed to the atmosphere, and resisted the action of water more perfectly.

The absorption of water by gutta-percha, india-rubber, and compounds of india-rubber, such as vulcanised india-rubber, Wray's mixture, and a compound with mica, under various pressures and temperatures, and from water containing different degrees of salt in solution, had been fully investigated. These experiments served to show that an increase of pressure up to 50 lb. per square inch did not increase the rate of absorption, which was found to be more rapid from pure water than from sea water, and from sea water than from brine. Raw and unvulcanised india-rubber absorbed water in greater quantities than the other materials; while, next to gutta-percha, vulcanised india-rubber showed, both in fresh and salt water, the greatest insensibility to absorption.

The results of experiments on the insulating and inductive capacities of wires coated with india-rubber, in combination with gutta-percha, compared with those of special gutta-percha and pure india-rubber at different temperatures, were then given. The lengths experimented upon varied from 600 to 2,500 yards. The specific resistance of special gutta-percha decreased from 9·11 at 50 deg. Fah. to 1·50 at 80 deg. Fah., or to about one-sixth of its original value; while the combination of india-rubber and gutta-percha had, under the same circumstances, only gone down to about one-third of its insulation at 50 deg. Fah. The inductive capacity of the combined india-rubber and gutta-percha wire, and of pure india-rubber covered wire, was as 0·7 to 1. Notwithstanding the comparatively high insulating property of india-rubber, its low inductive capacity, and its power to resist heat, its gradual dissolution in sea water was a circumstance which alone rendered it inadmissible for submarine wires, unless it was securely enclosed in another waterproof medium, and gutta-percha appeared, in every respect, well suited for such outer covering. It was desirable that the india-rubber should be brought upon the wire without the application of heat, or solvents, both of which often entailed a gradual decomposition of that material, particularly when exposed to atmospheric influence in contact with copper. Dr. W. A. Miller had stated that the liquefaction was the result of a process of oxidation, from which it might be inferred that the effect could not take place where oxygen was excluded. It, moreover, was important to produce a perfectly cylindrical covering, and taking advantage of a peculiar property of india-rubber cohering perfectly where two fresh cut surfaces were brought together under considerable pressure, the author had constructed a covering machine which fulfilled the several purposes. Such combined india-rubber and gutta-percha covered wires had been tried under various circumstances, exposed to the atmosphere, to water or the moisture of the ground, for nearly two years without betraying any signs of gradual deterioration of the india-rubber, or the appearance of faults. A circumstance greatly in favour of the bi-covered wire was that the gutta-percha shrank upon the india-rubber covered wire, and when any mechanical injury to the covering occurred the yielding india-rubber was forced into the gap by the elastic pressure exercised by the gutta-percha, and prevented the appearance of a fault.

The outer covering of cables, as hitherto constructed, was certainly the least perfect part. An iron sheathing was very necessary to protect the insulated core in shallow waters, but for cables in more

than thirty or forty fathoms of water the iron sheathing was an element rather of weakness than of strength. It rendered the cable ponderous, its shipment expensive, the paying-out risky, and repairs impossible, owing to the difficulty of raising a heavy cable from a great depth under any circumstances, and the absolute impossibility of doing so after corrosion of the iron wire had made some progress.

When the Falmouth and Gibraltar cable was first contemplated the author, in conjunction with Mr. Forde, proposed to cover each iron wire with gutta-percha, with a view to prevent oxidation; but the system was not acted upon, except by way of experiment. Mere protection of the wire was, however, not sufficient in the author's opinion. It was capable of mathematical demonstration, that in paying out a wire sheathed cable, with a considerable strain upon the breakwheel, it would untwist while in suspension in the water, to a considerable extent, causing elongation of the core to the amount of say 1 per cent., or even more. On reaching the bottom, the strain and consequent twist would be released. Copper wire could not be elongated more than 2 per cent. without receiving a permanent set; and it was also a well ascertained fact, that when telegraph core had been stretched at any time beyond the limits of elasticity of the copper, the latter, being henceforth too long for the more elastic covering, would tend to assume a serpentine form, and to push its way through the insulating material by slow degrees, particularly in places where short bends or kinks occurred.

Based upon these views, the author designed a sheathing of the following description:—The insulated conductor, or core, was passed in the sheathing works through a series of three machines in close succession. In passing through the hollow spindle of the first machine a close spiral covering of hemp, previously saturated in Stockholm tar, was applied in such a way that each string was and remained under a given strain. The second machine was similar in construction to the first, but supplied a second covering of hemp wound in the opposite direction to the first. The rope thus formed passed next through a stationary clip, with longitudinal grooves to prevent it from turning round in the operation immediately following, which consisted in the application under the influence of great pressure, of from three to six strips of copper, or other metal, which might best resist the action of sea water. These strips were accurately guided into the revolving covering tool, so as to overlap each other equally for nearly half their breadth, the pressure applied being sufficient to crush or socket the one metal down where it was covered by the other. This cable had no tendency to untwist; its extension, with half the breaking strain upon it, did not exceed one-half per cent., and being very strong, and of only double the weight of water, it would support about eight miles of its own weight in the sea.

Considering that good ship's sheathing lasted about ten years when the ship was at rest, and that the cable had two layers of metal, with hardened tar between, it appeared not unreasonable to suppose that this sheathing would last at the tranquil bottom of the ocean from twenty to thirty years at least. Several short lengths of this cable were now being tried, under various circumstances, and the results, so far, were promising of success upon a larger scale.

After the meeting Mr. F. C. Webb (Assoc. Inst. C.E.) explained a modification of the ordinary sextant, by which larger angles could be measured than with the instruments now in use. Two sextants (by Messrs. Fletcher, of Leadenhall-street) were exhibited, one on the common arrangement and the other on the modified principle.

It was stated that when the arm of the common sextant was at zero the lines of incidence and of reflection of an object seen in the horizon glass, formed a certain angle with one another, both at the object and horizon glass, and that this angle, termed the constant angle, deducted from 180 deg., gave the extreme theoretical angle which could be measured. Practically this measurement was still further reduced, by the limits within which it was possible to reflect an object from a plane surface with accuracy, and which, if assumed as 170 deg. instead of 180 deg., would give the angle from which the constant angle must be deducted to obtain the extreme angle capable of being measured. The smaller the constant, therefore, the nearer would this angle approach 170 deg., with a given amount of accuracy. It was observed that this constant angle was dependent on the relative position of the object glass, the eye piece, and the horizon glass, and was, in fact, the angle formed by a line drawn from the eye piece to the centre of the horizon glass, with a line drawn from the centre of the horizon glass to the centre of the object glass.

The reduction of this constant angle to a minimum was effected in the modification alluded to by placing the eye piece very near to the object glass, and the horizon glass as far as possible both from the object glass and the eye piece. The extreme angle capable of being measured was thus considerably increased, and with conditions more favourable to accuracy; for whilst the angles of incidence and reflection in the object glass were not smaller than in an ordinary sextant, those in the horizon glass were constantly larger.

With a given angle to be measured the conditions were more favourable to accuracy, since the lines of incidence and reflection formed larger angles with the reflecting surfaces, both in the object and the horizon glasses.

In marine and land surveying, and in taking altitudes of celestial objects with an artificial horizon (where the angle to be measured was double the altitude), this increase in the capabilities of the instrument was, it was believed, a manifest advantage.

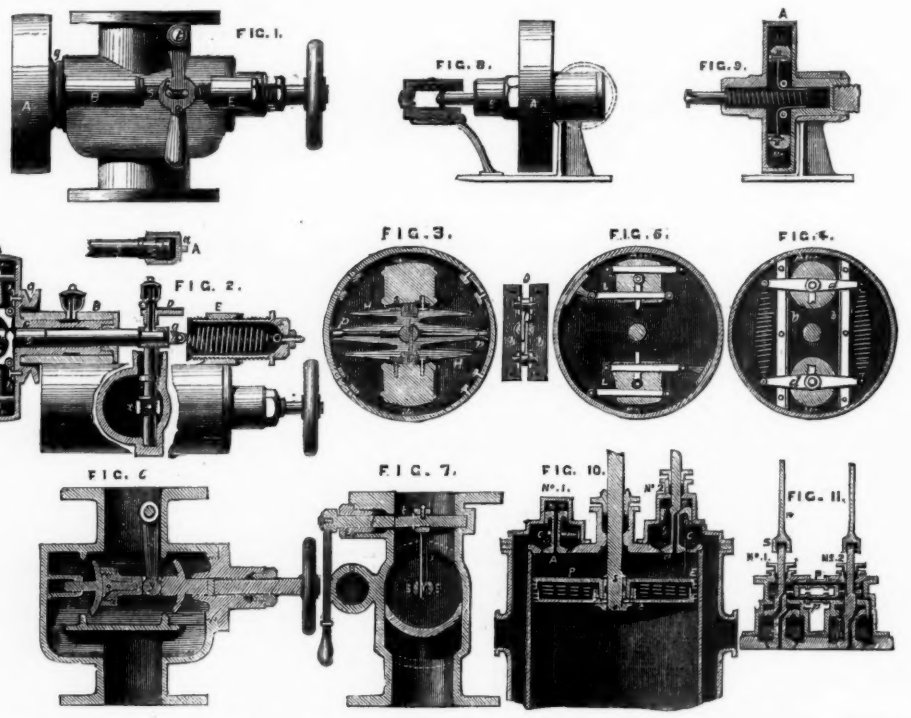
NEW WESTMINSTER BRIDGE.

The east half of this work was opened for public traffic on Saturday morning last. The new bridge has been in progress for several years, although the active work of construction dates hardly further back than 1859. The arches of the bridge are seven in number, each formed of seven ribs, which are of cast iron nearly up to the crown, where, to avoid danger from the concussion of heavy loads, they are of wrought metal. The arches vary in span from the smallest of 96ft., to the largest in the centre, of 120ft., and from a height above high water level of from 16ft. to 20ft. The materials used in the construction of the whole bridge have been 4,200 tons of cast, and 1,400 tons of wrought iron, 30,000 cubic yards of concrete, 21,000 cubic yards of brickwork set in Portland cement, 165,000 cubic feet of granite, and 46,000 cubic feet of timber. Its gradient is 12ft. lower than the old bridge, and its total width more than double; so that, while it lays claim to the honour, which few will deny it, of being the handsomest bridge over the Thames, it is also, size for size, by far the cheapest that has yet been built, costing per superficial foot less than half the price of any similar structure in London. The length, breadth, and cost of each of the metropolitan bridges have been as follows:—

	Length. ft.	Breadth. ft. in.	Cost per sq. ft. £ s. d.
London	904	53 6	11 6 0
Southwark	800	42 6	11 5 10
Blackfriars	994	42 0	3 15 6
Waterloo	1,380	41 6	10 0 0
Hungerford	1,536	13 4	4 16 6
Westminster, Old	1,160	43 0	7 16 0
Westminster, New	990	85 0	4 0 0
Vauxhall	840	36 2	9 16 0
Chelsea	922	40 0	2 5 0
Proposed new bridge at Blackfriars	980	76 0	3 5 0

Thus it will be seen that the new bridge is very nearly twice as wide as any of the bridges over the Thames. Within the parapets it is 84ft. 2in. Of this the footways occupy 28ft., the road for the light traffic 39ft., the tramways 14ft. 8in., and the space between them 2ft. 6in. The tramways consist of iron plates, bolted to timbers, and laid upon an elastic bed of cork and bitumen. The curb of the footway is formed of Ross of Mull granite; the footway itself is of Blachfield's terra cotta. It inclines towards the parapet with a fall of 1½in., and a gutter on each side carries off the water.

SHAW'S GOVERNORS FOR STEAM ENGINES.



This invention, by John Shaw, of Ferrol, Spain, has for its object the better regulation of the speed of engines when working under variable loads, and is applicable alike to marine, stationary, and portable engines. It consists in the combination of a small and highly sensitive governor with an equilibrium valve, in which special arrangements are made to reduce the friction of its working parts.

Fig. 1 shows a general view of the apparatus, A being the governor, which revolves in the circular bracket B, cast upon the valve-box, and whose spindle S acts upon the valve lever D, regulating thereby the flow of the steam, air, water, &c., through the valve. The plan of the governor is shown in Fig. 3. Two small weights *w*, *w*, are attached to flat springs H, which are secured to the inner periphery of the case A, as shown. When this case or pulley is made to revolve the spring transmits its motion to the weights *w*, and serves the double purpose of giving them motion and of resisting their centrifugal force. As there is no friction of joints to overcome, the slightest variation in the centrifugal force of the weights is met by a corresponding change of position in the spring; a highly sensitive equilibrium of the two forces being thus obtained, similar in principle to a spring balance. The governor pulley A is driven at a high velocity by the engine it is to regulate. The irregularities of the engine's speed being thus multiplied upon the governor, cause it to feel sensibly an almost imperceptible variation in the said speed, and correct it. The movement of the weights *w* is made to act upon the valve lever as shown in Fig. 2, where A is a section through the governor case. Two small levers *b*, *b*, carried in suitable brackets *b*, *b*, fixed to the inside of the case, transmit the motion of the weights to the spindle *s*, which, by means of the stud *c* formed upon the shackle *a*, works the valve lever D. A spiral spring situated in the tube F is attached to the shackle *a*, the said tube being screwed and working in the circular bracket E, cast also upon the valve-box. By means of this arrangement the speed of the engine may be regulated with the greatest exactitude, and varied at pleasure whilst it is in motion, by simply turning round the tube F. In this Fig. the brackets B, E, are shown in section, G being the bearing formed on the governor case. A section also through the valve-box at *t* shows the arrangement of the spindle that works the valve. To prevent the friction caused by the spindle S revolving in the shackle *a* from interfering with the sensitiveness of the governor, it is driven by a cross-bar *k*, which takes its motion from the inner periphery of the case, the ends of the bar being provided with small rollers *p*, which run either against the springs or against a projection on the case formed there for the purpose; by this means the little power necessary to turn round the spindle is made to act upon it at a considerable leverage, lessening thereby the resistance which the friction might otherwise offer to the spindle's longitudinal motion.

Fig. 6 shows the valve arrangement. To avoid the friction caused by taking the valve spindle through a stuffing-box the spindle is cut short as at *r*, and the valve is worked by a lever *x*, fixed on the spindle *t*, inside the valve-box, this spindle being worked by the lever D, and passing through a stuffing-box *z* in the usual way. As the end *z* of the lever *x* travels only the distance the valve opens, the movement of the spindle *t* in the packing is very slight, while the governor acts upon it with the leverage from *t* to *c* in its favour. The packing may, therefore, be kept tight enough to prevent leakage without interfering with the valve's sensitiveness. A spindle *r*, screwed and working through the valve cover, acts upon the valve either to regulate the amount of opening or to shut it altogether. One valve, therefore, serves the double purpose of throttle and stop-valve. An arrangement is made in the lever D, Fig. 1, for liberating the stud *c* of the shackle, and thus allowing the governor springs to relax themselves when the valve is shut and the engine at rest. When the end *h* of the case A, Fig. 2, is in its place the governor presents the appearance of a small solid pulley, which serves the double purpose of covering up the working parts and of receiving the motion from the engine, either by means of a strap on the periphery A, or by a gut on the part *g*. The governor may be driven at any speed, but a rate of from six hundred to eight hundred revolutions per minute gives excellent results in practice.

The advantages possessed by this governor are efficiency, compactness, and lightness. The full steam pressure may be given to the engine, and its load thrown off or on at pleasure, without producing sensible variation in its speed, "provided there be no unnecessary steam space between the valve and the cylinder," while the working rate may be varied at pleasure when the engine is running. As an example of its compactness and lightness, the governor for a 20-horse engine is contained in a pulley 8in. in diameter and 2½in. wide outside measurement, the whole apparatus, including governor, throttle, and stop-valve, occupying a space of 16in. × 11in. × 10in., and weighing 69 lb. The governor-proper, with its accessories, weighs 25 lb. This governor may be applied to any equilibrium valve, and upon this principle a good governor may be constructed in a variety of ways. Fig. 4 shows an arrangement which works well. The weights *w* being small solid wheels, which roll against angle brackets *b*, *b*, and exert their centrifugal force against two spiral springs, by means of the cross-bars *d*, *d*¹. Fig. 5 shows them driven by two links, arranged after the fashion of a parallel motion, by which means the cross-winding strains to which the conical governor is subjected are avoided. Figs 8 and 9 show the governor arranged as a speed-indicator, the spindle *s* indicating upon an index-plate the revolutions made or the distance travelled in a unit of time by any machine by which it is driven.

THOMPSON AND STATHER'S HYDRAULIC PRESSES.

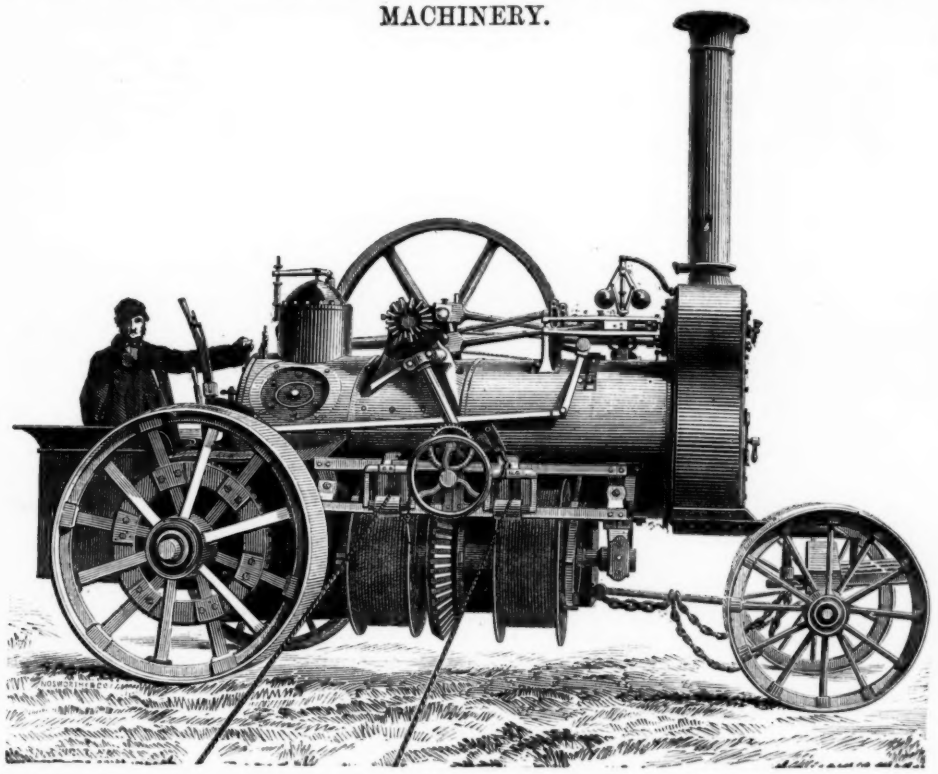
This invention, by Messrs. Thompson and Stather, of Hull, relates to those presses in which one large and two small pumps are employed for working a pair of presses, or double press. The invention consists in fitting stop valves commanded by handles accessible to the attendant, whereby communication can be opened with both or either of the presses as required. Fig. 1 is a plan; Fig. 2, a side elevation; and Fig. 3 an end view of a hydraulic press fitted in this manner. A is the large pump; B^1 and B^2 are the small pumps; C^1 is the stop valve for the large pump to the press pipe D^1; C^2 is the stop valve for the large pump to the press pipe

D^2; E^1 is the stop valve from the small pump B^1 to the press pipe D^1; E^2 is the stop vave from the small pump B^2 to the press pipe D^2; F is the lever for working the pumps; G, G, are the links; H is the pillar or stand, and I, I, are the pump rams; J is the cistern; K, K, are weights on the valves; L is the cross head, and M is a guide. The pump B^1 has no connection with the stop valve E^2, nor with the press pipe D^2; each small pump has its separate stop valve and press pipe. The large pump has two stop valves, so that it may act with either of the small pumps as may be required. All the stop valves have separate handles, and are entirely under the control of the pressman.

Doings at Dublin.—Dublin is to have an "Exhibition and a winter garden." A company has been formed, of which the directors are forty of the most influential and active noblemen and gentlemen in the city, with the Duke of Leinster as chairman, and Mr. Benjamin Lee Guinness as vice chairman. Mr. Guinness, a short time ago, purchased the fields called the Coburg Gardens, at the south side of Stephen's Green, containing about 15 acres. This ground is to be converted into a winter garden, in the centre of which the palace is to be erected, at a cost of £50,000. The building is to contain a large concert hall, a concert room adapted for the musical societies, a gallery for the exhibition and sale of pictures and articles of *virtu*, a department for the display of manufactures and useful arts, a polytechnic museum and theatre, a public bazaar, reading rooms, refreshment-rooms, gymnasium, &c.

Naval Gossip.—The report of the Iron-Plate Committee is now in the hands of the Duke of Somerset, but for reasons of public policy it has been decided that, for the present, it shall be kept secret.—Mr. Reed, who lately received an appointment of the value of £600 per annum to superintend the building of the small screw steam vessel Enterprise, has been commissioned to proceed on a visit to the several public dockyards, and while thus employed he is to receive an extra pay at the rate of fifteen shillings per diem.—In some experiments at Shoeburyness, on Friday, with a new iron target, 4½in. thick, one shot from the 300-pounder Armstrong, charged with 50 lb. of powder, went clean through it. The target was supported behind by other plates of ironwork, which alone are equal to a stratum almost as thick as the armour, so that the total thickness of iron is little short of 9in.—The Admiralty have at length settled with Captain Coles. The terms, after considerable deliberation (says the *Army and Navy Gazette*), have been arranged as follow:—The nation becomes the exclusive possessor of the invention in consideration of paying down £5,000, and granting to Captain Coles £100 for every cupola brought into the service for the next fourteen years.—Mr. Scott Russell's target of 4½in. plates, so strengthened at the back as to be nearly 9in. thick of solid iron, was fired at the other day by the 10½in. gun, which, with 50 lb. of powder, sent one ball completely through it.

YARROW AND HILDITCH'S STEAM PLOUGHING AND CULTIVATING MACHINERY.



The illustration represents the engine employed by Messrs. Yarrow and Hilditch for working their ploughing and cultivating tackle. The peculiarity consists in the mode of arranging the drums for hauling the implements and the locomotive gear. The power of the engine is transmitted to the drums through the bevel shaft, and they can be thrown in and out of gear alternately as required. The drum-shaft is continued on to the fire-box, where a pinion is fixed which can be thrown into gear with the driving wheels, and thus the engine rendered self-propelling. The gearing is so proportioned that the implements travel about 3 to 3½, and the engine at about 2½ miles an hour. This arrangement of drums is capable of working implements on the roundabout or any other system, but Messrs. Yarrow and Hilditch work it on a peculiar plan patented by themselves. They conduct the engine at intervals along the headland, and have two single acting implements, which are propelled in action alternately from the centre of the field to the engine, and from the opposite headland to the centre of the field; they are likewise drawn back, out of action, by a thin wire rope passing round a light anchorage from the back of one implement to the back of the other, so that the engine is always employed hauling one implement in action towards itself, and one away out of action towards the anchor. The following may be enumerated as being some of the principal advantages claimed by the patentees:—The system is one of direct action, the implements being always hauled towards the engine whilst in action, and never away from it, as is the case in all other plans of working.

As the draught ropes are not passed round any pulleys or snatch blocks, the continual bending of the rope while the strain is upon it is entirely avoided, and thus the wear and tear on the ropes (the principal item in steam cultivation) is considerably lessened.

Owing to there being no heavy and cumbersome anchors, the tackle is easily and quickly shifted about from field to field.

Owing to the one implement having been drawn back to the one end of the field when the other reaches the engine, running into the anchor is prevented, and the work can progress in misty or foggy weather, as flags and signals are dispensed with.

Owing to the implements being conducted back out of action on the unploughed land to the exact place where the next set of furrows is to commence, the headlands are very much reduced and no tapering strips of unploughed land left, as is the case with all double-acting implements.

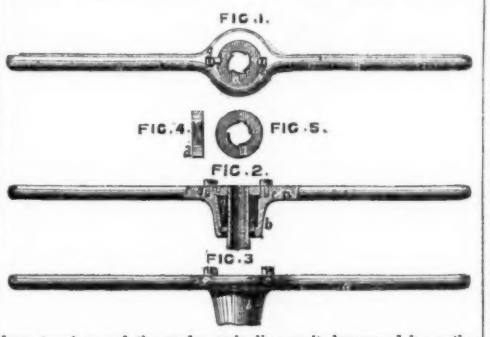
We may add that this invention is of comparatively recent date, and consequently has not yet been extensively introduced, but Messrs. Coleman and Sons, of Chelmsford, are now manufacturing them, and have two sets at work, one of 8-horse power, which has been and is cultivating seven acres a-day to an average depth of 8in., which, considering the stiffness of the soil, may be looked upon as a most satisfactory result.

RUSSELL'S HAND STOCKS AND DIES FOR CUTTING SCREWS.

This invention, by John James Russell, of Wednesbury, has for its object improvements in hand stocks and dies for cutting screws. For these purposes, in constructing hand stocks and screw dies to be used therewith, the central part of the stock is made with a circular opening or recess of suitable dimensions to receive a die, which in place of being made in two pieces, as is ordinarily the case when making dies for the common hand stocks, is made of a single piece, and of a circular or cylindrical form. The die is retained within the recess or opening in the stock by means of the projecting heads of two screws screwed into the stock at opposite points of the diameter of the die. The die is of steel, and is made with cutting edges projecting inwards at four points at equal distances apart on the inner circumference of the die, and these cutting edges are made by preference somewhat bell-mouthed where they first begin to cut or tap the end of a tube or rod. A die thus formed will admit of being again and again re-formed after it is worn away and blunted by simply softening it and hammering its exterior opposite where two sets of the projecting cutters are situated, so as to force such opposite cutters towards the centre of the die, and then hammering it opposite where the other two sets of cutters are situated, so as to drive those cutters also towards the centre. The die is then to be made complete by screwing in the proper screw tap and by again tempering the die. In order to insure the end of a tube or rod being correctly tapped, a hand stock is formed with a suitable hollow or proper holder below where the die is received, in which holder a thick disc or plate perforated with a hole corresponding with the external diameter of the tube or rod to be tapped is placed and held; through this disc or plate the end of the tube or rod is passed, which ensures that end being correctly held to the die.

Fig. 1 is a plan, Fig. 2 a longitudinal section, and Fig. 3 a side view of a hand-stock and die constructed in the manner preferred for carrying out the invention; Fig. 4 shows separately a section, and Fig. 5 a plan of the die.

a is the frame of the stock, on which is a projecting boss *b*, through which is a circular opening as shown. This boss receives at the bottom of the opening the disc or guide plate *c*. In this plate is a hole through which the tube or pin which is to have the screw thread cut upon it will pass freely. At the top of the opening and concentric with the guide plate *c* is the screw die *d*, which is received in a recess formed for it in the stock. This die is, as before stated, shown separately at Figs. 4 and 5, and is made in one piece of a circular or cylindrical form. This die is kept in its place by the screw *e* and by the wedge piece *f*, which is itself held in position by the screw *g*, the wedge piece *f* also prevents the die *d*

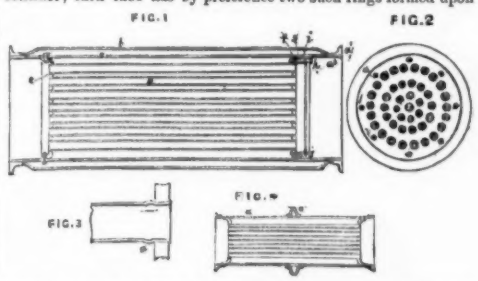


from turning, and the wedge or incline on its lower end keeps the guide plate *e* down in its proper position. The screw die *d* is shown to be formed with four cutting edges, and they are, as is shown, made bell-mouthed where they first begin to cut or tap the end of a tube or rod. In order to cut a screw thread on the end of a rod or tube the rod or tube is first passed through the hole in the guide plate *c*, and its ends then enter the conical mouth of the die *d*. As before stated, several dies are made of the same external diameter, so that any one of them may be inserted in the recess formed to receive it in the stock.

STOTHERT'S CONDENSING APPARATUS.

This invention, by George K. Stothert, of Bristol, relates to condensing apparatus. For these purposes it is preferred to construct a condenser in a cylindrical form, the cylinder being somewhat longer than the tubes contained therein. The two ends of the cylinder are made with flanges, and external of the cylinder is a jacket or casing extending nearly the whole length of the cylinder, leaving a water space between the external surface of the cylinder and the interior of the jacket, which water space communicates with the interior of the cylinder by openings near the two ends of the cylinder. The tubes are fixed into two plates or discs, one of which is fixed near one end of the cylinder, and the other is arranged to slide within the cylinder near its other end, a gland or ring and packing being used to keep the same steam and water-tight. Fig. 1 is a longitudinal section, and Fig. 2 is an end view of condensing apparatus arranged according to the invention. *a*, *a*, is the cylindrical body of the condenser; a^1, a^1, are flanges at the extremity thereof; *b* is a jacket or casing surrounding the cylinder *a*, and enclosing a water space between itself and the cylinder; a^2, a^2, are passages through the cylinder *a*, connecting the exterior water space with the interior of the cylinder *a*; *d*, *d*, are tubes, they are fixed at their ends into tube plates *e* and *f*; the tube plate *e* is bolted to the cylinder *a*, near one end thereof, but the tube plate *f* is free to slide within the cylinder; it has a flange b^1 upon it, this receives the packing ring *g* over which a packing of fibre is placed; *h* is a gland, it is drawn up by bolts *i* so as to cause it to press on the fibrous packing and thus make a tight joint. The inlet for the condensing water is at one end of the cylinder *a*, and the outlet is at the other; it passes through the tubes *d*, and also through the water space outside the cylinder *a*. The steam or vapour to be condensed is conveyed into the interior of the cylinder *a*, by a pipe passing through the side of the cylinder and also through the casing *b*. It will be seen that in this arrangement, when the tubes expand or contract in consequence of change of temperature, there will be no strain thrown on the joints which secure the tubes as would be the case were both the tube plates *e* and *f* fixed to the cylinder *a*, but the tube plate *f* will slide to or fro within the cylinder; thus injury to the joints will be avoided which otherwise would be very liable to occur. It is preferred to bore the portion of the cylinder *a* over which the plate *f* works in order to obtain a true surface for the packing to slide upon.

When the apparatus above described is employed as the condenser of a condensing steam engine the cylinder *a* is put in communication with an air-pump to maintain the requisite vacuum therein. The apparatus may be employed in connection with high-pressure steam engines in order to obtain hot water with which to feed the boiler. If preferred the apparatus may be worked in a different manner to that above described, the condensation water being caused to circulate within the cylinder *a*, and the steam or vapour to be condensed being caused to pass through the tubes *d*, and the space between the cylinder *a* and the casing *b*. It is obvious that the condenser need not be circular in section, it may be square or of other form; circular will, however, usually be most convenient. When iron tubes are employed it is preferred to galvanize them, and if of brass or copper to tin them. When the arrangement above described is not employed, and where both of the tube plates are fixed, the joints between the tubes and the tube plates may be rendered less liable to injury by making them in the following manner:—A portion of each tube is expanded into a ring, so as to form an expansion ring to the tube in order to allow each tube to expand or contract; each tube has by preference two such rings formed upon



it, one near each of its ends, in order that such rings may come against the interior surfaces of the tube plates or discs. Fig. 3 is a section of a tube secured in this manner, together with a portion of the tube plate into which it is fixed; the expanded ring on the tube is shown at *a*, it is produced by a tool of suitable form which is introduced into the tube and caused to revolve while it is expanded by a wedge or otherwise; this expanded ring gives a slight amount of longitudinal elasticity to the tube, and it also considerably strengthens the joint. In some cases the cylinder of the condenser is made in two lengths, and they are connected by a hollow band which will admit of the cylinder expanding lengthwise. A longitudinal section of such a condensing apparatus is shown at Fig. 4; the tubes are fixed in a tube plate at each end, and these are both fixed to the cylinder *a*, which is itself rendered somewhat elastic by means of the hollow ring a^1. In order to diffuse the steam equally amongst the tubes a concentric perforated interior cylinder around the cluster of tubes may be used, there being a suitable space between the interior of the water casing and the exterior of the perforated cylinder in order to receive the steam.

THE NORTHERN OUTFALL SEWER.

On Saturday this great engineering work, estimated to cost nearly three-quarters of a million of money, and in the construction of which some three years will have been spent, was submitted to the inspection of the council and members of the Institute of Civil Engineers, and several military and scientific men of eminence, on the invitation of Mr. Bazalgette, the engineer to the Metropolitan Board of Works.

Starting at Old Ford, a point where the high and middle level, two of the three great lines of sewers which are to drain the whole of the northern portion of the metropolis, converge, this northern outfall sewer goes on to Barking, a distance of about five and a half miles, crossing the main river Lea and five of its branches, the East London Waterworks feeder, and (by a tunnel) the Eastern Counties Railway, the top of the brickwork of the arch of the sewer being on a level with the under side of the railway. It then crosses in succession the Stratford-road and the North Woolwich and Southend lines of railway, and proceeds thence, through East and West Ham and Plaistow, to the Thames, near Barking-creek. From the river Lea the high and middle level lines of sewers proceed side by side for about a mile; then, joined by the low level, all three run parallel for the remaining distance to the point of outfall. At Abbey Mills a pumping station will be erected for lifting the sewage of the low level line to the level of the other two, a height of some 35ft. The whole of this northern outfall sewer, running in these three parallel lines, is above the surface of the ground at an average height of 20ft. For the greater part of its length it is bedded on a solid bank of concrete, averaging 12ft. in depth and 50ft. in width. The portion nearer the outlet, for a mile and a-half over a piece of marshy land, is carried upon a substructure of concrete piers, with brick arches. The Lea and its tributaries are crossed by means of iron aqueducts or tubular bridges. The brickwork of the line, throughout its entire length of five miles, will be covered by an earthern embankment, 40ft. wide at the top, with sloping sides. This it is in contemplation to use as a roadway, and probably in course of time dwelling-houses will be built on either side of it. In size each of the three lines of sewers is 9ft. high by 9ft. wide, having a semi-arch at the top, segmental sides, and an invert, and presenting to the eye when seen in a cross section three tunnels, running side by side. The discharge into the Thames will take place regularly at two hours after high water. Great reservoirs will be constructed near the place of outlet, in which the sewage from the three lines will accumulate from four hours after high water until two hours after the following flood tide. These reservoirs, all of which will be covered over, will empty themselves in two hours, and ordinarily the sewage from them will be conveyed by culverts to the level of low water mark. The whole cost of the northern outfall sewer is estimated at about £625,000. The work, about half of which is completed, has been proceeding for the last year and a-half, and will probably be finished towards the end of next year. It is hardly necessary to state that it is being carried out by the Metropolitan Board of Works as part of the grand intercepting scheme of sewerage in course of progress for draining London on both sides of the Thames, designed by Mr. Bazalgette, their engineer. The contractor is Mr. George Furness, the resident engineer being Mr. Edmund Cooper. As matters of curiosity, it may be stated that about 500,000 yards of concrete will be used in the work, 20,000 rods of brickwork, 800,000 bushels of cement, and 100,000,000 of bricks. Tramways are laid along the whole line of the work for conveying the materials to be used in its construction; five locomotive engines are constantly in use, and 500 trucks, while employment is given to about 2,300 men, forming the contractor's staff. Dotted here and there along the line are mills for making concrete, one of them turning out as much as 360 yards of concrete a day. The whole line has an average fall of two feet in a mile. All the brickwork is laid with Portland cement, in the proportion of three of sand to two of cement. Within a quarter of a mile westward of the Lea, at a point where the high and middle level lines of sewers meet, an overflow chamber, which is intended to play an important part in the scheme, has been erected. This chamber is constructed with what are called weir walls, for the purpose of allowing the sewage water, when surcharged with heavy rainfalls, after reaching a certain height, to overflow and discharge the superabundant mass, which might otherwise burst the sewers, into the river Lea. It answers, in fact, the purposes of a safety valve, and will always prevent the sewers running under pressure. The northern high level line, about nine miles in length, commencing at Hampstead, and draining in its course the districts of Highgate, Holloway, Stoke Newington, Hackney, and Bow, is entirely completed and in use. The middle level line, extending from Bayswater to Old Ford, and draining all the intervening country, is now in the course of construction by Messrs. Brassey, at a cost of about £300,000.

THE MANUFACTURE OF PEAT FUEL.

At an ordinary general meeting of the Institution of Civil Engineers of Ireland, held on 14th May, in the Museum, Trinity College, Dublin—M. B. Mullins, Esq., Vice-President, in the chair—C. Hodgson, Esq., read the following paper:—

ON IMPROVEMENTS IN THE MANUFACTURE OF PEAT FUEL.

There are few subjects which have attracted more general attention in this country, or which have been pursued with so little success heretofore, as that of the utilisation of peat on any large scale. The land is burdened with nearly three million acres of bog, which, by resisting the efforts of the cultivator and impeding local intercourse, go far to neutralise any *recoupement* derived from them in the shape of an inferior fuel obtained in most seasons with difficulty. It is therefore but natural that many efforts should have been made to turn these barren wastes to some useful purpose, and consequently we find from time to time the philanthropist, the speculator, and the man of business emulating each other in this pursuit. But one common enemy has hitherto baffled the efforts of all classes, rendering abortive the most ingenious contrivances for the solidification of peat into a compact fuel, and frustrating the most elaborate chemical processes for the development of its more valuable constituents. This grand obstacle to progress is water, which is capable of being absorbed by peat in an almost incredible proportion, and of being retained with an obstinacy not easily overcome. It is this property in peat which has hitherto baffled so many efforts to convert it into a more available fuel. In the first place, it is exceedingly difficult to deprive blocks of peat, however small, of the contained water; and secondly, as the water does evaporate to a certain extent, air replaces it, keeping the pores much distended, so that a bulky and importable substance results, which always contains from twenty to thirty per cent. of water. Few of those who have given their attention to this subject have appreciated the magnitude of this practical difficulty; very many have even omitted to test thoroughly the average quantity of moisture in our peat bogs, and will not believe the reports of those who know from actual experience how much water the Irish peasant raises and spreads out upon the ground in order to obtain a ton of fuel. Even very lately a pamphlet appeared, on the strength of which it was intended to found a commercial undertaking, and which assumed, as its starting point, a proportion of contained water not more than one-fifth of that which actually exists. The following table gives the average of several hundred tests by careful evaporation, showing the quantity of water contained in peat in different conditions of the bog; and in various stages of desiccation, under the ordinary method of cutting and air-drying, no attempt is made to distinguish between the light and dark brown and black varieties of peat, as the quantity of water contained depends far more upon its position in the bog drainage, and upon the amount of drying which when cut it has received, than upon the ordinary difference of quality.

	Water.	Peat.		Water.	Peat.
The general mass of undrained peat bogs, not including the edges or the heathy surface .. from	92	+ 8	to	95	+ 5
Bog edges and parts of bog, more or less drained, in the state in which peat is generally cut..from	88	+ 12	to	91	+ 9
Thin upper surface of a well-drained bog for about 1 in. deep, all vegetation being cleared off ..from	75	+ 25	to	82	+ 18
Turf in the state in which it is usually "footed," or raised into small piles ..... from	75	+ 25	to	80	+ 20
Turf when ready to clamp, or build in larger piles ..... from	50	+ 50	to	60	+ 40
Turf ready to stack ..... „	25	+ 75	to	35	+ 65
Turf as generally used..... „	20	+ 80	to	35	+ 65
Carefully stacked turf, kept from 6 to 12 months in stack..... .....from	18	+ 82	to	20	+ 80
Turf well saved, and kept in a dry house for about two years.....from	12	+ 88	to	15	+ 85

It will thus be seen that no small obstacle lies in the way of those who would prepare peat for burning, by whatever method it be attempted; but those who have calculated on obtaining by the common system any considerable supply for commercial purposes from a single district of bog have been met by the peculiar practical difficulty which besets this manufacture. For when large quantities of common turf are required, contrary to the usual rule in other productions, which diminish in cost proportionably with an increased make, the price of peat per ton is found inevitably to increase directly its manufacture is stimulated beyond a certain very moderate limit. The cause of this is obvious; the turf cutter can only work round the edge of a bog, or upon occasional main drains. So long as he wishes only to produce a small quantity from a given length of bank he can himself spread the sods as he cuts them; if, however, more is required he must be attended by a wheeler, which at once doubles the cost, and where there is a belt of land of more than 40 yards wide to be covered, two or more wheelers are necessary. The cost of again collecting the dried turf, and concentrating it at any given place, of course increases *pari passu* with the increased cost of spreading. To give some idea of how much produce can be practically counted upon within a given district, it may be stated generally that from 1,000 to 1,500 tons obtained from a line of turf banks an English mile long is a large yield for one whole year's operations, and that this can only be completely prepared, brought down from the bog, and delivered at road or water side, at a cost of about 5s. per ton. If, however, a number of small farmers were to cut from the same mile of banks about half the above quantity it would probably cost them about 3s. per ton similarly delivered; whereas, on the other hand, if it were desirable or even possible to obtain, say, 2,500 tons from the same locality, it could only be effected at a cost of 7s. to 8s. per ton, and much of the peat would only receive indifferent drying, from being necessarily carried back on to the interior of the bog. The truth of these observations was clearly and unfortunately demonstrated in the case of the late Irish Peat Company, who required at their works, near Athy, a constant supply of 50 tons per day, or as much of that quantity as could possibly be obtained, for the manufacture of oil, tar, paraffine, &c. Relying upon the statements of several writers, probably corroborated by their first experience of producing small quantities for experiment, they assumed that the common turf of the country (their raw material) would cost them 2s. 6d. to 3s. per ton, but they soon found that cost increased to 5s., and, long ere they had secured even the minimum supply required to carry on the works with a prospect of commercial success, they found their average cost of peat to be from 6s. 6d. to 7s. per ton, and this increase of outlay, coupled with the downright impossibility of obtaining a much larger supply, were amongst the proximate causes of failure in that truly enterprising effort. Turning from this part of the subject, and admitting that peat manufactured in the ordinary way is a cheap and useful domestic fuel for those who can cut it for themselves and use it on the spot, we come to the main object of this paper, viz., a discussion on the improvements attempted or introduced in the above manufacture. And here it will be advisable to recapitulate the obvious defects in common peat which require to be corrected, the properties which it is desirable to develope in it, and to state generally its constituents as a fuel when compared with coal and other combustibles, thus setting before us what has to be done in the matter, what kind of article we may hope to produce, and what will be its value. Common turf, independent of any difference in chemical constitution, has in itself and in its mode of preparation five main defects, which render it practically inferior to coal—first, the consumer never obtains it in a sufficiently dry state to give its full effect in combustion; secondly, as from one-third to one-fourth parts by weight of the peat of commerce is simply water, the consumer is always obliged to pay carriage on one ton of water for every two or three tons of actual fuel he receives: this constitutes a disadvantage quite distinct from that last named; thirdly, it is so bulky and porous an article that it is impossible to convey it as cheaply as coal, and for the same reason it requires much larger arrangements of firegrate, &c., to produce a given effect than is required for the same with coal, and from its lightness (though capable of producing a very intense heat) it will not bear the stimulation of a powerful blast; fourthly, the manufacture of common turf depends at all times upon favourable weather: its supply is therefore always precarious; fifthly, from the circumstances already explained it is impossible to obtain a large quantity of fuel, as much, for instance, as would be extracted from a coal mine of very moderate capacity, from any one estate or even considerable tract of bog. The qualities, therefore, to be produced in an improved fuel from peat so as to raise it as nearly as its chemical constitution will admit to the standard of coal are as follows:—

1. Perfect or nearly perfect dryness, so that all the substance paid for by the consumer may be actual fuel, and not partly water, retarding combustion and increasing the cost of carriage.

2. Density, if possible, equal to that of coal, so that it may rank equally with coal in capability of transport (a most important quality), and also be a sufficiently compact fuel to be used with advantage in the same firegrates generally in use for coal.

3. Hardness or tenacity, which to a great extent accompany density, enabling the fuel to be moved without much loss from abrasion, to be consumed in strong blast furnaces, or possibly to support the burden of metallic ores under reduction.

4. Any improvement in the mode of manufacture must include the completion, at least, of the drying process by artificial means, or else perfect dryness can never be attained, nor can any amount of dryness be depended upon with certainty in this climate.

5. Whatever method is adopted for natural drying previous to finishing by artificial means (it being impossible practically to dry from the primitive state artificially) it must be such as shall produce a partially dry substance in large quantities without incurring an increase of cost in proportion to the increased demand for it. We now come to consider the chemical constitution of peat, and its consequent theoretical value as compared with coal. Finding many discrepancies in the various analyses extant, both of coal and peat, which probably arise as well from difference of manipulation as from the considerable variation in quality of each fuel, it is fair to take a mean analysis in both cases. The following may be relied upon as representing the general constituents of each substance:—

Peat.		Coal.	
Carbon	57 per cent.	Carbon ..	85 per cent.
Hydrogen	6·5 „	Hydrogen ..	4 „
Oxygen	32 „	Oxygen ..	3 „
Ash	4·5 „	Nitrogen ..	3 „
		Ash	5 „
	100		100

Comparing these analyses, it will be seen that almost the only essential difference between the two fuels regarded as calorific agents is that peat is deficient of carbon by about one-fourth of the quantity contained in coal, its place being taken by oxygen, and as fuel in combustion can receive all the oxygen it requires from the atmosphere it is manifest that any contained in the fuel cannot be taken as a portion of its value. Of hydrogen, which is four times the value of carbon as a calorific agent, peat generally contains a little more than coal, but this excess cannot safely be counted upon, as a considerable portion must be supposed to combine with oxygen, and forming water, to be partially lost as an effective agent.

We must, therefore, look to the proportions of carbon in each as the best test of the relative value of the two fuels, and from this we arrive at the conclusion that the duty of perfectly dry peat ought to be two-thirds that of average coal.

And here it may be stated that this theoretical value is now found to be fully borne out in practice, for with compressed peat perfectly dry two-thirds the duty of coal has been repeatedly performed during the last twelve months. In two qualities of no small importance peat does excel coal. It contains very little or no sulphur, which is of great advantage to any metal exposed directly to the action of its flame, and in scarcely any variety does the ash vitrify, a defect in most coal which is productive of much trouble to the firemen, and considerable waste of grate bars. Relying on the excellence to which it thus seemed possible to bring peat fuel when those disadvantages were overcome on the one hand, and these perfections obtained on the other, many men have started with high hopes and eager anxiety to carry to a successful issue so desirable an enterprize, and, so far as the actual physical possibility of the matter, many have succeeded. But unfortunately in these degenerate days, physical possibility is of no use whatever, unless it be accompanied by the far more important qualification of financial possibility; it is an easy and a pleasing pursuit to try what good things can be made out of comparatively worthless materials, but it only becomes a useful pursuit to the operator and to mankind in general when the "good things" are intrinsically more valuable to humanity than the labour and material which have produced them.

Many have made beautiful and compact specimens of peat fuel, have produced charcoal from it, have made moulded ornamental articles with it, and converted the spongy mass into a fine lubricating oil, clear white paraffine, and gas of high illuminating power, but how many have fulfilled the one commonplace little condition of "making it pay?" As has been before stated, the one obstacle to the fulfilment of this little condition is water, and this paper would never have been written were it not that there has lately been developed and put into operation a method of preparatory desiccation which, leaving five-sixths of the water behind in the bog actually *in situ*, enables the operator to obtain with much rapidity a substance or raw material for future operations consisting of very nearly equal parts of peat and water, instead of laboriously cutting and moving 9 or 10 tons of dead weight to obtain the material for one ton of real fuel. The discovery of this new process, coupled with progressive improvements in compressing machinery, have brought the author's hitherto experimental work at Derrylea, near Monasterevan, to a point of efficiency which leaves no further doubt as to the possibility of producing a dry peat fuel with reasonable profit, and at such a scale, as when generally adopted, cannot fail to prove of benefit to the country at large.

Before proceeding to describe in detail the process now in operation we will trace some of the different methods which have heretofore been tried for the drying and consolidation of peat. To attempt a history of them all would be unnecessary and wearisome, and present a retrospect not by any means encouraging. In many parts of Ireland, where even turf fuel is scarce, the peasantry make for themselves an article called "hand turf," which is formed by working the wet substance into a pulpy mass with the feet and hands, and afterwards cutting it into squares as it lies like paste on the ground; these, when they obtain a certain consistency, are repeatedly turned over and piled in heaps, and when tolerably hard are stacked for winter. This mode produces a fuel rather more dense and compact than common turf, but it is exceedingly costly, and no large quantity could be made. In Holland and Holstein, where fuel is very dear and the peat bogs are often found totally submerged, a process somewhat similar is carried on; the peat is scraped up with perforated scoops which allow the water partially to drain off. Having been spread on a flat piece of ground, it is then trodden out by oxen or men, and afterwards moulded as we should common bricks. These are placed to dry on hard sloping ground or wooden trays, and afterwards piled, but this operation will only pay where fuel is exceedingly scarce and the climate tolerably dry. An improvement on both these methods is now being attempted in Ireland; the wet peat is passed through a kind of conical cullender made of perforated zinc or other metal, this accomplishes the mashing process very completely, and strains off any sticks or rough particles, leaving the fuel when afterwards dried of a very fine and close texture. An ordinary brick machine forms the strained mass into blocks, which it is proposed to dry by exposure to the atmosphere or by artificial means, but the manufacture is not yet carried on on an extensive scale. Specimens, however, which have been carefully dried seem very compact and peculiarly adapted for making peat charcoal or coke of a more than ordinary tenacity.

The three foregoing methods have equally the disadvantage of dealing with, and frequently handling, eight, nine, or ten tons of substance for the production of one ton of fuel, and of occupying either immense time and space for air drying, or burning a large, perhaps ruinously large, quantity of fuel to attain an artificial desiccation; indeed, so varied have been the attempts to dry peat altogether by artificial means that its impossibility may be taken as an axiom. Containing, as usually cut with the slane, about eight or nine parts water to one of peat, it is difficult to conceive how artificial heat or currents of air sufficient to evaporate eight or nine tons of water could possibly be obtained by the combustion of one ton of peat fuel without even expecting any portion of the ton to be saved for sale. Such evaporative duty, as one to eight or nine, is considered very good when the best coals are burnt in the furnaces of well-constructed boilers, and although a closed boiler is probably not the best instrument for evaporating a large quantity of water economically, yet the fact that in peat the water is intimately mixed with an extremely non-conducting substance renders it probable that in this condition it is even more difficult to effect evaporation than in a closed boiler, where the water is left free to the action of the natural currents produced by heat. While experiencing the difficulty of obtaining a large supply of dry common peat, the Irish Peat Company erected two very large drying houses, similar to those used on the Continent for wood (which, however, when cut is nearly as dry as air dried peat). These houses were 150ft. long, 20ft. wide, and 10ft. high, and cost a very large sum of money. They were filled with furnaces and long flues, and very ingenious arrangements were made to ensure constant currents of air, at one time even a fan blast being used. They were maintained at a temperature of from 100 deg. to 120 deg., and the peat, cut in ordinary sods, was introduced in lattice wagons, which allowed the air free access; but after protracted trials, and the consumption of much more fuel than could possibly be dried, the attempt with wet peat was abandoned, and others made with partially dry peat; but in no case was even a shadow of advantage gained, and the experiment went only to show that a considerable elevation of temperature, though combined with good artificial currents, will not compensate for the disadvantage of massing large quantities of peat together, thus hindering each portion from giving forth its moisture freely to the unsaturated atmosphere. The person who first attempted to expel from peat the water by pressure was Mr. Wye Williams, who made an extended experiment, with this view, at Cappogue many years ago; he succeeded, by hydraulic pressure, in reducing wet peat to half its original weight and one-third its original volume, but the remaining water was so closely incorporated with the peat that very little time was saved in drying, and the blocks expanded a good deal during desiccation, so as not to be much more dense than common turf. This attempt was lately repeated on a very considerable scale at the Irish Peat Company's works, but with precisely similar results. The idea of drying peat in the ordinary manner, pulverising it, driving off the remaining water from the powder and then compressing it, appears to have originated twelve or fourteen years ago, with several persons about the same time, for there are not a few defunct patents on the subject, but their authors will appear to have had the idea that the peat powder must be hot, and that the combination effected under pressure was to be prolonged by some oily development in the peat itself, due to the heated state in which it was to be fed into the mould, and perhaps a more mistaken or troublesome delusion never hampered a really valuable principle. A few blocks of this dry, hot compressed peat were produced by hydraulic or screw pressure about this time *i.e.*, previous to 1850, and having a high density, and burning exceedingly well in consequence of their perfect dryness, it became a question how such were to be produced in quantity, for hydraulic pressure was clearly too slow in action to be of practical use; variations of the lever and eccentric principle were therefore tried, and by moving them very slowly some tolerably good blocks were formed, but an attempt to drive any of them at a "paying" speed generally resulted in a failure, and if not, the blocks were found to swell again and become too brittle for carriage. A machine of this kind was placed in the Dublin Exhibition in 1853, and another was set up at a bog in Kerry at about the same time, but never was brought into steady operation, probably from the same cause. It was constructed with a lever actuated by a cam, and was arrested for two or three seconds during the formation of each block. A machine was next constructed by Gwynne and Son for Mr. Hodgson, and erected in Galway in 1854, but this also was ultimately abandoned from constant failure in the different parts. All these machines suffered from two manifest defects: they were complicated with notions for filling and discharging the mould, in which the pressure was applied, besides the main motion for compression, and when driven at any speed exceeding five or six blows per minute they failed to produce the desired effect, because the continuance of the pressure became then quite too transitory. But had success attended any of these machines, had any of them produced so much as two or three tons of fuel as dense and as portable as coal, the real difficulty of the actual manufacture would only then have commenced, for no provision had yet been made to supply these machines with dry powder of peat in any paying quantity. It was soon seen that to depend on making and grinding up common peat in this country would never answer, both on account of the small supply to be obtained in any locality, and because even that supply would cost too much to leave a profit on the manufacture. A patent has lately been taken out by the author for compressing peat dry and cold in a machine consisting simply of a horizontal reciprocating ram, working into a tube or cylinder of perfectly uniform bore, very much resembling a cannon with open breach like the Armstrong gun. Into this tube the peat powder falls as the ram draws back at each stroke, and very shortly filling the whole length, a considerable friction begins to take place against the sides of the tube; this soon increases to such an extent that, as each charge falls in, it is consolidated perfectly between the advancing ram and the column of peat in the tube before the frictional resistance of this column is overcome and the whole mass moves on. Thus simultaneously a block is formed at the breech end, and one made perhaps a minute before drops out at the further extremity. This machine combines the advantages of requiring no feed and delivery motion, of retaining each block fast in the tube, which is about five feet long, for more than a minute, while at the same time it delivers them at the rate of sixty per minute, making for one tube about 15 cwt. per hour. It is now at work at Derrylea, and is certainly the first machine which has in the United Kingdom produced several hundred tons of peat fuel of a density equal to coal. To supply this machine with dry material now became the grand difficulty, but here a fortunate discovery removed almost all difficulty at one stroke. The author discovered during last year that by harrowing over the surface of the bogs with a very light harrow a powdered peat four times as dry as the general mass would be obtainable cheaply and in any desired quantity. Operating only on the upper stratum of the bog, and removing a thin layer by two or three successive harrowings and scrapings each day, the great bulk of the water is never encountered at all, but sinks gradually away day by day to the drainage. This operation may be carried on at any season of the year, on every day not actually raining, but of course it proceeds more advantageously in summer, when large stores of the powder or mull are collected and heaped in embankments, which are found not to re-absorb water. The average proportion of water is about 55 per cent., and the material when collected costs about 5d. per ton. A few hours are allowed to intervene between harrowing and scraping, so that the air may assist in drying out the thin stratum exposed to it. The complete desiccation of this powder is easily effected by passing it over extensive plates of iron heated by the waste steam from the compressing engine, and it is then fit for being compressed. By this mode peat standing in this primitive bog in the morning is harrowed and scraped, brought in, dried on the steam surface, compressed, and before night falls as a complete and excellent fuel in the canal boat, which conveys it to market.

Mr. Hodgson's paper closed the session 1861–2 of the Institution of Civil Engineers of Ireland. The next session commences in November.

Prussian Steam Engines.—Large numbers of steam engines upon the plan of G. H. Corliss, of Providence, U.S., are now made in Silesia and two of these are shown in the Exhibition.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

COMPOUND ENGINES.

SIR,—Some time ago I indicated a pair of single cylinder engines previous to their being compounded, or what is usually termed McNaughted. Since the alterations I have again indicated them, and find that, although they have less machinery to drive, the diagrams give out nearly 20 per cent. more H.P.; hence arises an advantage apparent and not real in calculating the consumption of fuel. I have asked the opinion of several friends accustomed to the indicating of engines, and they, like myself, find that engines always indicate considerably more H.P. after being compounded than before, the machinery remaining the same. I find that H. W. Harman Esq., C.E., late Chief Engineer to the Manchester Boiler Association, in one of his able reports alludes to the indication of compound engines, and as it may interest some of your readers, whose enlightenment is the object of your valuable journal, I enclose extract. Mr. Harman says:—

"It may here be observed that, owing to increased friction, &c., engines which have been compounded invariably indicate more horses' power than before, the machinery remaining the same; hence arises an advantage, apparent and not real, in calculating the consumption of fuel.

"I alluded to this circumstance in my last report, and subsequent consideration has led me to conclude that the gross amount of power exhibited by "compound diagrams," as at present calculated, is fallacious; my impression was that the velocity of a piston, and the figure delineated from it, should in the same cylinder always bear a direct ratio to each other; but facts that have come before me appear to demonstrate that in compound engines this is not the case, and that the velocities of the pistons are not, each and singly, coincident with the pressures upon them.

"By way of illustration: Disconnect either cylinder and endeavour to obtain corresponding diagrams at corresponding velocities, and it will prove to be an impossibility. I believe the duplicate figures may be got, but at a greatly reduced speed of pistons. To further elucidate my meaning, — suppose a compound engine, making twenty-five revolutions per minute, I should say that speed was due to the combined action of both cylinders, and not to each singly; for example, to represent the effective power of each, probably eighteen revolutions might be attributed to the action of the high-pressure and seven revolutions to the low-pressure cylinder; and I am of opinion it is at such, or similar compensation ratios of velocity (yet to be ascertained), that the respective diagrams should be computed. If I am correct in this view of the subject, it follows that to calculate compound diagrams in the usual way, by velocities not their own, is a very serious error, and gives a fictitious return in engine power, and in fuel consumed.

"In reference to this subject I desire to add that I must not be understood as calling in question the advantages or otherwise attending engines that have been compounded, but simply as directing attention to an interesting point in mechanical science: that of ascertaining whether the same conditions really apply to diagrams taken from such engines, and calculated in the usual manner, as from those engines that have only one cylinder. I think not."

I myself admit that advantages have been derived from the compounding of old and badly constructed engines; but, where new engines have to be erected, I still maintain that, if properly constructed and proportioned, and the working parts through which the power is transmitted of proper strength, a suitable cut-off motion, regulated by the governor, applied similar to those of Messrs. Petries, of Rochdale, or Kays, of Bury, and lastly, though not least, a proper person entrusted with the care of the engine, single cylinder engines will be found more economical in every way than any compound engine yet erected. SINGLE CYLINDER.

NAYLOR'S STEAM HAMMER.

SIR,—In your paper of the 23rd inst., on the subject of machinery in the International Exhibition, you very justly observe that among 800-horse marine engines and 32-ton locomotives it would have been more in keeping to have shown a 10 or 12-ton steam-hammer instead of the small ones now exhibited.

The Kirkstall Forge Company, who exhibit two small steam hammers made on my patent principle of single or double action, applied for 900 square feet; but unfortunately it could not be had; they could only get 100 square feet. Hence the "miniature" hammer in place of the monster that was to have been sent.

As space could not be found in the Exhibition for the Kirkstall Forge Company to place their large Naylor hammer, may I ask for a little space in your valuable paper for some of its dimensions and particulars. The cylinder is 34in. in diameter, with room for a stroke of 6ft. 6in.

The piston, piston-rod, and hammer-block are made of the best Yorkshire iron, and together weigh 7½ tons. The hammer face is of cast iron, 1½ tons, making the actual weight of the hammer 9 tons.

The weight of cylinder and frames	34½ tons
Base plate and cover plates	32½ "
Anvil and its connections	72 "
Making a total of	148 "

And, further, may I ask for a little more space to place before your readers a comparison of effect of a single-acting gravity steam with that of mine when working double action.

A steam hammer may have more or less force after falling a given distance than a block of iron of the same actual weight falling freely through the atmosphere.

For instance, a single-action hammer will be somewhat retarded in its fall by the piston having to force some of the steam which had lifted it out of the cylinder into the atmosphere. One maker experimented upon his hammer, and took diagrams of resistance by an indicator, and in a paper read before the Institution of Mechanical Engineers showed it to have been 20 per cent. of the weight of the hammer. My double-action hammer, when working double-action, is propelled downwards by the steam upon its piston, in addition to the gravity of the hammer itself; consequently its speed must be higher than such a weight falling freely through the atmosphere. Let us place the effect of two hammers, of nine tons each, working upon a piece of iron or steel on the anvil 2ft. thick, and keeping six inches clear of the cylinder cover, we have an actual stroke of 4ft. For simplicity of argument we will not take the resistance into question. Then the effective length of stroke would be

$$= \frac{\text{Stroke} \times \text{Propelling Force}}{\text{Weight of Hammer}}$$

In my hammer the cylinder has been given as 34in. diameter, and with 45 lb. per square inch of steam, would equal a force of 18 tons, due to the steam, and 9 tons added as gravity would represent a propelling force of 27 tons. Then $4 \times 27 \div 9 = 12$. The velocity at the end of its stroke of 4ft. would be equal to such a weight having fallen through the atmosphere 12ft. and $8\sqrt{12} = 26{\cdot}7128$ft. per second as its velocity.

The gravity or single-action hammer would by the same rule be $4 \times 9 \div 9 = 4$, and $8\sqrt{4} = 16$ft. per second.

In your paper of (I believe) April 5th, on the subject of Projectiles, are these words:—"Now the actual forces contained in moving bodies are as the squares of their velocities."

In Sir W. Armstrong's letter in the *Times*, of April 10, are these words:—"The force of a projectile is equal to its weight multiplied by the square of its velocity."

Such are my authorities of what a blow is equal to. And the same principle, being a principle, must hold good with the effect o high velocities in hammers striking an objectupon the anvil equallyf as much as with projectiles striking Warrior targets. Here follows the result.

The gravity hammers $= 16^2 \times 9 = 2304$.

The Naylor double-action $= 26{\cdot}7128^2 \times 9 = 6912$, being a difference of 3 to 1 in the power of the blow. And as the double-action hammer falls in one-third the time of the gravity hammer it follows that it can give two blows for the other's one. These double-acting hammers, however, speak best for themselves when seen at work. The Kirkstall Forge Company commenced to make these hammers in the year 1858, and they have now on hand No. 172. One firm has nine, another has five, and another four. Others are to be found in many places too numerous for insertion in your valuable space for such communications. WM. NAYLOR.

Queen's-road, N.E., May 28, 1862.

LAW'S MACHINERY FOR RAISING AND DOCKING VESSELS.

IN inclined slipways for the heaving-up of vessels out of the water it has heretofore been customary to employ some fixed source of power at the upper end of the slipway, and to impart motion therefrom to the cradle upon which the vessel is supported by means of a chain or rope; and, in the case of large vessels, when a very heavy chain is required, much inconvenience and difficulty is experienced in disposing of such portion of the chain as has been hauled up, and power is lost in having to move the chain in addition to the cradle. To remove these difficulties, Henry Law, of 15, Essex-street, Strand, attaches the machinery by means of which the cradle is to be moved to the cradle itself, so that the two move together without the use of any rope or chain, otherwise than as such may be employed as the means of connection; and he effects this by constructing a powerful rack upon the slipway, against the teeth of which a pinion or an endless screw moved by the machinery attached to the cradle is made to bear, and thus a continuous progressive motion is imparted to the cradle, either to raise or lower it along the slipway; or he effects the same object by means of traction rods so formed as to lay hold of the teeth of the rack, or of studs or projections upon the slipway, and which, being moved alternately backwards and forwards by hydraulic pressure, or by cranks, or by any other known mechanical means, lay hold of the successive teeth or projections, and thus produce a progressive motion in the cradle, and by having two or more of such traction rods suitably arranged such progressive motion may be made continuous.

For convenience the moving power and machinery is placed in a water-tight vessel attached to the cradle, and the shaft or traction rods by which the connection with the slipway is effected are carried through stuffing boxes or glands so as to exclude the water. And, furthermore, there is constructed an air-tight chamber open at the bottom, forming a species of diving bell, which is attached to the fore part of the cradle in such a position as to cover the portion of the rack or slipway against which the pinion, screw, or traction rods are working so as to enable them to be constantly under inspection, and to allow of a workman removing any extraneous substance which might otherwise obstruct the working of the machinery and the progressive motion of the cradle, and the entrance to such air-tight chamber is formed by a species of air-lock so as to enable a workman to pass into or out of the same without allowing the admission of water, and the requisite pressure of air is maintained by means of an air pump.

This part of the invention is shown in Fig. 1, which is a longitudinal, and Fig. 2, a transverse section of the water-tight vessel containing the moving power and machinery. A is a ship resting on the cradle B, supported upon rollers C, C, C, which run upon the lines of rails D, D. A powerful rack E, E, extends along the centre of the slipway, in which are engaged the teeth of the pinion F firmly fixed to the shaft G, the bearings of which rest in plummer blocks attached to the framing of the water-tight vessel H. The shaft and pinion G and F are contained within an air-tight chamber I, which, being open at the bottom, and constantly supplied with air from an air pump, forms a species of diving bell, and enables a person to inspect the whole of the rack plate E during the progress of the pinion, and to remove any dirt or other extraneous substance which may have been deposited upon it. The entrance to, and exit from, this chamber is effected by means of the vertical tube J, so arranged with double air-tight doors K, K, as to form a species of air lock, and so to enable a person to pass into or out of the chamber I, without allowing the escape of the compressed air or the admission of the water from below. A second shaft L, which is connected with G by the wheel M and pinion N, passes from the air-tight chamber I into the water-tight vessel H, through a stuffing box O, so as to prevent the compressed air from escaping from the former. The steam engine with its boiler, or other motive power, is placed within the vessel H, as in the engine room of an ordinary steam-boat, and being connected with the shaft, imparts its motion through the wheel and pinion M and N to the pinion F, and so causes the vessel H to move upwards or downwards along the slipway, carrying with it the cradle B and ship A, to the former of which it is connected by a powerful coupling P. To enable the person within the chamber I to communicate promptly with the person in charge of the machinery, so as to have the same immediately stopped, should any impediment be met with upon the rack plate E, a small shaft or spindle Q is carried through an air-tight stuffing box on the side of the chamber, having two hands or indexes fixed immovably and parallel, one at either extremity, and two similar dial plates, one on either side, so that either index being placed to any word, signal, or direction upon its dial plate, the other index will point out the same word, signal, or direction upon the other dial plate, and so communicate the intelligence required between the persons within the chamber and the vessel respectively. To attract immediate attention the spindle should be so arranged as to sound a bell whenever the indexes are moved.

Fig. 3 is a longitudinal section of a vessel similar to that hereinbefore described, but in which the moving power is made to act upon the rack plate E by means of an endless screw instead of a pinion. The corresponding letters have the same significance as before; L is a shaft to which the moving power is applied, and transmitted through the wheel M and the pinion N to the endless screw R, which being engaged by the teeth of the rack E, and its end bearings attached to the framing of the vessel H, by its revolution imparts an upward or downward progressive motion, along the slipway to the vessel H, and consequently to the cradle with the ship upon it.

Fig. 4, is a longitudinal section; Fig. 5, a transverse section; and Fig. 6, a sectional plan of a vessel, similar to that above described, but in which the moving power is made to act upon the rack E, E, by means of traction rods or pawls moved alternately backwards and forwards by hydraulic pressure, and so formed as to lay hold of or press against the teeth of the rack, and so to produce a continuous progressive motion in the vessel H. The corresponding letters have the same significance as before; S is the cylinder of an hydraulic press, and T is its plunger or piston, to the crosshead of which two traction rods U, U, are connected by a joint; the rods U, U, are attached at their further extremities to a cross beam V, the whole being so contrived that, when the plunger T is pushed into the cylinder S (which may be called its up stroke), the cross beam V in moving with it, slides freely over the surface of the teeth of the rack, but when the plunger is pushed out of the cylinder (or making its down stroke), the beam V coming in contact with the front face of the teeth of the rack E, is stopped in its motion, and the continued application of the power causes the cylinder S to move in the contrary direction, or to ascend the slipway, carrying with it the vessel H, to which it is immovably attached. The movement of the plunger T when making its down stroke, is produced in the ordinary manner, by pumping water or any other suitable fluid into the cylinder S through the pipe W when the stroke of the plunger is completed, a valve X is moved, by which the pipe Y is connected with the force pump while the pipe W is brought into connection with an open tank or reservoir; the further extremity of the pipe Y is made to form another small plunger or piston Z within a cylindrical cavity formed in the centre of the larger plunger T; by the continued action of the force pump forcing fluid into the cylinder Z, the larger plunger T is caused to move into the cylinder S, or to make its up stroke, the fluid contained in the latter being displaced through the pipe W. As the plunger T moves, it carries with it the traction rods U, U, and the cross beam V, the latter sliding in the manner already described over the backs of the teeth of the rack, until upon reaching the top of any one of the teeth the beam V drops down in front of it in a position to engage it; at the same instant the valve X is moved back into its former position, by which the pipe Y is brought into connection with the reservoir, and the pipe W with the force pump, the continued action of which causes the plunger T again to resume its down stroke and the vessel H again to move along the slipway. On each side of the hydraulic press S, is a similar one of half the area *a*, *a*, with a plunger *b*, *b*, bearing against a crosshead *c*, to which is attached the hinged strut or pawl *d*, arranged (like the beam V) to slide freely over the back of the rack E, when moved up the slipway, but to engage with and push against the face of the teeth of the same when attempted to be moved in the opposite direction. Precisely the same arrangement is adopted as that above described, for causing the plungers *b*, *b*, to move alternately into and out of their respective cylinders, in doing which by the action of the pawl *d* against the teeth of the rack E, the cylinders *a*, *a*, and consequently the vessel H, to which they are fixed, are moved with an intermittent action along the slipway in an upward direction. The force pump by which the hydraulic presses are actuated being supposed to move with a uniform speed, the up stroke of the plunger T will be performed in as much less time than the down stroke as the area of the plunger T exceeds that of the plunger Z, and the up stroke of the plungers *b*, *b*, in as much less time than their down stroke as their areas exceed those of the plungers *c*, *c*, or in about one-eighth of the time; that is to say if the plungers took four minutes each to make their down strokes, they would require only half a minute to complete their up strokes. Furthermore, it should be observed the relative lengths of the pawl *d* and traction rods U, U, are so arranged that when the plunger T is commencing its down stroke the plungers *b*, *b*, are in the middle of their down stroke, and *vice versa*. From the combined action of these two circumstances, it results that the upward motion of the vessel H, along the slipway, due to the alternate movement of the plungers *b*, *b*, and T, in place of being intermittent, becomes continuous and nearly uniform.

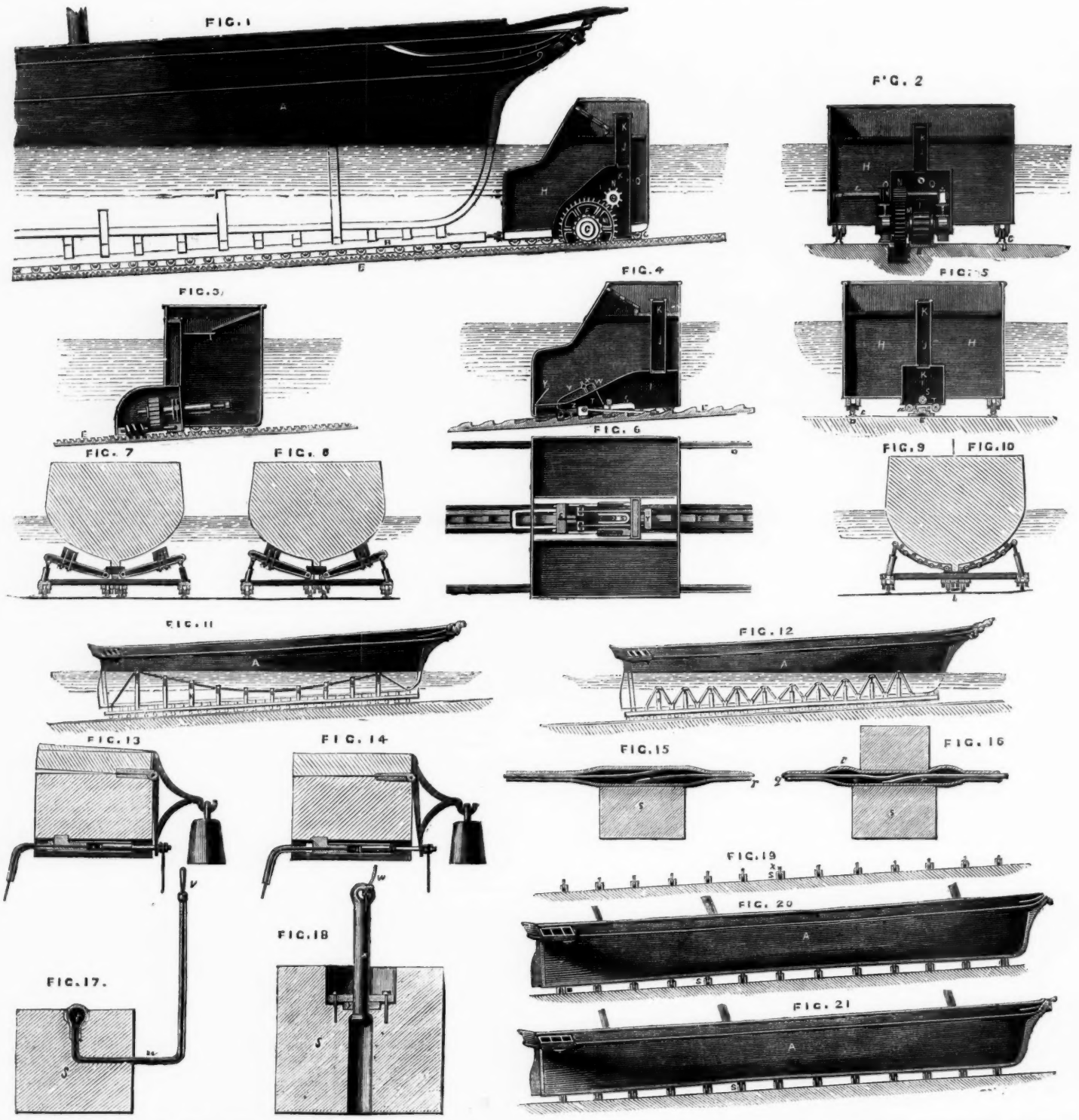
The second part of the invention consists in constructing the apparatus for the immediate support of the sides of the ship or other vessel when grounded upon a cradle, or in a dry dock, of hinged levers or jointed or flexible straps capable of adapting themselves to the form of the vessel, so that by raising up or tightening the extremities of such levers or straps, a uniform support is afforded to the vessel, and the pressure is more evenly distributed over its surface. In some cases such levers and straps are connected with each other laterally by means of rods or ties, arranged in such a manner as to form a species of network by tightening up the extremities of which the sides of the vessels would be perfectly embraced, so as to afford a uniform and evenly distributed support. This part of the invention is shown in Fig. 7, which is a transverse section of the cradle, showing the ship at the instant of grounding upon it, and resting upon the keel only. To the centre of the cradle on each side of the keel blocks, at convenient distances apart, are attached the levers *f*, *f*, by the hinged joints *g*, *g*; upon their upper sides are sliding blocks *h*, *h*, so arranged as to be capable of having their positions upon the levers altered so as to suit the various forms of different ships; the outer extremities of these levers are supported upon props or struts *i*, *i*, being so arranged as to admit of their being raised and lowered by means of jacks or ropes and pulleys, or any other of the well-known mechanical appliances suitable for such purpose. Fig. 8 shows these levers raised so as to support the sides of the vessel previous to the cradle being drawn up out of the water. Fig. 9 shows a modification in which in place of the levers jointed straps *j*, *j*, are attached at one of their extremities to the centre of the cradle, and at the other to props or struts *k*, *k*, with the means of being raised or lowered as already described. Upon lifting the ends of the straps they are brought into contact with the sides of the ship, as shown in Fig. 10, and being flexible assume its form, by which means the ship is supported upon a much larger number of points, and the consequent pressure upon each is proportionately reduced, while the tendency to strain or alter the form of the vessel is considerably diminished; the strap taking the place of the water in supporting the ship in a much more perfect manner than with the present plan of sliding blocks drawn against the ship's side. The levers or straps may be united together with lateral tie rods, as shown in Fig. 11, so as to embrace the sides of the ship in a species of network.

Another mode of arranging the flexible or jointed straps is shown in Fig. 12, the straps *j*, *j*, being arranged in pairs, the upper extremities of each pair being connected and supported by a prop or strut *k*, common to both, by which arrangement the straps assume a diagonal or triangular position, and great additional steadiness and security are obtained.

The third part of the invention consists in constructing the blocks or supports upon which the vessel is intended to rest when grounded either upon a cradle or in a dry dock, in such a manner as to show whether the vessel is bearing upon or in contact with each block, and also to show the moment at which such contact takes place with each particular block or support, and this is effected by attaching to each block an electrical apparatus, so contrived that the contact between the block and the vessel either makes or breaks an electric or voltaic circuit, and so indicates to a person above the water, by striking a bell, deflecting a magnetic needle, or by any other of the known means of giving a signal, that the vessel has taken a bearing upon the block; or the same purpose is effected by having a tube or other vessel capable of being compressed and filled either with oil, water, or any other suitable fluid attached to each block, and so arranged that when the ship comes in contact with the block, the compression of the tube or other vessel containing the fluid shall be transmitted to a pressure gauge or other indicator placed above the water; or it is effected by having a wire connected to each block in such a manner that the grounding of the vessel upon the block shall give motion to the wire, which latter being carried to any convenient point above the water in a similar manner to the wires of ordinary dwelling-house bells, shall by ringing a bell or moving an index or other indicator, show that the vessel is in contact with the block.

Figs. 13 and 14 show one form of applying this part of the invention. *l* represents either one of the keel blocks or one of the sliding blocks for supporting the sides of the ship; to its upper part is attached a hinged flap *m*, which is retained in the position shown in Fig. 13 by means of a counterpoise weight, or of a spring, so that it stands about an inch above the general surface of the block until the vessel comes into contact with it, depresses the flap *m*, and brings it into the position shown in Fig. 14. On the under side of the block (within a recess) is fixed a small tube of vulcanised indian-rubber *n*, into one end of which is inserted a metal rod *o*, the other extremity of which is connected with an arm or lever *p* attached to the movable flap *m*, and to which is also connected one of the conducting wires *q* of a galvanic battery or magneto-electric machine. Into the other end of the tube *n* is inserted the extremity of the other conducting wire *r* of the same battery, the whole being so adjusted that when the flap *m* is raised, as shown in Fig. 13, the ends of the rod *o* and the conducting wire *r* within the tube *n* shall be in contact, and so allow of the electric or galvanic current flowing through the closed circuit, and indicating the fact that it is so flowing by the deflection of a magnetic needle or other known means, while upon the vessel coming into contact with the flap *m* and pushing it down into the position shown in Fig. 14, the metal rod *o* being drawn away from the conducting wire *r*, the electric or galvanic circuit is broken, and the knowledge of this fact is imparted to an observer by the magnetic needle ceasing to be deflected, or by any other of the known means of determining the existence or

LAW'S MACHINERY FOR RAISING AND DOCKING VESSELS.



cessation of an electric current. The rod *o* and conducting wire *r* are so attached to the tube *n* as to render it impossible for water to enter into the space between them, which would disturb the action of the apparatus; the elasticity of the india-rubber allows the elongation of the tube *n* and permits the separation of the rod *o* and conducting wire *r* when the flap *m* is depressed. It is necessary that the conducting wire *r* should be entirely insulated from contact with the water, and this may be effected by coating it with gutta-percha or vulcanised india-rubber. It is not necessary that the second conducting wire *q* should be connected with the rod *o*, but only that it should enter or dip into the water, which would itself form a sufficiently good conducting medium between the two.

In the arrangement above described the grounding of the ship is shown by the electric circuit being broken. Figs. 15 and 16 show another modification, in which the same fact is indicated by the circuit being completed. *s* is the block for the reception of the ship; *t* is a vulcanised india-rubber tube, fixed in a recess in the upper part of the block, so as to project a small distance above it; into the two extremities of this tube are inserted the two conducting wires *q* and *r* of a galvanic battery, their ends being flattened out and attached respectively to the upper and under sides of the interior of the tube *t*. Under ordinary circumstances the natural elasticity of the india-rubber would preserve the tube *t* in its cylindrical form, as shown in Fig. 15, and by causing the separation of the wires *q* and *r*, would interrupt the current of electricity, but upon the ship resting upon the block *s*, the tube *t* would be compressed, as shown in Fig. 16, the wires *q* and *r* brought into contact, the electric current established, and so the fact indicated to the observer above the water.

Fig. 17 is an arrangement for showing the grounding of the vessel upon the block by means of the compression of a tube filled with oil, water, or other suitable fluid. *s* is the block for the reception of the ship; and *t* a vulcanised india-rubber tube, fixed in a recess in its upper surface, so as partially to project above the same; to this tube a small rigid pipe *u* is attached, terminating above the surface of the water in a glass tube *v* (or arranged in any other convenient manner for showing any variation in the height of the contained column of fluid); upon the grounding of the ship upon the block *s*, the tube *t* would be compressed, and the fluid thus expelled from it would increase the height of the fluid column in the tube *u*, and give notice of the fact by means of the glass gauge *v*.

The fourth part of the invention consists in constructing the blocks or supports upon which the vessel is intended to rest when grounded either upon a cradle or in a dry dock, in such a manner that when the form of the vessel is not known, or is supposed to have become altered from its having been strained or hogged, or in any other case where a difficulty might occur in knowing how to adjust the several blocks, so as to insure each one receiving a due share of the weight of the vessel, in any of such cases the vessel being first grounded upon the cradle or in the dock, and then removed, shall show what space, if any, was left between the vessel and each particular block, giving, as it were, a perfect impression of her form, so as to enable each block to be raised to such a height as to insure its taking its due share in the support of the vessel, and so to prevent the latter from being injuriously strained; and this is effected by attaching to each block a movable rod projecting above its upper surface, and so arranged as to admit of its being pushed downwards by the vessel when in the act of grounding, and remaining in whatever position it may so have been placed, and so indicating by the height of its upper surface above the block what distance, if any, existed between the vessel and the block. This part of the invention is shown in Figs. 18, 19, 20, and 21, in which *s* represents one of the blocks for the reception of the ship, and *x* is a rod passing through a stuffing-box or collar of india-rubber or leather *y*, so as to impart to it sufficient friction to prevent its moving except by the application of considerable external force. A line or light rope *w* is attached to an eye in the upper extremity of the rod, to enable it to be drawn up into the position shown in Fig. 18, the rod being prevented from being drawn entirely out by the projecting head at its lower extremity. Fig. 19 shows a line of keel blocks, arranged for the reception of a vessel, the keel of which is known to be hogged, the whole of the rods having been left projecting above the blocks; Fig. 20 shows the vessel lightly grounded upon the same, so as to touch only upon the blocks at the stem and stern, and touching at the intermediate points only upon the tops of the sliding rods. It is obvious that upon the removal of the vessel each rod will show the intervening space which was left between the keel of the vessel and the block to which it belongs, and this space being made up with timber packing on each of the blocks, the vessel may then be safely grounded upon the blocks without any alteration taking place in its form. The keel blocks thus prepared, with the vessel grounded upon them, are shown in Fig. 21.

Fire Engines.—A large and handsome fire-engine, constructed by Messrs. Merryweather and Son, of Long-acre, and superbly decorated by Signor G. M. Casentini, of Hercules-buildings, Lambeth, was presented, on Monday evening, by the residents of Lambeth, to Mr. Hodges, the distiller, whose admirable fire brigade has so long rendered such valuable protection to life and property on the south side of the Thames. The presentation was witnessed by a large company, among whom was the Duke of Sutherland. Nearly 100 invited guests afterwards sat down to dinner with Mr. Hodges.

Fortress in Plymouth Sound. — The Minister of War has declined to accede to the request that a fort behind Plymouth Breakwater should be suspended until the Defence Commissioners have made their report. Consequently the preparations are now nearly completed, and in the course of a fortnight, probably, the divers will be at work levelling and excavating the rock for the foundation. The fort will be an oval, whose longer diameter is 160ft., and the shorter 130ft. The depth of water at the ebb is 36ft., and at the highest tide 52ft., and the foundations will be carried up 6ft. above high water mark, so that there will be masonry 58ft. deep, with a superficial area of 20,800ft., and, supposing the whole to be solid, a little under a million cubic feet of masonry. It will not, however, be entirely solid, but a portion of the space between high and low water will be water-proof magazines. Upon the top of the foundation, which, as we have said, will be 6ft. above the highest springs, the superstructure constituting the fort will be raised. How that superstructure will be built no one as yet knows. At present it is imagined that the fort will be iron-plated; but as some five years will elapse before this portion of the work can be commenced, there is opportunity for Sir William Armstrong to invent his patent thunderbolts, and for the authorities to change their minds sixty times. It is scarcely possible that these foundations will not be strong enough to carry any superstructure and ordnance that may be invented.—*Western Morning News.*

TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

TO OUR READERS.

By a strange transposition which occurred last week in making up the formes of THE ENGINEER, *a lengthy article on Steam Hammers was divided, the first half appearing by itself while the concluding portion was appended to another article. The error was only discovered and rectified when our edition was in part ready for delivery. We much regret the occurrence, and can only explain to those of our readers to whom we were compelled to send out the first portion of our edition, that the article on the International Exhibition should have properly concluded with the words "unconsidered prizes generally," in the middle of the first column of page 318; the next paragraph being the continuation of the article on Steam Hammers, apparently ending at the bottom of the first column on the next page.*

J. R. G. G.—*Shall appear next week.*
H. K.—*In type, and will appear next week.*
K. P.—*We do not think Mr. Watson has any patent for sawing the slits in knotter bottoms.*
INCRUSTATION.—*Please address your question to the proper quarter—the Secretary of the University.*
J. McD.—*Can you not state your questions fully by letter, so that we may reply to them in this column?*
I. W. C.—*The plan you propose is the same, with the exception of the stones, as that adopted by Mr. Hawkshaw.*
H. S.—*The Engineer of the Pneumatic Post Company is Mr. Latimer Clark, of No. 1, Victoria street, Westminster.*
G. E.—*Bevel gearing of 3 to 1 would not work well together if one wheel were changed so as to make the proportion 2 to 1.*
NORMAN.—*You ought, as the inventor, to be a good judge of an infringement of your invention. Can you not put your case in such a light as to submit it with confidence to a solicitor?*
SUBSCRIBER.—*Whoever, among our thousands of subscribers, sent us the slip headed "Engineering in Russia" for insertion, will find the same paragraph in* THE ENGINEER *of 16th inst., page 299.*
A CONSTANT READER.—*Most assuredly the flaw in your boiler flue is dangerous. Should your boiler explode, as it is likely to do at any moment, it might go hard with you were it proved that you were so long aware of the defect which you have described to us.*
J. M. (Greenock).—*The number of* THE ENGINEER *(some time in November, 1859), in which the Injector was first described, is out of print. But it has been several times since described in our columns, and indeed very lately in connection with the proceedings of the South Wales Institute of Engineers.*
BOILER.—*To be qualified as a boiler inspector you should have a good practical knowledge of the construction and working of all kinds of steam boilers, boiler furnaces, pumps, safety valves, steam and water gauges, &c., and you should be able to calculate the strength of boilers and action of safety valves.*
ENQUIRER.—*There would be no great advantage in the use of a surface condenser with a land engine, unless the feed water was bad. The cost of a surface condenser is probably five times that of a common condenser. A Giffard Injector will feed the boilers provided the feed water is not much hotter than 100 deg.*

THE SOAP MANUFACTURE.

(To the Editor of the Engineer.)

SIR,—Would any of your numerous readers be so kind as to inform me of the best plan of boiling soap, by steam, without mixing the condensed water with it, and if this would be as economical and as quick as placing the fire under the pan. NORWICH.

Norwich, May 26th, 1862.

THE BRIDGENORTH WATER WORKS.

(To the Editor of The Engineer.)

SIR,—In your last number I find an extract from a Bridgenorth paper of rather old date, referring to the then unsatisfactory condition of the water-works of that town.

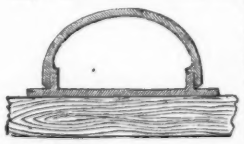
As one of the parties alluded to, and quite conversant with the facts of the case, I beg to observe that several accidents did occur after the engine was first started, but they were not at all attributable to the weakness of the mains, which are of a thoroughly substantial character. A defect in the air vessel was the sole cause of all the annoyance. This being remedied, the engine now performs its duty with perfect regularity, and I see no reason why the entire works should not continue to give uninterrupted satisfaction for many years to come.

Buckingham-street, Adelphi, May 28th, 1862. R. H.

CUPOLA SHIPS.

(To the Editor of The Engineer.)

SIR,—"A Bombardier" who, utterly ignoring Mrs. Glass's celebrated maxim of first catching your hare, deals so summarily with a cupola ship, and merely "jumps on deck, wedges the cupola fast, and then tows her away," winds up by saying "the locking of cupolas can never be prevented." Now, will "A Bombardier" so far oblige your readers as to explain how he would go about "locking" a cupola constructed as in the sketch?



May 26, 1862. J. LEONARD.

CUPOLAS AND FORTIFICATIONS *v.* MACINTOSH'S SYSTEM OF WARFARE.

(To the Editor of The Engineer.)

SIR,—In the *Times'* column of naval and military intelligence of the 26th inst., it is stated that "the conversion of the Royal Sovereign to a shield ship, on Captain Coles' principle is progressing with great rapidity;" but it is considered that "the down draught through the shield and towers will carry down the gases evolved by the burning of the powder, when firing the guns, and probably extinguish the fires in the furnaces;" and it is asserted by officers who were present in the attack of the allied fleets upon the sea defences of Sebastopol, that a similar difficulty was fully realised on that occasion, even with ships having a far better system of ventilation than the Royal Sovereign can have as at present arranged. May I ask, if the smoke of gunpowder causes such inconvenience, what would be the position of such vessels, if attacked by swift shot-proof steam vessels on Macintosh's system of warfare, discharging inflammable liquid with precision which ignites spontaneously, rushing into the crevices, destroying everything combustible, and rendering the air pernicious to life? In a like manner could the strongest sea face fortifications be rendered untenable.

May 28th, 1862. USEFUL EFFECT.

HERR HARTMANN'S LOCOMOTIVE IN THE EXHIBITION.

(To the Editor of The Engineer.)

SIR,—Seeing in THE ENGINEER, of the 2nd inst., a not altogether favourable notice of the locomotive exhibited by Richard Hartmann, of Chemnitz, Saxony, I hope you will kindly allow me to make the following observations.

This class of locomotive engine, with movable fore-axle and Bissell truck, for mountainous railways with many curves, has been well tested on the Saxon lines, by the engineers of which they are highly approved. They have been worked for many years, and have given such satisfaction that they are likely soon to be employed generally. According to testimonials, which I should be happy to show you, eleven of these engines are running on different railways. They are working on gradients of from 1 in 100 up to 1 in 35, and on curves of 275ft. radius, with the utmost security, viz., on a gradient of 1 in 100, with a weight of 194 tons on 45 axles, exclusive of engine and tender, at a speed of 22 English miles per hour; and on a gradient of 1 in 40 with lighter loads, at a speed of 23 English miles an hour. The tyres are of Krupp's steel, running up to 14,000 miles without being put in the lathe.

It is to be still remarked that since these locomotives have been running no accident has ever happened to them. GUSTAV HARTMANN.

23, Michael's-place, Brompton, May 26th, 1862.

SLOTTING MACHINES.

(To the Editor of The Engineer.)

SIR,—Having seen in your number of May 2nd an account of the London and North-Western Railway Company's workshops at Wolverton, permit us to make a few remarks regarding the slotting machines there, which we manufacture, viz., those with elliptical wheels, and which invention has not received the publicity it deserves.

We, in 1846, applied the same motion to a planing machine, and submitted our model to the Royal Society of Arts, Edinburgh, and in the same year were awarded the Society's Silver Medal for the invention. Since that date we have applied it to all reciprocating machines, such as slotting machines, planing machines, shaping machines, &c. Besides giving a quick return, the elliptical wheels being made in the proportion of 2 to 1, act like a wheel and pinion in going through the cut, thereby greatly increasing the power of the machine just at the moment this is required. The machines you refer to about Glasgow were all (nearly without an exception) made by us. We believe there is a planing machine in the machinery department of the Crystal Palace, Sydenham, with drawings and descriptions of these elliptical wheels, but the invention and first adaptation we claim.

Annexed you have a copy of report of the Royal Society of Arts Committee.* THOMAS SHANKS AND CO.

Johnstone by Glasgow, May 23, 1862.

* Copy of report annexed, signed by James Slight, Commissioner of the Royal Scottish Society of Arts. Edinburgh, April 2, 1846.

THE ENGINEER *can be had, by order, from any newsagent in town or country, and at the various railway stations; or it can, if preferred, be supplied direct from the office on the following terms:—*

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THE ENGINEER.

FRIDAY, MAY 30, 1862.

THE MECHANICAL ENGINEERING OF WAR.

THE distinctive prefix "Civil," as applied to what has been generally held to be the most important branch of engineering, is in a fair way to be soon forgotten. Five years ago the men of Great George-street would have had grave doubts whether it was altogether professional to come before the public with propositions of any kind relating to the national defences. For with them it was nothing to be an "engineer," while to be a "C.E." was everything. The dignity of their profession turned especially upon the initial "C." But five years are an ample period for great changes, and within the last five years a volunteer army, a hundred thousand strong, has sprung up among the British people, and military science has been greatly popularised. And if the members of the Institution have not actually enrolled themselves, regimentally, under Col. Bidder or Col. Hawkshaw, they have certainly entered far upon the province of the military engineer. The principal proceedings of the Institution within the last two years and a-half have been dedicated to the Construction of Artillery and the National Defences, and the members of the United Service Institution must admit that both subjects were treated with greater amplitude and precision in Great George-street than they ever were in Whitehall-yard. The C.E.s, too, have individually said, written, and done something in the same direction, and there is now hardly a member, or an associate, or a graduate of the Institution who has not definite opinions upon, and a scheme or schemes for, forts, or batteries, or fighting ships, or works of some kind for offensive or defensive purposes. As for mechanical engineering, there is really nothing antithetical between it and military engineering, and whatever distinction there may be, it will soon be lost in the comprehensive initials M.E., which will apply equally to both. The most eminent mechanical engineers in the kingdom have taken up the construction of artillery both professionally and commercially, our most noted makers of marine engines have long been almost exclusively occupied in the construction of machinery designed expressly for war ships—indeed few commercial steamship companies would admit it into their vessels. Our commercial shipbuilders have secured large Government contracts for iron-clad frigates, and are giving great consideration to all questions of naval attack and defence, while the iron masters are watching, with the keenest interest, the cross action of plates *v.* ordnance and ordnance *v.* plates, and are only too ready to supply the nation with iron up to 15in. in thickness for encasing ships and forts so that they shall be absolutely impregnable to any and all projectiles.

We need not, then, endeavour to conceal the fact that the mechanical engineering of war now occupies a large, if not the larger share of the attention of our profession. It affords the widest and most attractive field for discussion, and it holds out the inducement of possible rewards otherwise attainable, if at all, only by a life long devotion to legitimate professional duties. Ships of war, forts, and guns have succeeded to the interest which collected about railways fifteen and twenty years ago, and to that of the important substitution of wrought for cast iron, by which it became possible to build the Britannia bridge in 1848. The whole subject of railway construction, and those of locomotive engines, iron bridges, pumping machinery, docks, piers, gasworks, lighthouses, and even submarine telegraphs, appear to have surrendered their former interest to the grim enginery of war. As for guns, it is certain that we shall not rest satisfied until the maximum of strength has been reached. We are a long way from this yet, for already the 10½in. gun, made up of coils by Sir William Armstrong, has not only exhibited an internal flaw, but has burst one of the outer coils. Inasmuch, therefore, as we are quite likely to require 20in. guns to burn 200 lb. of powder and to throw shot of 2,000 lb. weight, the prospect of obtaining such examples of ordnance in wrought iron, upon any plan yet adopted, is not encouraging. Mr. Longridge's wire gun would appear to offer the maximum strength in one direction, but the possibility of making it correspondingly strong in the breech, and, indeed, throughout its length, has never been ascertained. We are sufficiently aware, however, that mild steel is nearly twice as strong as good wrought iron, and not only is it stronger, but it is at the same time more ductile, although it can only be worked under the application of great force. Its hardness, and consequent power to resist the tremendous percussion resulting from the explosion of a heavy charge of powder within the chamber of a gun, is nearly twice that of wrought iron, but this hardness is not associated with brittleness, for ordinary wrought iron is as much more brittle than mild steel as ordinary cast steel is more brittle than wrought iron. Finally, mild steel is fusible, and can thus be cast into masses of any weight, and experience proves that, under the hammer, these masses may be made perfectly homogeneous, which can never be the case with non-fusible wrought iron, however piled, coiled, or worked together. It is only within the last six years that mild steel has become known. It may be defined as iron in combination with the least proportion of carbon which will suffice to render it practically fusible. The first makers who gave a repute to such a quality of steel (or iron, whichever it may be), were Messrs. Shortridge, Howell, and Co., of Sheffield, who produced it by a slow and expensive process, and sold it under the name of "homogeneous metal," a term equally applicable to cast iron, gold, silver, copper, lead, and some other metals. This homogeneous metal was the mild steel we have described, being prepared by the fusion, under a high heat, of wrought iron along with a small proportion of charcoal, and with the addition of any simple flux. Thus 40 lb. of wrought iron, not fusible by itself at any heat, was mixed with 5 oz. or 6 oz. of charcoal, and a little black oxide of manganese, or sometimes common salt, and sometimes prussiate of potash, and under a high heat the iron took up just enough carbon to become fusible, and was then poured into moulds. The melting pots could only stand two, or, perhaps, three charges, when they were burnt out and useless. The metal produced was then reheated, and worked like ordinary steel or iron. The Bessemer process has been found to be perfectly capable of producing a like quality of metal in masses of at least three or four tons in weight, and in less than half an hour after the pig iron, worth £2 10s. or £2 15s. a ton, has been melted. Mr. Whitworth's cannon, or at least the internal portion of them, upon which the greatest strain is brought, have always been made of the so-called "homogeneous metal," or mild steel, and are now made in masses of nearly four tons weight by the Bessemer process. We believe that the Whitworth guns have been proved to have the greatest absolute strength of any guns of their weight yet made. Something has been said of one of them being burst; but the bursting was found to result from an air space between the powder and the shot, and with air space it is believed that any gun which it would be possible to make could be burst.

What is known, therefore, of the properties and practical use of mild steel, already applied to the construction of guns of large calibre, justifies the belief that it is the most suitable material yet known for the construction of cannon, and far superior to wrought iron in any form of mechanical arrangement. In any case, too, the mild steel gun is cheaper than one forged solid or hollow in wrought iron, and it is very much cheaper than a wrought iron gun made by the roundabout mode of coiling. But Sir William Armstrong has been raised to his present position solely on the presumption that he has produced a practically perfect gun, and he abandons everything when he abandons the principle upon which that gun is made. Occupying a false position, that of a man sitting in judgment over his own rivals, Sir William obstructs, by every means in his power, any and every attempt to improve upon the contrivance which, although originated by others, accident and popular repute have made his own. In the meantime much attention is being given to the protection of ships and forts from Sir William's shot, and as there is a remote prospect that both he and his gun will ultimately be superseded altogether, and a much more formidable system of ordnance introduced, we shall have a long hearing of the cause of ordnance *v.* plates. That the former must triumph in the end we have never doubted, and it may yet happen that all our iron plating will go to the scrap heap, and ships go into action, as in the days of Collingwood and Nelson, with sides wholly unprotected.

THE PATENT LAWS.

WE are to have a commission to inquire into the working of the law of patents. Ever since patents for inventions were first granted, their operation has been, in many respects, unsatisfactory. That the balance of advantage has always been greatly in their favour has been generally believed, and there are abundant reasons for the conviction that anything like the abolition of patents would be attended with great national loss. Nothing of that kind, however, is at all likely at present, and the commission to be appointed by the Queen will have only to consider wherein patents may now be granted undeservedly, and how the inequalities and inconveniences attending the system may be reduced to a minimum. In bringing forward his motion for an address to the Queen, Sir Hugh Cairns expressed himself in terms much the same as those which we long ago adopted in treating of the whole subject of patents. He clearly distinguishes that, while no inventor has an inherent right to a patent, he has an unquestionable right to conceal anything he may have invented unless the public make terms with him for its disclosure. That, without some encouragement to divulge their plans, inventors would generally prefer to keep them secret is not only evident enough of itself, but even some of those, including the *Times*, who have lately attacked patents altogether, have formerly given great prominence to this consideration. More than ten years ago, and before the passage of the Patent Law Amendment Act of 1852, the *Times* wrote as follows:—

"The law, however, regards those who wish to derive a "pecuniary benefit from the result of their labour, inquiry, "and ingenuity; and we ask what such men would do, "supposing no law existed by which they could secure a "property in that which they had discovered? The "answer is obvious; they would endeavour to keep their "process a secret, and in those cases in which secrecy is "impossible, they would have no motive to go through the "trouble and expense of discovery. Where secrecy might "be possible, we should find the new process fenced round "by every mystery and mystification which the ingenuity "of the discoverer could devise. Secrecy would be "enforced on workmen, as far as possible, by keeping them "in ignorance; and when this became no longer feasible, "the sanction of oaths would be employed to that end. A "state of most painful suspicion and restraint would be "the condition of every one who was in possession of "an invention, and of all whom he employed. A more "mischievous, as well as a more disagreeable condition, can "hardly be conceived. The necessary uncertainty of suc-"cess, after every precaution taken, the suffering and ex-"pense attendant upon all such endeavours, would prove a "heavy counterpoise to all expected benefit from the inven-

"tion. Thus, under this system of no privilege, a large "class of discoveries would be wholly without protection, "and the remainder would be most imperfectly, and with "great labour and expense, guarded against unfair appro- "priation. On the other hand, putting aside for the mo- "ment any consideration of the difficulty attending the "means of attaining such an end, let us ask what would be "the effect of a promise made by society to every *bona fide* "inventor, that he should enjoy an exclusive property in "his discovery for a limited period? If such exclusive "property could be insured, if the right itself could be ac- "curately defined and easily acquired, society would, in "so far as depended upon the law, have done its utmost to "foster a spirit of discovery, because thereby it would "render certain such reward as the invention itself really "deserved; and to itself society would not by this means "do injury, for although there would be some delay in the "full and universal enjoyment of the benefit, whatever it "might be, resulting from the invention, yet, upon the "whole, ultimately there would be a greater harvest of "discovery than would accrue from a system by which no "reward was provided for him from whom the benefit "came. With common men the common motives to exer- "tion must be relied on, and society, by thus judiciously "protecting private interests, would promote the general "welfare."

Upon like reasoning Sir Hugh Cairns does not choose to attack the principle of patents. Indeed, he expressed his conviction that the changes made by the Patent Law Amendment Act of 1852 "were as beneficial and as useful "changes as were ever accomplished by one piece of legis- "lation." And all but one of the other speakers subscribed most fully to the propriety of patents.

Repeating that real inventors have nothing to fear from the commission to be appointed we may note the points to which its attention will be directed. At present, as is well known, patents for frivolous inventions are granted, and so, too, two or more patents are frequently granted successively for the same thing. But as to what is a useless invention, we fear no authority could properly determine in advance. In America, where a full board of examiners is employed at the Patent-office to decide upon applications for patent, and where, too, the Act requires, as a condition of patentability, that the invention be "new and useful," no attempt or pretence is really made to determine the question of utility. Sir Humphrey Davy, previous to the introduction of gas-lighting, did not believe in its practicability, which is an essential part of utility, since no invention can be useful which is not practicable. There was a time when the steam engine itself, and, afterwards, steam navigation, railway engines, and dozens, if not hundreds, of other most valuable inventions were generally deemed to be impracticable, and, therefore, not useful. To attempt, therefore, to determine the measure of utility of an untried invention would hardly be successful. But it is not easy to see how a patent for an absolutely useless invention can do harm, and, consequently, there is not much to fear from useless or impracticable inventions. If it were laid down, too, that no invention is patentable where no detailed description, properly illustrated, and sufficient to enable any competent workman or practitioner to carry out the invention successfully, is given, there could not either be much fear of obstructive patents, covering broad and vague generalities incapable of reduction to successful practice. The question of novelty is, after all, the most important in the grant of patents, and here an examining board appears to be necessary. It may not be that even they should have the power of peremptory rejection upon the apparent resemblance of an alleged invention to something previously known, but they should, we think, be required to note, upon the specification, any resemblance to prior inventions, leaving it to the applicant to determine whether he will then proceed with his case. At present there is no pretence of any search for novelty, and it is notorious that almost any invention may be repatented successively by almost any number of applicants. With the published specifications at hand, and with such indices as could readily be prepared, a competent staff of examiners could hardly fail to soon place all questions of novelty beyond all reasonable doubt. As for the question of the fees for patents, experience has certainly shown them to be higher than is necessary, and considering of how little consequence a few thousand pounds appear to be in the national treasury, and of how much consequence five or ten pounds generally are to the poor but ingenious inventor, we think that, with the weeding out effected by examiners, the fees might be considerably reduced without any fear of the undue multiplication of patents.

A grave question connected with patents is that of settling patent causes, as for infringement. But costly and uncertain litigation is by no means peculiar to patent property. There are abundant cases where vast fortunes have been sunk in the attempt to prove titles to real property, and we have lately had an example of what may be spent in proving a question of sanity. If patent suits can be simplified, as we believe they may, we shall be glad to see the subject properly taken up, but it is to be kept in view that this question does not affect that of the policy of liberal treatment of patentees on the part of Government.

PAPER MAKING MACHINERY IN THE EXHIBITION.

A few improvements have been made in paper making machinery since that introduced by Messrs. Fourdrinier, in the beginning of the present century, upon the original continuous paper making machine invented in 1799 by Louis Robert, of Essonne, in France. In the western annexe of the International Exhibition, Messrs. Bryan Donkin, and Co., of Bermondsey, exhibit a large machine, from their latest patterns, which is, they state, "on the "same principle as those erected by Mr. Donkin at Frog- "more, in Berks, in 1803, and at Twowaters, in Hertford- "shire, in 1804, which were the first machines ever used "for making endless paper." It is added, however, that "the machines for clearing the pulp, and for drying and "cutting the paper, were subsequent inventions." These, certainly, are not the only improvements of importance which have been made in this class of machinery since 1804, and yet the latest example of construction in this line is "on the same principle" as those set up nearly sixty years ago, when Mr. Donkin was the assistant of Mr. Hall of Dartford.

As commonly understood, paper making implies the whole course of manufacture in the conversion of rags, or other fibrous material, into paper. As technically accepted, however, the term includes only the production of paper from the pulp, or "stuff," as it is always denominated in paper mills. No pulp making machinery is shown in the Exhibition. The production of the "stuff," however, apart from its primary rank in the whole manufacture, is largely dependent upon skilfully constructed machinery and careful chemical treatment. To take a proper view of paper making, therefore, we should first enter the rag room, following the material thence to the finishing room, where the paper is packed for market. Within our present limits we can only take a cursory glance at the many intervening processes, and, as a good illustration of the whole, we may refer to a large mill lately erected for the Hon. William Napier, at Dartford, and supplied with machinery by Messrs. Easton, Amos, and Sons, of Southwark. We may note that the eminent firm of engineers just named entered into a contract, on the 5th of September last, to erect the mill in question, including every part of the construction of the buildings, wharf, steam engines and boilers, washing, beating, and poaching engines, and an 84-in. paper-making machine, capable of working at 90ft. per minute, and turning out 16 tons of finished paper weekly—the whole involving an outlay of about £40,000, and to be in full work on the first of last month. The contract was fulfilled to the day, the entire work being performed in the brief space of eight months. As a whole, this mill is probably the most complete and most nearly perfect of the kind in the kingdom.

The rags, which are brought from nearly all parts of the Continent, are unshipped from vessels, which come up Dartford Creek to the doors of the mill. After being weighed and opened they are turned over to women, who cut them into shreds and sort them into lots according to quality, removing, at the same time, all buttons, silk, woollen, or other substance not convertible into paper. The rags are next dusted and then boiled with caustic soda in large slowly-revolving iron boilers supplied with high pressure steam. They are then ready for the washing engines. These, as well as the beaters, are driven by a pair of compound or high and low pressure steam engines of 90-horse power collectively. Geared to the toothed fly-wheel are two stout shafts, upon each of which are spur-wheels for driving three washers and four beaters, or fourteen washing and beating engines in all. The machines of both these classes are almost identical in construction, each consisting of a stout cast iron drum, about 26in. in diameter and 2ft. 6in. long, mounted with a number of steel cutters, and revolving, within a cast iron tank, almost but not quite in contact with about twenty other cutters, fixed in a block of elm, and placed in the lower part of the tank, which is nearly filled with rags and water, the latter in constant flow through the tank. The cutters or knives in the revolving cylinder, which is covered by a case or hood, are arranged in separate groups of three each, there being, say, fourteen or fifteen groups in the washers, and seventeen groups or fifty-one knives in the beaters. The edges of all the knives or cutters on the cylinder are parallel with its axis. The knives in the "block" below are grouped within a width of 6in., and in their whole length diverge about $\frac{3}{16}$in. from the longitudinal direction of the revolving cutters with which they are so nearly in contact. By this adjustment the knives have a scissor-like action upon the rags. The revolving cylinder, which, in the washing engines, runs at about 160 turns a minute, and at about 180 in the beating engines, may be raised a little by an adjusting screw supporting the outer bearing of the cylinder. This is for regulating the action of the cutters on the rags. The revolving cylinder occupies the usual position in the tank, which is of cast iron in a single casting upwards of 2 tons in weight. There is a scoop-wheel for taking away the dirty water from the surface of the contents of the tank.

After between two and three hours' washing the semi-pulp, or "half stuff," as it is always called, goes to the draining beds, and thence to the poaching engine, where the material is treated with chlorine for the purpose of bleaching. It was formerly the practice to introduce chloride of lime, along with the partly worked rags, into the washing engine, but, as lime was left in the paper, it is now preferred to dissolve the chloride in water, and, after the lime has been precipitated, to add the liquid containing the chlorine gas to the half stuff in the poaching engine, of which there is one only for the fourteen washers and beaters. The poaching engine has a stone tank and a cast iron revolving cylinder with coarse projections, but has no knives. The quantity of bleaching material depends wholly on the colour of the half stuff. Were this made from fine cottons, already bleached, perhaps no chlorine would be required, but, for dark coloured rags, 5lb. or more of chloride of lime require to be dissolved for every hundredweight of rags.

From the poaching engine the half stuff goes into stone vats, where, after several hours, the chlorine exerts its full bleaching power. Thence the material is taken to the beaters, already described with the washers, and here, after three hours' active comminution, the pulp or "stuff" is finally prepared ready for the paper making machine. It is to be observed that while a rapid inlet and outlet of water is effected in the washers, very little of the water supplied to the beaters at the beginning of a charge is changed until the charge is finished.

The "stuff" goes first into two large circular wooden vats, called "stuff chests," and having each a slowly revolving agitator, much like a brewer's mash tun. As the level of the contents of these chests is frequently varied by the addition of fresh "stuff" from the beaters and by withdrawal to the machine, and as it is essential to uniformity in the thickness of the paper that the flow of "stuff" upon the table of the machine should be that due to some constant or unvarying head, the "stuff" is pumped from the "stuff chest" to a cistern which overflows at a fixed level. The "stuff pump" for this purpose is of the diaphragm variety, with but a comparatively small amount of motion, and the valves are large spheres, so that the action of the pump shall have the least possible tendency to form the pulp into knotty or felted clots, or into threads.

The whole process of producing paper from pulp consists merely in "felting" the fibres of the pulp together into a web, afterwards expressing from this the large quantity of water with which alone the pulp is workable, and finally pressing and drying the web or sheet thus obtained. The felting is accomplished by rapidly shaking the pulp from side to side, so that the innumerable minute fibres may interlock with each other. In hand-made papers—and all paper was once made by hand—this shaking was imparted by the arms of the workman. In the self-acting machine the pulp, discharged at a uniform rate from the cistern into which it is raised by the "stuff pump," falls into a receiver or vat, from which it is again raised by a lifter (which is a scoop wheel), and thence flows over the "sand strainer" to the "knotter." In the bottom of the vat is an agitator, called the "hog." The sand strainer is a slightly inclined table, with numerous transverse horizontal ledges. As the pulp flows over it these ledges intercept and retain any particles of grit, &c., which are heavy enough to be precipitated by their own gravity, and which would otherwise injure the quality of the paper. The sand strainer is commonly made of cast iron covered with zinc. The knotter is a large square gun-metal pan, of shallow depth, and having its bottom incised with numerous fine slits which, while they permit the downward passage of properly prepared pulp, are yet so fine as to intercept all knots and stringy collections of fibre, which would otherwise form unsightly asperities upon the surface of the paper. In the earlier machines a sieve was employed as a knotter, and to Mr. Ibotson is ascribed the invention of the slotted knotter, by which alone the longest and most valuable fibres of the pulp are allowed to pass on to the table of the machine. The date of Mr. Ibotson's patent was July 29th, 1830. The slits of the knotter vary from perhaps $\frac{1}{64}$in. to $\frac{1}{160}$in. in width, according to the coarseness or fineness of the pulp to be strained. Mr. Ibotson introduced, and Messrs. Donkin and Co. still use, a knotter formed of parallel brass bars, arranged like a furnace grate, but the knotter bottoms most preferred by other makers are those made by Mr. Henry Watson, of Newcastle-on-Tyne, who exhibits one of his knotter bottoms in the western annexe. In these the slits are sawn through the brass, which is of considerable thickness, say 1in. The slots are widened or flared as they open downwards. To these knotter bottoms Messrs. Easton, Amos, and Sons apply a diaphragm apparatus, which, being put in motion, produces an inspiratory and respiratory action through the slits so as to prevent their becoming clogged with the accumulation of knotted fibres which they serve to intercept.

From the knotter the strained pulp is delivered, over a gun metal or copper lip, upon the tables or endless web of brass wire cloth. This table is levelled with great accuracy, and the web is supported by, and carried forward upon, from 30 to 50 "table rolls" formed either of gun metal or copper. The pulp is prevented from flowing away at the sides of the table by means of thick india rubber straps, called the deckle straps, which move with the table, upon which they are pressed down by means of gun metal frames. The whole table, with breast and table rolls, deckles, &c., is supported upon a frame jointed at one end, and which is put in rapid side-to-side vibration at the other (or the end next the knotter) by a crank motion. The parts producing this lateral motion are collectively termed the "shake," and it is the shaking of the pulp on the table which felts together the fibres of the pulp into a cohesive web. The shaking, it will be understood, is greatest next the knotter, it being diminished to nothing at the opposite end of the table, where are the joints around which the "shake" works. The more rapid the shake the longer is the water contained in the pulp, and prevented from running through the meshes of the wire of the table. A considerable portion of the water does, however, escape in this manner, and an additional quantity is taken off by suction, as follows:—After the wire cloth, covered with pulp, has passed the table rolls it passes over two boxes with perforated covers, and within which a partial vacuum is maintained by means of a set of air pumps, worked by the steam engine which drives the whole machine. Under this exhausting action much of the water which has failed to run off through the meshes of the wire table is extracted. No part of the table to which the pulp has access should be of iron, as iron rust would irremediably discolour the paper. The bars, even, which regulate the width between the deckle straps, are often made of copper, although they are not supposed to come in actual contact with the pulp beneath them. In one of the English machines exhibited in the Exhibition these bars are of iron, as they are also in the foreign machines. In the new machine at Dartford, which we are now describing, they are made of copper. The table rolls are supported in bearings at the ends, and attached to the "shake." As the greatest accuracy in levelling these rolls is of much consequence the bearings should not only be of gun-metal, but each ought, rightly, to be adjustable by itself. In the Hon. William Napier's new mill the paper-making machine has 48 table rolls, each having an adjustable gun metal bearing at each end. The deckle straps should be of the best india-rubber, and those of Mr. Dodge, of Dowgate-hill, are in much favour among paper makers. The vacuum boxes with their covers are variously made of gun-metal, wood, and even of glass. The constant passage over them of the wire cloth can hardly fail to wear it out; and, therefore, in order to diminish the friction as much as possible, Messrs. Easton, Amos, and Sons at one time tried the experiment of employing glass as the material for the vacuum boxes. It was found, however, that, in comparison with hard wood, the latter was the preferable material of all, and it is accordingly employed in all the paper-making machines now made by that firm. The vacuum boxes, we may note,

have adjustable slides, which may be drawn apart or pushed towards each other, from both ends, to suit the width of the paper being made. The guide roller of the wire table has adjustable bearings, so that it may be tightened or loosened on either side to correct any tendency to lateral movement. A wire roller, called the dandy roll, is made to press upon the surface of the pulp when it is nearly freed from water, but while it is yet in a plastic state; and any device, sewn in wire upon the surface of this roll, is repeated at every turn upon the pulp, which is thus reduced in thickness at the points pressed upon by the wire, and thus what is called the "water mark" is produced in the paper.

From the guide roll of the table the cohering but still plastic web of pulp is taken upon a thick endless web of felt and passed between the couch rollers, heated by steam, and by which an additional quantity of water is expressed and evaporated, and a smooth surface given to one side of the paper web. To counteract the tendency of the felt to shrink and crumple the paper, it is forcibly distended, for which purpose various arrangements have been, at different times, employed. Formerly, a narrow leather or other band, with raised or flanged edges, was sewn on each edge of the felt, and small rollers, revolving on inclined axes, were made to work against these bands in such a way as to force them outwards, and thus to stretch the felt across its width. The contrivance now more commonly adopted is that of a pair of cylindrical wooden rollers, placed end to end across the machine, but diverging from each other, and from a line drawn square across the machine, each roller thereby tending to draw one-half of the felt outwardly from the other half, and to an extent sufficient to counteract its natural tendency to contract in width when stretched longitudinally. More lately Messrs. Easton, Amos, and Sons have adopted a long wooden roll, one-half of the length of which is cut with a coarse square thread right hand screw, the other half having a left-hand thread.

After the paper web has passed through the first or wet felt press it is conducted through the second, or dry felt press, where it is still further cleared of moisture and a smooth surface given to the opposite side from that treated by the wet press. The paper is now ready for the drying and glazing cylinders. In the machine which we have been describing there are, in all, twelve drying cylinders, each 3ft. in diameter, and three sets of glazing rolls with three in each set. Exhaust steam is admitted to these rolls, the heat being graduated in each according to the condition of the paper in passing. From the last set of glazing rolls the paper passes to the cutting machine, which cuts the continuous sheet of paper into sheets of the requisite length and width.

The sizeing of printing paper, it should be observed, is effected by an admixture of alum, ground up in oil, in the beating engine, while the surfacing sizeing of superior papers is given by treatment with animal gelatine after the paper leaves the cutting machine.

The ordinary rate of paper-making machines, turning off printing paper, is now from 50ft. to 100ft. per minute. The *Times* paper, which is made at the Taverham Mills, Norwich, at McMurray's, Wandsworth, at Saunders', Dartford, and by Mr. T. Wrigley, of Bury, is run off at the rate of about 75ft. per minute, or upwards of twenty miles in twenty-four hours.

In the Exhibition four paper-making machines are exhibited, one by Messrs. Bryan Donkin and Co., of Bermondsey, one by Mr. George Bertram, of Edinburgh, one by M. Laroche, of Brussels, and one by M. Dautrebande, of Huy, in Belgium. Of all, the most workmanlike appears to be Mr. Bertram's. It may be that Messrs. Donkin's machine is in no important respect inferior, but its old-fashioned framing and exposed gearing invite criticism. It has six drying cylinders 4ft. in diameter, while Mr. Bertram's has eight, each 3½ft. in diameter, thus giving one-sixth more periphery than Donkin's, while Messrs. Easton, Amos, and Son's new machines present a circumference one-half greater than Donkin's, with the advantage, moreover, of presenting twelve opportunities instead of six for regulating the temperature in the drying apparatus. Donkin's drying rolls are placed high up, and give the machine a top-heavy look, while Bertram's are placed lower. Donkin's has but two sets of glazing rolls.

In Bertram's table, with which is one of Watson's best made knotters, the rolls are supported in gun metal bearings, although each is not adjustable separately. In Donkin's machine the table rolls run in iron bearings, that is to say, a pair of long bars of iron with semi-circular notches cut in their upper edges. Bertram's machine is rated as 80in. wide, and Donkin's will probably turn off paper of about the same width, the endless wire table being 90in. wide and 34ft. long. The workmanship and the proportions of the working parts of both Donkin's and Bertram's machines are very good.

The foreign machines do not compare very favourably with those made in this country. Both Laroche's and Dautrebande's machines are lightly proportioned, and could hardly be expected to work advantageously at the high speeds adopted in English and Scotch paper-mills. In their general plan of construction they are like our own machines, and, indeed, all paper making machines are much alike in principle. Their table rolls, however, are small, and are not supported in the best manner, the "shake" is a cheap, rattle-trap contrivance, and the rolls are generally light and apparently wanting in support. These machines, it deserves to be said, are cheap, the price of Laroche's being £1,800 only, or about one-half the price of a large English built paper making machine. The foreign-made papers are generally light and not always of a quality which would command the English market, and we have no reason to doubt, therefore, that the machines exhibited by Belgian makers answer every purpose of the Belgian paper manufacture, making, we may suppose, as good a quality as is required in the continental trade.

We are aware of no important improvement in paper making machinery since 1851, and have no reason to look for any within the next few years. With the repeal of the paper duty, however, we may look for a great increase in the use of such machinery.

MANCHESTER ASSOCIATION FOR THE PREVENTION OF BOILER EXPLOSIONS.

AT the last ordinary monthly meeting of the Executive Committee of this association, held at the office, 41, Corporation-street, Manchester, on Tuesday, May 27th, 1862, Thomas Scoffield, Esq., in the chair, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abtract:—

"During the last month there have been examined 316 engines and 464 boilers. Of the latter, 9 have been examined specially, 10 internally, 74 thoroughly, and 371 externally; in which the following defects have been found:—Fracture, 6 (3 dangerous); corrosion, 50 (7 dangerous); safety-valves out of order, 6; water gauges ditto, 15; pressure gauges, ditto, 5; feed apparatus, 1 (dangerous); blow-off cocks ditto, 34 (2 dangerous); fusible plugs ditto, 6; furnaces out of shape, 6; Total, 129 (13 dangerous). Boilers without glass water gauges, 29; without pressure gauges, 10; without blow-off cocks, 34; without back pressure valves, 33.

"Explosions continue to occur to every description of boiler. One has happened during the last month to a locomotive in the vicinity of London, and another to a stationary boiler on the Clyde. Both of these were—as it is hardly necessary to state—beyond the sphere of the operations of this association. Each of these explosions was attended with fatal consequences, but I am not at present in possession of the engineering facts.

"The recent very frequent occurrence of explosions has monopolised, by the bare recital of their details, the entire space of the late reports, and left no room for considerations resulting from them, to which I think it is important attention should be drawn, and which, therefore, I now propose to do.

"It will be remembered that one of the late explosions arose from the failure of an angle iron, on which alone—as on a single thread—a large crown plate depended for its support. Several other explosions occurred to externally-fired boilers through failure of the plates just at the seams of rivets exposed to the flame. In some of such cases the plate is found to crack at the rivet holes; in others leakage occurs, from which corrosive action sets in, and steadily continues until the plates become so thinned that rupture and explosion ensue. Some explosions have occurred from corrosion consequent upon external damp; others from the acidity of the water; while others, again, of somewhat earlier date, have been occasioned by the collapse of the furnace tubes, consequent upon weakness of construction, which would have been remedied by the adoption either of flanged seams, T or angle-iron hoops, or other similar means.

"Thus it will be seen that all the above explosions occurred from the most simple causes, and that no mystery whatever need be attached to any one of them; while by suitable construction of the boilers in the first place, and due attention to their state of repair in the second, these explosions would in every case have been prevented.

"I am extremely desirous to keep this practical view of steam boiler explosions constantly in sight, since I am persuaded no head will be made against them generally, as long as their causes are considered to be matters of mystery, and their occurrence one of chance.

"Very few of the explosions that come under my notice occur from shortness of water, and I believe that to be a much abused idea, and the number of explosions resulting from it to be much exaggerated. It appears to be an almost stereotyped verdict at inquests, and the boiler attendant being frequently killed, there is seldom any witness to the contrary.

"I find that by far the most frequent cause of explosion is the insufficiency of the boiler for its working pressure, either on account of its original construction or state of repair consequent upon use; while those explosions resulting either from deficiency of water, or form extraordinary or reckless pressure, are comparatively rare. In other works, to prevent misapprehension, I find that explosion is more frequently due to weakness of the boiler than to excessive pressure of the steam.

"I know no means of ascertaining the sufficiency of the original construction of a boiler, or of detecting the weakening effect produced upon it by wear and tear—in short, of testing either new or old boilers—equal to the use of hydraulic pressure, and think all steam users would do well to make systematic use of this test once a year. In France, I believe, this plan is rendered compulsory by the Government, and it would be well were it generally adopted in this country voluntarily. Weak places in the plates may pass undetected, even on careful examination, while some parts may be inaccessible and concealed from view, but the hydraulic test is sure to detect and expose them all. Its timely application would have saved that most disastrous explosion which occurred some time since here in Manchester, at a locomotive establishment second to none in the kingdom for its high reputation, and since a defect passed unnoticed at such an establishment, where the construction of boilers, as well as the quality and strength of plates may well be supposed to have been thoroughly understood, it surely argues the necessity of the hydraulic test being generally applied.

"Mr. Muntz, a steam user in Birmingham, states in a letter published on the Millfield boiler explosion, that he has for years adopted, with advantage, the plan of an annual hydraulic boiler test, and considers it a duty he owes to his workmen in consideration of their safety.

"The application of the hydraulic test is so simple, and the pump required so small, that each steam user could provide himself with one at very little expense, or some parties might find it worth their while to take up the proving of boilers by water pressure as an itinerant speciality of engineering practice. This association would be glad to assist in the general application of the hydraulic test, by inspecting the boilers when under pressure, and I feel convinced that, were the practice of this annual test generally adopted, which I trust it soon will be, explosions would become nearly, if not entirely, extinct."

NOTES FROM AUSTRALIA.

WE have advices from Sydney, New South Wales, to March 21, and from Melbourne, Victoria, to March 25.

The railway works which have been some time in course of execution by Messrs. Peto and Co. in New South Wales, are now nearly completed. The most interesting work occurred on the extension of the southern line, the viaduct at Menangle, to which reference has several times been made in THE ENGINEER. The viaduct is in course of erection across the Nepean river, and the altitude and violence of the stream after continuous rains rendered it necessary that the piers of the viaduct should be able to resist the pressure they would occasionally sustain, and that they should be carried to such a height as to leave the superstructure above the extreme flood level. The floor of the viaduct will accordingly be 6ft. above the highest water mark, which is 56ft. above the bed of the river. The principal supports of the viaduct consist of four stone piers, placed at a distance of 150ft. from each other; each pier will be oval in shape, the two centre piers will be nearly 80ft. by 20ft. at the base, tapering upwards to 52ft. by 12ft. at the top. In order to obtain foundations for the two central piers coffer-dams had to be constructed, and all the water pumped out. The foundations for the first pier (that upon the northern bank) being above the water, were obtained without much difficulty, but the preparations for those for the second and third were necessarily impeded by the tedious preliminary processes. Upon the removal of the water out of the coffer-dam for the second pier a solid base was soon found, but within the enclosure for the third pier the operations were less satisfactory, the bed of the rock being found to have sunk at one end, requiring the removal of a great quantity of sand and mud and a descent to a much greater depth for the foundations than was anticipated. A steam engine has been constantly employed for the purpose of pumping out the water, the inflow of which it was found impossible to prevent, in consequence, partly, of several of the piles for the coffer-dam having been broken by striking against logs of timber in the bed of the river. The fourth pier will not rest upon the rock, but upon a timber platform, which will be fixed upon parallel rows of bearing and sheathing piles; the former will be driven down to the rock at a depth of from 45ft. to 60ft., and the latter will be driven about 8ft. below the level of the platform, their use being to confine the sand around the piles. On the top of the bearing piles there are to be sills, both longitudinal and transverse, tenoned on to them, and on these two layers of diagonal planking 4in. in thickness, and above this will be the masonry. The quarry which supplies the stone for the piers is about a mile and a quarter from the site, higher up the river. A tramway connects the quarry with the northern approach to the bridge; it is for the greater portion of the distance upon an easy incline, allowing the loaded trucks to run down without any traction. Rails are also laid down the incline to the temporary staging across the river; by means of an endless rope the descent of the loaded trucks on one line exerts the power required to bring up the empty trucks on the other. The blocks of stone are cut at the quarry in 16-in. courses, and, after being dressed at the yard, are sent down the incline to the pier, where they are hoisted to their destination by means of shears. The piers are not entirely solid, six vertical openings being left, which are filled in with concrete up to the flood level, and above that with clay; a saving of masonry being thus effected without impairing the stability of the columns. Between the first and second piers three or four bays of staging are being put up to support a temporary superstructure on which to place and rivet together the iron plates; these are coming out from England in lengths of 30ft. or 40ft., and will, on being fastened, form two parallel solid girders. Upon these there will be cross girders, 3ft. apart, and above will be the planking, which will be similar to that of ordinary railway bridges, excepting that it will be close planking. There will be a clear roadway of 24ft.; the eastern side will be devoted to the railway, leaving a sufficient width for a carriage road if this should be found desirable. In addition to the portion of the viaduct within the four piers, the length of which will be about 500ft., two lengthy viaducts have to be constructed for the approaches to the bridge at either end. The viaduct on the northern side will be 980ft. in length, with 26ft. openings, the length of the piles varying from 8ft. to 19ft.; this work is nearly finished. On the south side there will be a viaduct 440ft. long with 25ft. openings. With regard to the progress made with the viaduct—the first (the northernmost) pier is finished; the second is rather more than half finished; the foundations are being laid for the third pier, and for the timber rests for the fourth pier a large number of the piles have been driven. The works have been pushed on with great activity; about 130 quarrymen and 50 masons have been employed, many working night and day. At the present rate of progress the masonry will be completed in July, but it is now scarcely possible that the whole of the ironwork can arrive by that time. Intelligence has been received of the loss of the Indian Ocean, in which about two-thirds of the ironwork was shipped; the other third—for the centre span—was shipped in the Oaklands, which vessel had not arrived in March. The unfortunate accident will, necessarily, delay the completion of the extension, and it is scarcely possible that the railway to Picton can be opened at the beginning of next year, the time specified in the new contracts. Beyond Menangle all the cuttings are finished, excepting those at Spaniard's-hill and near the Picton station; both of these are in a forward state. For a considerable distance the lower layer of ballast is laid, the stone being obtained at various places in the neighbourhood of the line. For the upper layers stone from the quarry at Menangle is to be used, and consequently none of the permanent way is yet formed beyond Menangle.

The western extension, from Blacktown to Penrith, a length of twelve miles, may now be spoken of as finished, the portion upon which the rails are not yet laid being very small and rapidly diminishing. Four miles of the extension—as far as Rooty Hill—were opened for traffic three months since, and, although no station has yet been erected (a railway carriage being used as a substitute for a building) a large amount of traffic has sprung up, both in goods and passengers, the saving of distance by the teams and coaches being very considerable. About 200 men were working in March on the western extension, which is as large a number as could be employed upon the small amount of work remaining to be done. The opening of the extension to Penrith is not, however, likely to take place for some months, as the line is to be continued a mile beyond where Sir M. Peto and Co.'s contract terminates. The further extension was authorised by Parliament last session, and the Government have been in treaty with the owners of the land through which the line will pass. The line will have to be proclaimed, tenders invited and accepted, and the work executed before the railway can be opened beyond South Creek, as it would not be worth while to put up temporary buildings for a station at the present end of the works. The permanent station at Penrith is to be within a short distance of the river. The northern extension is now completed as far as Black Creek, and the station buildings at the latter place are almost ready for use. It was stated to be the intention of the Government to run trains to Black Creek at the end of March, but no public announcement to that effect had been made. The station is only about a third of a mile from the northern road, with which it has been connected by a good road. The works beyond Black Creek are in an advanced state, and promise to be completed before the end of the year. The only one of the three trunk lines into the interior which the Government have been authorised by Parliament to proceed with is that to the south beyond Picton. The contract for this extension will shortly be submitted to public competition, and the Government will probably be guided by the tenders they receive in deciding as to the manner in which the works will be carried out, whether in large contracts upon the present system, or in small contracts under the immediate direction of the railway department. The line between Morpeth and East Maitland, to carry out which a public company was formed, but which the Assembly, after at first refusing, subsequently consented to allow the Government to construct, is to be commenced very shortly. The extension will only be two miles and a half in length, and will connect the Great Northern Railway with the head of the navigation of the Hunter. It is also intended soon to commence a branch line from Blacktown on the Great Western Railway to Windsor, for which £60,000 was appropriated last session. The sum voted was for a horse railway, and as Mr. Whitton has strongly opposed the construction of such a line, the Government have determined on appointing an officer specially to carry out that work, and have advertised for "a competent engineer, having experience in the formation of horse railways, to take the superintendence of the works." The plans will have to be approved of by Parliament before the work can be proceeded with.

Five new telegraphic lines are about to be proceeded with in New South Wales. The longest of the extensions will be that from Orange to Wagga Wagga, which will connect with Sydney the Lachlan and the Burrangong diggings, and will also, by being joined at Wagga Wagga with other lines, afford a second line, independent of the present one, connecting Melbourne with Sydney. Its estimated length is 250 miles, and it has been contracted for by Mr. B. Rush at £43 per mile. Eight months are allowed for its completion. The next longest line will be that from Grafton to Tenterfield, which will connect the Clarence district with Sydney, and also with Queensland. This extension has been contracted for by Mr. Mark Faviell, at £39 per mile, and is to be completed in six months, its length being 125 miles. An extension of the southern line from Campbelltown to Wollongong and Kiama has been contracted for by Mr. W. Monk, at £38 per mile. The length of the line will be 60 miles, and four months are allowed to complete it. A contract has also been taken by Mr. T. E. Ellis for the construction of a line from Mudgee to Wellington, a distance of 60 miles. The price agreed upon is £43 per mile, and the work is to be finished in four months. A second wire is being stretched on the post between Muswellbrook and Scone, a distance of 12 miles. Mr. B. Rush is the contractor, and the price agreed on is £20 per mile.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

334. John Adams Knight, Symond's-inn, Chancery-lane, London, "Improvements in washing machines."—A communication from Riley Porter Wilson, New York, U.S. —*Petition recorded 8th February*, 1862.

465. Robert Pickin and William Edward Pickin, Birmingham, "Improvements in the manufacture of carriage bodies."—*Petition recorded 21st February*, 1862.

843. John Haworth, Southampton-street, Bloomsbury, London, "An improved method of conveying telegraphic messages and signals by means of electricity without the intervention of any continuous artificial conductor."

849. William Frederick Henson, New Cavendish-street, Portland-place, London, and Henry Henson Henson, Parliament-street, Westminster, "Improvements in wicks for candles and lamps."—*Petitions recorded 27th March*, 1862.

921. Herrmann Lorenz and Theodor Vette, Berlin, Prussia "Improvements in filters."—*Petition recorded 1st April*, 1862.

934. William Clark, Chancery-lane, London, "An improved apparatus for manifold writing."—A communication from Mr. Joseph Charles Thomas Devaux, Boulevart St. Martin, Paris—*Petition recorded 2nd April*, 1862.

947. Joseph Lee, Traction Engine Works, Lincoln, "Improvements in traction engines and boilers for traction, locomotive, and other purposes." —*Petition recorded 3rd April*, 1862.

985. George Haseltine, Fleet-street, London, "Improvements in lamps especially designed for burning hydro-carbon oils." - A communication from Anson Platt, M.D., and General William Rosecrans, Cincinnati, Ohio, U.S.

989. James Carrington, Queen's Gate Mews, Kensington, Middlesex, "Improvements in the form of bricks, and in the arrangement thereof for paving stables and stable yards."—*Petitions recorded 7th April*, 1862.

993. Hugo Levinstein, Pinner's-court, Old Broad-street, London, "Improvements in lustreing silk and in machinery or apparatus employed therein."—*Petition recorded 8th April*, 1862.

1041. Edward Hamer Carbutt, Bradford, Yorkshire, "Improvements in pistons."—*Petition recorded 11th April*, 1862.

1152. James Combe, Belfast, Antrim, Ireland, "Improvements in machinery for hackling flax and other fibrous substances."—*Petition recorded 21st April*, 1862.

1169. Charles Earp Elliott, Aldermanbury Postern, London, "Improvements in the preparation of dried yeast."—A communication from Messrs. Georg Grossberger and Hermann Christian Kurz, Nuremberg, Bavaria.—*Petition recorded 22nd April*, 1862.

1209. John Francis Brunet, King William-street, Strand, London, "Improvements in the manufacture of fringes, and in apparatus connected therewith."—A communication from Edme Paul Villain, Paris.—*Petition recorded 25th April*, 1862.

1252. William Clark, Chancery-lane, London, "An improved method of preserving animal and vegetable substances."—A communication from Mr. Jules Réné Lion, Boulevart St. Martin, Paris.

1263. Michael Henry, Fleet-street, London, "Improvements in apparatus for aerating liquids, and in fastenings for the said apparatus and for other articles."—A communication from Étienne Sébastien François, Boulevart St. Martin, Paris.—*Petitions recorded 29th April*, 1862.

1268. George Davies, Serle-street, Lincoln's-inn, London, "An improved electric apparatus applicable to various useful purposes."—A communication from François Ferdinand Auguste Achard, Paris.—*Petition recorded 30th April*, 1862.

1328. Herbert Allman, Bedford-row, Middlesex, "Certain improvements in the construction of locks."

1330. Robert Bushby, Little Ampton, Sussex, "An improved method of lifting or lightening ships for entering shallow harbours or docking and other purposes."

1338. Pierre Leon Auguste Theophile Sourre, Comdon, France, "An improved method of maturing spirits and wines."—*Petitions recorded 5th May*, 1862.

1360. Philip Howard Colomb, her Majesty's Dockyard, Devonport, Devonshire, "Improvements in arrangements and apparatus for signalling."

1362. Thomas Henry Hopwood, Hulme, Manchester, "Certain improvements in the means or apparatus to be employed for the purpose of raising sunken vessels or other submerged bodies, and also in the application of a self-acting balance and regulator to the pontoons used therein."

1364. Nicholas Wood, Hetton Hall, Durham, and Joseph Stockley, Newcastle-upon-Tyne, "Improvements in apparatus for grinding, smoothing, and polishing plate glass."

1370. Joseph Haley, Rochester-villas, Battersea, Surrey, "Improvements in armour plates for ships, boats, and batteries."—*Petitions recorded 7th May*, 1862.

1382. George Charles Grimes, Wandle-terrace, South-street, Wandsworth, Surrey, "Improvements in the manufacture of cigar lights, splints, matches, and tapers or vestas, and in machinery or apparatus employed therein."—*Petition recorded 8th May*, 1862.

1390. Thomas Kemp Mace, Birmingham, "Improvements in guards or protectors for hats and other coverings for the head."

1394. Thomas Fawcett, jun., Lisburn, Ireland, "Improvements in plaited fabrics for shirt fronts and other uses, and in the mode and mechanism for manufacturing the same."

1396. Thomas Welton, Grafton-street, Fitzroy-square, London, "Improvements in the preparation of beverages in connection with brewing."

1398. Francis John Bolton, Bolton-row, Mayfair, London, "Improvements in telegraphing for naval and military and other purposes, and in the apparatus connected therewith."—*Petitions recorded 9th May*, 1862.

1402. John Frederic Milward, Redditch, Worcestershire, "Improvements in breech-loading fire-arms."—A communication from John Bisset, New York, U.S.

1404. Robert Moore, Cannon-street West, London, "Improved apparatus for indicating the presence, position, or accumulation of liquids, gases, or vapours, and apparatus for preventing danger or damage consequent thereon."

1406. John Thomas Cooke, Leicester, "Improvements in battens used in weaving."

1408. Henry Dyson Taylor and Edward Robinson, Huddersfield, Yorkshire, "Improvements in piece dyed woollen fabrics, or fabrics composed of wool in combination with other fibrous sub-tances."

1410. William Henry Ronald, Montrose, Forfarshire, N.B., "Improvements in apparatus for signalling and indicating the position of shots in rifle practice."

1414. Henry William Sambridge, Birmingham, "Improvements in sliding chandeliers, gaseliers, and other pendent lamps."—*Petitions recorded 10th May*, 1862.

1416. John Milnes, Gloucester, "Improvements in portable apparatus for exercising the human body."

1418. William Clark, Chancery lane, London, "Improvements in smoke-consuming fire-grates."—A communication from Mr. Louis François Rojare, Boulevart St. Martin, Paris.

1420. Charles James Harris, King William-street, Charing Cross, London, "Improvements in the manufacture of detector, season, or non-transferable tickets."

1422. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in casting metals, and in the moulds and cores employed therein."—A communication from Joseph Harrison, Philadelphia, U.S.

1424. Henry Cartwright, Dean Broseley, Salop, "Improvements in propelling and steering screw steam vessels."

1428. James Leonard Wilson, St. John-street, Smithfield, London, "Improvements in calendering woven fabrics, and in the apparatus employed for this purpose."

1430. Ernst Ferdinand Lansky, Nottingham-street, Sheffield, Yorkshire, "An improved mode of, and apparatus for, working railway carriage brakes."—*Petitions recorded 12th May*, 1862.

1432. Samuel Bradley Ardrey, Birmingham, and Samuel Beckett, Oldham, Lancashire, "Improvements in machinery or apparatus for manufacturing spindles, part of which apparatus is also applicable to grinding and polishing other articles."

1436. John Beaujour Sardy, London, "Improvements in the construction of ships of war and other vessels."

1438. Arthur Wormull, Old Fish-street, London, "Improvements in trepanning instruments."

1440. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in the purification of colza, rape, and other oils."—A communication from Charles Henri Michaud, Paris.

1442. James Sivewright, Ravenhead, St. Helen's, Lancashire, "Improvements in the manufacture of polished plate glass."

1446. Richard Archibald Brooman, Fleet-street, London, "Improvements in louvre blinds or shutters."—A communication from Claude Robardet, Rue Malesherbes, Paris.—*Petitions recorded 13th May*, 1862.

1450. Charles Talbot Porter, Fleet-street, London, "Improvements in steam engine indicators."—A communication from Charles Richards, Hartford, Connecticut, U.S.

1452. Frederick Tolhausen, Fleet-street, London, "Improvements in the manufacture of velvets."—A communication from Antoine Denis, St. Etienne, Loire, France.

1456. Andrew Smith, Mauchline, Ayrshire, N.B., "Improvements in balances for weighing letters and other documents."

1458. Henri Gustave Delvigne, Rue St. Dominique, Paris, "Improvements in fire-arms.

1460. John Charles Brant, Forston-street, City-road Basin, London, "Improvements in the construction of armour-plated ships, and in cements or compositions for uniting iron to iron, and for uniting other substances, which compositions may also be used for caulking and for coating ships' bottoms."—*Petitions recorded 14th May*, 1862.

1462. James Fletcher and John William Fuller, Salford, Lancashire, "Improvements in machinery for rolling, bending, and planing metals."

1464. George Henry Sanborn, Fleet-street, London, "Improvements in machinery for spinning."—A communication from Isaac Rich, Boston, Massachusetts, U.S.

1466. Jean Pierre Jouvin, Rochefort-sur-Mer, France, "An improved process for preserving iron-plated and other vessels and metallic articles from oxidation, and preventing ships' bottoms from fouling."

1468. William Sissons, King-ston-upon-Hull, Yorkshire, "Improvements in machinery for driving piles by means of steam hammers."

1470. Josiah Stone, Dowgate hill, London, "Improvements in Downton's ship bilge pumps and fire engines."

1472. James Wright, Bridge-street, Blackfriars, London, "Improvements in machinery for digging, excavating, and removing earth, gravel, and such like substances."—A communication from Messrs. Couvreux and Combe, Rue St. Martin, Paris.

1474. Cooper Tress, Blackfriars-road, Surrey, "Improvements in the manufacture of hats, helmets, bonnets, or caps."

1476. Charles Girardet, Vienna, Austria, "An improved construction of buckle."—*Petitions recorded 15th May*, 1862.

Inventions Protected for Six Months by the Deposit of Complete Specifications.

1490. Nathan Ames, Saugus, Essex, Massachusetts, U.S., "A new and useful self-feeding card printing press."—*Deposited and recorded 16th May*, 1862.

1505. Edmund John Bridell, Middle Temple, London, "Improvements in the manufacture of substances artificially coloured, veined, or mottled, like marbles, or other substances."—*Deposited and recorded 17th May*, 1862.

Erratum.

1499. For "Tailbonis" read "Tailbouis."

Patents on which the Stamp Duty of £50 has been Paid.

1210. Johan Valda, London.—Dated 10th May, 1859.

1268 Charles Peters Moody, Corton Denham, Somersetshire.—Dated 23rd May, 1859.

1270. Frederick Joseph Bramwell, Great George-street, Westminster.—Dated 23rd May, 1859.

1350. George Hallen Cottam and Henry Richard Cottam, St. Pancras Ironworks, Old St. Pancras-road, Middlesex.—Dated 1st June, 1859.

1272. Nathaniel Shattswell Dodge, St. Paul's Churchyard, London.—A communication.—Dated 23rd May, 1859.

1279. Gilbert Daniel Jones, Clerkenwell, London.—Dated 24th May, 1859.

1284. Richard Atwood Glass, Leadenhall-street, London.—Dated 25th May, 1859.

Patents on which the Stamp Duty of £100 has been paid.

1139. Ignace Joseph Silbermann, jun., Essex-street, Strand, London.—Dated 21st May, 1855.

1167. James Atkinson Longridge, Newcastle-upon-Tyne.—Dated 24th May, 1855.

1170. James Park, Bury, Lancashire.—Dated 24th May, 1855.

1195. William Simson Young, Leith, Midlothian, N.B.—Dated 26th May, 1855.

1199. Charles Weightman Harrison, Woolwich, Kent.—Dated 26th May, 1855.

Notices to Proceed.

91. Thomas Soar, Nottingham, Jonathan Belshaw, Radford, and Marcus Soar, Nottingham, "An improved knocker to be attached to doors, shutters, or other parts of premises to which the same may be applicable, and applicable also for the reception of letters and other documents."

92. John Parker, Ivy House, Bradford, Joseph Wells and Benjamin Wells, Bowling, near Bradford, Yorkshire, "Improvements in steam engines, boilers, furnaces, and apparatus in connection therewith or applicable thereto."—*Petitions recorded 13th January*, 1862.

108. Thomas Harrison, Barningham, and John George Harrison, Kirby, Ravensworth, Yorkshire, "Improvements in ploughs."

113. William Cleland, St. George's-hill, Everton, Liverpool, "Improvements in treating and utilising certain materials used and products obtained in the manufacture of gas, and in apparatus connected with the said treatment."

114. Thomas Timmins and Thomas Simmons, Birmingham, "An improved bath, combining in itself the advantages of the hot air or Turkish bath with the vapour, slipper, hot and cold water shower bath."—*Petitions recorded 15th January*, 1862.

130. John Tow, Poland-street, Oxford-street, London, "Improvements in the construction of stoves or fire-places."

139. Thomas Roberts and John Dale, Manchester, "Improvements in the manufacture of gunpowder."—*Petitions recorded 18th January*, 1862.

145. Andrew Lamb, Southampton, and John White, West Cowes, Isle of Wight, "Improvements in lifeboats."

146. Joseph Bird, Bildworth, Nottinghamshire, "An improved crank axle applicable to cranks of any description whatsoever wherein the wear is mainly on one side thereof."—*Petitions recorded 20th January*, 1862.

154. John Bate, Crescent, Birmingham, "Improvements in machines for corking or stopping the mouths of botties, jars, or any vessel requiring to be stopped up air tight."

157. James Hyndford Rawlins, Hope Paper Mills, near Wrexham, "Improvements in machinery used in the manufacture of paper."—A communication from Oliver Woodworth, New London, Connecticut, U.S.

159. Richard Archibald Brooman, Fleet-street, London, "Improvements in street and road sweeping machines, parts of which are applicable to the separation of liquid from solid substances."—A communication from Victor Ferdinand Jeauneau, Cosne, France.

160. William Burgess, Newgate-street, London, "Improvements in reaping and mowing machines."

161. Michael Henry, Fleet-street, London, "Improvements in the mode of, and apparatus for, applying electricity to horology."—A communication from François Victor Guyard, Boulevard St. Martin, Paris.—*Petitions recorded 21st January*, 1862.

164. Isaac Roberts, Liverpool, "Improvements in combined hydraulic motive power engines and meters."

165. Francis William Gerish, East-road, City-road, London, "Improvements in printing presses."

167. Alfred James Beer, Canterbury, Kent, "Improvements in the valves of steam and other motive engines."—*Petitions recorded 22nd January*, 1862.

172. John Wallace, Haldane's Mill, near Alexandria, Dumbartonshire, N.B., "Improvements in reaping machines."—*Petition recorded 23rd January*, 1862.

184. William Clark, Chancery-lane, London, "Improvements in the manufacture of artificial flowers, leaves, and fruit."—A communication from Joseph Dominique Alphonse Favier, Boulevart St. Martin, Paris.—*Petition recorded 24th January*, 1862.

200. Francois Joseph Lalmand Lefort, Bothey, Belgium, "Improved mechanical arrangements constituting a secret and invisible safety lock, applicable to iron safes and other depositories."

203. Alexander Samuelson, Cornhill, London, "Improvements in hydraulic presses, and in the mode of working the same."—*Petitions recorded 25th January*, 1862.

205. Joseph Lillie, Duke-street, Adelphi, London, "Improvements in the method of protecting ships' bottoms from fouling, and in materials to be used therefor."

209. William Orr, Greenock, Renfrewshire, N.B., "Improvements in machinery or apparatus for the manufacture of sugar."—*Petitions recorded 27th January*, 1862.

236. James Benjamin Harby, Leytonstone, Essex, "An improved method of preserving electric telegraph cables and wires."—*Petition recorded 29th January*, 1862.

249. William Davies, Elizabeth-place, Old Bethnal Green-road, Middlesex, "Improvements in apparatus for cutting corks and bungs."

252. Adolphus Labousse, Brussels, Belgium, "Improvements in the manufacture of wheels for wagons, locomotive engines, and other vehicles used for railway purposes."—*Petitions recorded 30th January*, 1862.

261. John Hargreaves, Clifton-cottages, Clifton-road, Peckham, Surrey, "Improvements in the manufacture of pipes or tubes for conveying water, gas, acids, sewage, enclosing electric telegraph wires, and for other purposes, which improvements are also applicable to the manufacture of other vessels and articles, and in the machinery or apparatus connected therewith."—*Petition recorded 31st January*, 1862.

282. Laurence Hill, Port Glasgow, Renfrewshire, N.B., "Improvements in applying armour plating to war ships."

288. William Clark, Chancery-lane, London, "Improvements in processes for preserving and colouring wood, denominated xylochromic and xyloplastic processes."—A communication from Messrs. Heinrich Sperl, Dr. Richard Hagen, and Wolfgang Springer, Nuremberg, Bavaria.—*Petitions recorded 3rd February*, 1862.

328. William Clark, Chancery-lane, London, "Improvements in preserving timber, which are particularly applicable to the timbers of ships or other maritime structures."—A communication from Mr. Henri De Ladbarent, Boulevart St. Martin, Paris.—*Petition recorded 7th February*, 1862.

339. Marc Antoine Francois Mennons, Rue de l'Echiquier, Paris, "Improved apparatus for the administration of vapour baths."—A communication from Eliacin Edouard Pomier, Egriselles-le-Bocage, Yonne, France. —*Petition recorded 10th February*, 1862.

417. George Tomlinson Bousfield, Loughborough Park, Brixton, Surrey, "Improved modes of protecting iron boilers, tanks, and vats, from wear arising from galvanic action."—A communication from John Welton Wilcox, West Roxbury, Norfolk, Massachusetts, U.S.—*Petition recorded 19th February*, 1862.

481. George John Oram. Wilmington-square, Clerkenwell, London, "A revolving pendant for giving greater security to watches and lockets against theft."

484. Marc Antoine Francois Mennons, Rue de l'Echiquier, Paris, "Improvements in burners for heating by gas"—A communication from Carsten Richard Meyn, Carlshutte Rendsburg, Holstein.—*Petitions recorded 22nd February*, 1862.

606. Thomas Hack, Hammersmith, and Alfred Edwin Carter, Kensington, Middlesex, "Improvements in screw cocks."—*Petition recorded 6th March*, 1862.

806. George Hartshorne, jun., and Daniel Grainger Ward, Dudley, Worcestershire, and William Woolley, Tipton, Staffordshire. "Improvements in punching or perforating metal plates or sheets, and in apparatus or machinery to be employed for that purpose."—*Petition recorded 22nd March*, 1862.

879. Robert Lublinski, City-road, London, "An improved method of jointing crutch hooks on umbrellas or walking canes."—*Petition recorded 28th March*, 1862.

967. William Edward Newton, Chancery-lane, London, "Improvements in pumps for ships' use and other purposes."—A communication from Thomas Hansbrow, Sacramento, California, U.S.—*Petition recorded 4th April*, 1862.

1070. John Dargue, Cobden-street, Lister Hills, Bradford, Yorkshire, "Improvements in machinery for preparing and combing wool and other fibrous materials."—*Petition recorded 14th April*, 1862.

1164. James Chapman Amos, Grove, Southwark, Surrey, "An improved mode of, and improvements in, apparatus for supplying surface condensers with water, part of which improvements is applicable to blowers and rotary pumps generally."—*Petition recorded 21st April*, 1862.

1199. John Franklin Allen, New York, U.S., "Improvements in slide valves and valve gear for steam engines."—*Petition recorded 24th April*, 1862.

1210. Richard Christopher Mansell, Ashford, Kent, "Improvements in the construction of wheels to be used on railways"

1220. William Hale, John-street, Adelphi, London, "Improvements in rockets."—*Petitions recorded 25th April*, 1862.

1248. James Eglinton Anderson Gwynne, Essex-street Wharves, Strand, London, "Improvements in the construction of centrifugal pumps, and in the application thereof, parts of which improvements are also applicable to other pumps."—*Petition recorded 29th April*, 1862.

1340. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in steam generators."—A communication from Joseph Harrison, Philadelphia, U.S.

1342. Benjamin Cooke, Frathy House, Anthony, Devonport, "An improved construction of implement for cutting turf."—*Petitions recorded 5th May*, 1862.

1348. John Clarke and John Richmond, Chilvers Coton, Warwickshire, "Improvements in looms for weaving."—*Petition recorded 6th May*, 1862.

1383. Peter Tate, Park-terrace, South-street, Kensington, "Improvements in smelting furnaces."—A communication from Wlademer Raschette, St. Petersburg, Russia.—*Petition recorded 8th May*, 1862.

1422. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in casting metals, and in the moulds and cores employed therein."—A communication from Joseph Harrison, Philadelphia, U.S.—*Petition recorded 12th May*, 1862.

1490. Nathan Ames, Saugus, Essex, Massachusetts, U.S. "A new and useful self-feeding card printing press."—*Petition recorded 16th May*, 1862.

1505. Edmund John Bridell, Middle Temple, London, "Improvements in the manufacture of substances artificially coloured, veined, or mottled, like marbles or other substances."—*Petition recorded 17th May*, 1862.

And notice is hereby further given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days next after the date of the Gazette (and of the Journal) in which this notice is issued.

List of Specifications published during the Week ending 24th May, 1862.

2505, 1s.; 2506, 3d.; 2507, 1s. 4d.; 2508, 10d.; 2509, 3d.; 2510, 4d; 2511, 11d.; 2512, 7d.; 2513, 3d.; 2514, 1s. 9d.; 2515, 3d.; 2516, 9d.; 2517, 3d.; 2518, 3d.; 2519, 10d.; 2520, 8d.; 2521, 6d.; 2522, 1s. 1d.; 2523, 6d.; 2524, 10d.; 2525, 3d.; 2526, 3d.; 2527, 3d.; 2528, 10d.; 2529, 3d.; 2530, 1s. 4d.; 2531, 3s. 9d.; 2532, 3d.; 2533, 10d.; 2534, 7d.; 2535, 2s.; 2536, 2s.; 2537, 3d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for The Engineer, *at the office of her Majesty's Commissioners of Patents.*

Class 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2776. C. F. Hayes, *Enfield*, "*Generating steam.*"—*Dated 5th November*, 1861.

The object of these improvements is to obtain a very rapid generation of steam. For this purpose the patentee employs a metal pipe of small diameter, but of suitable strength, and suitably placed so as to be subject to the direct action of the heat of the furnace, as the means for holding and supplying the water during its conversion into steam. As steam is desired to be generated he causes water in very small quantities to pass into the heated part of the pipe, by which the water immediately becomes converted into steam, which, by a valve or other passage, passes into another pipe (or an extension of the piping) which is laid in coils or otherwise in a superheating chamber, and there this pipe terminates in a rose head or other suitable means adapted to finely distribute the steam obtained into this chamber, for the ready conversion of it there into high-pressure steam. He uses a small force-pump, worked by a steam engine or other power, for the purpose of forcing the water from a suitable reservoir into the piping. The superheating or surcharging chamber is formed and fixed so that the whole surface thereof may, as much as possible, be subject to the direct action of the heat of the fire, and of the heated products of combustion passing therefrom.

2778. S. A. Brooman, *Fleet-street, London*, "*Improvements in steam generators, and in furnaces for the same.*"—*A communication.—Dated 5th November*, 1861.

This invention consists in fitting in fire-boxes or furnaces of locomotive, marine, and other steam boilers, an arched or dome-shaped water vessel, communicating with the boiler for its supply of water through pipes entering the bottom or lower part of the vessel, and with the steam space in the boiler through serpentine pipes carried from the top or upper part of the vessel. The invention also consists in forming an air passage outside the fire-box or furnace, and in regulating the admission of air by means of a valve or valves, and causing it to enter both under and through the fire-bars and fuel and over the fire. By preference the fire-bars are formed in two sections, one—that upon which the fuel is received—is fixed, and the other is free to be moved by a weighted lever upon an axis upon which it is pivotted. The furnace door is fixed in the upper part of the casing, which forms part of the air passage, and in which a valve is placed to prevent any portion of the fuel entering and choking it. In some cases pipes traverse the crown or dome of the water vessel, and are wholly or partially opened or closed, as required, by a register plate worked by a handle extending outside the furnace.

2794. A. W. Williamson, *University College, Gower-street, London*, "*Steam boilers.*"—*Dated 7th November*, 1861.

This invention consists in constructing steam boilers entirely of tubes or tubular vessels arranged in such a manner that each tube has perfect freedom to expand and contract by being attached only at one end to, and communicating with, a tube or tubular vessel serving to connect a number of such tubes together, the other ends of such tubes being closed, and simply steadied or held in position by suitable contrivances. These tubes are placed either in a slanting or in a vertical position, with the closed ends either upwards or downwards, whilst the connecting tubes or tubular vessels to which they are attached are placed in a horizontal or nearly horizontal position. These tubes that are fixed with their closed ends upwards are filled only partially with water, the upper ends serving as steam chambers, whence the steam is conducted, through pipes fixed inside the tubes, into other pipes or equivalent passages fixed or formed inside the

connecting tubes, whence the steam is conducted in the usual way to wherever it may be required. By this arrangement, not only is each tube or element of the boiler capable of expanding and contracting without in any way straining the connections, but also any defective tube or tubes can be readily removed and replaced by another, or by others, without in any way interfering with the other connections.

2797. T. SCHWARTZ, *New York*, "*Air engines.*"—*Dated 7th November*, 1861.

The patentee claims, First, the specified means for maintaining constant temperature in compression and expansion. Secondly, the generator containing liquid for transmitting heat by external action to the working cylinder. Thirdly, so arranging the apparatus that a portion or branch current may be diverted from the body of compressed cold air, to be dilated to receive and convey so much heat as is to be acquired for the purpose from the furnace, while the rest of the main current is heated exclusively by the regenerator. Fourthly, the use of the exhaust pump, as set forth, whereby the condensation incident to regeneration of heat is made available in securing vacuum action. Fifthly, the means for assisting the operation of the regenerator by appropriating a portion of the heat to the feed current of the furnace through special heater. Sixthly, the interposition of an expanding receptacle in the return passage to the compression pump, to accommodate the conditions of supply to those of demand in working the same air over and over again. Seventhly, the means described, or any mere modification thereof, for controlling the working temperature of the engine, by checking the accumulation of heat. Eighthly, those certain peculiarities in the details of construction set forth and described with reference to the drawings.

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2811. D. COWAN, *Hungerford-street, Strand, London*, "*Pneumatic subaqueous tubes for passenger or goods traffic.*"—*Dated 9th November*, 1861.

This invention consists in constructing subaqueous tubes of solid or of hollow staves, or of a combination of solid and hollow staves of any size and length, and made of iron, wood, or other suitable materials. These staves are held together by a continuous iron band wrapped spirally round the tube so formed, or, if preferred, by hoops of iron shrunk on. The staves, or a portion of the staves forming the tube, being hollow or forming a hollow section, the tube can be regulated or weighted to the specific gravity of the water in which it is submerged, to remain at any desired level by the admission of water within the staves, and by subtracting water the tube can be made to rise. The machinery for the manufacture of the tubes is constructed as follows:—The staves are placed and arranged on a mandril, each one breaking joint with the other; the mandril being of the form, and nearly of the size of the tube, the staves have only to be placed thereon in manner similar to bricks on building an arch. Encircling the staves thus arranged is a ring, carrying a series of rollers within its interior circumference for the purpose of pressing the staves firmly together. Immediately behind the ring is another which revolves around the tube, and laps spirally round it one or more bands of iron, and it is driven by means of one or more endless screws and screw wheels. This ring is permitted to move only in the direction of its circumference, that is, to rotate, all lateral motion being prevented by suitable bearings or abutments, and a projection fixed to the said ring is in contact with the edge of the iron as it is wound on the tube; this projection not only keeps the coils well together, but thrusts the tube forward as the iron band acts as the thread of the screw.

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2823. A. TURNER, *Leicester*, "*Knitting machinery.*"—*Dated 9th November*, 1861.

This invention relates to that description of machinery which is known as the circular knitting machine, and the object of the invention is to produce in such machines fabrics with longitudinal stripes or patterns of various colours or different kinds of work. In ordinary circular knitting machines wheels provided with teeth composed of thin blades are used for the purpose of carrying up the threads under the beards of the needles to form the loops. The formation of longitudinal stripes on the fabric produced in machines of this description is effected according to this invention by the employment of threads of different colours, and dividing the needles into two or any desired number of sets, each set being made to operate upon its particular thread, from which such needles will form loops or work, the operations of the sets of needles being so arranged and combined that they shall produce a single but partly coloured fabric. This object is effected by the employment of wheels having teeth or notches constructed in such a manner as to admit of these teeth acting alternately as sinkers and pressers. To this end certain of the notches or teeth of these wheels are filled, so that, when the needles are brought round against these portions of the wheels, their beards will be closed by the filling pieces of the wheels pressing against them, and the threads will thereby be prevented from entering under the beards of the needles, but when the open parts of the wheels come round, the teeth of the wheels will carry the beards between, and pass them under the beards of the needles, so as to form loops. These pressing and sinking wheels are so arranged that the filling pieces of one wheel will act against certain of the needles, while the filling pieces of the other wheel will act against other needles, so as to produce various kinds of patterns, but all are so combined and arranged as to form a single fabric, and not a double or compound fabric, as has sometimes been done in machines of this class.

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

2818. S. W. CAMPAIN, *Deeping Saint Nicholas, Lincoln*, "*Apparatus for stacking straw, &c.*"—*Dated 9th November*, 1861.

For the purposes of this invention an endless rope, strap, or band is used, to which is attached a series of receivers or holders, which are alternately brought to the end of a threshing machine or other place where the receivers or holders are filled in succession, and are then brought over the stack and tilted so as to discharge the contents. These holders or receivers may be varied in their construction, but it is preferred that they should consist of a series of ribs of a bent or hook-like form, attached at one end to the endless rope, strap, or band, and at their other end standing out from it so that the straw or other vegetable matters may be placed into and be supported by the hook-like holders or receivers. These hook-like holders are attached near to each other on to the endless rope, chain, or strap, so as to form as it were a hollow skeleton frame, the hook-like parts forming the ribs, and these ribs are connected by cords, or chains, or otherwise, yet so as to permit the hook-like ribs, when they come to the point at which they are to drop their load, to tilt for that purpose. The endless rope, belt, or strap is carried by two or more wheels, the one nearest the threshing machine or point where straw or vegetable matter is supplied thereto being horizontal, whilst the wheel where the tilting takes place is vertical, or sufficiently inclined to cause the hook-like frames or ribs to be tilted, in order to discharge their contents. The wheel and endless rope, strap, or belt, where the tilting takes place, is supported by an upright pole or otherwise; the other wheel, where the feeding takes place, is combined with a threshing machine or other apparatus suitably arranged for giving motion to the endless strap, rope, or band.—*Not proceeded with.*

CLASS 5.—BUILDING.—NONE.

CLASS 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

2731. B. H. MATHEW, *St. James's, London*, "*Improvements in fire-arms and in cartridges.*"—*Dated 31st October*, 1861.

This invention comprises a new arrangement of parts for breech-loading arms, a new method of rifling arms, an improved back sight for arms, and an improved cartridge for breech-loading arms. The method of rifling consists in forming the grooves in such manner that the projectile shall be upheld truly and continuously during its passage through the barrel. Under one modification he carries this part of the invention into effect as follows:—He makes four grooves with their sides converging towards the common centre, and partially hollows the lands between the grooves, either of an equal depth throughout, or varying from the breech to the muzzle. He forms the improved back sight by imparting an additional and independent vertical motion to the ordinary notch, and by adding thereto two points capable of lateral adjustment to and from each other. The improved cartridge consists in forming the case with a flange projecting from the rear, and with a tail carried from the flange, in the end of which a percussion cap is inserted. In some cases the tail is dispensed with.—*Not proceeded with.*

2736. L. THOMAS, *Union-street, Berkeley-square, London*, "*Rifled ordnance and projectiles.*"—*Dated 1st November*, 1861.

This invention is particularly directed to the centring of the shot in the cannon, and to the equalisation of a minimum friction upon surfaces, the wear of which neither impairs to any appreciable extent the strength of the cannon nor affects its efficiency. The patentee proposes to form the curved surfaces, of what character soever they may be, in both the cannon and shot identical. This identity will render the usual contact of the two bodies a contact of surfaces, thereby avoiding the inequality of wear and friction which accompanies any irregularity of collision. He proposes that the surfaces of the shot and cannon which are brought into contact when the shot is fired shall radiate each to the axis of its own particular body. Any movement of the shot from the breech to the muzzle of the gun tends to the approximation of these surfaces, and to the concentring of the shot and cannon. Immediately these friction surfaces meet, the centring of the shot in the cannon is effected. The friction surfaces are reduced to the minimum area, and, in wearing, have no tendency to alter the primary conditions of the cannon and shot, and, therefore, have no deteriorating effect.

2774. E. BROOKS, *Birmingham*, "*Bayonets.*"—*Dated 5th November*, 1861.

This invention consists in fashioning or shaping the blades of bayonets by means of dies worked by a stamp, whether the whole of the blade be operated upon at the same time by one pair of dies, or different parts of the blades be operated upon in succession by different pairs of dies. Fashioning or shaping the socket, neck, and shoulder of bayonets by means of a pair of dies worked by a stamp.

2780. J. B. LOVE, *Philadelphia, U.S.*, "*Combining together and securing to the sides of navigable vessels and water batteries armour plates of iron or steel.*"—*Dated 5th November*, 1861.

This invention consists in rebating and boring the edges of armour plates so that the same, when adjusted together closely, shall produce accurately-fitting lap-joints that will leave both the inner side and outer side surfaces respectively of the said plates flush or even with each other. The plates also have tapering or conical holes transversely through the lapping portions, to correspond with each other respectively, for the admission from the outer side of corresponding bolts, whose outer ends, when the bolts are firmly inserted into the said holes, shall be flush with the outer side of the said plates. The invention also consists in intervening along between the said edges of each connecting pair of the said plates, when the same are being applied as armour to the vessel or battery, a thin strip of soft compressible metal, gum cloth, tarred felt, or any other similar compressible and durable material, so that, when the said conical bolts are driven firmly into the holes in the lapping portions of the plates in securing the latter to the walls of the vessel or battery, the packing shall be powerfully compressed and held between the said edges, and so produce a perfectly water-tight and durable joint thereat. The invention also consists in fitting together the upper edges of the highest tier of plates and the upper edge of the bulwark of the vessel, for the purpose of the better supporting the said plates, by means of an overlapping projection or flange formed on the inner side of the plates at this part, and also in constructing and applying a copping rail, which will closely embrace the upper ends of the said flanged plates, and the upper edge of the bulwark, of a curved form in its transverse section, and firmly bolted to the parts which it covers, so that it shall form a powerful support to the bulwark of the vessel, and at the same time serve to deflect shot or shell.

2785. G. DAVIES, *Serle-street, Lincoln's-inn-fields, London*, "*Fire-arms and ordnance.*"—*A communication.*—*Dated 4th November*, 1861.

The first part of these improvements relates to devices which, although applicable to fire-arms generally and to cannon of small calibre, are especially well adapted to such fire-arms as have been constructed for loading at the muzzle, but have to be converted into breech-loaders, and consists, First, in a breech hinged to the rear end of the barrel, and constructed so that the upper portion of the said breech may fit over an enlargement on the end of the barrel in a manner which renders the breech incapable of moving longitudinally when the cartridge is discharged. Secondly, in a device for retaining the lower portion of the breech in its proper position in respect to the end of the barrel. Thirdly, in a device for locking the breech to the barrel, and readily releasing it therefrom. Fourthly, in an inclined projection on the hinged piece, whereby the spent cartridge may be partially withdrawn on turning the breech from the barrel preparatory to the insertion of another cartridge. The second part of these improvements relates to revolving fire-arms, and consists, firstly, in combining and arranging a series of parts in a peculiar manner, and in such relation to the hammer-shaft as to revolve the cylinder the required distance by the act of cocking the hammer. Secondly, in so constructing the ram rod, which is connected to the fire-arm, that it can be readily adjusted longitudinally to suit the different loads with which it may be necessary to charge the chambers of the cylinder. The Third part of this invention relates to improvements in breech-loading fire-arms, in which the movable breech consists of an arm fitting into the stock, and so hinged to the end of the barrel that it can be turned up, thereby exposing the bore of the barrel for the insertion of the cartridge, and this portion of the improvements consists, firstly, in a device by which the fire-arm is rendered self-tightening at the breech. Secondly, in a device by which the discharge of the fire arm is rendered impossible unless the breech is depressed and locked to its proper position.—*Not proceeded with.*

2805. C. W. SIEMENS, *Great George-street, Westminster*, "*A vessel and gun or guns connected therewith.*"—*Dated 5th November*, 1861.

The object of this invention is the construction of a weapon, which is to approach an enemy's ship or works of coast defence in perfect safety to within a distance of from ten to twenty yards, and to discharge against it below the surface of the water a bolt weighing from fifteen to twenty hundredweight with a velocity not exceeding four-hundred feet per second, which bolt or projectile is made to explode after it has struck, so as to produce an irreparable breach in the side of the vessel from three to six feet below the water line.—*Not proceeded with.*

2832. A. SHANNON, *New York*, "*Cartridge for accelerating the flight of projectiles.*"—*Dated 11th November*, 1861.

The inventor states that he has discovered that cannon balls, musket and rifle balls, and other projectiles, can be fired with greatly accelerated velocity, and without increasing the quantity of powder, by dividing the charge of powder into sections by means of perforated diaphragms. On firing the piece the first section of powder, which may be common, or prepared to burn slow, starts the balls, overcoming inertia without strains on the fire-arm; the fire penetrates the perforated diaphragm, exploding the second section of powder, increasing the velocity of the ball, and firing through the second perforated diaphragm the third section of powder. These perforated diaphragms may be of felt or other suitable material, and provided with the proper number of holes punched in them. The larger the number of holes the quicker will one explosion follow the other, and the cartridge must be so made that all the explosions take place successively within the gun.—*Not proceeded with.*

CLASS 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

2724. R. W. WINFIELD, *Birmingham*, "*Ornamenting metallic bedsteads, &c.*"—*Dated 30th October*, 1861.

The patentee claims ornamenting the said articles by the use of ornaments composed partly of glass or enamel, and partly of metal, as described with reference to the drawings.

3759. S. OSBORNE, *Bayswater, Middlesex*, "*Hooped skirts.*"—*Dated 2nd November*, 1861.

This invention consists in connecting the hoops forming the skirt by tapes or ribands carried diagonally in opposite directions from the upper to the lower part of the skirt, in such manner that the tapes running in one direction shall cross those running in the opposite direction. The patentee terms this "diamond lacing," and he finds skirts so constructed are more steady, and have not that tendency to "wag" which belongs to skirts in which the hoops are otherwise connected.

2806. J. TYLER, *Pratt-street, Camden-town*, "*Clarionets.*"—*Dated 8th November*, 1861.

Hitherto in clarionets the C sharp in the third place, and the F sharp on the third ledger line below, have been produced by a closed key on the left side of the instrument when held to the mouth. The inventor changes the key which produces these notes from the left side to the right side, and he makes it an open key, which is closed by the fourth finger of the right hand. In the ordinary clarionet, on the right side, there is an open key, from which the notes D on the fourth line and G under the second ledger line below issue. The head or finger end of the lever of the latter key he places under the head or the finger end of the new C sharp key, and he presses down both by the fourth finger of the right hand when it is required. He passes a projection from the long lever B natural key under the heel of the D key. On the long lever B natural key being pressed down (by the fourth finger of the left hand), the D key is closed, the new key stands open, and produces the notes C sharp in the third space, and F sharp in the third ledger line below. The advantage is that the C sharp in the third space, and the F sharp on the third ledger line below, are produced by one finger of the left hand, instead of being produced as hitherto by the fourth finger of the left hand and the fourth finger of the right hand together.—*Not proceeded with.*

2829. W. CLARK, *Chancery-lane, London*, "*Safety lamps.*"—*A communication.*—*Dated 11th November*, 1861.

This invention relates to an improved safety lamp to be used in mines, gasworks, or distilleries, which differs from all other similar lamps in the following conditions:—First, when once lighted and closed it cannot be opened without completely extinguishing the light; Secondly, the metal gauze is screwed to the lamp, instead of being carried by the suspending part, so that, should this become detached by any cause from the lamp, the gauze will still be secured to the lamp, and preserved entire; Thirdly, the exterior and bottom of the lamps is free from anything that might be injured by blows, the mechanism being all enclosed, so that the lamp is incapable of getting out of order by shaking; Fourthly, the lamp, being constructed on purely mechanical principles, is not subject to disarrangement by rough usage. This lamp is formed of a lower circular chamber, on which is screwed the wire-gauze; in the centre of the said chamber is placed the wick holder, and the wick, which rises and descends therein, by means of a pinion on a rod, to which is attached a small ratchet which only allows the pinion to rotate in one direction. Supposing a wick of about 1¼in. in length to be lighted, the metal gauze is screwed on, and a plate is then fixed to the lamp by means of three notches and hooks, when by slightly turning said plate the lamp will become closed. This plate carries a toothed segment gearing with the pinion regulating the supply of the wick; hence, when the lamp is opened by turning the said plate, the segment will turn the regulating pinion, and cause the wick to return into the wick holder, and thereby completely extinguish the light.—*Not proceeded with.*

TRAFFIC RECEIPTS.—The traffic receipts of railways in the United Kingdom amounted for the week ending the 17th of May, on 10,176 miles, to £527, 831, and for the corresponding week of last year, on 9,936 miles, to £551,370, showing an increase of 240 miles, and a decrease of £23,539 in the receipts.

INSTITUTION OF CIVIL ENGINEERS.—The president, Mr. Hawkshaw, F.R.S., held a *conversazione*, on Tuesday evening, at the house of the Institution, 25, Great George-street. The attendance of members, naval and military men and others, was unusually full, numbering not far, probably, from 1,000 in all.

THE following appointments of naval engineers have been made since our last:—George Alexander, second-class assistant-engineer, to the Colossus; J. Crichton, second-class assistant-engineer, to the Emerald; John G. Oakshott, chief-engineer, to the Hastings; Edward W. Baker, chief-engineer, to the Indus, for the Donegal, when that ship is paid off; George Mills, engineer, to the Cumberland, for the Lily; William Laird, engineer, to the Asia, for the Nimrod; William H. Mothersole, engineer, to the Cumberland, as supernumerary; Thomas D. Andrewartha and James Rose, acting second-class assistant-engineers, to the Asia; William Greenhill, acting second-class assistant-engineer, to the Cumberland; Robert J. Roberts, engineer, to the Dromedary; J. F. Moreton and C. R. Lacy, first-class assistant-engineers, to the Indus, as supernumeraries; Wiliam Powell, first-class assistant-engineer, and N. F. Hockerston, second-class assistant-engineer, to the Dromedary; Charles A. Dewar, promoted to first-class assistant-engineer in the Princess Charlotte; James A. Dicks, confirmed as second-class assistant-engineer in the Cumberland.

THE MIDDLE LEVEL DELUGE.—Constructing a dam across a tidal stream one would have supposed to be a very elementary operation in practical engineering; but the rules laid down by the profession for such cases have to encounter two peculiar difficulties in the Middle Level drain—the strata of the country are of treacherous live sand and a soft yielding clay, and the Ouse tides rush with unusual rapidity. To persist, therefore, in repeating vain attempts to form a clay dam after more than one failure had proved their futility was a mistake, though complaint would, no doubt, have been general had not the readiest and quickest means been first tried. At last the engineers have resorted to the tedious but certain construction of a coffer-dam. By screw piles a platform has been erected over the drain, in which eight or ten piling engines are now driving piles in two rows some 30ft. apart, and at intervals of 7ft. in the rows, entirely across from bank to bank. The tops of the piles are connected together by strong timbers, diagonal iron braces holding the two rows of piling upright and rigid; and to support the structure against both the incoming tides and the outflowing ebbs, strong timber struts are being run from the central part of the framing to the piers of piling made on each bank, both above and below the dam. Thus the work is effectually secured as it proceeds, and when the timber skeleton dam is complete it will be filled with bags of clay, and the interstices sealed up with clay puddle, now being prepared by numbers of workmen along the banks. It may be ten days or a fortnight before this barrier is finally closed.

SINGLE-SHAFT COLLIERIES.—A recently-published return to the House of Commons contains copies of the replies of the inspectors of mines to a circular letter, addressed to them by desire of the Home Secretary, on the subject of shafts. The reply of Mr. Dickinson, dated from Manchester, on the 28th of February last, embraces information respecting the single or bratticed shafts at seventeen collieries and mines in the Manchester district. In point of actual numbers, the single-shaft collieries form only a small percentage of the whole. There are at present at work in this district 348 pumping and winding shafts, 6 entrances by engine planes, 66 entrances by levels, 198 air and ladder pits, and 46 shafts which are being sunk, making a total of 664 openings from the surface at present in use, exclusive of old pits and shafts not at present actually in use, except for airing old workings. Deducting from these the 16 single or bratticed shafts, and the 46 sinking shafts, making 62 together, there remain 602 entrances which are not single or bratticed. The production of coal in the district, as near as Mr. Dickinson has been able to ascertain it, is at the rate of 6,379,500 tons per annum, of which 6,280,500 tons are steam and house coal, and 99,000 tons are cannel coal. Of this total quantity about 240,000 tons per annum are raised from the single or bratticed shafts. Mr. Dickinson stated his opinion that it must be enacted, first, that every coal and ironstone working should in future be provided with proper means of egress for persons, by two distinct shafts or outlets, separated from each other by a secure division of natural strata; secondly, that, in case of any working previously in operation, which was not so provided with two distinct outlets, the working might be continued, provided the means were being carried on with due diligence to make the second outlet; thirdly, that for the purpose of exploring or proving ground, or connecting two or more distinct means of egress, or working a small tract of coal or ironstone, a single or bratticed entrance might be used, provided that not more than ten persons should be allowed to be below ground at the same time; and, fourthly, that after the 31st December, 1862, every winding pit or shaft, worked by steam or water power, should be provided with a proper self-acting fence at the top.

THE THAMES EMBANKMENT.—On Wednesday the committee reassembled at 12 o'clock, the Hon. Mr. Cowper in the chair; present—Lord R. Montagu, Sir W. Jolliffe, Sir J. Paxton, Mr. Urquhart, Lord H. Vane, Colonel Knox, Sir J. V. Shelley, Mr. Ker Seymer, Sir M. Peto, and Mr. Garnett, and remained in deliberation until 2 o'clock, when, on the admission of the public, the chairman said the committee had come to the resolution that, with a view to provide the greatest amount of relief to the most crowded thoroughfares in the vicinity of Westminster-bridge, and also to avoid unnecessary outlay in works and compensation on the part of the public, it was desirable that the roadway on the river embankment should terminate at or near Whitehall-stairs, and thence be diverted towards Parliament-street, in the direction suggested by Mr. Pennethorne. Mr. Burke, Q.C., on behalf of the promoters of the measure, objected to the decision of the committee. It took them by surprise. There had been no plan by Mr. Pennethorne in evidence, and they had had no opportunity of bringing forward rebutting evidence. The committee having overruled the objection, the case of the opposition for the City of London Gasworks Company was opened by Mr. Hope Scott, Mr. Richards, and Mr. Miller. They allege that the proposed embankment will seriously interfere with their works, and the manufacture of gas, which now amounts to nearly 500,000,000 cubic feet per annum; the quantity of coal brought by lighters alongside and carbonised being upwards of 50,000 tons during the same period. That for these purposes they require all the facilities that the river frontage now affords them, and the proposed embankment will materially interfere with their establishment and trade, upon which a million had been expended. Mr. M'Clean, the engineer for the promoters, was examined to show that they had offered to the City Gas Company two arches under the embankment, 8ft. high, in front of the works, but this had been objected to by the Metropolitan Board of Works, who deemed that arches of 4ft. would be sufficient. Mr. Phinn, Q.C., for the Metropolitan Board of Works, said this was so, and Mr. Mann, the City Gas Company's engineer, and Mr. Hawkesley having given evidence as to its inadequacy, the committee adjourned until Friday, to enable the parties to come to an arrangement.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

Iron Trade: *Improvement Maintained.*—Demand for Girders in the Derby District—Pig Iron: *Prices kept up*—Coal Trade—Progress of the Subterranean Fire—Proposed Orphanage for Ironworkers and Colliers—Hardware Trade: *Not Improved*—Alleged "Combination"—Workmen at the Exhibition.

The improvement of last week has been well maintained since the date of our report at that period. The statements made on 'Change in Birmingham yesterday (Thursday), and in Wolverhampton on the day before, were all to the effect that the demand for finished iron had, in the period referred to, improved as well for the home as for the foreign market. At the first-class works more is being done in heavy plate and in angle and T-iron than was the case last week; and the orders from the Federal Union are of a decidedly more valuable class. As compared with any other period in the past twelvemonth, there is more activity in the production of iron for girders for both bridges and also warehouses and other similar structures; and the large number of girder-makers in the Birmingham and South Staffordshire district are most of them quite busy. The large engineering firms at Derby have likewise received some valuable orders in the past few days, all on home account. For instance, Messrs. Handyside and Co., of the Britannia Foundry and Engineering Works, are fully occupied in their foundry department; orders have also just been given out to the Butterley Company for a large wrought iron lattice girder bridge to carry the Midland Railway over the river Lune at Lancaster; and to Mr. Haywood, of the Phœnix Foundry and Engineering Works, for the whole of the cast and wrought iron work required in the new Cotton's Wharves, which are to replace those burnt down last summer. A proportionate improvement is perceptible in the engineering and bridge-building establishments around Birmingham. Both in them, however, and in those of Derbyshire, much more might be done than is now being accomplished; and the illustrations we have given must be only regarded as conclusive of our position that the iron trade is somewhat reviving. Among the contracts open is one for girders—wrought and cast iron—for the London and North-Western Company, the tenders to be in on Wednesday next.

The pig-iron makers maintain the rise of last week, but no sales are being made.

The coal trade is without alteration.

A piece of colliery property at Moxley, near to Bilston, was seized on Tuesday morning by the subterranean conflagration, which has been for many years raging in that district of South Staffordshire, giving to the locality the name of the "Fiery Holes." It revealed its presence in a pit at Moxley belonging to Mr. Willim, of Bilston, by an explosion of gases, which blew the bricks out of the shaft, and forced them into the air to a great height, while they at the same time almost demolished two cottages near to the pit, to the rafters of which they set fire. Happily the pit, although in working order, has not recently been worked; but the inhabitants of the cottage were in considerable peril.

The mining case of Cotton *v.* Williams was, after four days' arbitration inquiry before a barrister in Birmingham, brought to a temporary close on Friday, in Birmingham. The plaintiff, the owner of the foundry and iron works at West Bromwich, claimed £1,507 for deterioration to land, loss of machinery, &c., by the "cramming-in" of a great portion of his works by the mining operations of the defendant. The defendant's case was supported by, amongst others, Mr. William Astbury and Mr. William Edwards, both of Birmingham. A considerable sum compromised in the £1,507 was agreed to between the two counsel. The other amounts are to be found by the learned arbitration; and some portion of the latter is subject to a case being stated by the arbitration for the decision of the court as to the extent of defendant's liabilities for damage to the foundry buildings under the reservation by which he claims to be entitled to work the mines.

The bereaved dependents of operative colliers and ironworkers of South Staffordshire are likely to be benefitted to a considerable extent by the recent great calamity at the Millfield Ironworks. It is expected that in all £2,500 will be forthcoming for the relief of the sufferers who still survive, and for the orphans and widows of the deceased. A considerable portion of this sum will be applicable to the support of the orphans. These the committee desire to take under their own care, putting them into a "home," which shall form the nucleus of an orphan asylum for children of that class in perpetuity. At a meeting of the General Committee on Friday last a resolution was passed requesting the chairman of the Ironmasters' Association to call a meeting of the members of the iron trade with a view to the discussion of such a scheme.

The general hardware trades have not improved in the past week. The japanners have now become very poorly off; but the tin-plate workers having to produce goods, some of them of an indispensable class, are many of them making four and a-half to five days a week at the best houses. Factors on every hand complain of the order-sheets that are being sent home, and of the very small lots now ordered through the post. The ironmongers even in the rural districts are not ordering to nearly the extent customary at this season; and prices are being cut down to a great fineness. The trade, however, is healthier, inasmuch as there is much less risk in accepting an order now than there was a twelvemonth ago. There are fewer bills finding their way back now than at that time. At the beginning of the week some little nervousness was felt relative to the effect of the rise of discount, but it is all gone now. Three per cent. will never check transactions. Some somewhat singular apprehensions have lately been expressed relative to an alleged combination of yellow metal producers. Whilst combination to keep up prices is always to be deprecated, there can be little doubt but that the day is gone for any such a combination as is alleged.

The Coalbrook Dale Company signified their approval of the efforts of those of their *employés* who had been engaged upon the contributions of that company to the Exhibition, by offering them their choice between a dinner or a ticket to visit the Exhibition. Those of the men who preferred the dinner to the trip were entertained last Monday.

A society is being got up in Birmingham, to which certain of the masters are subscribing liberally, every member of which will, after contributing during a certain period, be entitled to become one of an excursionist party to the Exhibition.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

State of Trade: *Sheffield: Manchester*—Mersey Docks and Harbour Board: *Lighthouse on the Welsh Coast: Unloading Ships with Steam Machinery: Approaches to the Landing Stages*—A Caloric Engine for Spain—Railway Topics: *West Riding, Hull, and Grimsby: Eastern Counties Amalgamation*—Lincolnshire: *Grimsby Docks: Boston*—Northern Matters: *The Border Counties Railways: State of Trade*—Scottish Matters: *Trial Trips of the Columbia (s. s.) and the Shun Lee (s. s.): Agitation for Reduced Gas Rates and Meter Inspection*—Steam Ploughing Trials in Essex and Suffolk.

At Sheffield, although business generally is still depressed, the steel houses continue fully employed. The demand for files is also, on the whole, good, especially for descriptions required for engineering purposes. The cutlery, silver, and Britannia metal trades are dull, without any immediate hope of improvement. Captain Palin, reporting as to the state of employment in Manchester, returns the position of the machinists and foundries of that city as follows:—Machinists working full time with all hands, 10; working full time with a portion of their hands, 24; working short time, 12; stopped altogether, 1. Foundries working full time with all hands, 8; working full time with a portion of their hands, 13; working short time, 3. It does not appear from the statistics compiled by Captain Palin that the state of affairs generally at Manchester has undergone any material change for the worse.

The Mersey Docks and Harbour Board recently dertermined on the construction of a light house on the Great Orme on the Welsh coast. The site selected is the most northern point of the Gogarth promontory, commanding a view of Beaumaris Bay and Menai Straits, with the Anglesea coast, as well as the headlands of Flintshire, &c. As part of the mountain lies nearest the direction of vessels sailing up and down the borders, the danger has been much felt by the mariner, and hence the necessity of proper lights and signals for protection against wrecks and damage, especially when the heavy sea, peculiar to the place at certain tides, becomes uncontrollable, and breaks against the rock with much fury The Mersey Dock Board, at its last meeting, agreed to erect an open shed on the west quay of the Canada Dock at a cost of £8,500, the shed to be 600ft. long and 72ft. wide. The engineer has been requested to conduct operations so as not to interfere with the working of the dock during the active import season.—Mr. Forwood called attention to a system of unloading ships by steam machinery on the dock quays, which he said had been successful in regard to economy and extraordinary despatch, although the gentleman who had tried it was not going to continue it. The engine, which was a high-pressure one, worked at 273 revolutions a minute, and there was no appearance of sparks or fire being emitted. Mr. Arnold asked why, if it had been successful, it had been discontinued? Mr. Forwood said, the lumpers had united against the working of the vessel where the engine was employed; and, therefore, there was no temptation for the gentleman to go to a further expense in trying it as against ordinary labour. Mr. Bold stated that he had seen engines of the kind at work at Milford, and if gentlemen from Liverpool could have seen them also they would have been greatly surprised. He believed the expense of an engine was £700, but probably it might be less now. A model of a comprehensive scheme for improved approaches to the landing-stages, suggested by Mr. Lyster, the engineer, was placed in the boardroom for the inspection of the board. The leading features of the plan are the construction of a road for passengers and vehicles, in continuation of Brunswick-street, across George's Dock; this road, on its termination at the George's Pier, to be connected with two branch covered ways leading direct to the north and south landing stages. Facilities are afforded for goods traffic to and from the ferry steamers at all stages of the tide. The plan will involve a division of the present George's Dock, and a re-arrangement of the dock space on each side of the proposed roadway, including the present George's Dock Basin. The Goree warehouses will also be removed, and the baths at George's Pier, in addition to other alterations required to give more extended space for the immense passenger and other traffic now concentrated in this locality.

Messrs. Fawcett, Preston, and Co., of the Phœnix Foundry, Liverpool, have constructed a caloric engine on the Ericsson principle. The engine consists of two parallel horizontal cylinders, each 32in. in diameter, with a stroke of 15in. A regulating fly-wheel works in the central space between the two cylinders, and the estimated pressure is 8 lb. on the square inch. The space occupied by the whole is about 9ft. square, and to the top of the fly-wheel is also about 9ft., so that, with the exception of the two flues, the whole working space occupied by the engine will be represented by a cubical space measuring 9ft. on each side. The consumption of coal is estimated at 600 lb. per day; and with this amount of combustion, and in the limited space mentioned, it is capable of working up to 8-horse power. The engine is intended to drive the machinery of a silk manufactory in Spain, for which purpose the owner got a smaller one on the same principle made some time ago; but, having occasion to enlarge his works, he is now getting an engine of augmented power to facilitate his operations. The engine works well, but, it is added, rather noisily. The consumption of coal, it will be seen, is at the rate of 7½ lb. per horse per hour, which is anything but an improvement on steam.

The West Riding, Hull, and Grimsby Railway, a project which has excited some interest, has passed the Commons' Committee. The scheme has been stoutly opposed by the London and North-Western, Great Northern, North-Eastern, and other parties, but all to no purpose. The bill, if it becomes law, will be the means of introducing the Manchester, Sheffield, and Lincolnshire Company into the manufacturing districts of the West Riding, and will open out a new and direct access to the port of Grimsby and to North Lincolnshire. It will also enable the Great Northern Company to shorten the route between Leeds and the south about seven miles, and to avoid the inconvenient detention at Knottingley. *Apropos* of railway litigation, it may be stated that the bill for the amalgamation of the Eastern Counties, Norfolk, and Eastern Union, which has passed the Commons, is to be again opposed in the Lords by the Eastern Union interest, who want to squeeze a little more dividend out of the general undertaking proposed to be created, while certain local bodies at Ipswich complain strongly of a system of preferential coal rates which the bill, as it at present stands, sanctions. Notwithstanding many difficulties and obstacles, the principle of amalgamation seems to be finding increasing favour in all directions, and the eighty or ninety distinct companies into which the British railway interest is now divided will probably be reduced during the next ten years to twenty or thirty.

The Grimsby Graving Dock is occupied by a fine iron steamer belonging to the Hamburgh and New York line, which has been brought in for repairs. Improvements and repairs are expected to be undertaken shortly at the old dock; some of the gates not being watertight, a great drawback to the retention of water in the dock. Another item of Lincolnshire information is that plans are in progress for extending the Boston, Sleaford, and Midland Counties line to Frieston shore, where excellent deep water accommodation can be obtained for shipping.

From the north we learn that the Government inspector has examined and passed the line of railway from Newcastle to Riccarton, and the Border Counties from Riccarton to Keilder, so that there is now open communication all the way between Newcastle and Carlisle. The works are now all but completed on the Whitrope and Riccarton contracts, and, except two miles from Shankend to Stobs, the line is ready for traffic. Men are crowded on every part of the works where their services can be made available, and the works will be completed with the least practicable delay. Trade matters at Newcastle remain in much the same state as last reported. The coke and steam coal trades are tolerably brisk, and the tone of the iron market is firm.

With regard to Scottish matters, the trial trips of two new steamers may be noted. The first of these, the Columbia, screw, built by Mr. Archd. Denny, and engined by Messrs. Denny and Co., for Messrs. T. S. Begbie and Co., of London, ran the distance between the Cloch and Cumbrae lights in 70 minutes, showing a speed of fully 11½ knots per hour, which was considered gratifying when the power (100 horses) and the size of the vessel (476 tons) were taken into account. The Columbia returned to Greenock in the afternoon, and left that port for Hamburg on Sunday morning. The second trial was made by the "Shun Lee" over the same course. The distance was run against the tide and a strong breeze in one hour, nineteen minutes, five seconds; and with the tide in one hour, ten minutes, thirteen seconds,—the average time taken between the Lights being one hour, fourteen minutes, thirty-nine seconds, or at the rate of eleven nautical miles per hour. The consumption of coal for three hours was 10 cwt., 3 qrs., and 9 lb. per hour. The "Shun Lee" then proceeded to the measured distance up the Gareloch, and the nautical mile was run in five minutes and three seconds, making nearly twelve nautical miles per hour. The dimensions of the above vessel are 185ft. length, 25ft. breadth, and 15ft. depth; tonnage, B. M., 587. She is fitted with a pair of direct-acting inverted condensing engines and tubular boilers of 120 H.P.; diameter of cylinder, 42in.; length of stroke, 30in.; fitted with separate expansion valves. During the trip the average draught of water was 11ft. 10in., with a cargo on board of 470 tons weight. The results of the trials were satisfactory to all concerned. The Shun Lee will, as soon as she receives her stores, proceed on to China, under the command of Capt. James Blow. She was built and engined by Messrs. Blackwood and Gordon, of Port-Glasgow. The keel was laid on 10th February, so that no time has been lost in building and fitting her out for sea.

Mr. Flintoff continues the agitation for a reduction of gas charges. At a meeting held at Glasgow he stated that during the last three years a saving had been effected in forty-five cities and towns in Scotland, amounting in all to £40,000. He advocated the claims of the new projected gas company, and urged strongly the necessity of a meter inspector being appointed by the Town Council, as meters might be so constructed that they would not cheat gas companies, but they would go 40 per cent. wrong against the consumer. A motion was afterwards proposed by Mr. Alex. Gow, and seconded by Mr. Goldie, to the effect that gas of a good quality ought to be furnished in Glasgow at 3s. 4d. per 1,000 cubic feet, and that inspectors should be appointed to test the illuminating power of the gas and the correctness of the meters, and that, as all attempts to get such inspectors appointed had failed, the meeting pledged itself to support a Gas Consumers' Company, and expressed a hope that the Town Council and Police Committee would sanction the opening of the streets for the company's operations. The motion was unanimously approved.

Interesting trials of steam cultivators—Fowler's, Howard's, and Smith's (of Woolstone)—will be made at the meetings of the Essex and Suffolk Agricultural Societies next week. A digging machine, the invention of Dr. Ager, Aylsham, Norfolk, will also be in operation at the Suffolk gathering. Fowler's plough—or, as the French style it, *l'appareil Fowler*—seems to be coming into increasing use in France.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£ s. d.	Dis. p. ct.
IRON, English Bar and Bolt:—			
in London	pr tn	8 15 0	3
in Wales	„	5 0 0	„
in Liverpool	„	5 10 0	„
Staffordshire Bars (Deliv. into boats at works; Nom. rates last qr. day for favourite brands.)	„	7 0 0	1
Sheet, Sngl.	„	8 10 0	„
Dbl.	„	10 0 0	„
Hoop	„	8 0 0	„
Rod, round	„	7 0 0	„
Nail Rod, sq	„	7 5 0	„
SHIPPING IRON, Staffordsh. Bars (Delivered in Liverpool 10s. per ton less.)	„	7 0 0	2
Sheet, Single	„	8 15 0	„
Double	„	10 5 0	„
Hoop	„	8 5 0	„
Rod, Round	„	7 0 0	„
Nail Rod, Square	„	7 5 0	„
IRON, Rails, in Wales, cash	„	5 5 0	nett
„ 6 months	„	5 7 6	„
Old, to cut up	„	0 0 0	„
Railway Chairs, in Wales	„	4 0 0	„
„ in Clyde	„	3 15 0	„
Pig No. 1, in Clyde	„	2 13 0	„
3-5ths No. 1 & 2-5ths No. 3		2 13 6	„
No. 1, in Wales	„	3 10 0	„
No. 1, in Tyne and Tees	„	2 12 0	„
Ditto, Forge	„	9 0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	„	3 10 0	„
Welsh Forge Pig (all Mine), at the Port	„	3 5 0	„
Acadian Pig, Charcoal	„	7 10 0	„
Scotch Pig, No. 1, in London	„	0 0 0	„

		£ s. d.	Dis. p. ct.
IRON, Swedish, Indian assortments	pr tn	11 5 0	2
Russian C C N D to arrive	„	16 0 0	„
STEEL, Swedish Keg, ham.	„	15 10 0	2½
Ditto, rolled	„	15 0 0	„
Fagot	„	17 0 0	„
SPELTER, on the spot	„	18 0 0	nett
To arrive	„	18 0 0	„
Hard, remelted	„	17 0 0	„
ZINC, in sheets	„	24 0 0	„
COPPER, Tile, 14 to 28lb.	„	94 0 0	2
Tough Cake	„	94 0 0	„
Sheathing and Bolts	pr lb.	0 0 10½	„
Sheet	„	0 0 10½	„
Bottoms	„	0 0 11	„
Old	„	0 0 8½	„
Yellow Metal	„	0 0 8½	„
Burra	„	96 0 0	„
Russian do.	„	0 0 0	„
LEAD, British Pig	„	20 15 0	„
Spanish	„	19 15 0	„
W. B.	„	21 10 0	„
Sheet	„	21 0 0	„
TIN, English Block, nom.	„	114 0 0	„
Bar „	„	115 0 0	„
Refined „	„	119 0 0	„
Foreign Banca	„	123 0 0	„
Straits	„	115 10 0	„
TIN PLATES, Charcoal, IC	pr bx	1 9 0	„
Ditto IX	„	1 15 0	„
Coke, IC	„	1 2 6	„
Ditto IX	„	1 8 6	„
Do. at Newport, 1s. pr bx less		—	„
Do. at L'pool, 6d. „		—	„
CANADA, Plates	pr tn	12 0 0	
QUICKSILVER	pr bt		

Rails.—The market is much stiffer, there having been a considerable inquiry this week.

Scotch Pig Iron.—The market has been very steady during the past week, and but little fluctuation has taken place in the price, which closed firm in Glasgow, 53s. 4½d. to 53s. 6d. for cash.

Spelter firm at £18. Some sales have been reported of good brands, at £18 10s. on the spot.

Copper has this day been reduced one halfpenny per pound.

Lead firm at our quotations.

Tin remains the same as last week. Banca quoted £123, and Straits £115 10s. The annual sale of Banca will take place on the 25th June, at Rotterdam, when 142,500 slabs will be put up, and 20,000 slabs more if arriving in time.

May 29th, 1862. Moate and Co., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Teak	15 10	17 0	15 0	16 0
Quebec, red pine	3 10	4 10	3 5	4 0
yellow pine	3 0	4 0	3 0	3 15
St. John, N.B., yel.	5 0	5 10	5 0	5 10
Quebec, oak, white	5 0	5 10	5 0	5 10
birch	3 10	4 0	4 0	0 0
Memel	0 0	0 0	0 0	0 0
elm	3 10	4 15	3 10	4 15
Dantzic, oak	3 10	6 0	3 10	6 0
fir	2 15	3 10	3 0	4 0
Memel, fir	3 10	4 0	3 10	4 0
Riga	3 5	3 10	3 10	3 15
Swedish	2 15	3 0	2 15	3 0
Masts, Queb. rd pine	5 0	6 0	5 0	6 0
yl. pine	5 0	6 0	5 0	6 0
rd pine	0 0	0 0	0 0	0 0
Lathwood, Dantz, fm	6 0	6 10	6 0	7 0
St. Peters.	8 0	8 10	9 0	9 10
Deals, per C., 12 ft. by 3 by 9 in.				
Quebec, wht. spruce	13 0	18 0	15 0	19 0
St. John, wht. spruce	13 0	16 0	15 0	17 10

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Yel. pine, per reduced C.				
Canada, 1st quality	17 0	18 10	17 10	19 0
2nd do	12 0	12 10	12 0	13 0
Archangel, yellow	13 0	13 10	14 0	15 0
St. Petersbg. yel.	12 0	12 10	12 10	13 10
Finland	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	15 0
Gothenburg, yel.	10 0	11 10	10 0	12 10
white	9 10	10 0	9 10	11 0
Gefle, yellow	10 0	11 0	11 0	12 10
Soderhamn	10 0	10 10	11 0	12 10
Christiania, per C 12 ft. by 3 by 9 in. yellow	22 0	25 0	22 0	24 0
Deck plank, Dntz per 40 ft. 3 in.	0 14	1 4	0 14	1 4
Staves, per standard M				
Quebec, pipe	70 0	75 0	80 0	85 0
puncheon	16 0	18 0	16 0	18 0
Baltic, crown pipe	160 0	170 0	170 0	180 0

SCOTCH PIG IRON REPORT.

	s. d.	
No. 1 Gartsherrie	57 3	f.o.b Glasgow.
„ 1 Coltness	57 3	do.
„ 1 Calder	53 6	do.
„ 1 G.M.B.	52 9	do.
„ 3 Do.	51 3	do.
M. Nos. Do.	52 0	do.

WARRANTS.

3-5ths No. 1 and 2-5ths „ 3 .. G.M.B.		s. d.	
	Cash prompt	53 4½	per ton.
	1 mo. open	53 7½	do.
	2 mos. „	53 9	do.
	3 „ „	54 0	do.

MANUFACTURED IRON.

	£ s. d.	
Bars, Govan	7 0 0	
„ Common	6 10 0	
Drumpeller, Common	6 10 0	
Do. Best	7 10 0	
Cramond Scrap Bars Delivered in London	10 5 0	less 5 per cent.
Plates and Sheets	9 0 0	to £9 10s.
Rails	6 5 0	
Pipes	4 17 6	
Chairs	3 15 0	

Glasgow, 28th May, 1862.

The pig iron market remains very inanimate; little disposition shown either to buy or sell.

To day the nominal quotation is 53s. 3d. for Mixed Nos. Warrants.

Shipments last week were 13,972 tons, against 16,748 tons in the corresponding week of last year.

Shaw, Thomson, and Moore, Metal Brokers.

Large Ordnance.—The United States Government have ordered of Messrs. Bessemer and Co., of Sheffield, a cannon of Bessemer steel to weigh 17,000 lb., or upwards of 7½ tons. Messrs. Bessemer and Co.'s own works are not yet, we believe, adequate to the production of such a mass, and it will probably have to be produced at some of the other works in Sheffield where the Bessemer process has been adopted.

CALVERT'S AIR OR STEAM ENGINES.

FIG. 4.

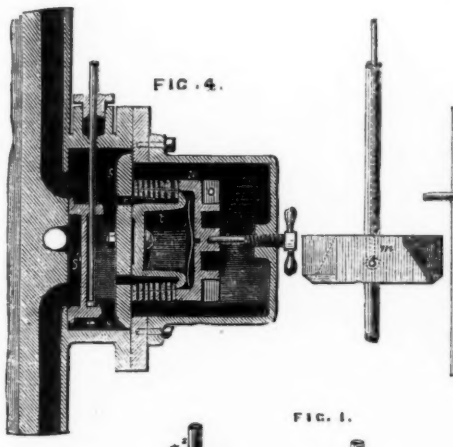


FIG. 5.

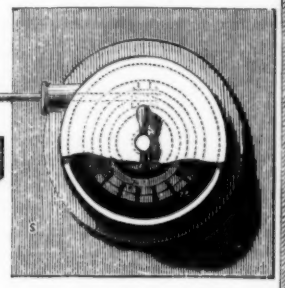


FIG. 2.

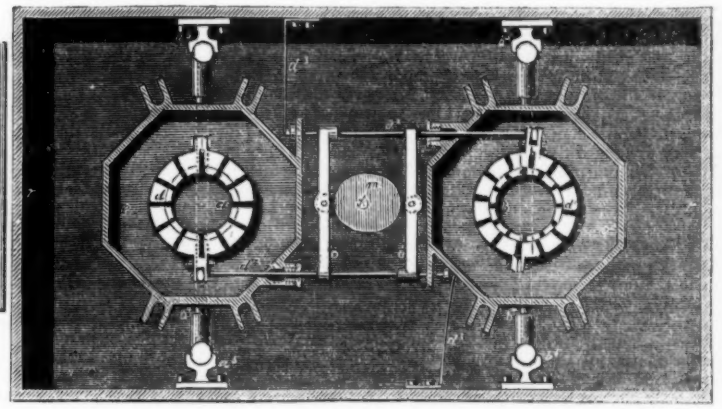


FIG. 1.

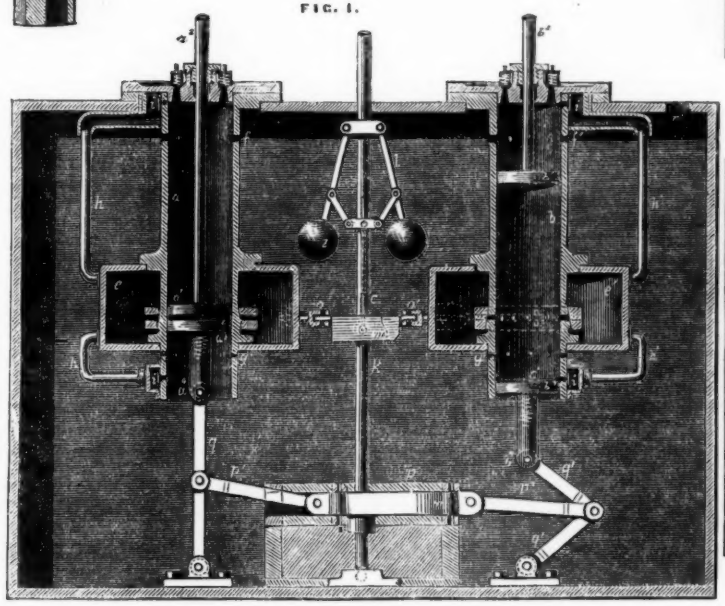
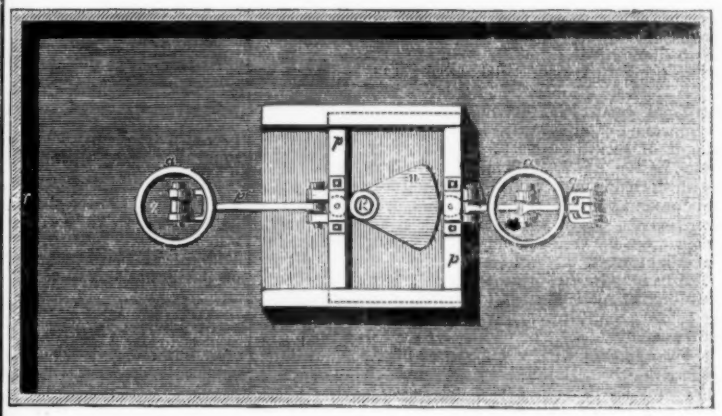


FIG. 3.



THE nature of this invention, by Francis A. Calvert, of Manchester, consists in supplying compressed atmospheric air or steam from a reservoir or boiler to one or two cylinders, each cylinder containing two pistons, each lower piston containing one or more vacuum valves to supply the upper pistons with air or steam when the expansive force of the compressed air or steam is expended.

The valves and the cushion chambers for the upper pistons are the same in principle as those described in the specification of a patent granted to Mr. Calvert, September 14th, 1860, and illustrated in THE ENGINEER, of April 26, 1861 (page 264, vol. xi.), with the addition of means for conveying the compressed vapour or air from the cushion chambers to the steam or air chest, and an alteration in the construction of the admission valve, which is annular, and fits on the exterior of the cylinder. The exhaust ports consist of annular rows of holes for the escape of the air or steam; these holes are placed at such a distance from the ends of the cylinder that the requisite space may be left for the cushions above referred to. Each air cushion is in communication with the chest containing the annular admission valve, the said chest being supplied by the reservoir or boiler, and when the air or steam in the cushion chambers becomes compressed to a greater degree than that in the chest, the surplus pressure is forced back into it. The lower pistons are actuated by toggle joints, and when a single cylinder is employed, the piston is counterbalanced. The said lower pistons have a traverse of about one-fourth of the length of the cylinder, the motion being imparted to them by a cam; the upper pistons are connected to a crank shaft, or they may be connected by a beam.

During the commencement of the stroke the two pistons in each cylinder travel together, but when the lower piston has completed its stroke the compressed air or steam is instantly admitted between the two pistons, and impels the upper one forward until it arrives at the end of the cylinder. Each cylinder is made to receive the compressed air or steam for propelling the piston during its upward stroke. When the air or steam is admitted between the pistons, the crank is at or near the point where the full leverage is obtained.

The duration of the admission of the compressed air or steam is regulated by a movable inclined tappet, which gives a larger or smaller amount of the compressed air or steam to the cylinder, but in every position of the inclined tappet the compressed air or steam enters at its full force, that is to say, so long as the engine is driving its load; but supposing the load to be suddenly thrown off, as in trip hammers and rolling mills, the lower end of the tappet being bevelled off, the regulator would be moved to a greater height, and would lift the tappet so that the admission valve would not be operated upon.

Fig. 1 is an elevation in section of one of the improved engines with two cylinders, which is intended to be worked by steam, Fig. 2. is a plan also in section through the steam chest and the parts on the same level; and Fig. 3 is a plan of the cam for actuating the toggle joints and lower pistons.

a and *b* are the two cylinders; a^1 and b^1 the two upper pistons fixed to the piston rods a^2 and b^2, which are connected in the ordinary manner to the connecting rods and crank shaft, the cranks of which are in line with each other on opposite sides of the shaft; a^3 and b^3 are the two lower pistons, which are constructed so as to act as exhaust and vacuum valves, that is to say, the body of the piston is perforated, and upon it fits a plate marked *c*, c^1, mounted on a centre stud, which passes through the centre of the piston, and projects underneath for a spiral spring. The plate is about one-fourth of an inch less in diameter than the piston to allow a supply of air or hot vapour to escape around it when the plate is raised, and the pistons open and close the exhaust port, as will be described hereafter. The lower pistons are kept in line with the cylinders by the crossheads a^4 and b^4 and slides a^5 and b^5, which are provided with rests to support the pistons when down.

The admission valves *d* and d^1 are annular and perforated, and fit on the exterior of the cylinders, which are also perforated. The valves are each made in two parts for the convenience of putting together; they are contained in the steam chests *e* and e^1, which are connected by suitable pipes with the steam boiler. The upper rows of holes *f*, f^1, form the upper exhaust ports, and the lower rows of holes *g*, g^1, form the lower exhaust ports; these exhaust ports are placed at such a distance from the ends of the cylinders that the requisite space may be left for the cushion chambers, which are similar in construction to those described in the specification of the patent granted to Mr. Calvert, Sept. 14th, 1860, No. 2218. The pipes *h*, h^1, form the connections between the cushion chambers and the steam chests *e*, e^1, each cushion chamber being furnished with a small flap valve *i*, i^1, the object of which is to allow the excess of pressure in the cushion chambers to pass into the steam chest, and to prevent its return when the action of the piston is reversed. The upper cushion chambers are provided with conical vacuum valves, which are connected by pipes (not shown) with the exhaust chamber or hot well *r* to prevent the admission of cold air into the cushion chambers.

To the crank shaft is fixed a bevel wheel gearing into another wheel on the hollow vertical shaft *k*, which carries the governor *l*, the movable inclined tappet *m* for working the admission valves *d*, d^1, and the cam *n*, for actuating the lower pistons a^3 and b^3. The governor *l* is connected by the rod l^1 with the tappet *m*, which slides up or down on the hollow shaft *k* with the opening or closing of the governor balls; the hollow shaft has slots through it to allow the bush of the governor and the tappet *m* to rise and fall. The tappet *m* in revolving acts alternately on two arms *o*, o^1, provided with anti-friction rollers; these arms are respectively attached to the rods d^2 of the admission valves *d*, d^1, as shown best in Fig. 2. These valves are moved about one-fourth of an inch, or more or less according to the size of the port-holes; each valve rod is provided with a spring d^3, by which the valves are instantly closed, when the tappet *m* ceases to act on the arms *o*, o^1.

The duration of the admission of the steam is thus regulated by the tappet *m*, which gives a larger or smaller amount of steam to the cylinder, but in every position of the tappet the steam enters at its full force, that is to say, so long as the engine is driving its load; but supposing the load to be suddenly thrown off, the lower end of the tappet being bevelled towards the centre of its shaft, the regulator would be moved to a greater height, and would lift the tappet so that the admission valve would not be operated upon.

The cam *n* acts upon anti-friction rollers supported in the frame *p*, shown best in Fig. 3, to which frame are jointed the links p^1 and p^2, each of which is connected to the toggle joints *q*, q^1, the upper links of which are jointed to the under side of the lower pistons a^3 and b^3. The top flanges of the cylinder are screwed to the upper part of the hot well or exhaust chamber *r*, which should be sufficiently tight to hold the water of condensation, and which is furnished with an aperture r^1 open to the atmosphere. The water collected in the chamber is removed at pleasure to the boiler, or otherwise disposed of.

The illustration represents the pistons a^1 and a^2 in the cylinder *a* in the positions they occupy when steam is admitted and the lower piston b^3 in the cylinder *b* has just arrived at the bottom of its stroke, while the upper piston b^1 is descending. The mode of operation is as follows:—When the pistons are near to each other, as shown in the cylinder *a*, the crank to which the piston rod a^2 is connected is 30 deg. below the horizontal line, or at about fourteen-fifteenths of its full leverage, consequently the percussive action of the steam is applied so as to produce on the piston a^1 a result similar to that of a steam or air gun upon the ball. The inclined tappet *m* regulates the duration of time for the admission of the steam; and it is preferred to admit steam during about one-twelfth of the stroke, but a greater or less amount of steam may be admitted.

During the admission of steam the lower piston a^3 is stationary, and it is supported by the toggle joints being in a vertical position; the upper piston a^1 having acquired the requisite momentum, continues its ascent to the end of the stroke. During the ascent of the piston a^1, should the expansive force of the steam be reduced below the pressure of the atmosphere, then the vacuum valve in the lower piston a^3 is raised, and admits the vapour from the hot well to preserve the equilibrium on the ascending piston until it passes the upper exhaust ports *f*; the remainder of the stroke of the piston a^1 compresses the vapour in the upper cushion chamber until the pressure becomes greater than that in the steam chamber *e*; the excess of compressed vapour is then conveyed through the flap valve *i* and pipe *h* to the steam chest *e*.

While the piston a^1 is compressing the vapour in the upper cushion chamber of the cylinder *a*, the piston b^1 is performing the same office in the lower cushion chamber of the cylinder *b*. The object of the cushion chambers is, first, to return a certain amount of compressed vapour to the steam chest while the cranks are turning their centre so as to be again applied to the piston with the steam from the boiler; secondly, to check the momentum of the piston; and, thirdly, to relieve the strain on the crank pin.

During the descent of the piston a^1, the upper piston b^1 and lower piston b^3 are ascending together, and when they arrive at the annular port holes, the steam is admitted in the manner before described in reference to the cylinder *a*. The object of the lower pistons is to obviate the necessity of filling the cylinders with steam until the crank is in the position for receiving the full force of the steam, and to increase its effective force by having a small space to fill.

We have described the improvements as applied to an engine to be worked by steam; but compressed atmospheric air rarified or otherwise may be used instead of steam.

Fig. 4 is a section, and Fig. 5 an elevation, partly in section, of an admission valve, applicable to engines of the ordinary construction, and working at the usual velocity, as the cushion chambers above referred to could not conveniently be applied to such engines so as to increase their velocity. *s* is the steam chest of a vertical or horizontal engine and s^1 the slide valve. The face of the steam chest lid is provided with a circular row of holes; *t* is the valve seating, which has a series of circular rows of holes opening into the V-shaped chambers t^1, and *u* is the valve surrounding the valve seating; the valve is furnished with holes corresponding with those in the valve seating. When the holes in the valve and valve seating coincide, the steam is admitted into the chambers t^1, and through the perforations in the face *s*, to the ordinary steam chest, care being taken that the admission port is at this time fully open, or nearly so, to convey the steam to the head of the piston, and that the piston is in the position for acting on the crank when at an angle of about forty-five deg., this position being found advantageous for applying the percussive action of the steam. The valve *u* is worked by the movable inclined tappet *m*, similar to that described in reference to the preceding Figs. 1 and 2. Mr. Calvert has been working an engine of this kind for some months.

MINERALS, STONE, &c., FROM HER MAJESTY'S FOREST OF DEAN.—It was announced some months since that it was intended by the Commissioners of her Majesty's Woods and Forests to form a collection of the coal and iron ore, stone, pottery, &c., from the Forest of Dean, and place it in the Exhibition, and that it was to be under the management of Mr. Grantham. This collection has been made, and is placed in the eastern annexe. Two large blocks of coal are exhibited by the Park End Coal Company of the Park End high delf and smith coals; a specimen of the rocky coal seam, by Mr. Henry Crawshay; and of the Yorkley seam, by the Bristol and Forest of Dean Coal Company; also a large block of two and a quarter tons in weight of black brush iron, and of smithey ore, by Mr. Henry Crawshay; and from Wigpool mines, by Mr. William Allaway, several specimens of smithey ore, and some purple ore. Trotter, Thomas, and Co., have sent a beautifully-turned Doric column of one stone, twelve feet in height, placed on a pedestal; and Mr. Hall, of Coleford, exhibits a fine stone, of three tons weight, with her Majesty's monogram and crown carved upon it. Mr. Terrett exhibits bricks, pipes, and clay from his works at Coleford. Some specimens of stone built into a wall, from the eastern side of the Forest, composed of red, silver grey, and grey colours, as a contrast of colours, is also placed in the collection.

HYDRAULIC MACHINERY IN THE EXHIBITION.

The Exhibition is particularly rich in hydraulic contrivances, a few of which are novelties, if we may be allowed thus to designate anything brought out since 1851. Giffard's wonderful Injector, embodying one of the most notable conquests of bold exploration, unguided by a single principle, into the region of mechanical discovery, is alone sufficient to mark an era in the history of hydraulic apparatus. Mr. Ramsbottom's contrivance for taking up water into the tenders of locomotive engines in rapid motion, although having only a special application, and although, too, it had been before proposed by others, is nevertheless worthy to take the second place in the rank of our recent acquisitions in the machinery now under notice. The centrifugal pump dates as far back as the former Exhibition, during which, indeed, it first became publicly known. Water pressure engines were used nearly a century ago, and Sir William Armstrong's application of hydrostatic force to the working of cranes was patented nearly sixteen years ago, yet the water crane was but little known in 1851, and to many it is even yet a novelty. Steam fire engines date from somewhere about 1832, but to our present engineers they represent the most recent application of steam to pumping machinery. Turbine water wheels, too, date as far back, at least, as 1823, yet they had acquired no considerable reputation in England up to the time of the former Great Exhibition. Water meters, too, although schemed long ago, have only lately been so far improved as to take their place among the requisites of the hydraulic engineer.

One of the most important applications of pumping machinery, that of raising water for the supply of towns, is represented in the western annexe, by a working model of the Cornish engine as made by Messrs. Harvey and Co., of Hayle. This construction of engine is now so well known as hardly to require any notice in this connection, and so diminutive is the example sent that visitors, including many engineers, are likely to overlook it altogether.

Messrs. Easton, Amos, and Sons send a large Appold's centrifugal pump with driving machinery, and Messrs. Gwynne and Co., of Essex-street wharf, contribute a large example of their pump, acting also by centrifugal force. Messrs. Easton, Amos, and Sons' pump, or draining machine, was illustrated in The Engineer of the 16th ult. (page 362 of the present volume). The pump fan, drawing in water both from above and below, and discharging it through the openings between six curved vanes, has been hardly, if at all, changed in form since it was first schemed by Mr. Appold. In the present example it is placed on a vertical axis, and is 4ft. 5in. in diameter, the inlets above and below being 27in. in diameter. The working speed is 118 revolutions per minute, at which rate the periphery of the fan moves with a velocity of 27¼ft. per second, equal to the theoretical velocity of water flowing out from a head of nearly 15ft. The lift at which the pump is adjusted to work is 6ft., at which it is understood to throw 100 tons of water per minute, equal to an effort of 41 effective horse power. The makers claim that Appold's pump is the only hydraulic contrivance which, without any alteration of its nominal speed, will throw a quantity of water nearly inversely to the lift, throwing nearly twice as much for example under a lift of 5ft. as under one of 10ft., the speed and the power applied being the same in both cases. In the present case the pump is driven by a pair of condensing engines of 20in. cylinders and 2ft. stroke, working steam of 50 lb. pressure, cut off at one-fourth stroke, and making 50 revolutions per minute. This speed is brought up to that of the pump by means of bevel gearing. The Appold pump, in the trials made by the jurors of the Exhibition of 1851, was said to have utilised 69 per cent of the power applied. In case the present pump were equally effective, the work done being that of 41 horses, the power applied would be 60 horses, and if one-fourth of the whole power of the engines were expended in friction, this would represent 80 indicated horse power, corresponding to an average pressure (including vacuum) of 21 lb. per square inch on the pistons throughout their strokes. The pump is placed in a tank, the capacity of which is 24,000 gallons, or about 100 tons of water.

Messrs. Gwynne and Co.'s pump presents an even more imposing appearance than that just described. It is placed on a horizontal axis, and throws a column of water which flows through a lofty entablature in a cascade 21ft. high and 10ft. wide. When we add that Mr. Rimmel has perfumed the contents of Messrs. Gwynne's tank with rose-water, it will be understood that there is no lack of spectators, whenever there is an average number of visitors in the building. The makers have supplied the following particulars of the pump and its working. It is 4ft. in diameter, and the suction and discharge pipes are 30in. in diameter. The pump is driven direct by a pair of horizontal high-pressure engines, having 18in. cylinders, 14in. stroke, and intended to make 210 revolutions per minute. The makers furthermore state that with an average pressure of but 25 lb. per square inch upon the pistons, throughout their strokes, which at the speed given corresponds to 188 indicated horse power, the pump will lift from 110 tons to 120 tons of water per minute through a difference of level of 21ft. With 110 tons, however, raised 21ft. per minute, the work done is equal to 157 horse power, and with 120 tons, 171 horse power. How this work, in addition to the friction of the engine and that of the water in ascending pipes, can be got out of 188 indicated horse power, is more than we can understand, and we may as well record our disbelief of it at once. We are not more convinced by the assertion of the makers that their pump can, at the same speed and with the same power, force about 400 tons of water per minute to a height of 6ft., an effort equal to 163 horse power.

We trust the jurors will ascertain what is the real per centage of useful effect of the Appold and Gwynne pumps on exhibition. If it is anywhere near 70 per cent. they are, for most purposes, unquestionably the most economical pumps in existence. For, if it give a good dynamical result, the centrifugal pump has everything else to recommend it—cheapness, simplicity, absence of valves, ability to pass objects which would choke any other pump, &c.

Of turbines in the Exhibition there is not one of the outward-flow variety.* Of the parallel-flow class there is Schiele's, exhibited by the North Moor Foundry Company, of Oldham, an inverted Jonval turbine by Mr. Richard Roberts, a turbine which is a cross between Jonval's and Fontaine's, by Messrs. Bryan Donkin and Co., and a Fontaine turbine by MM. Fontaine and Brault, of Chartres. Of the inward-flow class Messrs. Williamson Brothers, of Kendel, send several examples of the Thomson wheel. Turbines will never be used perhaps to a great extent in a country where coal is so cheap as in Great Britain, but they are in every respect preferable to water wheels of any other construction. They are cheap in first cost, require inexpensive foundations, and little gearing; and besides being unaffected by back water, they utilise a higher proportion of the theoretical effect of the water than any water wheel other than the best overshot. Schiele's turbine was illustrated in The Engineer of February 7th last (page 92 of the present volume). It is made to work either on a vertical or a horizontal axis. The water is admitted to the wheel through a spiral case surrounding it, and through carved guide vanes which conduct the water inwards, as in inward flow turbines. The wheel itself, however, has two sets of buckets, opening in contrary directions, so that, in a turbine with an upright shaft, one half of the water is discharged upwards and the other half downwards. The lower set of buckets are like those of any Jonval wheel, and the upper set are different only in so far as that they are inverted. The only advantage claimed for this arrangement is that of relieving the footstep from the weight of the column of water, but whether this advantage compensates for the force lost in turning the water, suddenly, at right angles, from the guide vanes into the buckets, we cannot say. The guide vanes and buckets are all cast in with the wheel and casing, and are necessarily thicker than if made in plate iron, while their form, too, can hardly be as accurate is if each one were shaped to a template. At the same time, however, the wheel and casing, as cast whole, are cheaper than if made with wrought iron guides and buckets. The makers claim for these wheels a per centage of from 75 to 85 per cent. of the theoretical effect of the water used, and this claim appears to rest partially upon a report by Messrs. Fothergill, Wrigley, and Co., of Manchester, to the effect that a 5ft. Schiele turbine, 2ft. 8in. high, and working on a 6ft. 1½in. fall, at the King's Mill, Huddersfield, gave by Mr. J. B. Francis' formula 75·6 per cent. of effect, by the formula of the Franklin Institute 81·34 per cent., and by Mr. Blackwell's formula 89 per cent. Without denying that the real efficiency of the turbine tried at Huddersfield might have been 75 or even 89 per cent., we must distinctly deny that either of the formulæ quoted were in any way applicable to the experiment. For none of these formulæ were deduced from observations made upon turbines of the same kind or working under like circumstances. Any one who wishes to see how Mr. Francis' formula was obtained may refer to The Engineer of August 2nd and 9th, 1861 (pp. 57 and 73, vol. xii.) where he may learn how carefully every condition of trial has to be taken into account. It would be of much service as well as of great interest to engineers to ascertain the real efficiency of the different turbines now in use in this country, by measuring the water expended and ascertaining the actual power developed, either through a friction brake or in lifting a weight. The results would be more definite, at any rate, than those obtained from various formulæ, one of which gives a result nearly 19 per cent. greater than that indicated by another. It is by no means our intention, however, that these observations are to be construed in any way unfavourably to Schiele's turbine under notice. It belongs to the most effective class of hydraulic prime movers, and, mechanically, is an exceedingly compact and commendable example of construction. Wherever there is water power to be had, the turbine has every advantage over the steam engine, not only requiring neither fuel nor attendance, but being cheaper in first cost and occupying less room, and withal free from danger. The North Moor Foundry Company's (Schiele's) turbine has adjustable slides at the inner apertures of a number of the guides, so that the admission of water to the wheel may be regulated according to the quantity at command. For all their turbines on vertical shafts, the same makers also apply Schiele's patent anti-friction curved bearing in the footstep. This step can be set up by a cottar, and there is a stuffing box to keep out water. Both their turbines—that on a vertical axis and that on a horizontal shaft—are represented in the Exhibition. The former is rated at 30-horse, and is 2ft. in diameter, and intended to work on a 25ft. fall. The latter is 10in. in diameter, and is intended for a 50ft. fall, at which it will give off 15-horse power, the inlet pipe being 7in. in diameter. By placing the outlet in communication with a suction pipe, the turbine may be placed at any height less than 30ft. above the level of the water in the tail race, giving precisely the same result as if immersed, and being far more easily accessible in case of repairs.

Messrs. Bryan Donkin and Co.'s turbine is described as of 36-horse power, and as making 150 turns per minute under a 40ft. fall. It is, substantially, a Jonval† turbine, without a suction box to permit of placing the wheel above the water in the tail race. The stationary guides do not occupy a whole circle above the wheel, but are divided into two groups, each occupying 90 degrees of the circle. These guides are covered or opened by two segmental slides moved by suitable hand gear. Thus only one half at most of the buckets of the wheel can be filled with water at the same time, and thus a wheel of twice the diameter of an ordinary Jonval turbine is required to do a given work. The guides and buckets are of cast iron, thick, and almost of necessity wanting in that accuracy of form essential to the best results with a turbine.

Mr. Richard Roberts exhibits a small model of an inverted Jonval turbine, the flow being upward, and this he describes as his "patent high pressure balance turbine." The object is to take off the weight of the column of water, as is done in the Scotch or Whitelaw and Starrett turbine, and to a considerable extent in Schiele's turbine.

MM. Fontaine and Brault, of Chartres, exhibit a Fontaine turbine, with its large rolling cones and other paraphernalia. It is not different in principle from a Jonval turbine, the chief peculiarity being in the use of an inner circle (or, rather, segment) of guides and buckets by which the quantity of water passing through the wheel may be more exactly regulated to the supply. The guides and buckets are cast in whole.

Messrs. Williamson Brothers, of Kendal, exhibit several examples of Thomson's wheel, which is of the inward flow variety, and called by the patentee the "vortex wheel." Mr. Thomson's patent was dated July 3rd, 1850, and consequently has upwards of two years longer to run. We do not recollect, at this moment, what is Mr. Thomson's precise claim, but Mr. Fairbairn, whose pupil he was, attributes to him the invention of the whole class of inward flow wheels, notwithstanding that such wheels have been most extensively used in America for the last twenty-five years, and repeatedly illustrated in American scientific works and newspapers. Cheapness of construction, however, and not high efficiency, has been the argument in favour of this class of motors in the United States, where, for large establishments and wherever economy of water is an object, they are being superseded by the outward flow turbine of the Fourneyron class, or by the parallel flow turbine of Jonval. That the Thomson wheel is a practicable and useful motor we cannot deny, but it can by no means be ranked first in merit among turbines. All wheels in motion must generate a corresponding amount of centrifugal force. In the outward flow wheel this force tends to accelerate the outward flow of the water, and the reaction due to this effort is taken up in the wheel. We do not mean that there is any positive gain, as the reaction from centrifugal force can never exceed the effort expended in generating it. But with respect to the inward flow, the centrifugal force is not only first produced with the same expenditure of effort, but, when produced, it is actually expended in, *pro tanto*, forcing back the influent water. Thus there is unquestionably a double loss of power. Then again, except in very large inward flow, or centre vent wheels, the outlet for the escape of the water is very contracted. This surely is a disadvantage, and it is one which Mr. Thomson has been able to mitigate only by giving a reversed or "ogee" curve to the buckets of his turbine. By so much, therefore, as he thus aids the escape of the water, he interferes with its useful reaction in the rotation of the wheel. If his regulating guides are useful, they are somewhat costly and objectionable in fitting up, and hence it is, we presume, that their number is restricted to four.

Of all turbines we believe the Fourneyron (outward flow) to be the most effective for a given quantity of water. It is at the same time rather costly, and requires care in its construction, and the exclusion of all solid bodies from the water entering the wheel. The Jonval (Koechlin) turbine is the simplest and cheapest of all, and can be so made as to suffer no injury from the passage of bits of wood, &c., between the guides and floats. It has been found, too, to give from 75 to 88 per cent. of the full theoretical effect of the water, averaging, we believe, several per cent. more than any inward flow wheel of whatever construction.

The application of turbine water wheels has received far less attention in this country than it deserves, and we can only wish that the small examples exhibited in the western annexe may serve to awaken fresh interest in so important a branch of hydraulic engineering. We occasionally find, in the reports of some of our new mining companies, and in the newspaper correspondence to which these reports sometimes lead, allusions to the use of the turbine for draining mines, and we have observed that, in many cases, this simple and most thoroughly tested motor is spoken of as an object of incomplete experiment, and, therefore, of doubtful practical value. Now, on the contrary, no motor is so certain in its action, provided only it be kept free from the obstruction of floating or sunken objects in the water, as the turbine. It can be adopted perfectly to very low if not the lowest falls,* and is, indeed, the only water wheel properly admissible for very high falls. It is, as we have said, unaffected by back-water except only by the inevitable accompanying diminution of the fall. Its cheapness, simplicity, and readiness of repair, need not be further dwelt upon, nor need we say more of the advantage of turbines in respect of simplicity of foundations, and in their rate of speed, which more nearly approaches that of the machinery they generally have to drive than does the speed of large water wheels. Contrasted with the steam engine, the turbine would, in every locality where water power is to be had, prove every way more economical, to say nothing of its entire safety.

Turning now from turbines, we have the hydraulic crane and a hydraulic capstan contributed by Sir William G. Armstrong and Co. Sir William, then Mr. Armstrong, first turned his attention to the utilisation of very high falls of water about 27 years ago. Others had long previously erected water pressure engines, but these had been adopted only where other power would have been applied under especial disadvantages. In 1846, Mr. Armstrong patented the application of water pressure to cranes, claiming particularly the use of sheaves or pulleys in the inverted order of the ordinary block or pulley, so as to obtain, from a short stroke of the hydraulic piston, a longer motion of the crane hook. But up to the year 1851, Mr. Armstrong continued to rely either upon a natural head of water, or upon that obtained by pumping water to a great height. The hydraulic tower, 300ft. high at the Great Grimsby docks, was reared solely to supply a head of water to the water cranes. At last, however, the simple contrivance of the "accumulator" was hit

* Messrs. Easton, Amos, and Sons, however, are making a small Fourneyron turbine to drive the quartz crushing machinery in the Australian department of the Exhibition.

† Also known as the Koechlin turbine.

* The workshop at the New River Company's pumping station at Stoke Newington is driven by a small turbine, supplied with water under a few feet head, from the hot well of the engines.

upon, and it is only strange that it was not thought of before. In the "accumulator," which is a hydraulic cylinder with a heavily loaded ram, a pressure equal to that of from 1,000ft. to 1,500ft. of water is constantly maintained. Relief valves are so placed that the various parts of the apparatus cannot be injured, either by over pumping or by sudden changes in the current of water. The system of water pressure cranes, gate closing machinery, &c., is one which may be applied with much advantage where a considerable number of cranes, &c., are to be worked in various parts of a large establishment. At the Victoria Docks, for example, upwards of four miles of mains are laid down for the transmission of water, under great pressure, to the various machines in connection with the accumulator, and thus, with entire safety in the working, a single boiler and engine may suffice for a multitude of operations. But for one, or even a moderate number of cranes placed near each other, the direct application of steam to the piston of the crane, as practised by Mr. Morrison, is preferable to the complication of the hydraulic apparatus. It may interest some of our readers to know that a small water pressure engine, working under a head of upwards of 200ft. of water, is employed to drive the tools in the workshop of the Chelsea Water Works, at Kingston.

The Injector was described in THE ENGINEER of November 4th, 1859 (page 330, vol. viii.), and has been so oftened described and discussed since that we need do no more than notice its presence in the Exhibition. The original maker, M. Flaud, of the Rue Jean Goujon, Paris, exhibits a number of Injectors in the French department of the annexe, and the English licensees, Messrs. Sharp, Stewart, and Co., of Manchester, show also eleven Injectors, ranging from No. 2 to No. 23, the latter capable, with steam of 50 lb. pressure, of throwing 6,000 gallons an hour, or sufficient for the supply of twelve 50-horse boilers. The "numbers" of the Injectors represent the diameter in millemètres of the contracted jet of water forced into the boiler, a No. 2 Injector throwing a jet of ·078in., or rather more than $\frac{1}{10}$in. in diameter, while a No. 23 throws a jet of 23 millemètres, or $\frac{9}{10}$in. diameter. The No. 8 size, throwing a jet ·3149in., or $\frac{3}{10}$in. in diameter, is that common for locomotives. The wonderful performance of this instrument leaves no occasion for recommending it to the attention of engineers and users of steam power.

Mr. Ramsbottom's apparatus for picking up water for the supply of locomotives while in motion was illustrated and described in THE ENGINEER of August 30th, 1861, (page 122, vol. xii), and again described in our number of the 2nd ult. (page 264 of the present volume).

There is a curious pump, called the "California pump," in the American department, a description of which we must reserve for a future occasion.

Messrs. Peel, Williams, and Peel, of Manchester, send a set of eight hydraulic pumps worked by a pair of steam engines on the same frame, Messrs. Routledge and Ommanney send a set of four hydraulic pumps worked by spur gearing, and Messrs. Thompson and Stather's oil machinery includes a hydraulic pump upon the plan illustrated in THE ENGINEER of last week. Pumps, cocks, and fittings of excellent quality are contributed by Messrs. J. Tylor and Sons, Benjamin Fowler and Co., John Warner and Sons, Hayward, Tyler, and Co., Thomas Lambert and Son, and others. Messrs. Tangye Brothers, of Birmingham, send hydraulic lifting jacks and other hydraulic apparatus. Perreaux's pump valves, made of india-rubber, treated with plumbago, and formed like the valves of the human heart, are exhibited in action, in glass pumps. Speaking of glass pumps, we should not overlook those exhibited by Mr. Chedgey, of the Grove, Southwark, who also sends glass rollers, pipes, &c. His glass pumps are much used by bleachers, paper makers, and others, for pumping bleaching liquor and acids.

Mr. F. O. Ward, of Mayfair, exhibits a steam engine and set of hydraulic pumps upon an arrangement which he has lately patented. The steam engine is placed horizontally on top of a small cast iron cistern, and the driving shaft is geared to a shaft resting in bearings at one end and near the bottom of the cistern. Upon this shaft, which makes but one revolution to three of the engine shaft, are cranks, working two connecting rods, one on either side of the cistern. Each connecting rod takes hold of the middle of a long plunger, both ends of which work into pumps placed opposite each other and fixed to the side of the cistern. By this arrangement Mr. Ward believes that four pumps may be made to do the work of twelve as ordinarily made and worked, and that the difference in the speed of the steam piston and pump plunger is also advantageous. Messrs. Wren and Hopkinson, of Manchester, are the makers.

As for steam fire engines there were to have been three in the building, but we have seen only one, that made at the Novelty Works, New York, and exhibited by Mr. Lee. It may be that Messrs. Shand and Mason's occupies a corner somewhere, but Messrs. Merryweather's, which appears in the catalogue, has not, we believe, been to South Kensington at all. Mr. Lee's engine, which has been tried on one or two occasions in London, is in the American department. It weighs 3,700 lb., or less than 34 cwt., and is of the smallest size made in America. It has an upright boiler with "annular" tubes, or a small tube placed within a larger one, the water occupying the annular space, while the fire is outside of the large and inside the small tube. At a late trial the engine commenced working in eleven minutes after the match was applied to light the fire, the water in the boiler being cold. The single horizontal cylinder is 7in. in diameter, with a stroke of 8½in.; and works a rotary pump on the fly-wheel shaft, the pump having a moving slide but no valves. The engine has thrown a 1-in. jet 150ft. high and 191ft. horizontally. Mr. Lee is not committed to the rotary pump, and prefers a variety known as "Worthington's duplex pump," for which he has taken an English patent, and which was illustrated in THE ENGINEER of the 23rd ult. One of these pumps is exhibited in the western annexe, and Messrs. Easton, Amos, and Sons are building a large steam fire-engine, in which the same kind of steam pump will be employed.

The steam fire-engine made by Messrs. Shand and Mason weighs, we believe, 2 tons 18 cwt. It has an upright boiler, a single 8½-in. steam cylinder, and a 7-in double-acting pump, the stroke of piston being 9in. It has thrown a 1⅞-in. jet 170ft. high, and upwards of 190ft. horizontally, the spray reaching to 220ft. The boiler raises steam of 60 lb. from cold water in fourteen minutes from the application of the match. The measured discharge of the engine into a tank, two 1-in. jets being on, was 376 gallons per minute. At the central station of the London Fire Engine Establishment, where these engines are used, a jet of gas is kept burning in the fire-box, and the water kept up to the boiling point, so that steam of 50 lb. pressure may, at any time, be raised in five minutes after lighting the fire.

Messrs. Merryweather and Son's steam fire-engine, intended for exhibition, weighs 3 tons. It has an upright boiler made of Bessemer steel, and the horizontal steam cylinder is 9-in. bore, with 15-in. stroke of piston, which is on the same rod with the piston of a double-acting pump of 6½-in. bore. There is no connecting rod nor any revolving part. The piston valves of the steam cylinder are worked direct from the piston rod, and it said that the engine can be driven at any speed from 1 to 150 double strokes per minute.

Altogether, the display of hydraulic machinery illustrates a considerable advance upon the practice of 1851. We have only to regret that it is improbable that the pumping machinery and turbines exhibited will be subjected to proper tests of power and efficiency.

TASMANIAN TIMBER, COAL, AND IRON.

THE Tasmanian Commissioners to the International Exhibition have prepared a notice of the products and resources of our Antipodean colony, as illustrated in the Exhibition. We extract the following portions upon the timber, coal, and iron of Tasmania.

In inviting all persons interested in the supply of the best colonial timber for the dockyards and railways of the United Kingdom to examine these well-authenticated and varied specimens, it may be well to lay before them the result of scientific experiments which were tried ten years since, with a view to test the qualities of the woods of Tasmania with the best woods of India, of Europe, and of British America.

It is well known in engineering circles that Professor Barlow, in his "Essay on the Strength and Stress of Timber," gives the details of an experiment in England on the English and Indian woods. These experiments, as also those of Captain H. C. Baker, on the Indian woods will be found in the article "Timber," in the *Encyclopædia Britannica*. Mr. Mitchell, D.A.C. General, made some similar experiments on the woods of Tasmania, and (in 1851) detailed the results in a paper read before the Royal Society of Tasmania, which is published in the Society's Transactions (vol. ii., p. 1), the object being to institute an impartial comparison between the woods of Tasmania and those of India and Europe—as given in the tables of Captain Hall and Professor Barlow. The experiments had been thus performed:—

A piece of each wood, two inches square, was laid with its ends resting on supports, 7ft. apart. Weights were gradually increased in a scale, suspended from the centre of the piece of quartering so placed. Its elasticity was ascertained by increasing the weights till the wood would no longer recover its straightness, after they were removed. Its strength was proved by increasing the weights till it broke asunder, and by observing its amount of deflection immediately before it broke. A portion of the broken wood then had a cross bolt passed through each end, and was suspended to try what weight it would bear before it could be pulled asunder lengthwise. To facilitate the experiment, a portion of the middle of this two-inch piece was turned down in a lathe, and afterwards filed to a quarter of an inch square. It was by estimate determined after it broke—what was its direct cohesion on the square inch.

The trials were made on blue gum, swamp gum, and stringy bark—on green specimens, and on others which had been seasoned under varied circumstances, and for different periods. The following is a condensed synopsis of the mean of all these experiments:—

No. of experiments.	Woods.	Specific gravity.	Weight and Deflection.*		Breaking weight.	Ultimate deflection.	Direct cohesion, in square inches.
			lbs.	in.	lbs.	in.	lbs.
31	Morung saul	947	349	1·09	881	1·123	
3	Teak	745	300	1·154	938	4·32	15·550
3	Poon	579	150	·822	846	5·91	14·787
3	English oak	969	150	1·590	450	5·90	9·836
3	Ditto..	934	200	1·280	637	5·10	10·853
3	Canadian oak ..	872	225	1·080	673	6·	11·428
3	Dantzig oak	756	200	1·590	500	4·86	7·386
3	Adriatic oak	993	150	1·430	526	5·73	8 808
3	Ash	760	225	1·266	772	8·92	17·357
3	Beech	696	150	1·026	593	5·73	9·942
3	Elm	533	125	1·685	386	6·93	5·747
3	Pitch pine	660	150	1·134	622	6·	10·415
3	Red pine	657	150	·755	511	5·83	10·000
3	New England fir ..	553	150	·931	429	4·66	9·947
3	Riga fir	703	125	·870	422	6·	10·707
	MR. MITCHELL'S EXPERIMENTS.						
15	Blue gum	1031	492	1·650	1031	6·39	29·743
3	Ash or swamp gum†	978	306	1·50	784	5·91	17 954
9	Stringy bark.. ..	991	417	1.625	867	5·07	23·443

By this table it will be seen that blue gum will sustain about double the weight of English oak before it breaks, and will even recover its elasticity after bearing a weight at which oak will break. Its mean cohesive power beyond oak is nearly, but not quite, in the proportion of 3 to 1. Mr. Mitchell states in his paper that, "The specimens experimented upon were chosen because their ages were vouched by the gentlemen supplying them, and not on account of their being specially calculated to sustain great weights. Pieces could, I have no doubt, be found capable of bearing greater weights than any I have recorded;" and adds as the result of his experiments, "The strength and elasticity of the blue gum exceeds generally those of all woods hitherto tested." There are probably many such superior pieces to be found in the Exhibition collection.

The result of these carefully conducted experiments has been completely borne out by observation in these colonies, whenever that wood has been severely tried, which fact the used and seasoned specimens now in the trophy will go far to demonstrate. It is to be regretted that the same tests have never been applied to some other Tasmanian woods, such as the oak, the light and tough Huon pine (of which the whaleboats are built), and the peppermint wood, both of which latter appear to be nearly impervious to atmospheric influences. The British Government possesses in the International Exhibition ample means of testing practically the blue gum, and comparing it in various shapes and conditions with other woods of first-class character. It may not, perhaps, be improper here to suggest that the appointment of a commission of inquiry to examine and report on the various woods in the Exhibition might possibly eliminate results of even national importance, now that a supply of British oak can no longer be relied on. In another quality for which British oak is distinguished, it is believed that blue gum excels. It has been said that oak is "less likely to rend, to break across, to splinter with common shot, than any other wood." Blue gum is essentially tough wood, the maul-heads, wheel-fellies, and boat-keels made of it, appear to be almost indestructible, and it is believed that it would stand the shot test well. In the possession of the Tasmanian Commissioners in London is part of the head of a blue gum pile, of which about two inches deep of the bruised head was sawn off after the pile had been driven into the earth. This portion of the pile had received 200 blows from a driving ram weighing 21 cwt., 27ft. drop; and the toughness of the small portion which had to be cut off will fully attest its suitability for such purposes. A wood so tough and elastic, which splinters so little, must be valuable for constructing railway carriages. It is constantly used for making ordinary carriages and other vehicles in Tasmania.

* While elasticity remained perfect. † Only used for splitting timber.

The superiority of Tasmanian woods, particularly the blue gum, having thus been carefully demonstrated by experiment, and amply corroborated by the experience of their durability, it remains to be determined whether they can be supplied of the large size and shapes required—say for ship-building.

The octagonal column is formed of eight spars of blue gum, stringy bark, white gum, silver wattle, blackwood, and sassafras. The eight sides of this column are formed at the base by eight large planks, set on end, of blue gum and stringy bark, from Dr. Crowther's timber establishment, at Oyster Cove. The thickness of the trees from which these planks have been taken will be seen at once by persons conversant with timber. The heart of Tasmanian trees is nearly always unsound. In these planks, as in all planks used in the colony for ship-building, the heart is cut off, and the width of the plank shows the size of the tree—outside of the heart. To show the length of which ship timber can be obtained, planks have been sent home of blue gum, measuring 90ft., and of stringy bark, measuring 80ft. in length, of equal width and soundness throughout.

Samples of other ship timber form the base of the Trophy—which is thus constructed:—Five planks (20ft. long) of blue gum, stringy bark, blackwood, and myrtle, the two former being fitted for ship-building, and the two latter for cabinet work, are first laid down. Placed across these are ship's keel-pieces (10ft. long, squared), of blue gum, and stringy bark. Immediately on these lie, transversely, joists of stringy bark, covered with ordinary flooring boards of the same wood. The frame-work of the pedestal placed on this floor is composed of blue gum, white gum, and stringy bark. The joists, quartering, and flooring boards of the pedestal platform are also stringy bark. The centre piece of the spiral staircase is formed of a spar of plain Huon pine, the stairs being made of this free-working and almost imperishable wood. These samples will show what Tasmania can supply of plain timbers. Of large ship's knees—the want of which has even caused a modification of British naval architecture — an unlimited supply can be obtained from Tasmania, where the stumps of the large trees which might supply them are left to rot after the tree has been cut up. These are also shown in the angles of the pedestal frame, of various conditions as to seasoning. A large blue gum knee, and also a blue gum crook, have been exposed to the open air nearly ten years, in the shipyard of Mr. McGregor. In other angles of the frame are three very fine ship's knees from Tasman's Peninsula, exhibited by Mr. Boyd. There are also three smaller knees, a blackwood crook (for curved bannister work), and fine Huon pine knee, in other angles of the trophy. In the interior of the pedestal are also some railway sleepers of blue gum and stringy bark and pieces of white gum, or gum-topped stringy bark, 12 × 6, 12ft. in length, contributed by Dr. Crowther, from Oyster Cove, and by Mr. James Boyd, from Tasman's Peninsula—together with some sleepers of blue gum and peppermint shown by the Commissioners. The split palings and roofing shingles here displayed are also fine specimens, varying in length from 5ft. to 15ft., and in breadth from 6in. to 24in. These are specimens of the ordinary splitting qualities of swamp gum, which is very valuable for this purpose, but is never used for any other. A longitudinal section of the swamp gum plank from Port Arthur, exhibited by Mr. Boyd, will serve to show the extraordinary length and size of Tasmanian timber. The plank from which this section was taken measured 230ft. in length. No available ship could be got to take it to London whole. The section has consequently been divided into 20ft. lengths, in such a way that the brand cut across shall in each case bear evidence of the former connection of the pieces severed. These large specimens, and some others which could not be sent in time, prove that Tasman's Peninsula, with its tramway and excellent harbour at Port Arthur, and its large forests of these valuable timbers—is well calculated for a timber supply station to the imperial dockyards in England. The finest specimens of ships' knees are all from Port Arthur, which, together with Dr. Crowther's establishment at Oyster Cove, have supplied nearly all the best shipping and railway timber now exhibited.

The attention of railway engineers is particularly invited to these durable woods, which it is believed can be supplied at a price which would render their use much more economical than the softer woods which have so frequently to be renewed. By the estimate of the late Mr. Robert Stephenson 2,800,000 railway sleepers required renewing (in 1854) every year, out of the 36 millions of sleepers in use in Great Britain. A blue gum, or stringy bark, or gum-topped stringy bark, or peppermint wood sleeper, would, under the most trying circumstances, last from fifteen to twenty years, and under ordinary or favourable circumstances might last three times that period. The sleepers now in use require renewing, according to Mr. Stephenson, every twelve or fourteen years. It is estimated that this quantity requires the wood of 7,000 acres of English forest land annually, while better woods are growing in the wild lands of Tasmania as common as weeds.

Coal exists in nearly every part of Tasmania, of which a valuable collection has been made by Mr. C. Gould, Government geologist, which will be found amongst the Tasmanian products. The main portion of the fuel used in Hobart Town is derived from mines at New Town, in the close vicinity of the capital, and from Tasman's Peninsula; but it is generally believed that coal beds of far greater value than those which have been worked, principally on account of their easy accessibility, exist in other parts of the island. The series of specimens from Mount Nicholas will illustrate the coal bed to which public attention has recently been most particularly directed. The seam of coal which crops out at various points on the side of Mount Nicholas, locally known as the Killymoon seam, overhanging Break-o'-Day Plains, at a height of about 500ft.—can be worked at an adit level, is distant nine miles from the port of Falmouth, is highly bituminous, and it is believed is well suited for steam, gas, and domestic purposes. The same seam crops out near Fingal and at various other parts, but the main seam is that now illustrated by samples from different portions of it. This coal bed is estimated to occupy an area of about fourteen miles, on the northern side of the Break-o'-Day plains. Various other portions of the bed are equally accessible, but although they are mostly bituminous, they are inferior in thickness to the Killymoon seam. Bituminous coal samples are also furnished from the coal bed of the Douglas river and from Long Point, both on the east coast. The coal from both these districts is good, and the coal bed from which they are taken is said to extend over an area of about fifteen miles, and the seam at the Douglas river to be above 8ft. thick. At Long Point it is 6ft. 10in. thick, very bituminous, and within an easy distance of the shipping place. This coal is rapidly rising in public estimation, and a company has just been formed to work it. Beds in the Mersey river have also been found, and, although limited in quantity, have been profitably worked, as they are easy of access. The coal is very bituminous, is used by the coasting steamers and in Launceston, and has been recently exported to Victoria.

The bituminous coal from Hamilton is said to be very good. It lies about 40ft. deep, in a seam 4ft. 6in. thick, and has been used, and favourably reported on, by the Derwent steamers, from the shipping place of which, at New Norfolk, it is about twenty miles distant.

The anthracite coal is abundant on the southern side of the island,

MACNAB'S MARINE STEAM ENGINES AND BOILERS.

FIG. 1.

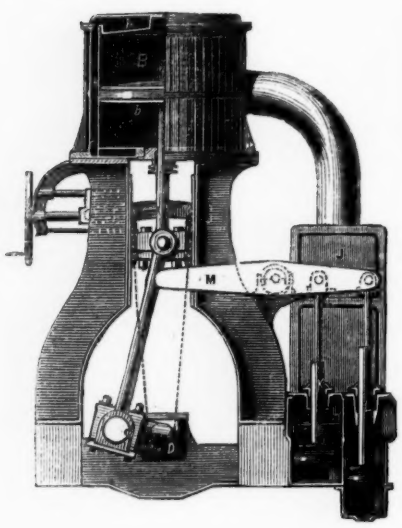


FIG. 2.

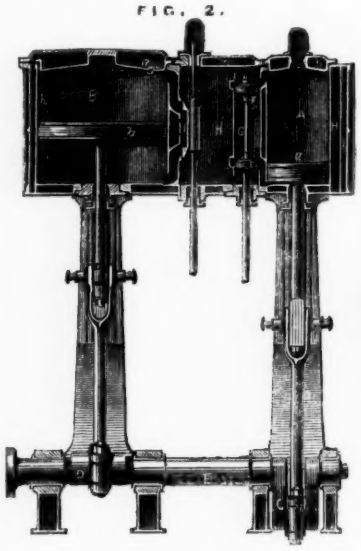


FIG. 4.

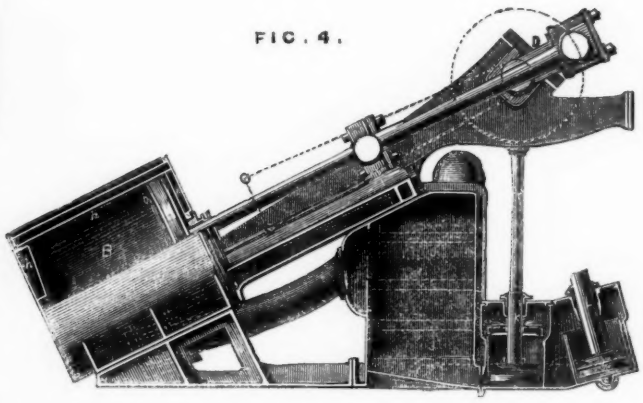


FIG. 3.

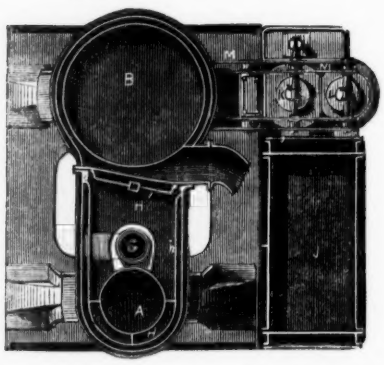


FIG. 6.

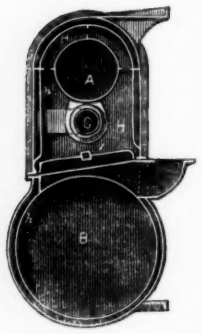
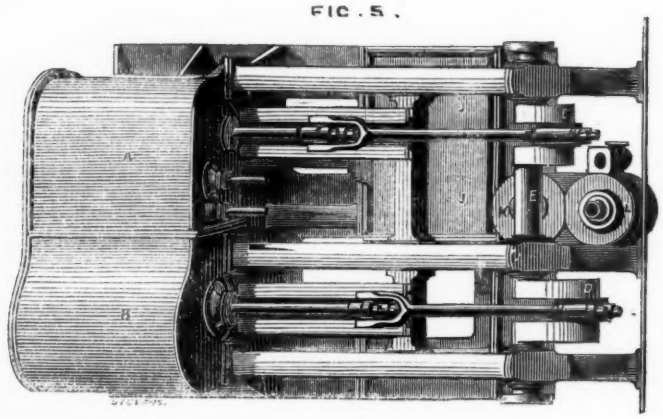


FIG. 5.



and specimens are exhibited from New Town, Tasman's Peninsula, Adventure Bay (Bruni Island), Three Hut Point in D'Entrecasteaux Channel. Four collieries are represented in the specimens from New Town, near Hobart Town. The coal at Tasman's Peninsula has been worked for twenty-five years, and largely used in Hobart Town. The seam is from 3ft. 6in. to 4ft. 6in. thick, is worked by a shaft twenty-five yards deep, and within about 100 yards of the water's edge.

The coal formation on the south side of the island extends round the mouth of the Huon to S.W. Cape, within which range many deposits have been discovered. With a supply so varied and extensive, some localities will probably be soon found to possess coal of first-rate character, easy of access. Private capital is seldom sufficiently in excess in the colonies to admit of its being relied on as the source of development of the mineral wealth which Tasmania doubtless possesses. The matter is one of national as well as colonial importance now that steam vessels may be expected to take a very prominent part in any future maritime war, and the attention of the Colonial Government has of late been specially directed to it. The labours of Mr. Gould, the Government geologist, have been almost concentrated on this matter recently, the Parliament have voted a sum of money for its investigation, and a commission has just been gazetted (March, 1862) to take charge of experiments on and the selection of some of the best specimens, easily and abundantly procurable, to be tested in bulk by the Admiralty authorities in England.

Galenza and copper ore have been found in different parts of Tasmania, but not hitherto in any considerable quantity. Iron ore abounds all over the colony. At Ilfracombe, eight miles from the Tamar, there are immense masses of rich ore, similar to that now exhibited, which will, doubtless, some day prove highly advantageous to the colony in connection with the vast coal-fields of the east coast. It is said to be nearly identical with the brown hematite of Mittigong, in New South Wales, the working of which has recently been discontinued in consequence of the great expense of transporting it over some seventy miles of land carriage to the sea. A tramway is already in operation at Ilfracombe from the vicinity of the ore to the water's edge, which circumstance may possibly enable these "hills of iron," as they have been called, to be profitably worked, when the same description of ore, less favourably situated, could not be made to pay.

Commissioner Biggs, who was deputed to report on the resources of these colonies in 1823, and whose report was printed by the House of Commons, thus writes on the iron ore of Ilfracombe: —

"At the distance of eight miles from Port Dalrymple (the Tamar) in Van Diemen's Land, considerable quantities of iron ore have been discovered on the surface, which, upon analysis in this country, have been found to consist of pure protoxide of iron (similar to the black iron ore of Sweden) and furnishing a very pure and malleable metal."

MACNAB'S MARINE STEAM ENGINES AND BOILERS.

This invention, by William Macnab, of Greenock, relates to improvements upon marine steam engines and boilers of the classes described in the Specification of Letters Patent granted to him, and dated September 26th, 1860 (No. 2341).

Fig. 1 is an end elevation partly in section; Fig. 2 is a longitudinal vertical section; and Fig. 3 is a horizontal section of inverted cylinder engines as constructed with the improvements, and suitable for driving the screw propeller; Fig. 4 is a vertical section, and Fig. 5 is a plan of the improved engines as arranged for driving paddle wheels; Fig. 6 being a section of the cylinders taken transversely to their axes.

The improvements in engines comprise in the first place an arrangement in which, in place of four steam cylinders, two high pressure cylinders and two low pressure cylinders, there are only two, namely, a high pressure cylinder A, which receives the steam directly from the boiler, and a low pressure cylinder B of larger size, in which the steam operates after acting in the high pressure cylinder A. The cranks C, D, acted on by the two pistons *a*, *b*, are, by preference, situated at right angles to each other upon the shaft E. The high pressure cylinder A receives steam by valves F, by preference of the piston class, working in a chamber or cylinder G, within a larger chamber H, situated between the cylinders A and B, into which chamber H the steam passes from the high pressure cylinder A. This chamber H also surrounds the high pressure cylinder A, and in the opposite side of it are the ports of the low pressure cylinder B, which are governed by an ordinary slide-valve I. The cylinders A, B, and their covers, and the intermediate chamber H, are surrounded by steam-jacket spaces *h*, as shown in the figures; and to induce a slight circulation of the steam in the jacket spaces in order that its temperature may be maintained, provision is made for allowing it to pass in very minute quantities from a part of the jackets farthest from the inlet into them. The opening for the passage of the steam in this way out of the jackets is by preference made into the intermediate chamber H, so that the steam is not lost, but mingles with and assists that which works the low-pressure cylinder B; and the steam is by preference first admitted into the part of the jacket spaces which surrounds the intermediate chamber H.

A pair of cylinders A, B, combined as described, may be arranged in various positions. In one convenient design (represented in Figs. 1, 2, and 3) the cylinders A, B are inverted, and a surface condenser J is placed against or beside the high-pressure cylinder A, while the air-pump K and current-pump L are placed against or beside the low-pressure cylinder B, being worked by a lever M connected to the piston-rod slide block.

In another convenient design of the engines (represented in Figs. 4, 5, and 6), the two cylinders A, B, are slightly inclined up towards the paddle shaft E, and the surface condenser J is disposed transversely under the connecting rods, while the air pump K and current pump L are placed nearly or directly beneath the shaft E, and may be worked by an eccentric on the shaft, or by a lever connected to the slide block of one of the piston rods. In all arrangements of the engines, the advantages of working very expansively are obtained with very simple parts, of less cost than those hitherto working in that way.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

KRUPP'S CAST STEEL.

Sir,—Mr. Mushet is again totally wrong in his statement respecting the quality of the large ingot exhibited by Mr. Krupp, viz., in stating that it is of a hard quality, and perfectly useless for the manufacture of guns, &c., the fact being that both this ingot and the one split up in the longitudinal direction is of the softest quality, and used by Mr. Krupp for guns, shafts, and other similar articles requiring perfectly sound, and at the same time the toughest quality of steel.

It was farthest from my wish to elicit in the slightest degree Mr. Mushet's praise respecting Mr. Krupp's manufacture, as I am sure that Mr. Krupp only desires that his steel should take its stand upon its own merits, my only object being to show that, in 1860, I was correct in asserting that the steel is cast perfectly sound by Mr. Krupp, a fact which Mr. Mushet totally ignored.

Respecting Mr. Mushet's statement of his capability of casting steel guns perfectly free from honeycombs, let any of your readers go down at the present time to the butt at Woolwich, and they will see for themselves one of these famous sound guns with quite sufficient honeycombs in the bore, from muzzle to breech, to entirely contradict such an erroneous assertion.

I may add that, notwithstanding the large ingot exhibited by Mr. Krupp was cut in to the depth of 8½in. on each side, it required upwards of 150 blows of the 50-ton hammer to break it. This sufficiently speaks for itself.

9, Chepstow-place, Camberwell New Road, Alfred Longsdon.
May 24th, 1862.

[The above letter had been mislaid, which accounts for the lateness of its appearance.—Ed. E.]

STEAM HAMMERS.

Sir,—Will you be so kind as to ask Mr. William Naylor in your paper, first, if he is aware of the fact that, before his double-acting hammer strikes, the steam is always full on the underside of the piston? Secondly, does not this fact upset completely the elaborated calculations in his last week's letter, since, at the moment of contact, the fall of the hammer is retarded by the whole force of the steam, which in the case of the nine ton hammer quoted is eighteen tons. Can Mr. Naylor tell me how much per cent. he loses of the effect of his blow by this very serious defect?

Also, Mr. Naylor states that one maker of single-acting hammers found a loss of 20 per cent. of the weight from the resistance of the escaping steam. Will he kindly inform me whether it is not equally necessary that the steam should escape from the underside of a double acting hammer piston, and whether the resistance it offers to the fall of the piston will not increase with the velocity of the hammer, and, consequently, be much greater in his hammer, and whether his hammer, therefore, is a bit better than his single-acting neighbour?

Also, may I ask if the large hammer at Kirkstall is at work, and if so, is it convenient for forging heavy jobs, and if the complication of gear of his hammer does not make it far more liable to break down than a good strong single-acting hammer with hand gear, which for ordinary heavy forgings is found to be quite quick enough.

June 3rd, 1862. Logic.

ROTARY ENGINES.

Sir,—I regret that at present I have not time to reply at length to "J. S." Suffice it to say that I am strongly of opinion that, although the rotary steam engine may be the best in theory, it will never compete in practice with the ordinary reciprocating engine, inasmuch as no expansive rotory engine with which I am acquainted is at all equal to the present expansive engine.

If possible I will reply at length, if you will permit me, to "J. S.'s" able letter at an early date. It may be more satisfactory to him to know that I agree with him on very many points.

May 30th, 1862. V. P.

THE AUSTRIAN NORTHERN RAILWAY.

Sir,—The owners of railway shares will find an object of peculiar interest in a series of drawings exhibited in the Austrian Machinery Department of the International Exhibition, by Professor Stummer of Vienna, showing the statistical history of the Northern Railway of Austria by way of graphical illustration.

This is accomplished by a tabular arrangement. A series of perpendicular lines separate the successive years, and subdivide the latter into their respective twelve months. The perpendicular columns resulting hereby serve to represent the scale of time. Horizontal lines furnish a decimal division of the height into horizontal partitions, and these serve to represent the scale of quantity, the height of one small horizontal partition being the quantitative unit for all the quantities inserted. By these means the fluctuations in the traffic, the receipts and expenditure, and all other statistic results of interest relating to the management of the railway are shown by the insertion of differently coloured lines, and appear to the eye of the observer at a single glance, without the necessity of a tedious labour in gathering similar information by comparing dead figures.

It is to be believed that many a shareholder could get a clearer insight into the management or mismanagement of his property if the directors were obliged to attach to their reports a sheet somewhat similar to those in the Exhibition. K.

(For continuation of Letters see page 342.)

The New Whitworth Gun.—The 7-in muzzle-loading gun, made at Woolwich on Mr. Whitworth's principle, is now completed. The gun has been bored and rifled on Mr. Whitworth's hexagonal system, and will carry an elongated shot weighing 125 lb. The proof charge will be 35 lb. of powder, with a probable increase after the first rounds. The weight of the gun is 7 tons 8 cwt. and 1 qr.

TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

H. K.—*Again crowded out.*

AN OLD SUBSCRIBER.—*We have never heard of such a work.*

W. L.—*We know of no work giving correct elevations and cross sections of London bridge.*

R. E. (Glasgow).—*Mr. Child's specification is numbered 2,135 for the year 1858; price 10d.*

W. B.—*Any large London coal merchant ought to be able to supply you with Welsh Malting Coal.*

S. P. I. E.—*Messrs. Pontifex and Wood, of Shoe-lane, and Messrs. Shears, of Bankside, make such work.*

I. S.—*It is our impression that Allen's link is patented, but we cannot at this moment refer to the patent.*

J. H. B.—*Had you sent the same inquiry to Mr. Weale, 59, Holborn, he could have sent you a list of several such works.*

F. S. M.—*Your application should have been made to the Under Secretary of State for India, India Office, Victoria-street, Westminster.*

A BEGINNER.—*We know of no work on Boiler making giving the information as to setting out egg ended boilers. We published the necessary rules upwards of two years ago, and a rule is also given in the Practical Draughtsman, published by Johnson of 166, Buchanan-street, Glasgow.*

J. N. M.—*The same results can be obtained with any rotary engine of the same size with the same amount of steam. It is not a question of the dynamical performance, but of the simplicity and wearing qualities of rotary engines. If you have made any improvements in these respects we shall be glad to hear of them.*

R. B. (Manchester).—*The area of a pipe 2in. square being 4 sq. in., that of a door covering an end of the pipe bevelled off to 45 deg. will be 5·65 sq. in., or nearly one half more, and it will accordingly require a weight nearly one half greater to hold it shut than if the door closed the end of the pipe when cut off square. If you attach a single weight in the position of the one marked 2 lb. 14 oz. in your sketch, it will require to be one half as heavy as the total pressure on the 5·65 sq. in. of the door. It would take the same force or pressure to turn a journal 9in. in diameter and 4in. long as one 4in. diameter and 9in. long, supposing the load to be the same on both. But as the journal 9in. in diameter would move 2¼ times faster at the wearing surface than that 4in. in diameter, the pressure, or force expended in turning it, would move through 2¼ times the space, and consequently 2¼ times the total mechanical power would be expended.*

CUPOLAS AND FORTIFICATIONS *v.* MACINTOSH'S SYSTEM OF WARFARE.

(To the Editor of The Engineer.)

SIR,—Reading a letter in THE ENGINEER, of the 30th ultimo, signed "Useful Effect," induced me to inquire into the matter. I find a patent granted to John Macintosh, in 1855, for the "Application of Incendiary Materials to be used in Warfare," which was stopped by the Government, and another patent granted to him in 1852 for the firing of guns under water by the aid of vulcanised india-rubber, together with a self-plugging lateral explosive shell. If these inventions will be only half as effective as the inventor believes them to be, and if firing under water in close contact with an opponent is practical, what is to become of our proposed fortifications, or our armour-plates, which extend 4ft below the line of flotation, whether on wooden or iron bottoms, against submarine artillery?

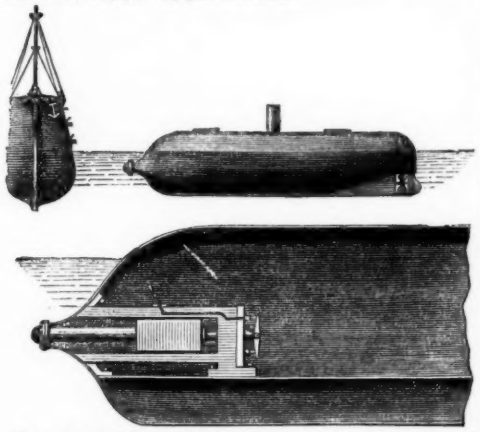
NAUTICUS.

June 4th, 1862.

A STEAM-HAMMER NAVAL RAM.

(To the Editor of The Engineer.)

SIR,—I take the liberty of sending you a scheme for sinking ships which, I think, might be carried into effect by a naval engineer, and shall feel greatly obliged if you will spare room for it, if worthy of notice, in the next number of your paper. My plan is as follows:—



If a very powerful steam hammer or ram was fixed in an iron coated ship, as in my sketch, and the ram made to work through the bows, it would be able to strike a vessel with terrific force, and so break her timbers, and the damage done being under water, the vessel would consequently sink. The bow of the vessel would have to be constructed purposely for the steam hammer or ram to work through, which could easily be done.

I hope you will be able to form an idea of my plan by these few remarks.

Bankfield House, Bury, Lancashire, May 2, 1862. J. R. G. GRUNDY.

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THE ENGINEER.

FRIDAY, JUNE 6, 1862.

RAILWAY WHEELS AND TYRES IN THE EXHIBITION.

IT is generally accepted as an axiom that only the very best wheels, tyres, and axles should be used under railway passenger carriages. Many superior examples of these details of railway rolling stock are exhibited at South Kensington. Each deserves the careful notice of railway men, who, guided by certain general principles, and more particularly by experience, may be able at last to select the best. There are cast iron, wrought iron, cast steel, and wooden wheels. There are wheels with and without separate tyres. There are wheels made, variously, by casting, forging, and stamping. There are solid and hollow wheels, rigid and elastic wheels, disc and spoke wheels, and some wheels are made in a single piece, while others are made in fifty or more. To arrange these examples in the order of merit would be impossible without long trial of all. There are some wheels which may be at once pronounced to be less liable to break than others, but the former may, perhaps, cause the greater injury to the line, for the wheel and rail react mutually on each other, and a very hard wheel, however durable of itself, will soon knock a soft, malleable rail to pieces. Some of the wheels are very cheap in price, others are dear, yet this consideration, apart from all others, may deserve little weight in a comparison where the safety of life is concerned. Yet no practical engineer or railway man can wholly dismiss such considerations from his mind.

One improvement not long since made in railway wheels is that of stamping them into shape while hot. In welding a wheel together from separate pieces, a strain is left in the whole when the last weld is made. For, being put together hot, the welded parts must afterwards contract, and they can do so only by straining upon other parts already cold. On the Continent much attention has been paid to this defect, and, for the last few years, wheels have been made by stamping them while hot and in the "rough," into the finished shape, at a single operation. One mode of doing this is that of M. Arbel, whose process is adopted by a large number of the Continental railway wheel makers. In England, Mr. William Owen, of Rotherham, has adopted M. Arbel's plans, and sends wheels thus produced to the Exhibition. Not only are the parts, of which the wheel is built up in the rough, welded solidly together, but, as the whole is at one temperature at the moment of stamping, the contraction is distributed alike throughout the boss, spokes, and rim. The stamping is effected by a steam hammer of great power, and such is the solidity thus imparted to the wheel that, on cutting it open in a lathe, no trace of welding can be discovered. The Compagnie Generale de Materiels de Chemins de Fer, of Brussels, exhibit a number of wheels made by Arbel's process, and wheels thus made are to be found under most of the foreign locomotives and railway carriages in the western annexe. The spoke wheels of this make are much of the ordinary form, except that the spokes are generally oval in section. The Belgian makers, however, exhibit some wheels with six broad spokes 5in. or 6in. wide in the direction of the plane of the wheel.

The Bochum Company, whose works are but a few miles from Herr Krupp's, and Messrs. Naylor, Vickers, and Co., of Sheffield, exhibit solid cast steel wheels, cast whole and without separate tyres. Of wheels of this kind the Bochum Company show a pair of driving wheels about 5ft. in diameter, while Messrs. Naylor, Vickers, and Co. send a pair 7ft. in diameter, fitted to the axle. The latter are of the disc form, or without spokes, the disc being corrugated so as to facilitate the contraction of the casting, without strain, when newly poured. Of the wear of wheels of this make, we have no evidence at hand. We have, however, seen their strength illustrated by trials of the greatest severity, and should suppose them safe against fracture. When the wearing face of the rim becomes so much worn as to be no longer useful, it is, we presume, to be turned down flat, and a separate steel tyre to be shrunk on in the ordinary manner. The wheels are necessarily costly.

Mr. William Bridges Adams, of No. 4, Holley Mount, Hampstead, N.W., exhibits wheels fitted with a hoop spring between the rim and the tyre. But, instead of bringing forward a mere model, or a pair of new wheels to illustrate a scheme, Mr. Adams sends a pair of 3ft. 6in. wheels, fitted with Staffordshire tyres of Messrs. Lloyds, Fosters, and Co.'s make, which have actually run 106,143 miles, *without being once turned*, under a heavy four-wheel passenger carriage, on the North London Railway. The tyres are still in good condition. Common Staffordshire tyres, thus set upon a hoop spring, so as to give elasticity on the wheel, have greatly outworn the very best Lowmoor tyres, set in the ordinary manner. On the Eastern Counties line this mode of setting tyres has been adopted to some extent, and we are informed that the leading tyres of some of the engines have thus been kept up, without turning, for a mileage of 34,000 miles, whereas tyres of the same make, and set in the usual manner, have to go into the lathe after running only 14,000 miles under the same class of engines. On the St. Helen's line, in Lancashire, this mode of setting tyres has been carried out on all the wheels—leading, driving, and trailing—of some of the engines. A moment's reflection must show that the elastic medium which preserves the tyre must also favour the rail, and this is a subject which railway managers may as well examine carefully. The value of the same principle has been for some time recognised in America, where, however, it has been somewhat differently applied. Cast iron driving wheels with wrought iron tyres being generally used there, the rim of the wheel is cast with shallow recesses across its width, so that it somewhat resembles a toothed wheel. Into each of these recesses a block of seasoned oak is driven, the sides of the recess being "dovetailed," so as to hold the wood firmly in place. The wood projects a little beyond the ribs which separate the recesses, and the tyre is heated and shrunk on in the usual manner, bearing wholly on the wood (on the side, not the end, of the grain), and having no bolts or rivets to fasten it to the wheel. In noticing the continued success of this arrangement, the *American Railway Times* of the 17th ult. says:—

"If the foot of a horse was made of solid iron or steel and "rigidly connected with his legs, what would become of "his legs after a few days', or even hours', travel over a "stone pavement? Just what becomes of the majority of "locomotive tyres at work in this country: they would be "knocked to pieces, worn out, entirely disabled. Nature, "however, does not do things in this rigid and unaccommodating way. She provides such an elastic medium in "the foot of a horse, that notwithstanding the immense "labour performed and the hard unyielding nature of the "surface of the road, the foot lasts as long as the horse "does. Just look at the mode of action when the animal puts his foot upon the ground, and then will be seen "the most consummately perfect adaptation of material. "Notwithstanding the great weight of the body as compared with the small surface of the feet, so perfect is "the spring, that the foot seems hardly to touch the ground. "Just what nature has done for the horse, Mr. Griggs has "done in the most economical, simple, and effective manner "for the locomotive wheel. 'I am satisfied from my own "experience,' writes Mr. David Upton, of the New York "Central Railway, 'that a tyre will last twice as long "placed upon wooden blocks, than when shrunk upon the "casting in the old way:' and he says, further, 'More than "two years ago I put a set of these wheels (Grigg's) under "a 30-ton freight engine, and after eighteen months' constant service drawing heavy freight trains, the tyres were "turned up, although they scarcely required it, the engine "being in for other repairs; and the tyres are now good "for another year's wear at least.' This testimony from "such a source as Mr. Upton is sufficient proof of the "value of the blocks, even if we had not already a large "amount of other experience of the same kind."

Mansell's wooden or "safety" wheel is exhibited by various makers. The Eastern Counties Railway Company send a pair fitted to an axle, partly to show the construction and working of the French anti-friction roller bearing lately introduced by Mr. Sinclair into the rolling stock under his charge.

The cheapest railway wheels on exhibition are some from Canada, and from Prussia and Austria. We are not sure, either, but they are among the most durable. They are cast iron, chilled wheels of the kind almost exclusively used on all railways in the United States. One pair of 33-in. wheels of this kind, cast from Canadian iron, at the Radnor Forge, near Three Rivers, Canada East, is exhibited as taken from a post-office car on the Grand Trunk Railway, and after running 150,000 miles. The chilled surfaces of the rims are still in excellent condition. A wheel of nearly the same kind is also exhibited by Mr. James Harris, of St. John's, New Brunswick. This is of the pattern known in the States as the Washburn wheel, a pair of discs, with an intervening annular hollow space, extending from the nave halfway to the rim, the connection therewith being completed by a single thickness of iron, stiffened by short and nearly radial ribs on the back. It will be understood that we are thus only describing the *form* of the wheel, for as for construction, it is cast, complete and ready for boring, in a single piece. Only the wearing surface of the rim and flange is formed by an iron mould, against which the fluid metal "chills" with such hardness that no file can cut it. A 33-in. wheel, which is the usual size for the bogie-wheels of American railway carriages, generally weighs from 500 lb. to 550 lb., and in the States, with pig iron at £4 10s. a ton, these wheels seldom cost as much as £3 each, ready for boring. The selection of iron, however, for chilled wheels requires care. It must combine several qualities, not commonly associated in the same iron. Thus, it must be hard in order to chill well, and it must, at the same time, be tough, or the wheel will not be strong. The chill should be complete for about ½in. from the surface, blending thence gradually with the rest of the iron. The form of the wheel should be such that the rim can contract without much strain after the nave has "set," and even then much care must be taken to have the wheel cooled gradually. The spoke form was formerly adopted for chilled wheels, and the nave or hub was then commonly divided, by three radial slots, into three portions. After the wheel had cooled these slots were run full of lead, and a wrought iron band shrunk on each end, when the wheel was ready for boring. Now, however, the single or double plate wheel is used, and the hub is made solid. In the best American railway wheel foundries, the wheels are taken red-hot, and as soon as they have "set," from the founder's mould boxes or flasks, and transferred to brick kilns previously heated to a very high temperature. In these kilns a number of wheels, just cast, are hermetically sealed up and left to cool gradually during three or four days, the radiation of heat being checked to the necessary degree for this purpose. By this treatment all parts of the wheel are cooled together, so that, when cold, no part is under strain. By this plan, therefore, some of the most eminent wheel founders in America, as Messrs. Asa Whitney and Sons, of Philadelphia, now cast their wheels with a single flat disc, stiffened at the back with straight radial ribs. Such a wheel, taken hot from the sand and cooled in the open air, would crack in two in less than a quarter of an hour, but, cooled in the kilns which we have described, it appears to have nearly the strength of wrought iron. The gradual cooling in the kilns, previously heated red hot, does not have the slightest effect on the chill. This will last for a long time, but, when once worn through, the whole wheel is useless. Cast iron chilled wheels are exclusively used in America for the leading wheels of the heaviest express locomotives, and as invariably for tenders. They seldom break, even in winter, with the ballast (when there is any) of the permanent way frozen solid, and with the thermometer showing from 30 to 45 degrees of frost. Considering the villanous permanent way which prevails in America, and the general use of miserable blocks of india-rubber as a substitute for springs, the endurance of these wheels is, indeed, remarkable. One principal cause of injury, by which many chilled wheels are destroyed, is in the use of brakes on every carriage wheel in the train. The brakemen often put on the brakes with such force as to slide the wheels, whereby the chill is softened by the friction, and a flat place once begun soon enlarges, as the wheel always turns to it when again made to slide. The chilled wheels are not always truly circular, and require to be correctly centred in boring. Of a hundred cast in the same mould there will also be a perceptible difference in diameter, and therefore each pair for one axle requires to be accurately mated in size.

A. Ganz, of Ofen, opposite Pesth, exhibits also cast iron double-disc chilled wheels in the Austrian department of the annexe. One was cast in 1855, and has evidently been in service, perhaps long and severe, although the chilled surface is still in excellent condition. Another wheel of the same pattern is exhibited as it came from the foundry.

G. H. Ruffer, of Breslau, also exhibits similar wheels in the department of the Zollverein.

Messrs. Peter Wright and Son, of Oldbury, exhibit wheels of which that portion between the nave and rim is made of a pair of thick wrought iron plates, rivetted to

and through a rib rolled on the inner circumference of the tyre. A Continental firm, Hoerder and Co., near Dortmund, go further, and make a deep groove in each side of a heavy rib rolled on the inner circumference of the tyre, and then close into these grooves the edges of suitable flanges rolled on a single plate wheel-body in which the nave is formed.

Krupp's and Bessemer's steel tyres, as well as those of the Bochum Company, and Naylor, Vickers, and Co., were sufficiently noticed in The Engineer of the 2nd ult. We may only add that the Continental make is now sold at £85 per ton, and those made in Sheffield at £65. The Weardale Iron Company also show Bessemer steel tyres. Of wrought iron tyres there are several examples rolled whole, or without weld, and so accurately to form and size as to require neither turning nor boring. Mr. Owen, of Rotherham, exhibits such tyres, and so do the Blænavon Company, of South Wales. The Lowmoor, Bowling, and other standard makes of best tyres are well represented.

The Patent Shaft and Axle Company, near Wednesbury, exhibit a pair of wheels fitted on the axle, one being Mansell's wooden wheel, the other a wrought iron wheel with Kirtley's rolled spokes. The tyres are secured by Gibson's annular key and clinched dovetail fastenings. There are sections, also, of various other tyre fastenings, and among the best fastenings, Beattie's has been adopted by the Eastern Counties Company for driving as well as carriage wheels, and the inner flange, therefor, may be seen on some of the steel tyres made for that line and exhibited in Krupp's stand.

A fine pair of railway wheels, on the axle, made by a Prussian firm, Lehrkind, Falkenroth, and Co., also deserves mention.

The whole display of railway wheels and tyres is most creditable to mechanical progress during the last eleven years. Steel tyres are fast superseding those of iron for engines and passenger carriages, and improved wheels and tyre fastenings are brought almost daily into notice. Let us hope that we shall soon know and adopt the very best.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

THE ENGINEERS OF THE ROYAL NAVY.

Sir,—Though much has been said and written on the cause of the unpopularity of the Royal Navy with engineers, few have been able to point out its true source, to explain why the many gentlemen of education and position, students in our famous engineering establishments, see no attractions in the navy sufficient to induce them to adopt it as their profession—to tell why those who have a seafaring inclination accept employment in the merchant service in preference, and why the few who do enter the navy so soon apply for their discharge in disgust. The causes of all this are few and simple. It must be admitted that a great number of the engineers at present in the navy are not steam engine makers, are perfectly unable to direct or be directed in even repairing an ordinary break down, and are useful for little else but bullying their already overburdened subordinates, or augmenting the damages and breakages at their expense. Again: however well the seniority system may work with the executive officers—whose ages and abilities are, generally, as their standing in the service—it tells with mischievous effect among the engineers, who are entered at all sorts of ages, and with all sorts of abilities, and it is frequently the case that the good and skilful young engineer will, on joining the service, be sent to a ship where he has to obey the orders of a low, vulgar, and uneducated man, entirely destitute of any mechanical ability, or he, perhaps, may find his apprentice, or even labourer from the factory he has left through joining the service, before him in the position of his superior officer, his lord and master to all intents and purposes. An instance of this kind actually occurred not long ago; and parallel cases are in fact so common that it is one of the great causes of the navy's unpopularity. A young man from Manchester, now in a gunboat abroad, in writing home, observed, "I am blessed with two companions, who, although senior to me, are a satire on the name of 'engineer;' neither have ever seen a tube put in a boiler before or taken out; neither have the least idea of working; one knows nothing, and the other knows less; which in a rattle-trap like this is something horrible for me." These two are evidently fair specimens of those who joined the service by scores during the Russian war, as first-class men, with first-class pay, numbers of whom still remain, to the detriment of the engineers as a class, and whose abominable displays of ignorance at the merest mechanical operation would disgust any young engineer of even mild pretensions. Yes, these are they who, when they have bottled off a decent looking amount of time, and have merged into "chief-engineers," render the lives of those unfortunates beneath them so perfectly miserable that steady men have been known to rush into dissipation, and even prefer death, than endure it: and have not nearly all the chiefs and senior assistants at the present day risen from a class who are not mechanical engineers? Yes. Was ever a low man in a high station known to be other than a tyrant? No,—especially to those of his subordinates with whom he suffered by contrast. And did ever a man of real worth like the domination of the vulgar? No. Then why is the unpopularity of the young engineer's position in the navy to be wondered at? It is generally the case that the chief—who does little else but his book-keeping—leaves the duty of the engine room with the senior assistant, and knows little of the "general conduct, disposition, &c.," of the juniors but what is reported to him; and as to how far an impartial report would be made where the senior suffers so severely in contrast with the junior, I leave any one who knows anything about human nature to judge. If the young engineer were unappreciated by those immediately above him only, there would not be much to complain of, but the mischief does not end there: the captain fills up the confidential "quarterly returns" from information he receives from the chief, and these are forwarded to the Admiralty and entered in the "Record Books" there to stand against a man for ever!

Need we wonder why no enterprising young man ever places himself in a position to be thus trodden on? There is another irregularity to which engineers are subjected to in the navy, and which, had not the Admiralty such prolific means for remedying, it would not be so noticeable. I allude to their cabin accommodations, especially in line-of-battle ships. Let anyone go and see for himself, and down in the hold of the ship he will find it a packing case of a place, about twenty cubic yards in content. Here, in sad and bitter seclusion, will be found at meal times, and after working hours, six or eight ghastly-looking men of all ages, crowding uncomfortably together, and enduring by slow degrees all the horrors of the black hole of Calcutta. The miserable little lamp that glimmers in the place does not improve the purity of the atmosphere, already unbearable to a stranger from the exhalations of its occupants, and the effluvia arising from the decomposition of the remains of their daily meals and their closely-stacked provisions, which are stowed, prepared, and all but cooked under their very noses. In addition to all this the poisonous gases forming in the bilges alone renders the place unfit for animal life. Is it then fit for human beings for years together? There are many pigstyes preferable. But the moral degradation which the engineer suffers in the estimation of the officers and ship's company is not the most enervating effect of this odious treatment.

(To be concluded in our next.)

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

1001. Howard Ashton Holden, Birmingham, and Charles Weekes, Carmarthen, "Improvements in apparatus used in drawing water or other fluids from cisterns, tanks, or other vessels."—*Petition recorded 8th April*, 1862.

1110. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in machinery or apparatus for cutting the teeth of wheels, racks, or segments."—A communication from Ludwig Philipp Schultz, Carl Schultz, and Adolf Schultz, Mayence, Prussia.—*Petition recorded 16th April*, 1862.

1143. Walter Munn and David Ballantine, jun., Borrowstounness, Linlithgow, N.B., "Improvements in mills for grinding."—*Petition recorded 19th April*, 1862.

1163. Adam Dixon, Birmingham, "Improvements in knife and fork cleaning machines."—*Petition recorded 21st April*, 1862.

1187. Alfred Vincent Newton, Chancery-lane, London, "Improvements in looms for manufacturing tufted pile fabrics, and in the mode of operating such looms."—A communication from Halcyon Skinner, West Farms, West Chester county, New York, U.S.—*Petition recorded 23rd April*, 1862.

1211. Peter Robert Drummond, Perth, N.B., "A revolving rake for lifting objects from the ground."—*Petition recorded 25th April*, 1862.

1264. Edward Moore, Tewkesbury, Gloucestershire, "Improvements in the manufacture of dress shirts and dresses."

1265. Alfred Travis and Benjamin Travis, Dukinfield, Cheshire, "Improvements in engines for carding cotton and other fibrous materials."

1267. John Harrington and Thomas Perkins, Birmingham, "An improvement or improvements in mounting photographic portraits for visiting cards, and in mounting photographs in general."

1269. George Davies, Serle-street, Lincoln's-inn, London, "Improvements in the manufacture of nails, screws, and other analogous articles in malleable cast iron."—A communication from Ernest Lambert, Paris.

1271. James Maiden, Waterloo, near Ashton-under-Lyne, Lancashire, "Improvements in safety lamps."

1273. Thomas Piatti, Rue St. Louis au Batignolles, Paris, "Improvements in the propulsion of ships and other vessels, and in the means and apparatus employed for this purpose."

1275. James Oxley, Garden-street, Sheffield, Yorkshire, "Improvements in apparatus for cutting and chopping bread and other substances."

1277. John Money Carter, Monmouthshire, "Improvements in harness and the shafts of carriages."

1279. Werner Staufen, George street, Portman-square, London, "A new material to be used in the manufacture of brushes, and also applicable to the purposes for which bristles, horse-hair, and human hair are now used."

1281. James Murdoch Napier, York-road, Lambeth, Surrey, "Improvements in machinery for manufacturing projectiles."

1283. Henry Fowler Broadwood, Great Pulteney-street, London, "Improvements in the construction of pianofortes."

1285. William Edward Newton, Chancery-lane, London, "Improvements in lamps."—A communication from Samuel Holmes, New York, U.S.—*Petitions recorded 30th April*, 1862.

1287. James Swallow and James Allinson, Heckmondwike, Yorkshire, "Improvements in the manufacture of carpet fabric."

1289. Charles Pierre Alexandre Douchain, St. Cloud, France, "Improvements in apparatus for letting in or shutting off water or other liquids."—*Petitions recorded 1st May*, 1862.

1291. William Huntington and Thomas Huntington, Victoria Mills, Liverpool, "Improvements in the machinery for the manufacture of bread."

1292. Hermann Kohn, Unter den Linden, Berlin, Prussia, "A new method of making any kind of stuffs, textures, or fabrics waterproof."

1293. William Bodden and William Mercer, Hargreaves Spindle Works, Oldham, Lancashire, "Improvements in certain parts of machinery for slubbing and roving cotton and other fibrous substances."

1295. Robert Walker, Glasgow, Lanarkshire, N.B., "Improvements in malting, and in apparatus therefor."

1297. Ormrod Coffeen Evans, Church-street, Old Kent-road, Surrey, "An abdominal truss intended for the more perfect support and cure of hernia."

1301. Matthew Paul, Dumbarton, Dumbartonshire, N.B., "Improvements in windlasses and capstans or ships' winding apparatus."

1303. Henry Welch, Millwall, Middlesex, "Improvements in securing or attaching armour plates on or to ships or vessels."—*Petitions recorded 2nd May*, 1862.

1305. William Mosbman, Cleveland-terrace, Gloucester-road, St. Mary, Islington, London, "Improvements in the manufacture of bonnets, hats, or coverings for the head."

1309. Edward Omerod and Christian Schiele, Manchester, "Improvements in machinery or apparatus for cutting or dressing stones, which are also applicable for hammering, crushing, or otherwise reducing metals and other materials."

1311. Jean Marie Herdevin and Joseph Alexandre Jullien, Rue Gaillon, Paris, "Improvements in sluice cocks."

1313. John Mortimer Heppel, Great George-street, Westminster, Middlesex, "Improvements in the construction of the permanent-way of railways."

1315. William Black, Wood-street, Northampton, "Improvements in lottery and ballot boxes."

1317. Michael Henry, Fleet-street, London, "Improvements in the process of, and apparatus for, preparing materials for the manufacture of paper, and in obtaining products from agents used in the said process, part of the invention being also applicable to apparatus for washing."—A communication from Jean Baptiste Vasseur and Xavier Lamotte, Boulevart St. Martin, Paris.

1319. Salvatore Merolla, Lago Castello, Naples, "Improvements in fire-arms."

1321. James Mellodew and Thomas Mellodew, Moorside Mills, Oldham, Lancashire, and Charles William Kesselmeyer, Manchester, "Improvements in looms for weaving."

1323. John Heyworth, Shawforth, near Rochdale, Lancashire, "Improvements in looms for weaving."—*Petitions recorded 3rd May*, 1862.

1325. Alfred Williams, New Windsor, Berkshire, "The construction of a backed form or seat capable of being converted into a level table with seat, or a desk either level or sloping, or at any angle."

1327. Louis Guillaume Perreaux, Paris, "Certain improvements in clocks or machines for keeping time."

1331. Thomas Francis Richard Brindley, Leonard-square, Finsbury, London, "Improvements in travelling and other flasks, decanters, bottles, and other necked vessels."

1334. Joseph Victor, Wadebridge, James Polglase, Bodmin, and William Rounsevell, St. Breock, near Wadebridge, Cornwall, "Improvements in the manufacture of safety fuses for mining and other purposes."

1335. Robert Burley, Glasgow, Lanarkshire, N.B., "Improved arrangements for using ordnance under water, and in part applicable otherwise."

1337. James Roscoe, Bell-lane, Leicester, "An improved lubricator for steam engines."

1339. Edward Brown Wilson, Parliament-street, Westminster, Middlesex, "An improvement in the machinery or apparatus used in the manufacture of malleable iron and steel."

1341. John Adcock, Marlborough-road, Dalston, Middlesex, "Improved apparatus for measuring and indicating distances travelled by wheel carriages."—*Petitions recorded 5th May*, 1862.

1343. Thomas Cadoure, Rue St. Martin, Paris, "Improvements in machines for the purpose of uniting together, by means of screws, leather used in the manufacture of boots and shoes and other articles composed of two or more pieces of leather."

1345. Augustin Morel, Roubaix, Nord, France, "Improvements in heckling machines."

1346. George Borthwick, Bedford, near Leigh, Lancashire, "Certain improvements in the construction of ships, boats, and rafts."

1347. Paul Chenaillier, Paris, "Improvements in apparatus for concentrating liquids, or for condensing alcoholic or other vapours."

1349. Walter Richard and John Richard, Edinburgh, "Improvements in the manufacture of printing types, spaces, and quadrats."

1351. William Greaves, Portland-street, Poland-street, Soho, London, "Improvements in safety stirrup bars."

1353. William Clark, Chancery-lane, London, "An improved buckle or fastening."—A communication from Jean Louis André, Boulevart St. Martin, Paris.

1355. James Edward Ransome, William Copping, and Lawson Lansdell, Ipswich, Suffolk, "Improvements in harrows."—*Petitions recorded 6th May*, 1862.

1356. William Edward Nethersole, Swansea, Glamorganshire, "Improvements in parts of railway trucks and wagons, parts of which are applicable to railway carriages."

1359. Charles Victor Fournier de Berville, Rue Blanche, Paris, "An improved safety coupling-bar for locomotives and other railway carriages."

1363. Charles Clark, City-road, Middlesex, "An improved cigar tube."

1365. Jeremiah Johnson and Arthur Chapman, Leatherhead, Surrey, "Improvements in apparatus for preventing collisions on railways."

1367. Richard Archibald Brooman, Fleet-street, London, "Improvements in swings."—A communication from Joseph Elliott Holmes, New York, U.S.

1369. George Tomlinson Bousfield, Loughborough Park, Brixton, Surrey, "Improvements in applying steam power to tilling land by means of a digging locomotive."—A communication from Elias Howe, jun., Brooklyn, New York, U.S.

1371. William Gossage, Widnes, Lancashire, "Certain improved apparatus to be used in the manufacture of soap."

1373. John McCann, Dublin, "Improvements in the mode of, and apparatus for, drying, cooling, and cleaning grain."—*Petitions recorded 7th May*, 1862.

1375. William Peer Gaulton and Major Booth, Manchester, "Improvements in apparatus or machinery for damping and steaming fabrics, part of which improvements are applicable for distributing fluids for other purposes."

1379. John Fowler, Leeds, Yorkshire, and John King, Chadshunt, Warwickshire, "Improvements in apparatus for tilling land by steam power."

1381. Charles Lungley, Deptford, Kent, "Improvements in apparatus for manœuvring ships and vessels."

1383. Astley Paston Price, Lincoln's inn-fields, London, "Improvements in straps or bands for securing articles, parcels, or luggage."

1385. Léo de la Peyrouse, Panton-square, London, "Improvements in treating neutral and acid fatty or oily substances, resins and resinous substances, and compounds or products containing paraffine."—*Petitions recorded 8th May*, 1862.

1393. James Fox Bland, Dorset-square, London, "An improved method of, and apparatus for, signalling between targets and shooters."

1395. James Oxley, Frome, Somersetshire, "Improvements in apparatus for facilitating the processes of mashing and sparging in breweries and distilleries."

1397. Nathaniel Symons, Cambridge-street, St. Pancras, "Improvements in all kinds of wheels, framework, girders, columns, and stancheons, blades of blowing fans, and paddle-wheels for steam vessels."

1399. Francis John Bolton, Bolton-row, May Fair, London, "An improved mode of, and apparatus for, displaying the lights in lighthouses."—*Petitions recorded 9th May*, 1862.

1400. George Carter Haseler, Victoria-street, Birmingham, "Improvements in the manufacture of lockets, and of a new application of Parkesine as a substitute for glass in the construction of lockets and other articles of jewellery."

1401. Jacob Geoghegan Willans, Clarence-place, Belfast, "Improvements in the treatment of the product from iron blast furnaces (whether moulded or otherwise) usually termed pig or cast iron or castings."

1403. William Clark, Chancery-lane, London, "The application of a vegetable fibre, alone or in combination with other matters, in the manufacture of felted and other fabrics, also as a substitute for flock or powdered wool, and as a material for padding or stuffing, and for other useful purposes."—A communication from Jean Louis Abeilhou, Boulevart St. Martin, Paris.

1405. Robert Moore, Cannon-street West, London, "Improvements in the construction and appliances of ships and other vessels."

1407. Richard Willoughby, Midmay-road, London, "Improved apparatus for exhibiting and giving rotatory and traversing motion to placards, advertisements, scenes, and other objects."

1409. James House, Market Lavington, Wiltshire, "Improvements in machinery or apparatus for crushing or reducing substances."

1411. Emerich Kolbenheyer, Vienna, Austria, "An improved apparatus for making ices and cold beverages."

1413. William Clark, Chancery-lane, London, "Improvements in lamps, and in apparatus for filling lamps with oil or fluid to be consumed."—A communication from Jacques Isidore Dézélu, Boulevart St. Martin, Paris.—*Petitions recorded 10th May*, 1862.

1415. Henry Walker, Gresham-street, London, "Improvements in making handles for crochet needles, pencils, penholders, and other articles."

1417. Gustave Fuhrmann, Passage des Petites Ecuries, Paris, "Improvements in melting and boring cast steel barrels, applicable to fire-arms and pieces of ordnance."—A communication from Frederick Lohmann, Witten, Westphalia, Prussia.

1419. John Buckingham Pope, West Riding and Haigh Moor Collieries, near Leeds, Yorkshire, "Improvements in apparatus for lowering and loading coals, minerals, or other substances."

1421. Henry Stockton Firman, Great Suffolk-street, Southwark, Surrey, "Improvements in apparatus for washing and cleansing textile fabrics or raw materials, and for forcing fluids or moisture from the same."—A communication from James Foster, Muscatine, Iowa, U.S.

1423. Henry Bayley and John Greaves, Stalybridge, and Leopold Newton, Oldham, Lancashire, "Improvements in machinery for turning, boring, cutting, shaping, and reducing wood and other substances applicable for the manufacture of various articles."

1425. William Nelson Hutchinson, Plymouth, Devonshire, "An improvement in screw propelled ships."

1427. Handel Ashworth, Hyde, Cheshire, "Improvements in machinery for opening and carding cotton and other fibrous substances."

1429. Alexander Bankier Freeland, Chatham-terrace, Palace-road, Upper Norwood, Surrey, "Improvements in the preparation or treatment of hops."

1431. Thomas Buckney, Peckham Rye, Surrey, "Improvements in portable 'tell-tale' timekeepers."—A communication from Armand François Collin, Paris.—*Petitions recorded 12th May*, 1862.

1433. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in the mode of carrying out submerged and other engineering works."—A communication from François Durand, Paris.

1435. Pierre Martinez Lopez, Paris, "Improvements in apparatus for sowing wheat or other grain or seeds."

1437. William Edward Newton, Chancery-lane, London, "Improvements in coffee pots and boilers for culinary purposes, part of which improvements are also applicable for generating steam."—A communication from Edward Fielding Woodward, Brooklyn, King's county, New York, U.S.

1439. Gideon Blake, Trowbridge, Wiltshire, "Improvements in apparatus for warming apartments."

1441. Robert Andrew Boyd, Duke-street, Southwark, Surrey, "Improvements in the manufacture of bacon."

1444. William Hartican, Islingword-road, Brighton, Sussex, "Improvements in fire-escape apparatus."

1445. Richard Archibald Brooman, Fleet-street, London, "An improved means or apparatus for shunting trains."—A communication from Jean Antoine Lamirotti and Paul Genuelli, Rue Ventadour, Paris.

1447. William Southwood, Kensington, London, "Improvements in machinery for manufacturing nails from either hot or cold bars of iron or other metal."

1448. Robert Marsden Latham, Fleet street, London, "Improvements in steering apparatus."—A communication from David L. Allen, New Brunswick, N.A.—*Petitions recorded 13th May*, 1862.

1453. Richard Archibald Brooman, Fleet-street, London, "An improved method of, and apparatus for, the production of photographic and stereoscopic portraits and pictures."—A communication from Leon Farrenc, Rue St. Quentin, Paris.

1454. John Ward Girdlestone, Canada Works, Birkenhead, Cheshire, "Improvements in projectiles."

1455. Henry Deacon, Appleton House, Appleton, Lancashire, "Improvements in the manufacture and production of certain colours, and in the apparatus employed therein."

1457. Edwin Whittaker and Jeremiah Clare, Hurst, Lancashire, "Improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun."

1459. John Smith, sen., Coven, near Wolverhampton, Staffordshire, "Improvements in thrashing machines."

1461. Adolphe Nicole, Soho-square, London, "Improvements in stop watches and timekeepers, and in instruments for measuring accurately short intervals of time."—*Petitions recorded 14th May*, 1862.

1478. Percival Moses Parsons, Blackheath, Kent, "Improvements in ordnance and other fire-arms, and in tools for rifling the same."

1489. George Haseltine, Fleet-street, London, "Improvements in churns."—A communication from Sidney Sweet, Dansville, New York, U.S.

1484. Amand Athanase Lamiable, South street, Finsbury, London, "Improvements in cementing cast and wrought iron to obtain cast steel."

1488. George Davies, Serle-street, Lincoln's-inn, London, "Improvements in the manufacture of ribs for umbrellas and parasols, part of which is applicable to the hardening of strips of steel generally."—A communication from Richard Augustus Stratton, Philadelphia, Pennsylvania, U.S.

1492. Frederick Stocker, Halkin street, Grosvenor-place, London, "Improvements in carriages."

1494. Alfred Vincent Newton, Chancery-lane, London, "Improved machinery applicable to the cutting of leather and other like uses."—A communication from Caleb Griffin, Boston, U.S.—*Petitions recorded 16th, May*, 1862.

1496. Christopher Binks, Parliament-street, Westminster, Middlesex, "Improved methods of obtaining oxygen and chlorine gases."

1498. Robert Davison, London-street, London, and Thomas Johnson, Bermondsey, Surrey, "Improvements in machines for washing and cleansing casks."

1500. James Hogg, jun., Orleans Villas, Twickenham, "Improvements in book covers."

1502. James Charles Hill, Knoll, Abergavenny, and David Caddick, Ebb Vale, Monmouthshire, "Improvements in puddling furnaces."

1506. Frederick Elsworth Sickels, Golden Cross Hotel, Strand, London, "An improved apparatus for steering vessels."—*Petitions recorded 17th May*, 1862.

1508. James Wright, Bridge-street, Blackfriars, London, "An improved method of sheathing iron or metal ships, in order to protect them from the action of salt water, fouling, and other such like influences."

1510. Robert Ramsden, jun., Kingsland-road, London, "Improvements in machinery or apparatus for mashing malt."

1514. Jesse Lee, Church Gate, Leicester, "Improvements in the construction of traction engines."—*Petitions recorded 19th May*, 1862.

1518. Marc Antoine Francois Mennons, Rue du Mont Thabor, Paris, "Improvements in certain descriptions of breech-loading fire-arms."—A communication from Alem Rousseau, St. Etienne (Loire), France.

1524. William Clark, Chancery-lane, London, "Improvements in paddle

and other hydraulic wheels."—A communication from Auguste Chesneau, Boulevart St. Martin, Paris.

1528. WILLIAM PETRIE, Charlton, Kent, "Improvements in vessels for boiling chemical products as sulphuric acid, and in apparatus for indicating the degree of concentration and temperature of such products in the boiler, which apparatus is applicable to other pyrometric purposes."—*Petitions recorded 20th May*, 1862.

1532. WILLIAM HICKLING BURNETT, Margaret-street, Cavendish-square, London, "Improvements in the mode of working telegraphic lines, and in instruments and apparatus employed for telegraphic purposes."

1534. WILLIAM BUSH, Tower-hill, London, "Improvements in the construction of ships, and in shields or armour for ships and batteries."

1536. LOUIS LEINS, Bucklersbury, London, "Improvements in travelling bags and apparatus used therewith."

1538. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in the manufacture of metallic or mineralised fabrics or surfaces."—A communication from Charles Husson, Rue St. Sebastien, Paris.—*Petitions recorded 21st May*, 1862.

1540. CHARLES WILLIAM SIEMENS, Great George-street, Westminster, "Improvements in electric telegraph apparatus."—Partly a communication from Dr. Werner Siemens, Berlin, Prussia.

1546. JOHN KENNEDY, Whitehaven, Cumberland, "Improvements in protecting the sides and decks of ships from the effects of projectiles."

1550. HENRY COOK, Manchester, "Improvements in electric batteries."—A communication from Jean Minotto, Turin, Italy.

1552. WILLIAM EVANS, Commercial-road East, London, "Improvements in obtaining motive power by machinery."—*Petitions recorded 22nd May*, 1862.

Invention Protected for Six Months by the Deposit of a Complete Specification.

1547. AUGUSTUS BRYANT CHILDS, New Oxford-street, London, "Improvements in wringing machines."—A communication from Francis Adams Cushman, Lebanon, New Hampshire, U.S.—*Deposited and recorded 22nd May*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

1304. GEORGE FREDERIC CHANTRELL, Liverpool, Lancashire.—Dated 26th May, 1859.

1311. WILLIAM WEILD, Manchester.—Dated 27th May, 1859.

1321. RICHARD ARCHIBALD BROOMAN, Fleet-street, London.—A communication.—Dated 28th May, 1859.

1725. THOMAS WEBB and JAMES CRAIG, Tutbury, Derbyshire.—Dated 30th July, 1858.

1331. OLIVER MAGGS, Bourton, Dorsetshire.—Dated 30th May, 1859.

1335. ARTHUR MICKELTHWAITE, JOSEPH PEACK, and SAMUEL JOHNSTONE, Sheffield, Yorkshire.—Dated 30th May, 1859.

1390. ROBERT BARCLAY, Bucklersbury, London.—Dated 7th June, 1859.

1325. ARCHIBALD SMITH, Princes-street, Leicester-square, London.—Dated 30th May, 1859.

1326. WESTON GRIMSHAW, Bowdon, Cheshire.—Dated 30th May, 1859.

1395. CHARLES DE BERGUE, Dowgate-hill, London.—Partly a communication.—Dated 8th June, 1859.

1361. JOHN WILSON, St. Helen's, Lancashire.—Dated 3rd June, 1859.

1370. ALEXANDER ROBERTSON ARROTT, St. Helen's, Lancashire.—Dated 3rd June, 1859.

Patents on which the Stamp Duty of £100 has been paid.

1243. CHARLES TENNANT DUNLOP, Glasgow, Lanarkshire, N.B.—Dated 31st May, 1855.

1224. JEAN BAPTISTE ACELIN, Paris.—Dated 29th May, 1855.

1263. HENRY CARTWRIGHT, Dean Broseley, Shropshire.—Dated 2nd June, 1855.

Notices to Proceed.

175. HENRY OWEN, Albert-terrace, Islington, London, "Improvements in the manufacture of stockings and other articles of hosiery."

178. ABRAHAM RIPLEY, Brook-street, Lambeth, Surrey, "Improvements in the construction of pistons."—*Petitions recorded 23rd January*, 1862.

185. JOHN LONGHURST, Ticehurst, Sussex, "Improvements in chains and chain cables."—*Petition recorded 24th January*, 1862.

194. CHARLES WEST, Derby-street, Westminster, London, "Improvements in the insulation and covering of wire, and in the preparation of the materials for insulating the same."

195. JEAN CLAUDE FRANCOIS MOUGIN, Paris, "Improvements in parcelonnettes or cradles for children or for dolls."

197. DICKINSON EDLESTON and HENRY GLEDHILL, Halifax, Yorkshire, "Improvements in means and apparatus for finishing textile and other fabrics."

198. EDWIN AUGUSTUS CURLEY, Green-terrace, New River Head, Clerkenwell, London, "Certain improvements in sewing machines."

201. FREDERICK ROBERTS, Maiden Newton, and ALEXANDER ROBERTS, Frome Vauchurch, Dorsetshire, "Improvements in apparatus for ploughing or cultivating land."

202. JOHN BROWN and JOSEPH DAVENPORT, Bolton, Lancashire, "An improved lubricating apparatus applicable to pistons."—*Petitions recorded 25th January*, 1862.

208. CHARLES WEIGHTMAN HARRISON, Lorimore-road, Walworth, Surrey, "Improvements in printing, stamping, embossing, perforating, and other like operations, and in the machinery or apparatus employed therein."

212. THOMAS JOHN ROBOTHAM, Burslem, and NATHAN HACKNEY, Hanley, Staffordshire, "Improvements in purifying slip glaze and other potters' materials."—*Petitions recorded 27th January*, 1862.

214. HENRY HUGHES TREPPASS, St. George's-terrace, Barnsbury Park, London, "Improvements in the construction, use, and employment of the kaleidoscope."

222. SAMUEL CUNLIFFE LISTER and JAMES WARBURTON, Manningham, near Bradford, Yorkshire, "Improvements in preparing cotton for spinning."

228. RUDOLPH BODMER and WILLIAM WILSON, Newport, Monmouthshire, "Improvements in the process of manufacturing artificial stones, parts of which improvements are also applicable to the manufacture of artificial fuel."—*Petitions recorded 29th January*, 1862.

238. BENJAMIN FOSTER and JOHN MOORE, Denholme, Yorkshire, "Improvements in machinery or apparatus for spinning and doubling wool and other fibrous materials."

242. MATTHEW COLLIER, Failsworth, Lancashire, "Improvements in looms for weaving."—*Petitions recorded 29th January*, 1862.

244. MATTHEW ALLEN, Worship-street, St. Leonard, Shoreditch, "Improvements in the construction of buildings for the prevention of fire, and in the materials to be employed therein and therefor."

245. THEOPHILUS GONTARD, Rue des Vieux Augustins, Paris, "Improved truss-plates producing an upward pressure."

247. JAMES FIRTH, Flush Mills, Heckmondwike, near Leeds, Yorkshire, "An improvement in finishing mohair cloth."—*Petitions recorded 30th January*, 1862.

269. WILLIAM SMITH, Bury, Lancashire, "Improvements in machinery for the manufacture of bricks, tiles, or other articles of a similar nature or character."—*Petition recorded 1st February*, 1862.

283. DAVID JOY, Manchester, "Improvements in machinery for forging metals, also applicable to other purposes."

287. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in machinery for spinning."—A communication from Henri Schlumberger, Guebwiller, France.—*Petitions recorded 3rd February*, 1862.

293. GEORGE MANWARING, Southampton, Hampshire, "Improvements in flushing apparatus for closets, sewers, and other water services."—*Petition recorded 4th February*, 1862.

300. WILLIAM EDWARD TAYLOR, Enfield, near Accrington, Lancashire, "Certain improvements in carding engines."

308. JOHN BELLAMY PAYNE, Chard, Somersetshire, "Improvements in the treatment or preparation of hemp, flax, and other analogous fibrous substances for spinning."—*Petitions recorded 5th February*, 1862.

318. EDWARD TAYLOR BELLHOUSE and WILLIAM JOHN DORNING, Manchester, "Improvements in the construction of hydrostatic presses suitable for packing and compressing cotton and other materials."—*Petition recorded 6th February*, 1862.

386. JOSEPH FEARNS LAWTON and JOHN LAWTON, Vale Mill, Micklehurst, near Stalybridge, Cheshire, "Improvements in the manufacture of flannel for shirtings and other articles of apparel."—*Petition recorded 13th February*, 1862.

438. JAMES NASMYTH, Rue de l'Etoile, Belgium, Brussels, "Improvements in apparatus for obtaining a circular motive power."—*Petition recorded 19th February*, 1862.

449. GEORGE FREDERICK LEE, New Bridge-street, London, "An improvement in tourniquets."—A communication from Thomas Scott Lambert, New York, U.S.—*Petition recorded 20th February*, 1862.

500. JEREMIAH WOODROW, Oldham, Lancashire, "A certain improvement in the manufacture of hats or coverings for the head."

511. WILLIAM MCINTYRE CRANSTON, King William-street, London, "Improvements in machinery for reaping and mowing."—Partly a communication from Walter Abbott Wood, Hoosick Falls, Rensselaer county, New York, U.S.—*Petitions recorded 25th February*, 1862.

580. JEAN BAPTISTE ANDRE QUIQUANDON, Paris, "Improvements in jacquard machines, and in the pattern cards to be employed therein."—*Petition recorded 3rd March*, 1862.

644. ALEXANDER CHARLES MAC LEOD, Hanover-square, London, "Improvements in ventilating hats and coverings for the head."—*Petition recorded 10th March*, 1862.

712. WILLIAM CLARK, Chancery-lane, London, "An improved brake for railroad carriages."—A communication from Augustine Irel Ambler, Roseline Nancy Ambler, and Warrick Martin, Milwaukee, Wisconsin, U.S.—*Petition recorded 15th March*, 1862.

904 WILLIAM MCINTYRE CRANSTON, King William-street, London, "Improvements in machinery for cutting corn and other crops."—A communication from James Smith Thayer, New York, U.S.—*Petition recorded 31st March*, 1862.

1109. JOHN STANTON, Birmingham, "Improvements in apparatus or machinery to be used in stamping or piercing metal washers and other similar articles."—*Petition recorded 16th April*, 1862.

1187. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improvements in looms for manufacturing tufted pile fabrics, and in the mode of operating such looms."—A communication from Halcyon Skinner, West Farms, West Chester, New York, U.S.—*Petition recorded 23rd April*, 1862.

1193. HENRY WHEATLEY, Hopton Mills, Mirfield, Yorkshire, "Improvements in or applicable to the employment of steam for heating or drying purposes."—*Petition recorded 24th April*, 1862.

1231. SQUIER CHEAVIN and GEORGE CHEAVIN, Boston, Lincolnshire, "Improvements in filtering and purifying water, and in apparatus employed therein."—*Petition recorded 26th April*, 1862.

1287. JAMES SWALLOW and JAMES ALLINSON, Heckmondwike, Yorkshire, "Improvements in the manufacture of carpet fabric."—*Petition recorded 1st May*, 1862.

1343. THOMAS CABOURG, Rue St. Martin, Paris, "Improvements in machines for the purpose of uniting together, by means of screws, leather used in the manufacture of boots and shoes and other articles composed of two or more pieces of leather."

1350. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in the manufacture and production of minium or red lead."—A communication from Charles Louis Pierre Burton, Rue St. Sébastien, Paris.

1352. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in the manufacture of soda and potash, and of their carbonates."—A communication from Charles Louis Pierre Burton, Rue St. Sébastien, Paris.—*Petitions recorded 6th May*, 1862.

1371. WILLIAM GOSSAGE, Widnes, Lancashire, "Certain improved apparatus to be used in the manufacture of soap."—*Petition recorded 7th May*, 1862.

1379. JOHN FOWLER, Leeds, Yorkshire, and JOHN KING, Chadshunt, Warwickshire, "Improvements in apparatus for tilling land by steam power."—*Petition recorded 8th May*, 1862.

1439. GIDEON BLAKE, Trowbridge, Wiltshire, "Improvements in apparatus for warming apartments."—*Petition recorded 13th May*, 1862.

1450. CHARLES TALBOT PORTER, Fleet-street, London, "Improvements in steam engine indicators."—A communication from Charles Richards, Hartford, Connecticut, U.S.—*Petition recorded 14th May*, 1862.

And notice is hereby further given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days next after the date of the Gazette (and of the Journal in which this notice is issued.

List of Specifications published during the Week ending 31st May, 1862.

2538, 7d.; 2539, 5d.; 2540, 3d.; 2541, 3d.; 2542, 11d.; 2543, 7d.; 2544, 6d.; 2545, 3d.; 2546, 3d.; 2547, 3d.; 2548, 6d.; 2549, 2s. 10d.; 2550, 3d.; 2551, 3d.; 2552, 9d.; 2553, 3d.; 2554, 3d.; 2555, 1s. 5d.; 2556, 6d.; 2557, 3d.; 2558, 1s. 4d.; 2559, 6d.; 2560, 3d.; 2561, 6d.; 2562, 10d.; 2563, 3d.; 2564, 5d.; 2565, 10d.; 2566, 3d.; 2567, 6d.; 2568, 1s. 4d.; 2569, 2s. 7d.; 2570, 11d.; 2571, 1s. 4d.; 2572, 3d.; 2573, 4d.; 2574, 3d.; 2575, 5d.; 2576, 10d.; 2577, 3d.; 2578, 11d.; 2579, 7d.; 2580, 6d.; 2581, 3d.; 2582, 3d.; 2583, 7d.; 2584, 7d.; 2585, 1s. 6d.; 2586, 7d.; 2587, 3d.; 2588, 9d.; 2589, 10d.; 2590, 3d.; 2591, 9d.; 2592, 3d.; 2593, 3d.; 2594, 6d.; 2595, 6d.; 2596, 2d.; 2597, 7d.; 2598, 7d.; 2599, 10d.; 2600, 3d.; 2601, 4d.; 2602, 3d.; 2603, 3d.; 2604, 10d.; 2605, 1s. 4d.; 2606, 7d.; 2607, 3d.; 2608, 3d.; 2609, 4d.; 2610, 6d.; 2611, 1s. 1d.; 2612, 3d.; 2613, 1s. 3d.; 2614, 1s.; 2615, 3d.; 2616, 10d; 2617, 6d.; 2618, 6d.; 2619, 5d.; 2620, 3d.; 2621, 5d.; 2622, 3d.; 2623, 7d.; 2624, 10d.; 2625, 10d.; 2626, 3d.; 2627, 3d.; 2628, 5d.; 2629, 3d.; 2630, 3d.; 2631, 3d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2878. W. E. NEWTON, *Chancery-lane, London*, "*Steam engine governors.*"—*A communication.—Dated 15th November*, 1861.

This invention consists in so arranging and constructing the parts of governors that the centrifugal and centripetal forces which are brought into action in the ball governor may be so equally balanced that the governor shall be made to act with the greatest possible accuracy, and be highly sensitive to any change of speed in the engine. The patentee claims the use of, or adaptation to, steam engine governors of a central weighted vessel, attached to, and moving with, the side of the governor, for the purpose of providing or exerting the centripetal force necessary for the proper action of the governor, as set forth. Secondly, in relation to the governor for marine engines, in which the centripetal force is obtained or furnished by the resistance of a spring, he claims the general arrangement and construction of parts shown in the drawings. He claims particularly the combination of a screw nut and collar with the centripetal spring, for the purpose of giving to the spring an initial deflection or compression, which is capable of accurate adjustment.

2905. J. TAYLOR *and* T. H. HEPWORTH, *Hyde, Cheshire*, "*Equilibrium lubricators for steam cylinders, valve boxes, &c.*"—*Dated 19th November*, 1861.

This invention consists in fitting in the interior of the cup or vessel containing the tallow or lubricating matter a spindle, having two valves, fast or otherwise, one at the top and the other at the bottom of the vessel, and fitting seatings in such manner that, when the spindle is pressed downwards, the upper valve is opened, and allows the lubricating matter to enter the cup or vessel, and, at the same time, close the lower valve and prevent any admission of steam; and when the spindle is raised, by a spring or other means, the upper valve is closed, and the lower valve opened, which admits steam to the top of the lubricating matter, so as to form an equilibrium, and allow the said matter to fall, of its own gravity, into the steam cylinder, valve box, or other vessel to which it is applied.—*Not proceeded with.*

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2751. W. WORSLEY, *Hucknall, York*, "*Self-acting railway signal.*"—*Dated 2nd November*, 1861.

This invention consists in having a lever crank, or crank with a lever working on a pivot or axle in or on a frame, and so applied as to allow of the lever being struck and depressed on the passing of a railway carriage by means of a side arm projecting from such carriage to a proper distance, and at a proper level to strike and depress such lever as much as needful. The said projecting arm is to be constructed, if needful, with a roller, where it would strike the lever; or the projecting arm may be constructed with a hinge to work up and down, and strike a pulley working in an inclined slip groove attached to the said frame, so as to draw the chain referred to over a curved crank or wheel, and so put the machinery referred to into operation.—*Not proceeded with.*

2760. T. LOCKIE, *Glasgow*, "*Wrought iron wheels.*"—*Dated 2nd May*, 1861.

This invention consists in forming wrought iron wheel spokes with fork-shaped heads, and welding the same upon a central ring, as described.

2771. J. ASHLEY, *Grosvenor-place, Bath*, "*Apparatus for attaching horses to carriages.*"—*Dated 4th November*, 1861.

The shafts and poles at present in use for attaching horses to carriages in single harness cause great distress to the horses, and are attended with considerable inconvenience and risk, especially in turning. To obviate the evils and risks arising from the use of the long shafts and poles heretofore employed, and to relieve the horse from the strains to which it is liable when using ordinary shafts or poles, according to the present invention very short shafts are used, coming only to the horse's waist or middle, and requiring the pad to be placed on the lowest part of the horse's back. The effect of these arrangements is to enable the horse to set more round to its work in turning, having no shaft obstructing it at the blade bone, and to step round accordingly with greater freedom and facility, and to turn in a smaller space, as well as with more ease and rapidity. As these shafts cannot touch the trace tugs, the harness will be saved from being defaced by the shafts, and the leather on the shaft points from being injured by the tugs; all risk of catching the rein, the bar bit or trace, round the point is also removed. These shafts are constructed without stops, their forward ends being bent somewhat downwards and outwards, and with fixtures on the foreside of the back band tugs to receive the belly band, which is thus attached on each side of the horse to the shafts before the tugs, and is separate from the tugs and the rest of the harness altogether, thus leaving the tugs on descending a hill or stopping at liberty to ease back on the shaft as the horse drops back, relieving the horse from the heavy strain occasioned by shafts with stops on his back and forelegs. The breeching is passed round the horse on each side through the kicking strap, and is attached to the shafts far enough behind the back band tugs to allow them plenty of play on the shafts in going down hill or stopping.

2773. J. LIVESEY, *Manchester*, "*Apparatus for communicating from one part of a railway train to another, and for coupling pipes.*"—*Dated 5th November*, 1861.

This invention consists of an improved pneumatic apparatus for sounding whistles or other alarums, by means whereof the guards and other persons may communicate with each other and with the engine driver. A system of pipes extends from the engine to the various carriages and vans of the train, and at each guard's van, or other convenient carriage, a branch pipe connected to a bellows and a whistle is applied; the end of this pipe is in communication with a small cylinder, the piston of which is connected to a lever fixed to the top of the usual steam whistle on the engine. When the bellows are worked the compressed air passes through the pipes and sounds the whistles.—*Not proceeded with.*

2788. W. RAMSELL, *Deptford, Kent*, "*Boats, barges, buoys, &c.*"—*Dated 6th November*, 1861.

This invention consists in constructing metal boats, barges, buoys, and other like structures, by stamping the same from one or more plates of metal by means of machinery consisting of top and bottom dies or straps and moulds, between which the plate of metal is pressed by steam or other gas, or by hydraulic pressure. The patentee employs a cylinder containing a piston, armed by preference with five piston rods, each and all of which are capable of being connected to, and disconnected from, the top die or stamp, according to the work to be performed. He drives the piston by admitting steam or other gas into the cylinder, or by hydraulic pressure. For making small boats, say 2ft. long and 4ft. 6in. beam, he takes a single sheet of metal, say iron, heats it, and stamps it by the machinery before described, either with a corrugated flat bottom, or with a curved bottom as desired. For larger boats he stamps up, say, two separate curved side plates, and unites them after the insertion of a rib in the centre to form a keel, and uses as many lengths as may be requisite to make up the length of the boat. Or he forms them of two side plates curved to the desired midship section, and inserts a flat, or corrugated flat plate, to form the bottom. In fact, by suitably shaping the dies and moulds he produces, in one piece or in several pieces, the form of structure desired.

2807. W. CLARK, *Chancery-lane, London*, "*Railway signal apparatus.*"—*A communication.—Dated 8th November*, 1861.

This invention relates to electrical apparatus intended to insure the safety of railway trains, and consists of two kinds of apparatus, the first being placed on the line, and the second near stations. The first apparatus, which is placed on the line, is worked thus:—The locomotive or tender in passing a signal disc oscillates a treadle or lever, which turns the disc to red, and indicates the line blocked. At the same time the locomotive raises a weight which prevents the treadle rising during the passage of the train over the part of the line governed by the said treadle and disc. The disc thus remains indicating "line blocked" until the train has arrived at the next disc, and there it again oscillates a second treadle, which turns the second disc to red, but here the movement of the disc establishes an electric or magnetic current, which controls the first disc and returns it to the indication of "line clear." Thus all the discs being in communication with one another, it is easily known if a preceding train has cleared the distance between the two discs. The second apparatus (which, as before mentioned, is placed near the stations) is intended to indicate throughout a sufficient range of that point in what position the disc is which commands the entrance and exit of the station. For this purpose a small repeating or controlling signal post is placed in the position in which it is wished to control the movements of the trains, similar to the posts hereinbefore described, and furnished with treadles worked by the foot, which serves the same as for the other posts, to turn the controlling disc. This apparatus is in electrical communication with the first disc of entry and exit to the station, so that it repeats all their movements, and of which it is a counterpart.—*Not proceeded with.*

2836. J. DAVIDSON, *Leek, Stafford*, "*Apparatus for communicating between the passengers and the guard and engine driver of a railway train.*"—*Dated 12th November*, 1861.

In performing this invention each compartment of the railway carriages is provided with a handle attached to a cord passing over a pulley fixed to a shaft extending the length of the carriage; these shafts are coupled to connect all the carriages of the train by a system of levers acting as a universal joint, but any other suitable covering may be used. The shaft at the guard's van is connected to a bell or other alarum, and the shaft of the tender or locomotive is connected to the steam whistle or other alarum; by this arrangement, when a passenger pulls the handle, the attention of the guard and engine driver is instantly arrested, and, as the action on the handle pushes out a slide or flag, the guard can ascertain from what compartment the signal has been given. By twining the shaft partly round the guard can at any time call the attention of the engine driver, and if requisite the engine driver can in like manner communicate with the guard.

2838. W. COOKE, *Spring-gardens, London*, "*Carriages.*"—*Dated 12th November*, 1861.

One portion of this invention consists in constructing a carriage of a form similar in outward appearance to what may be described as a double cab, but it is so constructed that, whilst from its lightness of structure it runs on two wheels, and may be drawn by one horse, four persons may ride in it with comfort and safety. In the centre of the said carriage, and in manner most convenient, the inventor places a suitable partition, on which may be a window to draw up and down, on each side of which partition he provides a seat. He also provides for the said carriage two separate entrances, namely, back and front. He also affixes sliding windows with suitable apparatus for regulating the same in position immediately over the axletree, and in the roof he provides a convenient seat for the driver, together with a box for his legs; the said box enters the carriage to a convenient distance without incommoding the passengers. He also provides at the bottom and sides suitable springs, and everything necessary to support, secure, or fasten the same. The axletree he places higher than the seats of the carriage, and the shafts he securely fastens to the carriage. Another portion of the invention consists in the adaptation and application to carriage or other windows of springs of wire gauge or other perforated material, so arranged as to form a series of folds extending and contracting at pleasure, for the purpose of allowing the vitiated air to pass off, at the same time that it admits pure air, and expels draughts or dust, the folds being so arranged that they rise and fall with the raising and lowering of the window, and are closely folded at the top of the window or opening when not in action.—*Not proceeded with.*

2874. C. H. MINCHIN, *Manchester*, "*Ventilators for railway and other carriages, &c.*"—*Dated 15th November*, 1861.

This invention is carried into effect as follows:—At the top of the aperture for the window sash, and behind the grooves in which the sash slides, the inventor places one or more strips of wire or silk gauze, jointed together so that they can be folded or opened out, the top strip being held by pivots working in bearings fixed to the frame. The bottom strip of gauze is mounted with a bevelled strip of wood or other material to which the top of the sash is made to correspond, and the strips are made to unfold or expand by means of weights or pulleys. At each or either end of the lower strip, or parts connected with it, there is a cord or chain, passing over a guide pulley at the top between other guide pulleys in the frame, and fastened to the lower part of the sash, or to weights and rods, or levers are employed for the same purpose. When the sash is placed in its lowest position the strips of gauze are closely folded together to allow the aperture to be of the largest dimensions; but as the sash is being raised the strips gradually unfold until they meet the sash, and cause the bevelled edges of the sash and bottom strip of the folds to be in contact. As the sash is still further raised it lifts the strips, closing them one after the other, by which means any amount of ventilation can be obtained.—*Not proceeded with.*

2889. W. NAISH, *Wilton, Wiltshire*, "*Saddle cloths.*"—*Dated 16th November*, 1861.

This invention consists in the manufacture of saddle cloths, or what are known in the army by the name of "numnahs," in a manner not hitherto adopted for that purpose. The inventor proposes cutting the saddle cloth of the desired shape from a sheet of felt or felted cloth, and recovering the same with any suitable woollen cloth, thus rendering great comfort and ease to both horse and rider.—*Not proceeded with.*

2891. J. HAWKINS, *Lisle-street, London*, "*Bits for riding and driving.*"—*Dated 18th November*, 1861.

This invention consists in forming a slot in each cheek of the bit intended to be made, and in these slots the ends of the mouth-pieces fit, the outer ends of which are enlarged so as to prevent the cheeks separating from the mouth-piece, but allow the mouth-piece to freely revolve and work up and down in the slots, but, when the mouth-piece has an eccentric projection on one side for pressing on the horse's tongue during the time of bending in or restraining the horse, the mouth-piece passes to the end of the slot, and the eccentric or projecting portion of it, which before was parallel with the length-way of the cheeks, will now stand at right angles with them, causing pressure more or less on the tongue of the horse; but when the shank is relieved from the mouth of the horse by slackening the rein or bridle, the mouth-piece will return by the action or working of the horse's mouth to its former position. When double mouth-pieces are applied the patentee makes one a fixture, and the other he makes so as to revolve and slide up and down, as is herein before described, or slide up and down only, as above mentioned.

2895. M. D. ROGERS, *Bromley*, "*Chain cable stopper.*"—*Dated 18th November*, 1861.

This invention is designed to assist the riding of ships at anchor for

fleeting the cable, and securing every link thereof while heaving in the cable. The patentee proposes to effect this by means of a metal frame fixed to the ship's deck, near the hawse holo ; this metal frame has a solid tongue or pawl hinged thereto from above, and the under side of said pawl or tongue is hollowed out to the form of the links of the cable; the bottom of the frame is also grooved for the links of the cable to slide in. The said pawl or tongue may be raised by a handle, so as to allow the cable to pass freely; but upon lowering the said pawl or tongue the cable will be securely held at any moment, and it is as easily and as quickly released.

2897. C. M. Pouillet, *Paris*, "*Constructing and fixing the rails of railways.*"—*Dated 18th November*, 1861.

This invention cannot be described without reference to the drawings.

2904. J. Lee, *Leicester*, "*Wheels of traction engines.*"—*Dated 19th November*, 1861.

This invention consists, First, in adapting transverse bars of metal to the felloes of the wheels of traction engines, to insure greater hold of the said wheels in the ground than heretofore. Secondly, in connecting together at will two of such said wheels placed at opposite sides of the engine, or only connecting one of the said wheels with the spur wheel of the engine, so as to be driven thereby. This may be effected by placing each wheel loosely upon the axle on which the aforesaid spur wheel is fixed, and by means of a lever wheel and clutch box fixing one or both of said wheels on the axles or releasing therefrom as desired. Thirdly, in adapting a broad wheel to the fire-box end of the boiler of a traction engine, the said wheel being constructed of two narrow felloes connected together by transverse bars or plates of metals; this wheel is mounted loosely upon an axle, on which is fixed a spur wheel driven by the engine; a lever wheel and clutch is also employed for fixing the said wheel on the axle, so as to be moved thereby as desired.—*Not proceeded with.*

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2837. G. Davies, *Serle-street, Lincoln's-inn-fields, London*, "*Bleaching cotton, &c.*"—*A communication.*—*Dated 12th November*, 1861.

This process of bleaching consists, principally, in submitting the fabric or material to be bleached to all the successive operations necessary for bleaching in the same vessel, without displacing the goods or materials, instead of removing them from one vessel to another, as ordinarily practised. The apparatus employed in the process consists, principally, of four vessels or reservoirs arranged side by side, and containing the different baths necessary for the bleaching operation, viz., the alkaline or lye bath, the soap bath, the acid bath, and the chloride bath, the two former being furnished with steam pipes for heating the contents. In front of these reservoirs, and upon a lower level, is placed the vessel in which the goods or materials are placed, and in which the bleaching operation is carried on; and each of the reservoirs is furnished with a tap by means of which its contents may be discharged into the bleaching vessel. The latter is provided with a perforated false bottom, the space below which communicates with a force-pump, by means of which the baths after using may be returned to their respective reservoirs. The bleaching vessel is also furnished with a discharge cock. This vessel is open at the top, and is furnished with a circular perforated wooden cover, which may be raised and lowered at will, and above the same is the pipe from the cold water supply, which is furnished with a stop cock having a perforated nozzle or rose for distributing the water.

2847. T. B. Collingwood *and* A. Butterworth, *Rochdale*, "*Throstle and doubling frames.*"—*Dated 13th November*, 1861.

The object of this invention is to remedy various defects in throstle and doubling frames wholly or partly, by certain arrangements which will in many, if not all, cases catch the "snarl" of the thread when it begins to form, or catch the thread when broken, and prevent it from flying and breaking or rendering other adjoining threads imperfect, and will at the same time prevent the material delivered by the rollers from "lapping" round them. The invention for this object consists in making the upper end of the spindle project above the top of the flyer, and in forming thereon a flange or flanges, groove or grooves; or it consists in making or forming a projection on the top or above the boss of the flyer, and in forming thereon a flange or flanges, groove or grooves, which will take hold of the thread when the snarl begins to form, or when it happens to break, so that the thread will accumulate on or about this said projection in the form of waste thread, till attended to by the "piercer."

2848. J. Hodgkinson *and* D. Greenhalgh, "*Apparatus for preparing cotton, cotton waste, &c.*"—*Dated 13th November*, 1861.

This invention relates to improvements applicable to certain descriptions of combing machines, and consists in collecting the fibrous material from the doffers of the machine upon a creeper of any material, or upon rollers. In connection with the creeper or collector there is a funnel or trumpet, through which the material passes, and, after passing betwixt rollers comes out in a sliver, which can be entered into a coiler, wound on a bobbin, or passed into a head of drawing. The patentees also employ a horizontal shaft with clearers, which revolve underneath each brush and doffer, for the purpose of gathering up the short fibre and dust, and, consequently, improving the other material.

2849. W. H. Hammersley, *Leek, Stafford*, "*Apparatus for stretching glossing, and finishing silk.*"—*A communication.*—*Dated 13th November*, 1861.

This invention consists in placing a cross head in the interior of a box or vessel, and causing it to work in suitable guides. To the said cross head hooks are attached which carry a roller, and motion is given to the cross head by a screw and nuts, the screw being turned either by hand or power. As the upper part of the vessel is placed another roller which can slide in and out of the box or vessel when required. The silk to be stretched is placed on both the rollers, and, by turning the screw, it can be stretched to any extent desired. At the top of the box is attached a steam pipe, which extends to a well at the bottom in order to prevent the condensed steam from wetting the silk.—*Not proceeded with.*

2853. J. T. Townsend, *Attleborough, Warwick*, "*Harness to be used in the manufacture of all textile fabrics.*"—*Dated 13th November*, 1861.

This invention consists in forming the harness of metal wire in lieu of cotton, flax, or other fibrous substances, as heretofore. These wires are used to attach the mails to the bars between which they are stretched instead of the cords usually employed. Instead of the lower bar independent weights may be attached to each, as is sometimes usual. The inventor makes the mails more elongated than usual, and points them more at the ends to avoid their presenting a shoulder by reason of the smallness of the wire, whereby to prevent their offering an obstruction to their passage through the warp.—*Not proceeded with.*

2867. G. Bridge, *Bollington, near Macclesfield*, "*Apparatus for preparing cotton, &c.*"—*Dated 14th November*, 1861.

In carrying out this invention the inventor causes a current of air to come in contact with the cotton or fibrous material just at the point where the feed rollers nip the material as it proceeds into the blowing machine or beater. The current of air coming in contact with the material at this position carries off the dirt or refuse that is not held between the rollers without any blowing away or waste of the fibres.—*Not proceeded with.*

Class 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

2854. T. Proctor, *Boston, Lincolnshire*, "*Apparatus for facilitating the stacking of straw, hay, &c.*"—*Dated 13th November*, 1861.

This invention consists in the use and adoption in mechanism or apparatus, for the purposes aforesaid, of a tray (or box without ends), which may be secured at one end to the end of the threshing machine, or may be fixed on a carriage or framing or otherwise; and it is preferred to make the said tray or box in two parts, secured together by screws or pins passing through projections at the sides of the said tray or box, or it can be secured by other fastening. To this tray or box endless bands or belts are adapted, in such manner that, upon motion being communicated thereto (through rollers and pulleys or wheels attached and provided with driving cords or straps, as also with a winch handle or crank), the said rollers and endless bands or belts aforesaid will be put in motion (upon applying manual power to said winch handle, or, in case of other than manual power, upon a substituted crank or power rigger or pulley being set in motion), and will cause the endless bands or belts first mentioned to travel upon the tray or box. The said endless bands or belts being connected together by cross pieces termed "slots" secured thereto, the straw, hay, or agricultural produce coming from the threshing or other machine will be carried forward (and upwards, if necessary, by slanting the tray upwards) to the other end of this apparatus, where the stack is in progress of formation. The first-mentioned bands or belts the patentee prefers to make of india-rubber, gutta-percha, or other suitable substance, and to provide the same with a joint and buckle, hook and eye, or other fastening for securing the ends together. He also provides movable legs adapted for supporting the apparatus, and slanting it upwards to the required degree, in order that the end nearest the stack in progress may be raised as the stack increases in height.

2884. M. Gibson, *Newcastle-upon-Tyne*, "*Reaping and mowing machines.*"—*Dated 16th November*, 1861.

In constructing reaping and mowing machines, in order to reduce the friction between the knife bar and the finger bar, and to prevent them from becoming choked, the patentee forms the knife bar with projections on the under side; these projections are received in grooves formed across the necks of the fingers; the bottom of the groove across each of the fingers is made to incline upwards from each of its ends, so that each projection only rests upon an edge across the centre of the groove in which it is received. The back of the knife bar has also projections formed on it behind the centre of each knife; these projections work against projections on the edge of the finger bar. As the knife bar is moved to and fro the projections on its under side remove at each stroke from the necks of the fingers any matter that might otherwise lodge and obstruct the motion of the knife bar; the projections behind the knife bar preventing a similar manner any matter from lodging between the edges of the knife bar and finger bar. When the knives are attached to the under side of the knife bar the knives may be formed with projections on their under side, in place of the projections being formed on the bar.

2896. R. A. Brooman, *Fleet-street, London*, "*Reaping machines.*"—*A communication.*—*Dated 18th November*, 1861.

This invention consists in certain arrangements of mechanism in which a rake is used, and has motions given to it so that, during one part of the revolution of the gathering reel, the rake shall act as one of the vanes of the gathering reel in gathering the crop towards the cutting blades, and so that, when the rake has been brought (with its teeth downwards) into a line with the cutting blades in front of the platform, or nearly so, it shall cease to revolve round the reel shaft, and is then made to move horizontally upon a vertical hinge above one end of it, with the ends of the teeth near to the surface of the platform, so as to push the cut crop off the platform at one side of it. Motion is then given to the rake, so as to cause it to rotate around the shaft of the reel, and also so that the rake shall be brought into a line, or nearly so, with the shaft of the reel at that part of its revolution, when it again begins to act as one of the vanes of the reel. During the intermittent motions of the rake above described the rotary motion of the reel shaft is continuous.

Class 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

2835. R. Bellis, *Chester*, "*Laying wood floors.*"—*Dated 12th November*, 1861.

This invention consists in fixing at one side of the joints on which the floor is to be laid angle iron, one face of which is made to project from the joist below the level thereof, and in inserting into the underside of each deal or board composing the floor T headed screws, one arm of which, on the boards being laid, become engaged under the projecting flange of the angle iron. The ends of the boards are wedged up against the side of the room or building being floored.

2853. L. Rolland, *Paris*, "*An improved spring door shutter, with a moveable lever.*"—*Dated 13th November*, 1861.

This invention consists in setting a stiff metallic wire along the frame of doors, a little behind and parallel to the line of hinges, and extending about the whole height of the said doors; the upper end of the wire is pinched in a little socket fixed to the frame, while the lower end, running freely in another guiding socket, is pinched below by a small cap carrying a hinged lever, which lever can be brought at pleasure in a horizontal or vertical position; in the first case, bearing against the door, it shuts it by the spring action of the wire; in the second case, standing up against the frame, it has no action on the door, which can remain open, or be shut by hand.—*Not proceeded with.*

2877. E. Loomes. *Whittlesey, Cambridge*, "*Machinery for moulding bricks, &c.*"—*Dated 15th November*, 1861.

This invention relates to that part of brick or tile making machinery at or by which the clay is forced out from the pug mill into or through the moulds or dies. The improvement consists in adapting to the lower end of the pug mill shaft one, two, or more eccentrics, cams, wipers, or other analogous contrivances, in combination with movable stops, against which the clay or substance to be moulded is pressed by the cams or wipers as they move round. By that means the clay is pressed or squeezed between the curved surfaces of the wipers and the stops, and will thereby be forced out of the mill through the apertures provided for the purpose, and will be pressed into or through moulds or dies.

Class 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

2824. W. J. Hay, *Southsea, Hants*, "*Improvements in protecting iron and wooden ships, caissons, dams, and other wooden or iron structures from decay, and from fouling, by vegetable and animal matters, and in preparing the materials employed therein.*"—*Dated 12th November*, 1861.

This invention consists in an improved method of treating the oxides of copper, and other metals, to prevent the uncertainty of their action by imperfect or not uniform application when used for keeping ships' bottoms or other structures free from animalculæ and other animal and vegetable matters; also when used to preserve woods and other materials from decay and the ravages of insects. For these purposes the patentee grinds in linseed oil the black or protoxide of copper, and then boils it with linseed oil until it is reduced to the suboxide, and by thus oxidising and oxidating the oil he forms a quick drying cupreous oil, which suspends the oxide in the form of a paint or varnish. To this he sometimes adds a small portion of silver or other metals and oxides. In those cases where greater durability is required from ships being on foreign stations, or not able to be docked periodically, he adds to the above-named paint an additional quantity of finely ground suboxide of copper, or when the paint is required to be black he adds the black oxide of copper in the same manner. The paint or varnish may be thinned by spirits of turpentine, naphtha, or any other cheap spirits, to any degree of consistency desirable. When it is to be applied to iron, one or two protective or non conducting coats should be first applied. This may be red or white lead, paint, or asphalte varnish, or waterproof glue in its liquid state, or other suitable material. This invention also consists in the use of zinc, either amalgamated or not, in contact with the inside or outside of iron vessels, ships, iron casings, and other structures, as a protection against electro-chemical action arising from any imperfect application of the protective varnish, paint, or other material, or from the accidental abrasion of the said protective coating or otherwise.

Class 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

2851. E. C. Kemps, *Birmingham*, "*Gas lamps, glasses, &c.*"—*Dated 13th November*, 1861.

This invention relates to gas lamps, their glasses and tops. The first part of the invention consists in constructing the framework, or parts that retain the glass of a hall lamp, so that a single nut and screw at the top of each pillar or upright bar thereof serves to unite the upper frame and the radial arms by which the lamp is supported and suspended from the centre. Another improvement in these lamps consists in supporting them by a hook and eye from the gas pipe, in such way that the lamp can be unhooked at pleasure without interfering with the gas duct. The next part of the invention relates to gas and other lamps, and their glasses and shades, and to the method of applying and fixing them to the fittings. These glasses or shades are generally supported by a triangular piece from the bottom, which throws a disagreeable shadow downwards. Now, according to this invention, the patentee supports them from the upper part; and, for this purpose, he makes the glass somewhat in the form of an inverted parabola or bell shape, that is to say, with the large end uppermost; this is formed with a lip, which is inserted within a ring fixed horizontally at the termination, and on a level with the gas arm of the lamp or chandelier, or other fitting. The glass rests on two lugs within the ring, and is inserted from below, and fixed by means of a screw opposed to the two lugs. The gas is conducted by a small pipe from the arm, and descends within the parabolic shade to a suitable point; an opening is made in the bottom of the shade for the admission of air. He further applies a top or cover, according to this invention, which harmonises with the contour, and completes the above form and arrangement of the shade.

Class 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

2716. J. H. Johnson, *Lincoln's-inn-fields, London*, "*Treatment of skins and hides.*"—*A communication.*—*Dated 29th October*, 1861.

According to this invention the skins and hides are to be submitted to a kneading, fulling, or other similar process, and whilst undergoing that treatment are to be incorporated with a mixture or mixtures of compounds of the fatty or oily acids, such as stearic margevin, or orlic acids, or other suitable fatty or oily acids or mixtures or compounds of the same, with metallic oxides, such as the oxide of iron, chronium, manganese, or any other suitable metallic oxides, in combination or in conjunction with the fatty or oily acids; silicates of the metallic oxides, or of the alkaline earths, such as baryta or lime may be used in combination or conjunction with the fatty or oily acids, either alone or in combination with any of the metallic oxides and the fatty or oily acids before stated. The improvements further consist in the employment of silicates of the metallic oxides, or of the alkaline earths, such as baryta, or any other suitable earthy compounds, in conjunction with the fatty or oily acids, either alone or in combination or in conjunction with any of the metallic oxides and the fatty or oily acids in a manner similar to those hereinbefore described.

2726. E. De Bassano *and* A. Brudenne, *Brussels*, "*Manufacture of stearine.*"—*Dated 30th October*, 1861.

The patentees claim converting any portion, or the whole of the oleic acid contained in the fatty matters, into elaidic acid in the concrete state during the process of acidification by the use of sulphurous acid gas in the nascent state, and also carbonaceous and other substances, or highly oxygenated bodies having the property of producing sulphurous acid, the same constituting this invention. Secondly, adding oleic acid to fatty matters during the process of acidification, for the purpose of obtaining solid matters of a good white colour, and easy to press, and for facilitating the conversion of oleic acid into elaidic acid as above stated.

2744. R. Mushet, *Coleford*, "*Manufacture of cast steel or of homogeneous iron.*"—*Dated 1st November*, 1861.

This invention consists in adding to and combining with cast steel or homogeneous iron during the process of manufacturing the said cast steel or the said homogeneous iron, by whatsoever processes either of these substances may be prepared, a triple metallic compound or alloy, consisting essentially of titanium, manganese, and iron, containing also carbon, in order to improve the quality of the cast steel or of the homogeneous iron produced. And the invention further consists in employing the said triple metallic compound in a similar manner, when the said triple compound has been previously partially decarbonised or wholly decarbonised in the manner described.

2761. G. Evans, *Gloucester-terrace, Portman-square, London*, "*Treating peat to render it us ful as fuel, and for illuminating and metallurgical purposes.*"—*Dated 2nd November*, 1861.

The object of one part of this invention is to readily deprive raw peat of so much of its moisture as may leave it fit for a variety of practical uses, and by which the patentee is able to convert it while wet, and in its pulpy state, into such a consistence that within a few hours of being raised from the moor it can be manufactured into fuel or material for other useful purposes. To attain this object he combines with the saturated peat other matters of a dry and absorbent nature, and which, by abstracting its water, so alter its character that the body or mass so formed can be readily compressed and moulded into shapes of any required size, while the materials so added do not injure the qualities of the peat, but rather improve them. The material he selects for this purpose is either mineral or vegetable carbon or charcoal, preferring vegetable carbon on account of its well known power of absorbing fluids, but which it will as readily part with under pressure. He sometimes, particularly for metallurgical purposes, adds unslaked lime or some earthy minerals used as fluxing agents. When the fuel is intended for the smelting furnace he sometimes mixes and incorporates with it the dressed ores of the metals and the required fluxes, thus supplying at one and the same time the fuel and the flux for the more ready reduction of the ores. For the production of illuminating gas he takes the crude oil obtained from coal, coal tar, the oil extracted from bituminous shale, petroleum oils, or any one or more of the cheaper hydro-carbonaceous materials of commerce, and incorporates them singly or combinedly with peat, adding, if necessary, a small quantity of caustic lime to facilitate the extraction of the water, and render more perfect the amalgamation of the peat with the oils, and in this manner he produces a substance from which gas for illuminating purposes can be obtained in great abundance.

2764. J. Bowden, *Sidford*, "*Dyeing*"—*Dated 4th November*, 1861.

In performing this invention the inventor employs a vessel provided with a perforated column through the centre, and with a grate near the bottom on which the fibrous materials to be dyed, either in a manufactured or unmanufactured state, are placed. This vessel is connected by pipes to the vessels containing the mordaunt, the fixing liquor, and the dyeing mixture, and all the vessels are connected to a steam pipe. When the articles are placed in the first vessel, and the lid or manhole has been secured, the mordaunt is forced from the vessel containing it into the articles to be operated upon; after the mordaunting is finished the mordaunt is forced back again into the vessel from whence it was taken. The mordaunt is then fixed by forcing the fixing liquor into the first vessel, and the ingredients which it is preferred to employ for fixing colours on cotton goods or fabrics are the silicates, arseniates, and phosphates of soda, but any other suitable ingredients may be employed. After the process of fixing the articles under operation may be washed, and then the dyeing mixture is forced into the first vessel until the process of dyeing is complete.—*Not proceeded with.*

2782. S. Griffiths, *Wolverhampton*, "*Manufacture of iron.*"—*Dated 5th November*, 1861.

This invention consists in the manufacture of iron entirely free from sulphur, and this result is obtained as follows:—First, during the process of reducing the iron from the mine in the blast furnace. Secondly, in the convertion of crude iron into malleable iron in the process of puddling. The inventor effects this important object in the first instance by putting a chemical compound into the blast furnace with every charge of mine, which acts upon the mine, and particularly the metal when in a fused state, as an emetic, causing the metal to vomit or throw off all the sulphur otherwise incorporated with it to the top of the metal or fused mass in the furnace, to be collected and removed as most convenient in the shape of solid sulphur. And Secondly, during the conversion of crude iron into wrought iron in the puddling furnace, and this important result he effects by mixing about one pound weight of another chemical compound with each charge in the puddling furnace while the iron is in a boiling state, which compound penetrates in an instant the most minute or infinitesimal parts of the iron, and from its affinity it immediately combines with the sulphur, and instantly passes off through the superincumbent cinder in the shape of sulphuric acid gas to the chimney or draught-way of the puddling furnace.—*Not proceeded with.*

2783. H. Orth, *Wissenborg, France*, "*Soap.*"—*Dated 5th November*, 1861.

This improved soap consists of a mixture or combination of about 100 parts, in weight, of finely levigated clay, such as pipe clay, China clay, or other suitable aluminous or silicious earths; twenty parts of caustic alkali, such as caustic potass, caustic soda, or caustic ammonia, or the carbonates or bicarbonates of soda, potash, or ammonia, corresponding to an equal amount of caustic alkali; and twenty parts of resinous matter, such as ordinary pure resin, or any other resin of a similar nature capable of being saponified. These proportions may be varied according to the quality of the soap it is desired to obtain, and the uses to which it is intended to be applied. In preparing this soap the resinous and alkaline or caustic alkaline ingredients are mixed with about fifty parts, by weight, of water, and boiled together, ebullition being continued until the alkali and the resin are combined and saponified. The saponified mass is then mixed with the argillaceous or earthy matters, the whole being worked into a homogeneous paste, which is afterwards dried, and which is then ready for use.

2784. G. T. Bousfield, *Loughborough Park, Brixton*, "*Electro-plating or depositing metals.*"—*A communication.*—*Dated 5th November*, 1861.

This invention consists in the employment of a solution of fused cyanide of potassa of great strength, in connection with a powerful galvanic current, whereby the patentee is enabled to plate iron and other metals rapidly and economically with copper, without the employment of either sulphate of cyanide of copper, and without danger or inconvenience to the workmen.

2787. A. Prince, *Tafalgar-square, London*, "*Furnaces for reducing zinc ores.*"—*A communication.*—*Dated 6th November*, 1861.

This invention consists in improved arrangements of furnaces for the purpose of reducing zinc from zinc ores, whereby the number of furnaces usually employed may be doubled in the same space. The patentee constructs an upper and lower set of muffles, with suitable beds in ranges of retorts placed one upon another, in such a manner that they cannot bend or burst and cause the furnace to become dirty. The foundation vault, hearth chimney, and iron bands are arranged as in ordinary furnaces of half the power of production, except that a slight increase in their length is made. By arranging the muffles in the furnace in a double range, the upper range resting on a bed placed on the lower range of muffles, the production of zinc in a reducing furnace may be doubled, and a better quality of metal obtained than by the ordinary method of a single range of muffles. The zinc is to be condensed from the muffles in suitable recipients, and the sublimed zinc resulting from the process is to be collected in proper receivers. A great saving of fluid is effected by this invention, 150 lb. of coal being sufficient to reduce 100 lb. of worked zinc ores.

2795. J. R. Wigham, *Dublin*, "*Apparatus for the manufacture of gas.*"—*Dated 7th November*, 1861.

This invention consists in the peculiar construction or arrangement of a vertical retort for the manufacture of gas, and especially as regards domestic purposes, whereby the waste or surplus heat produced by such retort is made available for domestic or cooking purposes, the retort being heated by means of a circular or other shaped stove or furnace, so arranged that the top plate of the same may be used for cooking. The retort consists of a metal cylinder, which passes through and is surrounded by a furnace enclosed around its sides with fire-brick, and mounted upon a suitable frame or standards, the top part of such furnace being covered in by a metal plate, upon which the utensils used in cooking are placed. The cylinder is supported vertically by means of a hollow ring or collar cast upon or around the top part of the same, the under side of the ring resting upon the metal plate or top part of the furnace. The hollow part of the ring or collar is filled with a metallic solution, into which a light lid or cover is inserted, serving to close and hermetically seal the upper mouth or opening of the cylinder; the cover is provided with a handle, so that it can be put on or taken off without danger or inconvenience when it is required to put in a charge. The lower mouth or opening of the cylinder, through which the charge is drawn, is hermetically sealed or closed by dipping it a sufficient depth into a receptacle containing a liquid "lute," such receptacle being held or supported in the ash-pit beneath. The retort is connected with the ordinary condensing and purifying apparatus arranged in a compact manner, and connected by a system of water "lutes," hydraulic or other joints.

2801. J. Barrow, *West Gorton, near Manchester*, "*Manufacture of benzole, naphtha, naphthaline, aniline, and carbolic acid.*"—*Dated 7th November*, 1861.

Heretofore in the manufacture of benzole, naphtha, naphthaline, aniline, and carbolic acid, the coal tar of gasworks has been employed, which has of

late become of such value, and so insufficient in quantity, as to greatly increase the cost of the manufacture of benzole, naphtha, naphthaline, aniline, and carbolic acid. The patentee has discovered that, by treating coal directly with a view to the manufacture of these products, and by avoiding, as much as may be, the production of gas, he is enabled more advantageously to manufacture the above-mentioned substances. For these purposes he employs, by preference, retorts like ordinary iron gas retorts, set horizontally, but in such a manner that, while the bottom and sides are capable of being heated to bright redness, the upper portion of the retort above the charge is carefully protected by brickwork from the fire and heat. The retorts are made capable of holding from 8 cwt. to 12 cwt., and he connects a series of pipes to each retort for the purpose of condensing the vapours evolved; these pipes may or may not be surrounded with water. The condensing pipes from several stills he causes to terminate in one large pipe, which he calls the main pipe, and from which he draws off the condensed oils. Having charged the stills with coal, using, by preference, that kind of coal known in the neighbourhood of Wigan as cannel slack (although any coal suitable for the manufacture of gas will answer the purpose), he allows it to remain in the stills as long as any oils are distilled over, and then rakes out the cokes and again charges the stills with slack. He does not find that the production of oils is materially increased or improved by allowing the stills to cool between each operation, although this may be done, and he, therefore, maintains the heat continuously at a bright red, so as to save time. It is advantageous to introduce steam into the retort during the process, or, at least, at the end of the distillation of each charge, to sweep out of the retort the vapours which it contains. The crude oils thus obtained he partially purifies by one distillation in iron stills heated by fire beneath until nothing is left in them but a small portion of pitch. In some cases the crude oil, and also the oil after the first distillation, deposits on cooling crystals of naphthaline. When this is the case he separates these crystals of naphthaline and presses them dry. He afterwards purifies the naphthaline by sublunation or otherwise, as is well understood. When he desires to separate aniline and carbolic acid, as is most frequently the case, he treats the crude oils of the first distillation with acid (using, by preference, hydrochloric acid) which unites with the aniline, and separates it from the other oils, and the remaining oils he treats with alkali solutions, or solutions of alkaline earths (using by preference caustic soda), which unite with the carbolic acid and separate it from the remaining oils. From the said solution of aniline and the alkaline solution of carbolic acid, both of which readily separate from the oil, he then obtains the aniline and carbolic acid, and he afterwards purifies them by any of the processes at present used by chemists.

2815. F. H. M. C. D C. F. DE LACOMBE, *Paris*, "*Generating hydrogen gas.*"—*Dated 9th November*, 1861.

These improvements relate to the generation or evolution of hydrogen gas for illuminating or other purposes, and to the apparatus used thereby, and they consist in projecting water in one or more small jets into an iron or other suitable vessel, kept at a suitable degree of heat by means of a bath of molten lead, or other suitable molten metal, and further superheating the steam thus produced by causing the same to come in contact with highly heated metallic parts, and finally introducing this superheated steam, with or without the adjunction of atmospheric air, into a highly heated retort (or retorts) partly filled with carbonaceous or other matter, suitable for causing the decomposition of the steam; or, if air be mixed therewith, of the steam and air. Part of the superheated steam, in conjunction with a draught of air, is projected on the fuel in the fire place of the retort (or retorts) and of the steam generating and superheating vessels.—*Not proceeded with.*

2 19. R. A. BROOMAN, *Fleet-street, London*, "*Obtaining alkaline phosphates.*"—*A communication.—Dated 9th November*, 1861.

This process, the subject of this invention, is applicable to all mineral and animal substances containing phosphate of lime, such as bones, animal black, coprolites, phosphates of lime (apalite or phosphorite). The substances are treated with a quantity of sulphuric acid in proportion to their richness in phosphate and carbonate of lime; soluble phosphates of limeare obtained which are separated by washing. If the acid solution thus obtained contains a small proportion of iron, it can, with advantage, be converted into Prussian blue through the action of prussiate of potash. The acid liquids are separated and evaporated, and when they attain a certain degree of concentration they may be considered as a powerful acid. In fact it is a mixture of free sulphuric and phosphoric acids, containing sulphate and phosphate of lime, as well as sulphates and phosphates of potash proceeding from the decomposition of the prussiate. If then to this acid liquor be added a salt of potash or soda, formed by a volatile acid (hydrochloric, carbonic, sulphuric, or nitric acid for example), and evaporation be continued to perfect dryness, there will be two products, first, a volatile product, which will be the acid of the decomposed salt, and, secondly, a solid and fixed product which will be a phosphate of soda or potash.

CLASS 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

2725. W. COOK, *Brixton, and* H. COOK, *Manchester*, "*Printing telegraphs.*"—*Dated 30th October*, 1861.

This invention consists in preparing the paper upon which the message is printed with salt of manganese.

2755. T. WALKER, *Chelsea*, "*Cables or chains for telegraphic and other purposes.*"—*Dated 2nd November*, 1861.

This invention consists in using pieces of iron or other metal pipes, and joining them together with certain joints, so as to form a continuous chain of any desired length; by passing an insulated telegraphic wire or wires through the pipes communication can be effected and continued across rivers, seas, oceans, or other places.—*Not proceeded with.*

CLASS 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

2564. J. FLINN, *Coventry, Warwickshire*, "*Watches.*"—*Dated 15th October*, 1861.

The patentee claims the addition to watches having a spring and barrel of the kind called a "going barrel," or watches without a fusee, of a wind-up consisting of a toothed wheel, taking into or engaging with another toothed wheel on the axis of the said going barrel, to the axis of which wind-up the key of the watch is applied in winding; the direction of the winding is the reverse of that of watches without fusees, as ordinarily constructed.

2565. C. WINANTS, *Saint Josse-ten-Noode*, "*Chase for printing presses.*"—*Dated 15th October*, 1861.

This invention consists in so constructing chases used in printing that the pages of type placed thereon may be tightened and firmly secured in position by means of eccentrics or volutes or scrolls, governed by a key or other suitable means, to cause them to press against the setting rules, and by them upon the pages of type, to secure them tightly in the chase; and, on turning the eccentrics, volutes, or scrolls in an opposite direction, the type is immediately released from pressure, and may be removed and changed with ease. By this means the patentee avoids the necessity of binding the pages of type with string. He also prevents the type from slipping or falling into "pye," and obtains a considerable saving of time.

2567. W. ROSS, *Glasgow*, "*Taps or valves.*"—*Dated 15th October*, 1861.

This invention cannot be described without reference to the drawings.

2572. R. A. BROOMAN, *Fleet-street, London*, "*Plates for the table.*"—*A communication.—Dated 15th October*, 1861.

This invention consists in manufacturing plates with divisions or partitions in them, for the purpose of keeping the meat, vegetables, sauces, &c., separate from each other.—*Not proceeded with.*

2574. T. FORSTER, *Sparrow Hall, Strentham*, "*Re-working waste vulcanised india-rubber.*"—*Dated 16th October*, 1861.

For this purpose the vulcanised india-rubber is suitably reduced by crushing rollers, or otherwise, and is then mixed with gutta-percha and sulphur. Pigments may be added to the mixture of vulcanised india-rubber, gutta-percha, and sulphur, if desired.

2578. W. CLARK, *Chancery-lane, London*, "*Means or apparatus for closing and securing mail bags and other packages.*"—*A communication.—Dated 16th October*, 1861.

This invention consists in the use of a piece of copper, with the surface hollowed out to receive a knot at the end of a piece of cord, the said hollow with the knot therein being filled with sealing-wax, the whole being so arranged as to prevent the package thus secured from being opened without detection.

2579. J. LISTER *and* D. MYERS, *Bradford*, "*Hoisting apparatus.*"—*Dated 16th October*, 1861.

These improvements in apparatus for arresting the fall of the cage or basket in a mine, or while being otherwise hoisted, relate, First, to a combination of parts connecting the rope or chain with the article to be lifted. In these hoists the patentees employ two guide rods, one on each side, and throughout the height of the hoist, which rods are embraced by suitable guides connected with the cage, two of which are levers, and constitute part of the safety apparatus; the others may be simple guiding parts. Within these levers or pivotted parts that embrace the guide rods are two levers, each one with its end abutting against the guide rods, and having their fulcra in the pivotted parts embracing the guide rods. The ends of the levers are attached by links to a stock or piece, which is again connected with the rope, as hereinafter described. The abutting levers have their connecting ends traversing in slots in a piece fixed to the cage or parts by which the article to be lifted is suspended. When the weight hangs on the rope the levers are moved upwards in these slots, so as to withdraw their ends from the guide rods, and allowing free motion up and down thereon, the weight being carried by the levers on which the slotted piece hangs at this time; but immediately the rope breaks, or the levers are released, they are drawn downwards by strong springs, which immediately force their ends against the guide rods, and also draw the embracing levers or parts against them, thereby gripping the guide rods hard, and preventing the descent of the cage. The embracing parts or levers are double cranked, and are pivotted at the lower part to the slotted bearing piece which is situated between guide rods. So far the above refers to safety apparatus in case of the breaking of the rope or chain, but the next part of the invention refers to the overwinding of the rope, whereby accidents often occur from the cage being pulled over the top pulley, to prevent which the patentees dispose a ring a little below the top pulley; this ring is fixed to the guide rods or other support, and in diameter is about equal to the distance between these rods. The stock piece before mentioned, to which the connecting links of the levers are attached, is not permanently attached to the hoist rope or chain, but consists of two cheek plates connected, and beneath which are two levers pivotted thereon; when their upper ends are approached to each other they grip and hold the barbed end of a piece of metal fixed to the rope, in which position the levers are held by a clamp surrounding the stock piece or cheek plates at that part. This clamp will slideup and down, but not easily, on the stock piece, and is longer than the internal diameter of the ring before mentioned, so that, when it is drawn up in contact therewith, it is immediately driven down on the stock piece, releasing the ends of the levers which embrace the barbed end of the suspending piece. The same action drives it down on the lower ends of those levers which before projected on each side of the stock piece, thereby causing the upper ends to separate, which releases the ends of therope, but at the same time causes those levers to expand or spread above the ring, so as to take hold thereof and suspend the cage.

2583. W. T. WESTON, *Trafalgar-square, London*, "*Screw-wrenches.*"—*Dated 17th October*, 1861.

This invention consists in forming on either side of the handle of a screw-wrench containing one fixed jaw or chop thereof a toothed rack, the situation of which is at that part of the handle of the wrench along which the movable jaw or chop is to slide, and in furnishing such movable jaw with an eccentric thread or helical worm formed on a disc or button having a milled edge, the disc being perforated with holes similar to a windlass or capstan, and placed with its pivot perpendicularly with regard to the rack into which it works, so that, by turning such screw or thread by means of its milled edge, or by the application of a lever to the holes, the movable jaw is caused to move along the rack as may be desired with respect to the fixed jaw of the wrench.

2586. C. DE GROTTE, *Brussels*, "*Instrument for corking bottles.*"—*Dated 17th October*, 1861.

This invention consists, under one modification, of a stand to which are affixed and connected the following parts:—First, a hollow vessel on which the bottle or other vessel to be corked is placed, the said vessel being formed raised at the centre thereof for the bottle to stand upon. Secondly, a taper glass or porcelain tube, connected and adjusted to the vertical part of the stand aforesaid, so as to admit the vessel which is to be corked to be placed underneath the same. Thirdly, a plunger rod working through guides fixed to the vertical part of the stand aforesaid, to maintain the plunger rod in a line with the centre of the glass or porcelain tube aforesaid, the said plunger rod being for the purpose of forcing a cork into the vessel to be corked, by means of a lever handle connected to the said plunger rod. In connection with the above it is proposed to employ a small semi-tubular piece of metal, which is inserted into the neck of the vessel intended to be corked, so that, as the cork is being forced into the vessel, the air therein, as it is compressed, will be allowed to escape up the semi-tubular channel thus formed; the semi-tube is then withdrawn, the cork filling up the space.

2604. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Braiding machines.*"—*A communication.—Dated 18th October*, 1861.

This invention relates to certain peculiar constructions and arrangements of parts of braiding machines: whereby such machines are enabled to work at greater speed than heretofore, and with greater precision and efficiency. According to this invention it is proposed to substitute helical springs for the weights hitherto employed for giving the requisite degree of tension to the several threads, such springs being in some cases connected to vertical sliding rods which work through the bottom holders, and descend and protrude underneath the same. When a breakage of the thread occurs, the projecting end of the rod strikes against a stop, and brings into action a disengaging lever, which instantly stops the machine. The threads on leaving the bobbins pass through suitable guide eyes in a vertical arm or bracket attached to the bottom holder, and thence through an eye in an oscillating detent lever, the nose of which when down becomes engaged with one or other of a series of ratchet-teeth formed on the head of the bobbin, and consequently, stops its further rotation on its axis. The lower parts of the bobbin holders, which travel along the guiding slots in the table of the machine, are of an oval or lenticular section, and have flanges above and below the slots to maintain them in their places. The slotted plate which is usually made in one piece is here proposed to be made in several parts, accurately put together and secured by means of ordinary screws to the bed plate of the machine. The travelling motion of the bobbin holders, along their guiding slots, is obtained from a series of horizontally rotating arms actuated by spur gearing, and the braid is taken up as fast as it is made by a worm-wheel and worm motion driven from the machine itself, or actuated by a handle or by separate driving pulleys. The tension springs above referred to may be situate either inside or outside the bobbin, as found most convenient.

2608. W. G. C. HUDSON, *Milk-street, Cheapside, London*, "*Portable apparatus for copying letters, &c.*"—*Dated 19th October*, 1861.

This invention is carried into effect in the following manner:—In a box or case made of wood or other material, or partly made of wood and partly of another material, and either through the centre thereof or some part of it, the inventor inserts a roller made of wood or metal, as preferred, having attached to one end thereof (which protrudes through one end of the box or case) or which forms part thereof, as preferred, a wheel having teeth or cogs therein, near to which is a movable check or repellant power to prevent the roller receding after being wound up, such winding being performed by a spanner or key. To the said roller is attached or connected, a sheet or piece of cloth, which passes through the front of the said box or case whereon the letters or other papers are laid for the purpose of being copied, and by the leverage obtained by pressing the said spanner or key the operation of copying is effected.—*Not proceeded with.*

2611. T. FEARNLEY, *Manningham, near Bradford*, "*Steam hammers.*"—*Dated 19th October*, 1861.

The patentee forms the steam cylinder annular, in order that the ram may pass through the inner or central part of such cylinder, and thereby have increased guiding surface in its motion, as also to reduce the height of it, and he forms the piston annular, with rods passing through the head of the cylinder to a cross head affixed to or formed upon the ram, or through the bottom of the cylinder direct to the hammer above the head. He also forms the "tup" or hammer to surround the cylinder, the piston rod being keyed into the hammer just above the head. In this case the cylinder is fixed to the upper part of the framing, and the framing below is bored to receive and guide the "tup" or hammer in its motion, while the inside of the "tup" or hammer is bored true to slide on the cylinder. He also gives motion to the valves of steam hammers by means of a spiral groove or feather cut or formed in the "tup" or hammer, acting upon a pin or stud in connection with the valve or valves.

2610. T. LEPEINTEUR, *Paris*, "*Fastenings for gloves, belts, &c.*"—*Dated 19th October*, 1861.

This invention cannot be described without reference to the drawings.

2613. J. MARSHALL, *Saville-row, St. James's, London*, "*The collection, concentration, and transmission of sound, so as to facilitate the hearing thereof.*" *Dated 19th October*, 1861.

The patentee claims the construction of apparatus for the collection, concentration, and transmission of sound in which a combination of reflecting surfaces is employed, which are so formed, and are adjusted in such relative positions, that the rays of sound are received on one or more of these reflecting surfaces, and are thence reflected in a concentrated manner on to one or more other reflecting surfaces, by which they are again reflected in a parallel or nearly parallel manner into a conducting tube, or into several conducting tubes, which conveys or convey them to the ear.

2614. BOURNE, *Oakamore, Stafford, and* E. KIDD, *Birmingham*, "*Machinery for the manufacture of metal tubes and cylinders.*"—*Dated 19th October*, 1861.

The principal object of this invention is to facilitate the manufacture of tubes and cylinders of metal or alloys of metal, more especially of that class known as solid or seamless tubes and cylinders, produced from an ingot mass or cylinder of metal or alloys of metal cast or otherwise prepared for what is technically termed the breaking down or reducing process. To accomplish this purpose the patentees construct improved machinery in manner following:—any given number of rolls or cylinders having slightly conceived peripheries and bevelled edges are mounted in a suitable frame work; the said rolls or cylinders, when definitely fixed in a working position, are relatively angular, the effect of which may be stated thus. When the metal or alloys of metal designed for a tube or cylinder is fed in upon an ordinary mandril between the rolls or cylinders, for the purpose of rolling to a required length, diameter, and thickness, the combined action of the rolls or cylinders, whose motion is rotary, simultaneously imparts a spiral motion to the metal or alloys of metal then undergoing the rolling process, so that independent of their agency the metal or alloys of metal is passed through with great speed, and is then introduced and rolled in like manner again until the same is in a condition to be "finished" at the draw bench by the usual method.

2615. J. WAINRIGHT, *Connaught-place West, Middlesex*, "*Ventilators.*"—*Dated 19th October*, 1861.

This invention consists, First, in perforating the lower bar of the lower sash of window frames, and in fitting over the same, inside the window, a slide made with perforations and solid parts, in such manner that the perforations in, and solid parts of, the slide may be brought entirely or partially over the apertures in the sash bar. In some cases the inventor arranges a trough for the reception of the air. The air then enters the apertures in the lower sash bar, passing through tubes carried up the side frames, and communicates with the air trough. Outlets are provided in the tubes at various levels. The upper sash frame remains as described in the specification of a former patent granted to the inventor.—*Not proceeded with.*

2620. H. LAMPLOUGH, *Holborn-hill, London*, "*Means for igniting the wicks of candles and lamp wicks.*"—*Dated 21st October*, 1861.

This invention consists in applying to the ends of the wicks of wax, tallow, or other candles, and also to the ends of the cotton wicks used in lamps at which they are intended to be lighted, any of the known compositions which are used on wax taper lights or matches for ignition by friction or percussion, so that candles or lamp wicks having such composition thereon may be readily ignited by friction, pressure, or percussion properly applied to the composition in the usual way, and such composition may of course be applied at each end of the wick of the candle, so that after one end has been ignited and extinguished, the other end of the wick may be ignited by means of the composition applied thereon. The ends of the wicks of the candles or lamp wicks are to be dipped in the usual way in any of the known solutions or mixtures which are now applied to the ends of vesta, lucifer, or other taper lights or matches, for the purpose of ignition by friction, pressure, or percussion. In the dwarf lights, such as are publicly known as Childs' night lights, the patentee sometimes inserts a wick, which has been previously prepared with such like composition at one end thereof, into the wax, tallow, or other material of which the body of the night light is composed after it has cooled. He also uses wicks prepared with such like composition for floating wicks in lamps in which oil or other suitable liquid is burnt.

2621. C. MCDOUGALL, *Manchester*, "*Fastening the bands of covered steel or other materials used for crinolines.*"—*Dated 21st October*, 1861.

This invention consists in passing the ends of the band of covered steel or other material used for crinolines into a double clip, having at each end a number of curved or angular elastic teeth on one or both sides, bending inwards, in such manner that the ends of the material can be entered but not withdrawn except intentionally.

2623. J. T. SMITH, *Barrow-in-Furness, Lancaster*, "*Collecting the inflammable gases evolved from blast furnaces.*"—*Dated 21st October*, 1861.

The patentee claims covering the top of blast furnaces with a dome or arched cover, through openings in which dome or cover the materials are charged into the said furnaces, the said dome or cover always preserving a clear or open space above the said materials, from which space the inflammable gases are collected by means of a pipe or pipes.

2629. R. WINNIATT, *Bristol*, "*Machinery for kneading dough.*"—*Dated 21st October*, 1861.

In machines for this purpose, as heretofore constructed, a series of blades fixed to a straight axle, and revolving round the axis of the same, are employed to effect the kneading or mixing of the dough. For the same purpose the inventor substitutes one blade forming several elements of a helical plane. This blade is held in its position, not by being fixed throughout its length to a solid axle, but by attaching each end of the screw so formed directly to a pivot which revolves in suitable bearings. The screw revolves in a trough of wrought iron galvanised, or of other suitable material, and in the ends of this trough are the bearings for the pivots attached to the screw. The screw or helical knife is set in motion either by the application of direct power, or by the intervention of rack and pinions, or by any other mechanical contrivance for effecting the purpose.—*Not proceeded with.*

2631. J. TOWARD, *Newcastle-upon-Tyne*, "*Apparatus for bending iron.*"—*Dated 21st October*, 1861.

This invention consists in the employment of three rolls, suitably grooved, driven by any ordinary gearing, and so arranged as to impart any desired curve to the iron which is passed between them. These rollers are placed on three shafts, and made to overhang the bearings, each roller being pushed on its shaft endwise, and kept in position by a collar, and driven by a key. Two of the three rolls are made in two halves, so that one half may be removed, and thus admit of the easy disengagement of the hoop when formed. By changing the position of the rolls from one shaft to the others, the feathers upon the angle or T-iron may be bent either externally or internally.—*Not proceeded with.*

2634. W. CONNELL, *Scravedstone Mills*, "*Apparatus for washing fabrics, yarn, wool, &c.*"—*Dated 21st October*, 1861.

This invention consists in the employment of a washing vessel mounted upon wheels, and running upon trams or guide rails. Above this vessel is arranged an oscillating lever beam, to which is jointed one or more rods carrying a series of beaters or stampers, which are made to descend on to the goods contained in the washing vessel, and to rise again alternately by imparting a vertical vibratory or oscillating motion to the lever beam through the intervention of suitable cams, tappets, or wipers, driven either by power or by hand. This lever beam is provided with an adjustable counter weight, whereby the power of the blow or the descent of the beaters or stampers may be regulated to any desired extent, according to the nature of the goods under treatment. During the action of the beaters or stampers, the washing vessel is caused to travel to and fro along its rails by means of a rack and pinion, or other suitable mechanical contrivance, a mangle wheel and pinion, or other self-acting reversing gear, being adopted for that purpose.—*Not proceeded with.*

2635. H. FROST, *Manchester*, "*Apparatus for measuring fluids.*"—*Dated 22nd October*, 1861.

This invention consists, First, in an improved piston for fluid meters, the packing rings of which are sprung into grooves formed in the periphery of the piston plate; or the ring may be formed with an internal groove and spring on the edge of the piston plate. The rings are also made to spring outwardly by their own elasticity for keeping themselves, as well as the joint bit, in contact with the interior of the cylinder; their form also permits the fluid to act inwardly and directly upon them for the same purpose. Secondly, in an improved valve, consisting of a movable plate for covering the ingress and egress ports, and a movable cover or chamber fitting on a rib or mid feather cast or fixed on the plate. By this contrivance the fluid is made to reverse the position of the plate, and thus to change the course of the fluid passing through the ports without the aid of the additional valve, and without the flexible or other packing described in the specification of letters patent granted to the patentee, in conjunction with D. Chadwick, on the 28th of April, 1857 (No. 1290). Thirdly, in an improved apparatus for measuring fluids, consisting of a movable chamber or box sliding on a flat plate, or in an angular trough, the said chamber being kept in contact with the surfaces on which they move by their own gravity; the chambers are moved to and fro on the surfaces by the fluid which is being measured acting against a stationary division plate, which forms a partition between the fluid which is entering the chamber and the fluid which is escaping therefrom. Fourthly, in working the indicating ratchet wheel by a lever with a movable stud in a slot for regulating the length to be travelled by the said lever, according to the quantity of the fluid that is being measured, and by the application of two or more catches working in the ratchet wheel for avoiding the back lash of the teeth, thus ensuring greater accuracy of registration. Fifthly, in placing the indicating wheels and dials within the case of the meter under a glass, the object being to dispense with the stuffing box now required for the rod by which motion is conveyed to the indicator; in this case, the glass may serve as a dial.

2636. G. ENGLAND, *New Cross*, "*Planing machines.*"—*Dated 22nd October*, 1861.

This invention relates to a peculiar construction and arrangement of apparatus for planing curved surfaces in iron or other metal, or hard substances, which arrangement may be easily adapted to ordinary planing machines. According to this invention it is proposed to secure the planing tool to an arm or holder which is suspended from a stud centre at its upper end, and is, consequently, capable of being moved or adjusted laterally thereon, so that the tool will describe the arc of a circle, the radius of which depends on the length of the arcs, whilst facility is, at the same time, afforded for adjusting the height of the working centre by means of a screw spindle, for the purpose of regulating the depth of cut. The length of the arm, from the working centre to the point of the tool, corresponds to the radius of the concave curved surface to be cut, which length may be increased or shortened according to the radius of the curve required. The actual adjustment of the tool for each succeeding cut is effected by a horizontal screw spindle, whilst the height of the cross slide, which carries the working or stud centre of the cutter arm, is regulated by vertical screws in each standard. The metal to be operated upon may be carried in the ordinary planing machine bed.

2638. F. O. WARD, *Hertford-street, Mayfair, London*, "*Hydraulic presses.*"—*Dated 22nd October*, 1861.

This invention has for its object to diminish the weight of metal, and the number of working parts hitherto deemed necessary in hydraulic presses, and the apparatus connected therewith, and to combine increased relative strength with easier and cheaper construction, more compact disposition, greater portability, less risk of bursting, and generally more economy and efficiency than have been heretofore attained in this manufacture. The specification of the invention is unusually elaborate, and cannot be quoted here in detail.

2639. H. MAY, *Tewkesbury*, "*Goloshes.*"—*Dated 22nd October*, 1861.

This invention consists in making the back part to rise up at the back of the heel and ankle to a point, say, two, three, or more inches above the ankle, and to be fastened around the ankle by a strap or suitable fastening, instead of being secured round the instep as usual. Goloshes fastened round the ankle are more comfortable wear than when fastened across the instep; besides, the piece rising up at the back protects the back part of the boots, especially from wear by contact of the steel hoops of crinoline, as also from

the mud, such back part of the golosh embracing the back part of the leg and ankle. The goloshes in the fore part and the sides are made somewhat in the ordinary form of leather goloshes. The upward extension of the back part also offers convenient hold for pulling them on.

2242. G. Archer, *Raunds, Northampton*, "*Sewing boots and shoes.*"—*Dated 23rd October*, 1861.

This invention is carried into effect as follows:—After the patentee has lasted the boot or shoe in the usual manner, he tacks the welt all round, and pierces upright holes for the stitches straight through the said welt and the upper leather and insoles; he then takes out the last and turns back the insole to the toe of the boot or shoe, and then takes two threads and begins sewing at the middle of the toe, using one of the said threads for sewing one side of the boot or shoe, and the other for sewing the opposite side, working each of the said threads alternately until he gets to where the heel is placed. He then puts in the said last again, and afterwards sews the "seat" and finishes the boot in the usual way.

2246. C. Brison *and* A. Chavanne, *Lyons, France*, "*Ovens, kilns, or furnaces.*"—*Dated 23rd October*, 1861.

The patentees claim providing ovens, kilns, or furnaces in which retorts are or may be used for various manufacturing or other purposes with vertical retorts, each of them provided with a suitable movable lid, and also with a movable obturator for closing or opening at pleasure the bottom of the retort, this obturator being jointed to a lever for allowing the easy and effectual working of the same, substantially as described.

2248. H. Keach, *Holloway*, "*Cigars.*"—*Dated 23rd October*, 1861.

The inventor envelopes that portion of the cigar termed the mouthpiece, being that part of the cigar which is placed in the mouth during the operation of the smoking, with a cap or cover which he composes of metal, or other moist resisting substance (by preference of metal), and attaches the same to the cigar by means of an adhesive substance, or by pressure or otherwise.—*Not proceeded with.*

2249. J. F. V. Deliry, *Soissons, France*, "*Mechanical kneading trough.*"—*Dated 23rd October*, 1861.

This invention consists of a cast iron annular basin, into which is placed the bread stuffs for working them. This basin, which is carried by three or more rollers, according to its size, revolves around a central vertical steady shaft. The required rotary motion for working the dough is given to the basin either by a hand crank, or a hand running on a pulley keyed on a horizontal shaft carrying a bevel pinion, which pinion cogs with a tooth crown fastened under the bottom of the basin. In the first case the patentee puts a fly-wheel on the horizontal shaft to regulate the motion; within the cast iron basin there is a central enclosing partition, which leaves an annular space for working the dough, and the machinery impelling the kneading organs is lodged in the central chamber, over which is a movable covering plate embodied with a central casing, into which is fitted the machinery. This covering plate is raised up by means of a screw engaged in the central steady hollow shaft; the kneading pieces are raised up with the covering plate when the dough has been worked enough, allowing it to be taken off by separate lumps to form the loaves of various forms, which are placed in baskets or boxes that are ready for the purpose.

2254. J. H. Johnson, *Lincoln's-inn-fields, London*, "*Preventing and removing deposit in steam boilers.*"—*A communication.*—*Dated 23rd October*, 1861.

In carrying out this invention for the prevention of deposit in steam generators or boilers, it is proposed to apply to the interior of the water space of the boilers any convenient number of rotating screws or vanes (somewhat similar to a screw propeller for ships), or spirals, which latter are placed either inside the tubes when the water is contained therein, or outside the same when the tubes act as flues, but in all cases the screws or spirals are situate in the water space of the boiler and are either rotated by the action of the circulation of the water and the ascending steam bubbles, or by suitable mechanical contrivances moved from the outside of the boiler; the object being by their motion to prevent any matters from becoming deposited upon the surfaces of the boiler in their immediate neighbourhood, and to keep such matters in a state of agitation and suspension in the water, so that by frequent blowing off the water in the boiler and the sides of the same may be kept perfectly clean. Another part of this invention consists of a peculiar arrangement of apparatus for removing deposit after it has collected in such thickness as to hinder the proper action of the boiler. In applying this apparatus to the cleaning of one of the units of the boiler, for which letters patent were granted to me on or about the 30th day of August, 1859, (No. 1970), I remove the bolt used for holding the units together at any point where the boiler requires cleaning, and introduce into the necks of the units a metal tube having a slot cut transversely through it a short distance from the end. In this slot is placed a steel or iron plate, of a width equal to the outer diameter of the tube. From a centre midway between the ends and edges of this steel plate a hole is bored, and from the centre of this hole is described a circle fixing the length of the steel plate, which should be rather smaller than the largest inside diameter of the unit, the slot in the tube being rather longer than the steel plate. Through the hole in the steel plate and through corresponding holes in the tube a steel pin is inserted, finishing flush at the ends with the steel plate turning freely on the pin to any point needed. Inside the tube, which is enlarged for the purpose, small connecting links are placed, which pass on each side of the plate to where another hole is bored. Through this hole and through corresponding holes in the links, is placed another steel pin serving to connect the plate and links together. One or more cutters are fitted in suitable mortices at the ends of the steel plate. The tube may be made of any length to suit the number of units to be cleaned, and if very long may be made in sections for greater facility in handling. When the boiler is opened at any part for cleaning, the necks of the units are first freed from deposit, so that the tube may pass through them; and when the tube is in the unit, by drawing on the links above referred to, the steel plate will turn upon its centre, causing the cutters to come in contact with the inside of the unit and remove the deposit therefrom. If the tube be turned from the outer end by hand or other power, the cutters, by turning slowly on their centre at the same time, will clean the whole of the spherical interior portion of the unit. In order to facilitate the subsequent removal of the detached powdered matter it is proposed, when the units are in a horizontal position, to use a pipe of nearly the same size as the neck of the unit, and having a flexible end which dips down to the bottom of the unit; and by the employment of any convenient exhauster in connection with this pipe the powdered matter may be drawn out; but if the units be in a vertical position, then the powdered matter will fall down and escape when the lower caps are taken off.

2257. W. B Lord, *Plymouth*, "*Apparatus for closing and opening passages for the flow of liquids and fluids.*"—*Dated 23rd Oct ber*, 1861.

This invention consists of a portion of a ball with a handle for altering its position, and of a socket with a part cut away, through which the liquid or fluid is to be allowed to pass, or stopped from passing, according to the position of the ball. The patentee combines a slotted guard with the apparatus for the handle to work in.

2259. J. Baker, *Birmingham*, "*Ever-pointed pencil cases*" — *Dated 24th October*, 1861.

This invention consists in making the lead holder of ever-pointed pencil cases hollow from end to end, and also in making the pencil case open at its top, by which construction the introduction of a fresh lead is facilitated, it only being necessary in inserting a fresh lead to press the end of the lead into the lead holder as though the said lead holder were empty.—*Not proceeded with.*

2262. J. C. Heaton *and* J. Dean, *Rotherham*, "*Taps or cocks.*"—*Dated 24th October*, 1861.

This invention relates to a peculiar construction of taps or cocks, suitable either for high or low-pressure service, whereby considerable economy and simplicity are obtained over taps and cocks of the same class hitherto employed. According to one form or arrangement the improved tap or cock is composed simply of three or four parts, namely, the barrel, the valve, and a screw cap, or screw cap and spindle, the screw cap, when used without the screw spindle, serving the three-fold purpose of the plug, the crutch, and the cap. The actual valve face consists of a leather or other suitable washer, which may or may not be secured to the lower end of a short stem, the upper end of such stem having a cup, leather, or other suitable packing fitted thereto, so as to enable it to work water-tight inside the barrel. On the top of the barrel is cut a screw thread, which fits the internal screw thread of a cap or cover which serves to close, and in some cases to open, the valve, as hereinafter described; or, in place of the cap or cover opening or closing the valve, a screw spindle working through the screw cap may be used. When the cap or screw spindle is screwed home its inner surface at the top bears against the top of the valve stem, which is contained wholly within the barrel, and so holds the valve firmly down upon its seat; but by partially unscrewing the cap or screw spindle, by means of suitable lugs or projections formed upon it for that purpose, or by a convenient crutch handle fitted to the top thereof, the valve stem is released from the pressure of the cap or screw spindle, and the valve is then opened by the pressure of the water upon its under side. Should the pressure not be sufficiently great to force up the valve and stem, with its accompanying packing, the stem may be swivelled to the under side of the cap or screw spindle, so that, on raising the cap or screw spindle by partially unscrewing it, the valve will be lifted, in lieu of being opened, solely by the pressure of the water.

2263. W. Dicks, *Floore, Northampton*, "*Water meters.*"—*Dated 24th October*, 1861.

This invention relates to a peculiar construction and arrangement of low-pressure water meter, whereby greater economy, simplicity of construction, and increased accuracy of measurement are obtained. According to this invention it is proposed to employ syphons, in combination with suitable floats and oscillating conducting spouts. The syphons, of which there may be two or more, are contained in two separate water chambers, these chambers being placed side by side over a larger water chamber or tank, from which the supply is drawn off when required for use. An oscillating conducting spout is placed on the partition which separates the two syphon chambers, and is so arranged as to turn over and direct the supply from the service pipe into each chamber alternately, such oscillating motion of the conducting spout being made to transmit movement to any suitable registering or counting apparatus.

2266. R. A. Boyd, *Southwark*, "*An improved furnace or fire-place.*"—*Dated 24th October*, 1861.

This improved furnace or fire-place consists of a series of bars let into two rings, one at the top and the other at the bottom; and of a cylinder or grating placed behind and at some distance from the series of bars. The fuel is placed between the bars and the cylinder or grating. The fire-place is supported at some distance from the ground to allow of air passing up, into, and through the fuel to support combustion. To prevent loss of heat by radiation, the outer cylinder is surrounded with brickwork or fire-clay.

2267. E S Tucker, *and* F E. Manners, *Red Lion-court, Fleet-street, London*, "*Revolving and movable surfaces, applicable to the exhibition of advertisements.*"—*Dated 25th October*, 1861.

In carrying out this invention the inventors construct large drums of timber, iron, zinc, canvas, glass, paper, papier mache, vulcanite, zopiss, gutta-percha, leather, and such like substances, on the exterior surfaces of which they place advertisements, show cases, patterns, and illustrated and illuminated devices of every description. They make these large drums to revolve vertically or horizontally.—*Not proceeded with.*

2270. C. N. May, *Devizes, Wiltshire*, "*Garden pots.*"—*Dated 25th October*, 1861.

These garden pots are principally adapted for large pots to contain fruit, trees, camellias, and other large plants, in greenhouses and otherwise. The invention consists in forming earthen and other porous ware pots with a cup or basin surrounding it on the exterior, about midway of the height of the pot; or there may be two or more such basins disposed at different heights on the exterior of the pot. The basin or basins are formed of a piece with the pot, or they may be made separately, and afterwards applied and cemented thereto, to render their junction watertight. The inventor places water in these basins, which, by reason of the porosity of the pot, penetrates it and moistens the earth inside, and so feeds the roots of the plants.—*Not proceeded with.*

2273. L. Aron, *Paris*, "*Cravats, and their mode of attachment.*"—*Dated 25th October*, 1861.

This invention consists in the employment of a ring or slipping noose, having one or several fixed or jointed small bars, through which pass the two ends of the cravat, the small bars forming the point of support; by this means the rumpling of the stuff is prevented, and, at the same time, the cravat is kept tight at the proper place.—*Not proceeded with.*

2275. T. Moore, *Regent-circus, London*, "*Winelasses.*"—*Dated 25th October*, 1861.

This invention cannot be described without reference to the drawings.

2277. T. Richardson, *Newcastle-upon-Tyne, and* R. Irvine, *Hurlet, Renfrewshire*, "*Treating bones and gelatine.*"—*Dated 25th October*, 1861.

This invention consists in treating bones with muriatic acid or weak sulphuric acid, to dissolve out a portion of the mineral matter they contain, and in subjecting the bones so treated to the action of sulphurous acid. These improvements further consist in treating bones with sulphurous acid to dissolve out a portion of the mineral matter they contain, and in subjecting the bones so treated to the action of muriatic acid or weak sulphuric acid. The improvements further consist in treating the gelatine obtained from bones by either of the above plans, or by muriatic acid alone, with the sulphates, sulphites, hyposulphites, phosphates, or silicates of the alkalies, or with a solution of the disphosphates of lime and magnesia in sulphurous acid. These improvements further consist in increasing the sizing properties and hardness of gelatine from any source by the addition of one or more of the phosphates of lime and magnesia, or the silicates of the alkalies and bichromate of potash.—*Not proceeded with.*

2278. H. Gibson, *Tettisiog, North Wales*, "*Slate dressing machines.*"—*Dated 25th October*, 1861.

This machine consists of a wheel, in the form of an ordinary fly-wheel, working on a horizontal axis fixed upon a strong frame, with two, three, or more knives for cutting and trimming slates fixed at equal distances on the side of the wheel; or if two slate cutters work at the same wheel, then another set of knives may be fixed upon the other side of the wheel in alternate order. The knives should be fixed at such distance from the spokes of the wheel as to admit of the slate being presented to the knife without the projecting end coming in contact with the spokes of the wheel. The knives should be of sufficient length to cut the sides of the largest slates in ordinary use. They may be fixed either parallel to the spokes of the wheel or diverging slightly from them, but radially from the axis of motion, so that the inner end of the knife shall first come in contact with the slate. The slate to be cut is rested obliquely on a cutting edge fixed on the framework of the machine, and receives the revolving knife progressively from its inner to its outer extremity, as from a pair of shears. The knives, to make the progressive cut more gradual, may be slightly curved upwards like a scimitar. The size of slate to be cut will be regulated by gauges fixed in the usual manner in slate dressing machines. Knives may be sub-tituted for spokes in the wheel, but the patentee prefers fixing the knives at a short distance from the spokes, as above described.

2280. R. B. Greenwood, *Hackney-road*, "*Billiard rest.*"—*Dated 26th October*, 1861.

This invention consists of a small carriage mounted upon two wheels, which are turned true, and accurately fitted both fast upon the same axis. The carriage is provided with a split taper tube, by means of which it is readily adjusted on, and removed from, the end of the cue.—*Not proceeded with.*

2691. W. Taylor, *Newport Pagnell*, "*Joints or connections for metal and other pipes and tubes.*"—*Dated 26th October*, 1861.

This invention consists in forming a flange or collar on the ends of pipes and tubes, in making undercut grooves, two, three, or more, in the collars, and in the employment of dovetail cottars formed with a head at one end, and with a slot or groove near the other for the reception of a key, which cottars slide into the grooves, and are tightened up by the keys being driven into the slots.

2692. C. Stevens, *Charing-cross, London*, "*Apparatuses for indicating escapes of lighting gas from the conveying pipes, and determining the precise leaking places of the said pipes.*"—*A communication.*—*Dated 26th October*, 1861.

This invention cannot be described without reference to the drawings.

2694. W. Smith, *Stafford*, "*Preservation of stone, brick, &c.*"—*Dated 26th October*, 1861.

In carrying out this invention the patentee takes flint or other siliceous substance, and reduces it to a fine powder by calcination and grinding; if prepared after the manner of that used in the pottery trade it will be suitable for the purpose. To this he adds alum, or sulphate of alumina, reduced to a fine powder. The composition thus formed he makes into a paint by the addition of a suitable article, and for which purpose he employs dissolved glue, bituminous substances, linseed oil, and turpentine. The composition thus formed may be applied as a paint to stone, brick, or other material used in building, and will be found a protection against decay or damp. For this reason, therefore, this invention is applicable to walls of any description which it is desired to render waterproof.

2698. W. Ryder, *Belton-le-Moors*, "*Machinery for fluting rollers.*"—*Dated 26th October*, 1861.

The object of the First part of this invention is to regulate the depth of cut of all the cutters simultaneously, instead of regulating each cutter independently of the others, as is now customary. In performing this invention the patentee supports the bar to which the tool boxes are connected in eccentric bushes, each of which is furnished with a toothed wheel driven by pinions fixed to a side shaft. To this shaft is attached a hand wheel with divisions on its circumference; and, by turning this hand wheel partly round the eccentric bushes acting on the bar, cause all the cutters to rise or descend simultaneously, thereby regulating the depth of cut of the cutters. The details may be considerably varied, and each cutter can be regulated independently of the others, as usual. The Second part of this invention consists in an improved combination of machinery for cutting diagonal flutes in or on rollers. In order to accomplish this a slight lateral motion is given to the cutters by means of a template fixed to the carriage, acting on a lever which communicates the requisite to-and-fro motion to the boxes or slides supporting the cutters. By this means the rollers remain stationary while the cut is given, and they are turned partly round after each cut in the usual manner. The above improvements may be used in combination with each other, or separately.

2699. W. Clark, *Chancery-lane, London*, "*Obtaining and producing printing surfaces.*"—*A communication.*—*Dated 26th October*, 1861.

This invention relates to printing blocks for typographic and other purposes in which the characters or designs are obtained in relief; and also to copper plates, in which the designs are sunk in the surface, for printing either paper or fabrics. The blocks or plates are formed as follows:—A slab of plate is first suitably prepared and polished, on which surface is engraved, or sunk, any suitable design with an ordinary graving tool. The sunk design being completed, the slate slab is then prepared by the ordinary means, and submitted to a galvanic bath of salts of copper, which causes a layer of copper to be deposited on the slab, which penetrates into all the hollows of the designs and becomes solidified. The copper, on being detached from the slate, furnishes a surface of block in relief, which is then moulded and employed as usual.—*Not proceeded with.*

2700. G. M. Gilbert, *Worcester*, "*Improvements in preparing blue colour, and in apparatus for applying such colour to water.*"—*Dated 28th October*, 1861.

The preparations of blue colouring matter, according to this invention, are made up in the form of paste, or semi-fluid, which is preserved for use in suitable flexible vessels. These paste-like or partially fluid compositions of blue colouring matter are packed in suitable cases, which, when they are to be used in place of the ordinary blue bags of the laundry, are made of metal, tin, or lead, similar to those which have heretofore been used for storing artists' colours, but modified as follows:—Near the outlet end of a case or vessel is a partition of wood or other suitable material, around which, and between it and the interior of the case or vessel, the edges of a porous bag, of flannel or other suitable material, are tied before forcing the partition into the case or vessel, so that the upper end of the vessel is lined with such bag. The upper end of the vessel or case is perforated with numerous holes, so that when a quantity of the paste or semi-fluid preparation of soluble blue colouring matter is pressed through a hole in the partition into, and is contained in, the bag, the vessel or case may be used by placing the outlet end thereof into water, and, by moving it therein the desired quantity of blue colour may be diffused in the water.

2701. C. Adony, *Paris*, "*Raising sunken ships, &c.*"—*Dated 28th October*, 1861.

The chief object of this invention is to raise sunken ships and other bodies. For this purpose the inventor constructs apparatus, in which is a chamber or space, or chambers or spaces, from which he exhausts or extracts the air; or, in which he produces a vacuum or what is practically so called, and brings the same into communication with the interior of the sunken body, so as to draw out a quantity of water therefrom, whereby the body is lightened and raised, or its rising facilitated.—*Not proceeded with.*

2702. J. Watt, *Walworth, and* T. S. Haviside, *Cornhill*, "*Soap.*"—*Dated 29th October*, 1861.

This invention relates to the manufacture of white soap and pale yellow soap from kitchen stuff, ship fat, and other similar inferior and dark coloured fat or grease; and it consists in the application and use, in the manufacture of white soap and pale yellow soap, of the distilled fat acids that are obtained from kitchen stuff and other similar inferior and dark coloured fat or grease.

2704. J. Martin, *Liverpool*, "*Granaries.*"—*Dated 29th October*, 1861.

This invention consists in constructing together, and in combination with each other, a number of tall, square, or other suitably shaped chambers or bins for the reception and storage of grain, which vertical chambers may be built of brick, stone, wood, metal, or other suitable material or combination of material, and are supported upon arches of brick or stone, or elevated metal girders. The grain to be stored is carried above the top of the chambers or bins by means of elevators, as is well understood; from the buckets of the elevators the grain falls into a suitable hopper, which is provided with a swivelling discharge pipe, from which the grain falls into the chamber or bin over which it is placed; or the grain falls into a spout or channel fitted with a longitudinal archimedian screw of a coarse thread, by the rotation of which screw the grain is carried forward to and discharged at the part required; or, if preferred, the screw can be a fixture, and the external casing made to rotate.—*Not proceeded with.*

2705. E. Suckow *and* E. Habel, *Manchester*, "*Antifriction mechanism for receiving the end thrust of screw propeller and other rotating shafts.*"—*Dated 29th October*, 1861.

This invention consists in the application of one, two (the inventors prefer two), or more pulleys to receive the end thrust of screw propeller and other rotating shafts, which pulleys are placed with their axis in suitable bearings at a right angle to the axes of the shaft. The peripheries of the pulleys come against a ring collar or other surface formed or fixed on the shaft. The edge of the pulleys are made half round, and the prepared ring or surface on the shaft upon which the pulleys act is made flat, or *vice versâ*. Arrangements are applied for traversing the antifriction pulleys, so that the contact surfaces can be changed, and thus uneven wearing prevented. These arrangements may be a screw or screws acting either upon the axes of the antifriction pulleys, or the bearings carrying them, and turned by hand when required; or a screw cam or eccentric may be employed geared with the shaft, so as to receive a slow motion. The pulleys may be placed in a box, so that they can be wholly or partly submerged in oil or other lubricating material.—*Not proceeded with.*

2706. J. Bibbington, *Rochdale*, "*Machinery for breaking and crushing limestone, &c.*"—*Dated 29th October*, 1861.

This invention cannot be described without reference to the drawings.—*Not proceeded with.*

2709. W. Savile, *Nottingham*, "*Elastic surgical stockings, socks, &c.*"—*Dated 29th October*, 1861.

This invention consists in manufacturing the articles above mentioned on the ribbing frame, with the parts hereinafter mentioned added thereto, which the inventor effects in the following manner:—The elastic thread of india-rubber, which is covered previous to working it up with silk, cotton, or other fibre, is laid in between the frame needles and the machine needles, by means of an additional set of carriers, the throw of such additional set of carriers being regulated at each end of the machine, according to the length of rubber intended to be laid on the needles. These rubber carriers are placed in front of the frame, and above the needles, and, in addition to the carriers which lay the threads of which the fabric is made, the rubber carriers are dipped below the needles at each salvage until the course is finished, and they are required to lay again the rubber on the needles. Below the needles in front are two other sets of carriers, in addition to those mentioned above; the carriers of one such set which stand in front lay on the needles a fining thread to be worked with each alternate course in the leg of a stocking, if a stocking is being made, and the carriers of the other set, which lie between the last named set and the needles, lay on the needles a fining thread for the heel, the carriers of both these last mentioned sets being regulated as required at each selvage.—*Not proceeded with.*

2710. R. Gibbon, *Brentford*, "*Preparing grain for brewers.*"—*Dated 29th October*, 1861.

The patentee claims, First, the general arrangement of two or more sets of rollers, with separating sieves and other apparatus combined in one machine, as described, for preparing grain for brewers. Secondly, the construction of crushing rollers and their bearings of machines for crushing grain of chilled cast iron or steel. Thirdly, the arrangement shown in the drawings, or an equivalent one, preventing the back lash of the crushing rollers when running empty, of any description of machine for crushing grain. Fourthly, the construction of a weighing apparatus, as described, having a set or sets of figures or other references engraved or otherwise marked on the lever or beam, for indicating the weights specific gravity, and other particulars of barley and malt, or one of them, as described. Fifthly, the construction of a regulating "butterfly" valve for regulating the supply of grain to the feed roller, as described.

2711. J. Eaglesfield, *Devizes*, "*Gas-burners.*"—*Dated 29th October*, 1861.

This invention consists in placing a triangular or other shaped piece of iron, or other material, immediately above the apertures of an ordinary fish-tail burner, so that the flame or gas as it rises is split in two parts, and passes up on each side of the bar of metal; the flame, however, unites again some little distance above the splitting bar. The effects of thus splitting the flame are to cause it to burn with little or no blue, and, therefore to produce better combustion, and give a much greater light for the quantity of gas consumed than would otherwise be the case. The patentee raises one or two little brackets from the burner, on which he fixes the triangular bar in a horizontal position with an apex or angle downwards, so as to present a cutting or splitting edge to the issue of the gas, the cutting edge being disposed some little distance above the hole or holes of the burner, so that the jet or jets of gas impinge fairly against the cutting edge.

2713. M. Scott, *Parliament-street, Westminster*, "*Hydraulic presses.*"—*Dated 29th October*, 1861.

For many purposes for which presses are employed—such, for example, as for packing cotton and other fibres and similar materials—the press is required during a considerable portion of its stroke to exert but a comparatively small pressure, whilst for the latter portion of the stroke a much heavier pressure is required. In such cases the inventor employs, according to this invention, a compound press, consisting of two or more concentric cylinders; the innermost cylinder is fitted with a ram like an ordinary hydraulic press, and the cylinder is closed at the bottom, and is made itself to serve as the ram of another hydraulic press formed with the next concentric cylinder, and this may in turn form the ram of a third press. When the press is set to work, the water from a force pump or accumulator is directed first into the interior cylinder, and as this is of small diameter the ram thereof rapidly rises, but the pressure will be comparatively light. As soon as this pressure proves insufficient, a cock placed on the supply pipe of the inner cylinder is closed, and another cock is opened, so as to admit the water from the force pump or accumulator to the second cylinder, and in this manner the ram of the second press, which is the cylinder of the first, is raised, carrying its own ram with it, this being unable to descend, being blocked by the water enclosed beneath it. When the second cylinder is brought into work, the action of the press will be slower, and the force exerted will be greater in proportion as the sectional area of the ram of the second press (or the cylinder of the first) exceeds the sectional area of the ram of the first press. Where a third cylinder is employed, it is brought into action after the second, in a similar manner, the second press being then in turn blocked by the water enclosed in it.—*Not proceeded with.*

2714. J. Hayward, *Liverpool*, "*Apparatus for raising water.*"—*Dated October*, 1861.

This invention has for its object improvements in raising water for the purpose of draining marshes or fens, irrigation, lifting sewage from a lower to a higher level for draining towns, supplying domestic wants, or other purposes. In carrying out these improvements the patentee takes a tank or reservoir which may be made of any suitable shape or size, capable of being made air-tight by suitable valves or cocks; this tank is placed so as to receive the contents of a stream of water which flows into and fills it by gravitation, and is emptied as hereafter described. Connected with this tank by an air-pipe (which is made of such dimensions as are required to

afford a free passage of the air when the apparatus is in use) is another tank placed at a suitable height above the water or other fluid to be lifted, and also made air-tight by suitable valves; this tank may be either above or below the level of the first named tank. The water being admitted into the first chamber or reservoir, fills it; the valve then shuts against the admission of water, and at the same time an exit valve is opened; the water in giving out forms a partial vacuum, and this acts upon the second reservoir by means of the communicating pipe before referred to, and the partial vacuum thus formed in the second reservoir lifts the water from the fen, marsh, sewer, or other place to be drained, or from which it is to be raised, into the tank or reservoir. When filled, the inlet valve to this tank or reservoir shuts, and the egress valve opens, causing the delivery of the water thus raised at its required level. Should the water require to be lifted or delivered at a height above that which the head of water supplying the first reservoir will give, the same process may be repeated by having two or more of these apparatus fixed at suitable levels.

2715. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Machinery for enamelling moulded and other surfaces.*"—*A communication.*—*Dated 20th October*, 1861.

This invention relates to a peculiar construction and arrangement of machinery or apparatus for applying enamel to the surface of wood mouldings in the process of preparing them for gilding, as well as for the purpose of making an enamelled surface upon all materials capable of being heated in this manner. The essential features of this invention consist in the employment of a plate, the lower edge of which is formed or shaped the reverse of the transverse form of the moulding to which it is applied, when such plate is made self-acting to the surface of the moulding while being traversed longitudinally over it. Also in the employment of a hopper, or other suitable receptacle to contain the enamelling composition, having the lower edges of the two end plates thereof formed or shaped the reverse of the transverse form of the moulding to be enamelled, such moulding constituting at the same time the bottom of the hopper or receptacle.

2718. M. A. F. MENNONS, *Paris*, "*Composition for igniting lucifer matches.*"—*A communication.*—*Dated 30th October*, 1861.

This igniter is composed of any of the solid resins, either fusible or soluble, combined, as after described, with a certain proportion of amorphous phosphorus. When a fusible base is employed, thirty-three parts of the resin are melted over a slow fire, after which sixty-six parts of alcohol are poured on and mixed; ten parts of amorphous phosphorus are then added to the mass, and the whole is thoroughly incorporated, forming a homogeneous paste, which is applied in one or several coats to a paper, wooden, ceramic, or other suitable surface. When a soluble base is adopted thirty-three parts of the resin are dissolved in sixty-three parts of alcohol; to this solution are added ten parts of amorphous phosphorus, and, the whole being thoroughly mixed, the compound is applied as above to a suitable tablet or other surface. The matches are inflamed by simple friction on the surfaces thus prepared.—*Not proceeded with.*

2719. M. A. F. MENNONS, *Paris*, "*Horticultural cases.*"—*A communication. Dated 30th October*, 1861.

This invention cannot be described without reference to the drawings.—*Not proceeded with.*

2721. E. BODEN, *Worsley Mills, near Manchester*, "*Lamps.*"—*Dated 30th October*, 1861.

This invention is particularly applicable to carriage lamps in which candles are burnt; in these lamps it is now customary to connect the socket containing the spring and the candle to the lamp by means of a projection on the socket fitting in the groove; this connection is very objectionable, as the socket is liable to work loose and drop out. Now this invention consists in making the socket with a screw which is screwed into a nut soldered to or otherwise attached to the bush of the lamp; by this means, when the socket is screwed to the lamp, it is securely connected thereto. The candle shield in the socket by a cap with a bayonet joint as in some lamps of the present construction.—*Not proceeded with.*

2722. W. COWPER, *Oldham*, "*Machinery for cutting and dividing wood into scantlings or laths.*"—*Dated 30th October*, 1861.

The wood to be divided is, according to this invention, secured upon a movable table, similar to that of the machine for planing metals, the surface of the table being provided with narrow grooves in the direction of its length at such distance apart as shall be equal to the thickness of the scantling or laths required. The table is moved forward by suitable gear, so as to bring the wood upon it against and under a series of disc knives or cutters, fixed upon a horizontal shaft, which is placed above and across the table, the edges of the disc knives or cutters just entering the grooves in the table. The shaft carrying the disc knives or cutters is arranged in suitable bearings, so as to be rotated by suitable gear, and so that it can be adjusted in its height above the table.—*Not proceeded with.*

2723. R. W. WINFIELD, *Birmingham*, "*French pulley rods.*"—*Dated 30th October*, 1861.

In constructing these pulley rods the patentee employs only iron. He makes the ends of the pulley rod, that is to say, those parts of the pulley rod in which the pulleys or rollers work, of the kind of iron commonly called malleable iron, or the kind of cast iron which can be annealed or made malleable by being heated in contact with powdered hematite or peroxide of iron. He makes the rod or cylindrical portion of the pulley rod of a tube or hollow cylinder of wrought iron, without any casing of brass. He connects the tubular portion or rod with the ends in the ordinary manner, that is to say, by a transverse pin and solder. The pulleys or rollers are fixed in the pulley rod ends in the usual manner.

2727. J. L. NORTON, *Belle Sauvage-yard, London*, "*Apparatus for raising water.*"—*Partly a communication.*—*Dated 30th October*, 1861.

For the purposes of this invention there is formed at the upper end of a pipe leading to the source of supply a chamber of convenient form, and the opening of the supply pipe into the chamber is fitted with a ball valve. The top of the chamber is closed with a flexible disc, usually of leather, with a hole through it at the centre. In this hole a metal ring is fixed, to which also a ball valve is fitted, opening out of the chamber already mentioned. To the metal ring in the disc a rod is attached, by which the centre of the disc may be moved up and down, deflecting the disc alternately in either direction. When the disc is deflected upwards, the capacity of the chamber is increased, and a partial vacuum formed in it; this is at once supplied by liquid entering the chamber by the supply pipe. When the disc is deflected downwards, the capacity of the chamber is diminished, and as the valve prevents the liquid returning into the supply pipe, it is forced to pass through the passage in the disc, raising the valve; it thus enters another chamber which is connected with a pipe for conducting the liquid to the locality where it is required.

2729. R. A. BROOMAN, *Fleet-street, London*, "*An improved steel button, and method of manufacturing the same.*"—*Dated 30th October*, 1861.

This invention consists in manufacturing a spherical steel button with a shank, and in a single piece, without soldering. The invention cannot be described in detail without reference to the drawings.—*Not proceeded with.*

2730. E. WATSON, *King-street, London*, "*An improved fastening for buttons, studs, solitaires, broaches, civil and military decorations, and other like articles.*"—*Dated 30th October*, 1861.

This improved fastening consists of, by preference, three bent pointed prongs, or pointed hooks, set about equal distances apart round the back or inside of the button or other article. The prongs are inserted one after the other in the scarf or other garment to which the article is to be fastened. Although by preference the inventor uses three pointed hooks, yet two and more may be used.—*Not proceeded with.*

2733. G. NORMAN, *Stoke Newington-green*, "*Mounting of cots or cradles.*"—*Dated 31st October*, 1861.

This invention consists in causing cots or cradles to rock longitudinally, or from head to foot, in lieu of from side to side.

2735. G. HOLCROFT, *Manchester*, "*Blast furnaces.*"—*Dated 1st November*, 1861.

This invention consists in the application of additional tuyeres, placed on a higher level than the ordinary tuyeres, for causing currents of air to act on the charges in the furnace before they descend to the level of the ordinary tuyeres.

2737. D. LANG, *Skinner-street, Saw-hill, London*, "*India-rubber boots and shoes, &c.*"—*A communication.*—*Dated 1st November*, 1861.

In carrying out this invention the inventor first designs the model of the particular shape and configuration of the foot or other part for which the article is to be made, and then he also forms a mould or matrix corresponding with the external form of the boot, shoe, or other article when moulded and finished upon the first mentioned model. The model and matrix are so formed that the interstice between the external surface of the core mould and the internal surface of the matrix shall correspond exactly with the dimensions and thickness of the elastic material at every part of the boot, shoe, or other article. By preference he proposes to use india-rubber vulcanised, but other materials professing the requisite qualities for these articles and this process of formation may also be used. The peculiarity of the said invention consists in the form of the moulds and parts thereof, and in the design and production of boots, shoes, and similar articles, like the ordinary leather boots, shoes, &c., to be worn next to the foot, having a solid sole and heel, vamp, back, and leg formed without any seam or foundation, every part being solid, and the whole in one piece when finished.—*Not proceeded with.*

2738. W. J. WILLIAMS, *Warnford-court, London*, "*Process for correctly transmitting the effect of the main levers in platform scales to the steady aid or weighing beam of platform scales.*"—*Dated 1st November*, 1861.

This invention consists in substituting two short cranks or angles of a form either similar to, or acting in the same way as, bell cranks, or their equivalents, for the shaft or rocking lever generally used in platform scales, to convey the effect of the main levers, such levers being vertical to the steel yard or weighing beam.

2739. W. CLARK, *Chancery-lane, London*, "*Photographic albums.*"—*A communication.*—*Dated 1st November*, 1861.

At the present time the cards are introduced into photographic albums at an opening of the same width as the card, made at the lower part of the leaf, which, being made in the thickness of the card, leaves a projecting edge, and renders the picture difficult of removal. The inventor obviates this disadvantage by covering the projecting edge with a sheet of paper, which guides the picture card over the projection, and prevents its catching.—*Not proceeded with.*

2743. B. MITCHELL, *Greenwich, and* W. BRUNTON, *Penge*, "*Shears.*"—*Dated 1st November*, 1861.

This invention cannot be described without reference to the drawing.

2745. M. *and* M. MYERS *and* W. HILL, *Birmingham*, "*Metallic clips or points for holding, connecting, and adjusting crinolines, &c.*"—*Dated 1st November*, 1861.

This invention consists, First, in making metallic clips or connectors for joining or uniting crinolines, and for such like purposes, where the material is of a uniform width; and, Secondly, in making such connectors that they may be adjusted so as to suit the various widths of the crinoline or other material required to be joined. In the first case the patentees make a clip by preference of thin steel, having spring catches formed of or applied to the same at each end, and into this clip they slide tongues barbed or serrated on their outer ends, which are turned down at right or other convenient angles for holding the crinoline, and in these tongues slots are formed for receiving the bent ends of the spring catches, which in use hold the tongues in position; but when the tongues are required to be pulled out, in order that the crinoline or other like material may be applied or adjusted, the spring catches have to be elevated before the tongue or tongues are intended to be pushed back within the clip, until the bent ends of the spring catches drop into the slots before named; and the improved clip, suitable for holding or uniting any general width of crinoline or like material, is formed of two parts, the one having a series of teeth bent down for holding the crinoline, and the other presses over the unprotected edge of crinoline or other material, and over the free portion of the other part. The first they make with a series of longitudinal slots, and in the other part a spring catch which catches into the slot in immediate connection with it, according to the width of crinoline or other material to which such clips are applied.

2746. A. SMITH, *Mauchline, Ayrshire, N.B.*, "*Producing or delineating ornamental lines and figures on metal and other surfaces.*"—*Dated 1st November*, 1861.

This invention relates to the application and use of a ruling machine, the invention of W. Smith, for which British letters patent, dated the 14th day of November, 1853 (No. 2639), were granted to him, which is used in the ornamenting of Scotch fancy wood work, and known in the trade by the name of a "checking machine." This new application or use consists in operating with a cutting point in place of a mathematical pen, and, by means of either straight or waved lines, producing ornamental figures upon metallic or other surfaces, chiefly with the view that these surfaces, after being so ornamented, shall be either gilt or plated with the object of adding to their beauty and preserving them from atmospheric oxidation.—*Not proceeded with.*

2748. A. SMITH, *Mauchline, Ayrshire, N.B.*, "*Combined book marker and paper cutter.*"—*Dated 1st November*, 1861.

This combined book marker and paper cutter is manufactured by preference in what is known as "tartan work." In this manufacture the surface of the wood of which the article is formed is decorated with patterns or devices in imitation of plaid or tartan fabrics. A piece of wood shaped to the form of the intended knife is decorated with the tartan pattern, and another piece, corresponding in shape to the handle part of the cutter, is prepared in like manner. These two part are superimposed, and are rivetted to a spring, which is arranged between the pieces.—*Not proceeded with.*

2750. W. B. SMITH *and* W. BENNETT, *Cornwall*, "*Preventing the injurious effects occasioned by smoke, sulphur, and the deleterious gases, which escape from stacks, chimneys, calcining houses, chemical and other furnaces.*"—*Dated 1st November*, 1861.

This invention consists in confining and preserving such gases, &c., so that they may be turned to valuable purposes. In order to effect this object the flue, which is conducted from the back of the fire, must be carried on to a small case in which is a blast fan, from whence the flue is continued to a chamber, or, if need be, to a succession of chambers. When the blast fan is made to revolve rapidly it causes a draft in the flue, which can be regulated as desired, and which carries onward the smoke and the gases evolved during combustion, and the air which passes into the fire, and discharges them into a chamber or succession of chambers, where they are heated according to their nature, no air being allowed to escape but that which is harmless, and this is passed through a finely perforated metallic plate, or through a sheet of canvas or such like material, which is affixed to the outlet from the chamber into which they are discharged.—*Not proceeded with.*

2752. J. S. BROOKS, *Hackney*, "*Chest protecting brace.*"—*Dated 2nd November*, 1861.

This invention consists in combining a back or chest protector with a brace or braces by connecting the two parts of the braces together by attaching to them a piece or pieces of flannel, cloth, wash leather, or other suitable material, which said material (or materials), when the protector is required for the back, covers the space between those parts of the braces which reach from the shoulders to the back of the article of dress to which the braces are attached, the braces not crossing each other; and when the protection is required for the chest, the said material (or materials) covers the space between those parts of the braces which reach from the front of the shoulders to the front of the article of dress to which the braces are attached. The braces are not crossed one over the other. The protecting brace or braces may be formed in separate pieces, as above stated, or in one and the same piece.

2754. J. C. WILSON, *Bucklersbury, London*, "*Apparatus for the manufacture of sugar.*"—*Dated 2nd November*, 1861.

This invention consists in a new and improved combination of the horizontal class of steam boiler, with steam engine, connecting gearing, and sugar cane mill all united together on the same iron foundation plate or girders. Also in a novel and peculiar arrangement of bevel and spur gearing, by means of which the said combination, or others of a like nature, can be most conveniently effected. The invention cannot be described without reference to the drawings.

2762. S. W. WORSSAM, *King's-road, Chelsea*, "*Machinery for cutting wood.*"—*Dated 2nd November*, 1861.

This invention cannot be described without reference to the drawings.

2765. J. C. ANDERSON, *Croydon*, "*Apparatus for projecting cricket balls.*"—*Dated 4th November*, 1861.

This invention cannot be described without reference to the drawings.—*Not proceeded with.*

2768. G. HORTON, *Sheffield*, "*Improved construction of skate.*"—*Dated 4th November*, 1861.

This invention cannot be described without reference to the drawings.

2769. W. CLARK, *Chancery-lane, London*, "*Water meters.*"—*A communication.*—*Dated 4th November*, 1861.

This invention consists in the arrangement within a stationary cylinder or cylindrical pipe of two or more oblique bladed wheels, secured at suitable distances apart on a central shaft, so applied as to rotate freely within the said cylinder or pipe, and two or more series of stationary spiral water passages surrounding the shaft in the spaces between the said wheels, such passages and the blades of the said wheels being at angles of 45 deg. or thereabouts to the axis of the shaft and cylinder or pipe, but their obliquity being in opposite directions relatively to the said axis, so that water passing through the said cylinder or pipe may be caused to strike the blades of the wheels perpendicularly, or nearly so, to the faces thereof, by which system of wheels and passages the water, as it passes through the cylinder or pipe, is made to act on the several wheels in succession.—*Not proceeded with.*

2766. J. ARCHER, *Birmingham*, "*Weighing machines, balances, and scale beams.*"—*Dated 4th November*, 1861.

The first part of this invention relates to weighing machines, balances, or scale beams in which, as ordinarily constructed, the beam turns upon fixed bearings on the top of the column, or other fixed part of the frame or stand of the machine, or balance or scale beam. The First part of the invention consists of a small rectangular vertical frame, open at its top, which said frame is provided at its upper end with centres or edges by which it is hung or supported upon the bearings in the fixed frame or stand in which the beam ordinarily turns. The said frame hangs vertically, and in its inner vertical sides slots are made extending to a short distance down the said inner sides. In the bottom of the said slots steel or other hard curved planes are fixed horizontally, and on the said planes the knife edges of the beam rest and turn. In the sides of the said slots, against which the ends of the knife edges bear, steel or other hard planes may be inserted and fixed vertically. The beam is placed in the said frame, its knife edges resting on the hard curved horizontal planes in the said frame. The frame in which the beam turns is capable of an oscillating motion upon the fixed stand or support. The beam thus acquires a freedom equal or nearly equal to that of a suspended beam, and a blow or shock given to the fixed support or stand is not transmitted to the planes on which the knife edges of the beam turn.

2770. W. T. WESTON, *Trafalgar-square, London*, "*Spring and fastening.*"—*Dated 4th November*, 1861.

This invention consists in the application of a fastening to a straight rod or bar of hardened and tempered steel, thereby to twist or turn it, so as to form a spiral, in order that in the continual effort to regain its natural position it may exert an action or force analogous to that exercised by springs of some other different constructions.

2781. J. B. BOURQUIN, *Newman-street, Oxford-street, London*, "*Ornamenting the covers of photographic albums, books, writing cases, &c.*"—*Dated 5th November*, 1861.

This invention consists in applying thereto decorations resembling inlaid woods, known as marqueterie and wood mosaics. This the inventor proposes to effect by printing upon veneers mosaic and other designs, and thereby imitating differently coloured woods arranged in patterns. Having selected, say, a veneer of white wood, he attaches the same to cloth by cement before printing to protect it from breaking or splitting under the pressure to which it will be subjected. The wood being damped is placed in the lithographic press to receive the prepared design, which is then transferred thereto in the same manner as coloured designs are applied to paper. When printed with the requisite number of colours to complete the pattern the wood is laid aside for the colours to harden, and when this is accomplished the wood is polished and varnished, and may then be applied to the book or other cover in the form of a border, corner pieces, lines, panels, or even as an entire covering for the lids or for the back, as may be thought desirable.—*Not proceeded with.*

2786. H. D. BRADT, *Boston, U.S.*, "*Machinery for lasting and pegging shoes.*"—*A communication.*—*Dated 6th November*, 1861.

This invention consists in the construction of a lasting and a pegging mechanism, constructed and made to operate together in manner set forth. Also in the combination of a back latching mechanism and its unlatching mechanism with the hammer and the peg driver. Also in the peculiar screw or worm by which the movements and intervals of rest of the vertical shaft of the lasting mechanism carriage are produced. Also in a peculiar self-adjusting presser, by which the carriage of the lasting mechanism is maintained in gear with its driving pinion. Also in the lasting mechanism adjustable carriage, made substantially in the manner, and so as to operate as described. Also in a lasting block as constructed of a bed block heel and toe and lateral or side clamps, or crimpers, and arranged substantially in the manner, and so as to operate as described. Also in a peculiar mechanism for actuating the heel and toe crimpers of the lasting block. Also in the combination and arrangement of an adjustable toe rest with the lasting block. This invention cannot be described without reference to the drawings.

2789. F. H. SCHRODER, *Hampstead*, "*Evaporating.*"—*Dated 6th November*, 1861.

This invention is intended chiefly to apply to the evaporation of the liquid parts from sugar when in a state of syrup in order to obtain it in a crystalline condition. It is, however, applicable to evaporative purposes generally. The invention consists in placing the syrup or other matter to be evaporated in an open pan heated by steam or hot water let into a jacket or case in which the pan is placed, and in causing a series of concentric cylinders, through which a blast or current of hot or cold air is forced, to revolve in the syrup, a portion of the cylinders being continually in the syrup, and another portion revolving in the atmosphere. The cylinders are each formed with slots running in the direction of their length.

2790. F. G. STUHER, *St. James's-road, Brixton*, "*An improved hygrometer for measuring the humidity of the atmosphere, dampness of beds, garments, &c.*"—*Dated 6th November*, 1861.

This invention relates to the application of cellular porous or scaly substances (such as wood, wool, hair, silk, and other like substances) which have been rendered sensitive to humidity for the purpose of measuring different degree of the same. To this end, such substances, after being cleansed from dirt, grease, or other impurities, are placed in solutions of certain salts or materials, which are either deliquescent at the time, or may become so (such as chloride of calcium, carbonate of potash, chloride of sodium) and by pressure, with or without heat, made to imbibe into their minute pores, cells, or vessels, portions of such salts or materials. These substances, now rendered sensitive to humidity, will swell or expand with moisture, and shrink or contract with drought, and this movement in a multiplied degree is made to express the various changes.—*Not proceeded with.*

2800. W. A. SHEPARD, *Pall Mall, London*, "*Preparing and treating india-rubber and gutta-percha, &c.*"—*Dated 7th November*, 1861.

For the purposes of this invention, in preparing gutta-percha, it is first thoroughly washed and cleansed by any one of the well-known methods used for that purpose which may be preferred. The gutta-percha thus partially purified is then thoroughly masticated, and placed in an iron vessel in which a vacuum is created, and the air is thus exhausted from the pores of the gum. The gum is then charged with the fumes of sulphur, which are admitted into the vacuum, or a small quantity of sulphur may be ground with the gum before it is placed in the vacuum vessel. The quantity of sulphur in this preliminary process will vary in amount from 1 to 1½, and sometimes 2 oz. of sulphur to 2 lb. of the gum, according as the gum is good or poor, but care must be taken that not sulphur enough is added to produce vulcanisation. The gutta-percha thus treated is next exposed to a high degree of heat, which may vary from 300 to 450 deg. Fah., according to the different qualities of gutta-percha which require different degrees of heat to drive off the volatile impurities, the best quality of gutta-percha requiring the lowest degree of heat. In the manufacture of articles where it is desirable to prevent any partial oxidation of the gutta-percha taking place at this high temperature, the patentee admits into the vacuum vessel air which has passed through highly heated tubes, or through a bath prepared by means of pumice stone saturated with the prussiate of potash, or otherwise prepared to answer the purpose; or he applies the heat directly to the gutta-percha in vacuo, which is preferable. This is especially important in the manufacture of articles in which the compounds of the gutta-percha either applied to fabrics, or otherwise, are to be much exposed to the action of the atmosphere, for a partial oxidation of the gutta-percha in the preliminary process causes a subsequent decay of that material, and the compound spread upon the fabrics then cracks, and, if subjected to wear, comes off. When the above conditions are not required, steam may be used to impart heat in the preliminary process. The time of this preliminary heating will vary from two hours and a half to four hours. The gum is now once more thoroughly masticated or kneaded to free it from any lingering impurities, which is very important, and bring it into suitable condition for mixing, and it is then ready to be combined with other ingredients for the purposes of subsequent vulcanisation and of manufacture. By thus treating gutta-percha in the preliminary process it becomes highly purified, and so consistent that more uniform and more satisfactory results are obtained in the subsequent process and vulcanisation than by other methods. In fact, this preliminary process, and the masticating or kneading or pressing between rolls, are indispensable. Gutta-percha thus prepared according to this invention, as above described, is next combined with sulphur, or certain compounds of sulphur, such as the hyposulphate of lead, or any equivalent compound of sulphur, by grinding and mixing with care to give a proportion of one ounce of sulphur to a pound of gutta-percha, but the use of sulphur is much preferred. With the gutta percha thus purified and combined he mixes various ingredients to make the different articles of manufacture required, and these ingredients vary according to the various uses to which the manufactured articles are to be applied. He mixes with the prepared gutta-percha fibrous materials, prepared chalk, or Paris white, carbonate of lead, oxide of zinc, carburet of iron, or graphite, magnesia, vegetable oils boiled to a proper consistency, emery, pitch, different kinds of tar, gums, colouring, and other materials according to the kind of goods.

2804. H. MONTUCCI, *Paris*, "*Apparatus for goffering or embossing stuffs in high relief.*"—*Dated 8th November*, 1861.

The patentee claims the exclusive use and manufacture of moulds containing a movable piece calculated to produce wedge-like types, the casting of movable wedge-like types by the mould as related, and the taking of the impressions of the design on another roller by means of drying paste, the whole essentially as described.

2810. A. B. BERRARD, *Paris*, "*Apparatus for separating metals from their ores.*"—*Dated 8th November*, 1861.

This invention cannot be described without reference to the drawings.

2812. M. MORGAN, *Wellington-street, Strand, London*, "*An improved gaiter or covering for the leg.*"—*Dated 9th November*, 1861.

This improvement has for its object to cover the leg in the fashion of gaiter or knickerbocker by a legging requiring no support either by strap, button, buckle, or other fastening. It is composed partly of canvass and partly of leather; any material possessing the necessary suppleness and elasticity may be employed. One vertical seam only is made in the article. It is passed over the boot before the boot or shoe is put on, and over the trouser or other vestment reaching the knee; the shoe is then put on, and the lower part of the legging pressed down, fitting neatly over the instep, and together with the shoe giving the appearance of an entire boot. For ladies the inventor inserts a small gore of elastic webbing in the lower part of the legging, and at one of its sides. Also, in all cases where it is required to be pulled over the shoe, a gore of elastic webbing may be inserted at the lower part of the legging where least observable.—*Not proceeded with.*

2813. G. SIMPSON, *Glasgow*, "*Boring apparatus.*"—*Dated 9th November*, 1861.

This invention cannot be described in detail without reference to the drawings.

2814. R. MCNAIR, *Glasgow*, "*Casings for stitching machines, &c.*"—*Dated 9th November*, 1861.

This invention cannot be described without reference to the drawings.

2816. S. HAGUE, *Westwinsted, Connecticut, U.S.*, "*Hoes, adzes, &c.*"—*Dated 9th November*, 1861.

Heretofore, in manufacturing hoes, adzes, or other similar tools, their eyes have been formed by welding together two lips of iron over a spindle or other suitably formed instrument, which is an expensive mode of constructing these implements. Now, the primary object of this invention consists in producing these articles of a superior quality, and at less cost, and the patentee has, therefore, devised a method of construction whereby

the eye and blade of the hoe, or adze, or other similar article is made from a single piece of iron, or other suitable material, without welding, and the operation may be described as follows:—The metal intended to be used as the material is first rolled into strips or bars, and afterwards punched or perforated with holes at suitable distances, so that the strips or bars may be cut up into various pieces. These pieces, after being properly heated, are next placed on a perforated anvil or die plate, upon which (that is, on the piece of iron or other material placed thereon) a hammer having a flat or other face then falls, and the piece of iron or other material on the perforated anvil or die thus yields to the form of such anvil or die, and the impression is made for the eye. The piece of iron or other material so treated is then taken to the plater, who draws it to a suitable thickness, and it is then returned to the eye maker, and is heated and placed on a perforated die, which die gives it the exact form or size required by the action of a corrugated punch; as the punch descends to form the eye, it carries the metal down to the bottom of the forming die when the eye is formed.

2820. R. A. Brooman, *Fleet-street, London*, "*An improved spinning toy.*"—*A communication.—Dated 9th November*, 1861.

This toy is constructed as follows:—A spherical ball is fixed loosely upon a spindle which passes through and is a fixture with a wheel, the rim of which may be round, square, flat, or of any other form, and is united to the boss by curved arms. A string is wound upon a grooved collar fast on the spindle, and by rapidly withdrawing the string the toy is made to spin. Sometimes the sphere is repeated below as well as above the wheel.—*Not proceeded with.*

1. E. Loysel, *Cannon-street, London*, "*Match boxes or cases.*"—*Dated 9th November*, 1861.

This invention consists in forming these articles of porcelain, parian china, or other earthenware, and making a portion of the external part of the article with a roughened surface on which the matches may be rubbed for the purpose of igniting the same. The roughening of the surface may be effected during the manufacture of the article by corrugating, ribbing, or indenting the same by any suitable tool, and of course leaving such corrugated, ribbed, or roughened surface unglazed. These match boxes or cases may be made of any convenient form or design that the taste of the manufacturers may dictate, and they may be provided, if desired, with lids or covers to protect the matches when they are placed in the boxes.

2822. W. E. Newton, *Chancery-lane, London*, "*Apparatus for manufacturing and containing gaseous liquids.*"—*A communication.—Dated 9th November*, 1861.

This invention relates to a novel mode of constructing that kind of apparatus which is generally known under the name of "gauzogene," and which is employed for the purpose of producing and containing gaseous liquids. These apparatus as now constructed are generally composed of two vessels, connected together by a metallic joint, which renders them heavy, cumbrous, and expensive. The improved apparatus which forms the subject of the present invention consists, simply, of one vessel made of glass, porcelain, or other suitable material, in which are placed the water and chemical salts necessary to produce the gas with which it is intended to impregnate the liquid. An aperture is made either at the top, bottom, or other convenient part of the vessel, and a recess is provided to receive a small perforated vessel in which the salts are placed. This small vessel is secured in its place by a screw cover or capsule, and the small vessel being perforated the water from the large containing vessel may be allowed to run among the solid salts, and cause the gas to be disengaged and percolate through the water. A suitable tap, connected with a tube which extends to the bottom of the containing vessel, will serve to draw off the gaseous liquid from the vessel when required.

2824. W. Clark, *Chancery-lane, London*, "*Portable and other filters.*"—*Dated 9th November*, 1861.

This invention relates, First, to a portable water filtering apparatus applicable for army service, and also for domestic purposes. The filter is formed of two reservoirs of cloth, coated with india-rubber, separated by a filtering substance contained between two metallic plates pierced with holes. This simple arrangement renders the apparatus easy of transportation, as the two reservoirs being flexible may be folded so as to occupy but little space.

2825. T. O'Reilly, *Dublin*, "*Table or apparatus for tailors to work at without sitting.*"—*Dated 9th November*, 1861.

This invention cannot be described without reference to the drawings.

2830. J. J. Sherlock, *Kensington*, "*Gas-meters.*"—*Dated 11th November*, 1861.

This invention has for its object the rendering a gas-meter capable of delivering as near as may be the quantity of gas within the hour for which it is constructed, and at the same time of correctly measuring the quantity of gas passed through it, although a less number of lights have been burning than the meter is arranged to supply. For this purpose the patentee applies to a meter the apparatus herein described, so as to insure the meter working at a pressure not exceeding a regulated and determined maximum pressure. The apparatus is composed of a bent tube, in which is placed any suitable fluid; one end of this tube is connected with the valve-box, into which the supply of gas first enters, consequently the fluid in the bent tube will be subjected to the pressure of the incoming gas. The other end of the bent tube has a float connected with a lever so arranged as to tend to close the inlet valve when the pressure of the gas depresses the leg in the bent tube, which is connected with the valve-box, and so raises the fluid and the float in the other leg of the bent tube. The gas, after passing the inlet valve, flows to a second valve chamber, where, in the case of wet gas-meters, there is a second valve, acted on by the ordinary float of the meter. By these means the maximum pressure at which the gas shall pass into a meter may be readily regulated.

2831. G. F. Wilson *and* G. Payne, *Battersea*, "*Treating fatty and oily matters.*"—*Dated 11th November*, 1861.

This invention consists in treating fatty and oily matters with nitrous fumes, and then further subjecting them to the action of water at a high temperature and pressure; or, after subjecting them to the action of nitrous fumes, to distil the products in like manner to that described in the specification of a former patent of the patentees, or to the combined action of the said water decomposition and distillation.

2833. C. O. Crosby, *New Haven, Connecticut, U.S.*, "*Pointed trimming.*"—*Dated 11th November*, 1861.

This invention cannot be described without reference to the drawings.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(*From our own Correspondent.*)

Continued Improvement in Finished Iron: *Demand for Girders*—The Admiralty Orders to be Thrown Open: *Much Satisfaction thereat*—Pig Iron Trade: *Advancing Prices*—Coal Trade—General Hardware Trades: *Slightly Better*—Board of Trade Returns for April: *Metals Specified*—Japanese Ambassadors in Birmingham.

Owing chiefly to the continued excellent demand for plates for girder and bridge building, both for home and also foreign use, there is tolerable activity still displayed at the leading works in South Staffordshire, and this week more animation is being displayed than has been observable for some time past. There are not so many inquiries about as there were a fortnight ago, but the orders that have flowed in through the usual channel are of considerable value. The plates for naval purposes in America have not yet been given out, but there is reason to conclude that when out a goodly proportion will be received in this district. Much satisfaction is expressed here at the announcement made in the House of Commons, on Thursday night, to the effect that in order to obtain the best iron that can be procured the Admiralty have it in contemplation to throw the privilege of tendering open to the trade generally. The satisfaction which is experienced is two-fold. First, it is an admission that, by the exclusive practice hitherto adopted, the best iron has not been obtained; and, next, it is felt that a market will now be open from which many have long been excluded. The fact is especially gratifying to ourselves, for it will be remembered that we have been long arguing that the country was not served by the practice which has long prevailed at the Admiralty, whilst the iron trade generally had a valid cause for grave complaint. The earlier that cause is removed the better for the trade and the country. That is so near even as next autumn we are in the interest of the nation generally and the ironmasters in particular heartily thankful.

Yesterday in Birmingham the agents of hematite houses were very firm in demanding the advanced rates of pigs of that description. Indeed some hesitated to accept orders at those rates until they should learn what was the position of the concerns which they represented in regard to stock. Following the course taken by these houses, and by the makers of cinder iron in South Staffordshire, the producers of first-class iron here have now advanced their prices half a crown a ton. For such samples £3 5s. was demanded yesterday. We have not, however, heard of sales at that figure; but probably it will be obtained at the end of the month.

Coal is unaltered.

In the general manufacturing trades of Birmingham and Wolverhampton and their districts there is slightly more being done this week, and there is decidedly less unemployed labour in the market.

While the Board of Trade returns for April show a considerable falling off, as compared with the corresponding period of last year, in the total value of the exports of British manufactures and products, they, at the same time, show that there is a continued improvement in consecutive months. The total declared value of the April exports was £9,822,888 against £10,905,213 in the corresponding month of last year, and £11,352,440 in that of 1860. But in February the total was only £8,320,059, and in March £9,664,649. In this better state of things hardwares and cutlery, certain classes of iron and copper, brass, and lead manufactures have shared very fairly. The returns for the month of April in the present and the two preceding years are as follows:

Month ended April 30th.

	1860.	1861.	1862.
Pig and puddled iron	£99,106	£123,291	£125,238
Bar, angle, bolt, and rod iron ..	235,860	203,570	218,137
Railway iron	339,734	362,865	226,892
Iron wire	20,857	20,805	24,193
Cast iron .. .. [plates	58,433	61,199	43,728
Iron hoops, sheets, and boiler	108,543	87,704	85,648
Wrought iron	193,862	203,893	170,811
Steel, unwrought	80,673	71,210	80,109
Copper, unwrought	97,490	30,519	60,657
„ wrought	215,240	147,504	192,623
Brass, all sorts..	14,653	7,849	15,695
Tin, unwrought	20,817	38,032	28,031
Tin plates	150,843	81,715	93,305
Zinc, all sorts	15,619	13,452	13,101

There was a great increase in the second description of iron to France, the Hanse Towns, Turkey, and the United States, and it may be noticed, as a sign of improved trade with America, that the shipments of all descriptions of iron to that country, except railway and pig and puddled iron, show a considerable increase upon those of the corresponding period of last year, notwithstanding the continued blockade of the southern ports. The great increase in the exports of iron and copper to France speak well for the operation of the commercial treaty, so far as the interests of metal manufactures are concerned. As regards copper, it is only the unwrought metal that France takes in large quantity; but the exports of iron to that country rose in value from £33,606 to £48,981 for pig and puddled iron; from £9,723 to £25,241 for bar, angle, bolt, and rod iron; and from £9,634 to £39,169 for railway iron. Sweden, Prussia, and Spain also increased their demand for railway iron—the falling off in the exports of which was due chiefly to the very great diminution which took place in the supplies required for India. Machinery also fell off, steam engines from £147,053 to £109,644, and other descriptions from £247,010 to £157,420. There was an increase, however, in the value of the steam engines exported to India, Australia, and Brazil, and of other kinds of machinery to Holland and the Hanse Towns. Hardwares and cutlery, as already stated, show a considerable improvement, the value of the April exports rising from £298,738 to £323,621 as compared with the corresponding period of last year. This increase took place chiefly in the exports to France and Spain. The silver and electro watch and jewellery trades were less brisk, the exports showing a decline in value from £39,976 to £38,836. The metallic imports, excepting those of steel and tin, show a decline.

Their Excellencies the Japanese Ambassadors "did" the lions of Birmingham on Thursday afternoon and Friday last. The places visited were Messrs. Chance's glassworks; the Bromford Forge the pin manufactory of Messrs. Edelsten and Williams; the gun manufactory of Mr. Clive; and the Proof House. The mayor entertained them at a banquet on Thursday night.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(*From our own Correspondent.*)

The West Hartlepool Harbour Company's Steamers—Sheffield Trade: *Still Depressed*—A Coal-Cutting Machine Worked by Compressed Air—Visit of Distinguished Foreigners to the Britannia Works, Bedford—Liverpool: *Mersey Docks and Harbour Board*—Bridge over the Trent at Keadby—Clyde Shipbuilding.

The fine screw steamers of the West Hartlepool Harbour and Railway Company have been purchased by Messrs. Pile, Spence, and Co., ship-builders, of West Hartlepool. It is intended to continue running the boats to Hamburgh, Rotterdam, and St. Petersburg, as heretofore, and although they have been run at a direct loss to the company ever since their purchase, it is expected that now they will be a source of revenue both to the speculators and the West Hartlepool Company.—Messrs. C. Mitchell and Co., of Low Walker, launched on Saturday afternoon a screw steamer named the Liguirid, for the Mediterranean trade. Her dimensions are:—Length over all, 196ft.; breadth of beam, 25ft.; depth of hold, 15ft. 6in. She is to be propelled by engines of 120-horse power nominal, constructed by Messrs. R. Stephenson and Co., on their patent principle. On Saturday, also, there was launched from the yard of Messrs. J. Wigham, Richardson, and Co., of Low Walker, a screw steamer, named the Star of Australia, intended for the trade between Sydney and the New Hunter River, New South Wales. The dimensions of the vessel are:—Length, 140ft.; beam, 21ft. 6in.; depth, 11ft. Her engines, manufactured by Messrs. R. and W. Hawthorn, are of 45-horse power, and she is fitted with a steam winch and other modern improvements.

Sheffield trade still continues depressed. With regard to the iron, machine, and tool trades of Leeds, the Local Chamber of Commerce observe in their monthly report:—"The demand for merchants' iron has decidedly improved, and the makers are full of orders, especially for better qualities. The general tone of the iron trade here may be considered good. The machine trade continues in a languid state, little new machinery being wanted in the generally depressed state of trade. The engineer tool makers keep their hands working full time, and the demand is about equal to the production. The locomotive makers are very busy, and have a good supply of orders on hand. The cut nail trade is very quiet, especially for export." Captain Palin, reporting with respect to the state of employment at Manchester, returns the position of the machinists and foundries as follows:—Machinists working full time with all hands, 10; working full time with a portion of their hands, 23; working short time, 13; stopped altogether, 1. Foundries:—Working full time with all hands, 7; working full time with a portion of their hands, 13; working short time, 4. The general movement of affairs at Manchester is unfortunately increasingly unfavourable.

A coal cutting machine, worked by a compressed air engine, is now in practicable operation on the premises of the West Ardsley Coal Company, at their pit on Tingley Moor, near Ardsley. The patentees are Messrs. Donisthorpe, Firth, and Rothery. The implement is applicable to all kinds of pits, whether of coal, ironstone, or fire clay. The engine-house contains a powerful engine, and the compressed air engine, the "pressed air" itself being conducted in patent bitumenised pipes to a distance of nearly a mile from the bottom of the driving shaft, the pressure being about 50 lb. to the inch. The friction is almost inappreciably small, the powerful agency being delivered to the cutter in its narrow working almost with the same motive force that it has at the pit head. The cutter itself is a neatly constructed machine, made to run on the tub-carriage way. It requires a man to direct it, and this "tenter" can, by working round his wheel, advance the pick or cutter over the face of the bed of coal, and thus, in the course of working, bring down the blocks of mineral as he requires them. It is well known that, owing to the fissures in coal seam and the looseness of the roof, streams of gas are plentifully given off in workings; and this gas is exceedingly troublesome and dangerous to the hewer. If this mischievous gas can be driven away, and the general ventilation of mines improved the ordinary operations of colliers will be carried on at a considerable advantage over the present condition of things, and it is one of the principles of "the compressed air coal-cutter" to accomplish this result. As the cutter is working away with considerable force at the coal a stream of pure atmosphere is discharged from the machine at every stroke, and this current of fresh and dry air by filling the "hole," cannot fail to add considerably to the ventilation.

On Saturday the Britannia Works, Bedford (Messrs. Howard's) were visited by some of the foreign Commissioners and jurors of the International Exhibition, the party being composed of Swedes, Danes, Prussians, Austrians, Italians, Spaniards, Portuguese, and French (we beg pardon of the *grande nation* for inadvertently placing its representatives last on the list). The party minutely inspected the machinery and operations carried on at the works, and were taken to see the new steam plough and steam cultivator at work on the farm of Mr. Bodger, of Cardington, &c. After dining with Mr. James Howard the visitors left for London by the last train.

At the last meeting of the Mersey Docks and Harbour Board various additional minor works were ordered to be carried out at Birkenhead. It was also determined to offer Messrs. Peto and Co. £8,000 in full discharge of their claims for damages alleged to have been sustained by them in the business of the Canada Works, Birkenhead, on the withdrawal of the water from the Great Float, and to grant them an extension of their lease, after its expiration, for a period equal to that during which water was excluded from the float. The Marine Committee submitted a report containing plans of the river as surveyed during the years 1860-61, with books of sections and reference and details of the changes which have taken place since 1819-1822, the date of Giles's survey

The completion of a new bridge across the Trent at Keadby seems to be a work of some difficulty. Cylinders have been sent nearly 30ft. below the bed of the river, but no solid foundation has yet been reached. A powerful engine is at work daily drawing up water and sand, and hopes are entertained that all obstacles will be soon overcome. Another item of news from a not very distant point from Keadby—Hull—is that a fresh effort is about to be made to put on a direct line of sailing vessels between that port and our English possessions. The speculators in the matter are the United Kingdom Shipowning Company (Limited); and Messrs. Samuelson and Co. of Hull have received orders to commence the construction of ten iron clippers, five of which will hail from the Humber, and five from the Thames.

In reference to Clyde shipbuilding we may note the launch from the building-yard of Messrs. T. Wingate and Co., Whiteinch, Partick, of an iron paddle steamer owned by Messrs. Brown, of Bangor. The vessel named the Heroine has been built for the passenger traffic between Belfast and Bangor in conjunction with the Hero, constructed by the same firm. On Saturday the saloon steamer Prince Consort, built for the Loch Lomond Steamboat Company by Messrs. Caird and Co., of Greenock, made her trial trip. The Prince Consort, which was built under the superintendence of Mr. Young, the Loch Lomond Steamboat Company's manager, is of the following dimensions:—Length over all, 157ft.; breadth over sponsoned deck, 33ft.; length of main saloon, 33ft.; breadth, 18ft.; height of ceiling, 7ft.; length of dining and smoking saloons, 28ft.; breadth, 17ft.; length of promenade deck, 120ft. by 18ft. The Prince Consort is propelled by a pair of diagonal engines of 70-horse power, and fitted with expansion valves. The boiler is 10ft. diameter, and the pressure is 40 lb. on the square inch. The speed of the vessel is 18 statue miles an hour.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£ s. d.	Dis. p. ct.
IRON, English Bar and Bolt:—			
in London	pr tn	5 15 0	3
in Wales	„	5 0 0	„
in Liverpool	„	5 10 0	„
Staffordshire Bars (Deliv. into boats at works)	„	7 0 0	1
Sheet, Sngl. (Nom. rates last qr. day for favourite brands.)	„	8 10 0	„
Dbl.	„	10 0 0	„
Hoop	„	8 0 0	„
Rod, round	„	7 0 0	„
Nail Rod, sq	„	7 5 0	„
SHIPPING IRON, Staffordsh. Bars (Delivered in Liverpool 10s. per ton less.)	„	7 0 0	2
Sheet, Single	„	8 15 0	„
Double	„	10 5 0	„
Hoop	„	8 5 0	„
Rod. Round	„	7 0 0	„
Nail Rod. Square	„	7 5 0	„
IRON, Rails, in Wales, cash	„	5 5 0	nett
„ 6 months	„	5 7 6	„
Old, to cut up	„	0 0 0	„
Railway Chairs, in Wales	„	4 0 0	„
„ in Clyde	„	3 15 0	„
Pig No. 1, in Clyde	„	2 13 0	„
3-5ths No. 1 & 2-5ths No. 3		2 13 6	„
No. 1, in Wales	„	3 10 0	„
No. 1, in Tyne and Tees	„	2 12 0	„
Ditto, Forge	„	9 0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	„	3 10 0	„
Welsh Forge Pig (all Mine), at the Port	„	3 5 0	„
Acadian Pig, Charcoal	„	7 10 0	„
Scotch Pig, No. 1, in London	„	0 0 0	„

		£ s. d.	Dis. p. ct.
IRON, Swedish, Indian assortments	pr tn	11 5 0	2
Russian C C N D to arrive	„	16 0 0	„
STEEL, Swedish Keg, ham.	„	15 10 0	2½
Ditto, rolled	„	15 0 0	„
Fagot		17 0 0	„
SPELTER, on the spot	„	18 0 0	nett
To arrive	„	18 0 0	„
Hard, remelted	„	17 0 0	„
ZINC, in sheets	„	24 0 0	„
COPPER, Tile, 14 to 28 lb.	„	94 0 0	3
Tough Cake	„	94 0 0	„
Sheathing and Bolts	pr lb.	0 0 10½	„
Sheet		0 0 10½	„
Bottoms		0 0 11	„
Old		0 0 8¾	„
Yellow Metal		0 0 8½	„
Burra	„	96 0 0	„
Russian do.	„	0 0 0	„
LEAD, British Pig	„	20 15 0	„
Spanish	„	19 15 0	„
W. B.	„	21 10 0	„
Sheet	„	21 0 0	„
TIN, English Block, nom.	„	114 0 0	„
Bar	„	115 0 0	„
Refined	„	119 0 0	„
Foreign Banca	„	122 0 0	„
Straits	„	115 0 0	„
TIN PLATES, Charcoal, IC	pr bx	1 9 0	„
Ditto IX	„	1 15 0	„
Coke, IC	„	1 3 6	„
Ditto IX	„	1 8 6	„
Do. at Newport, 1s. pr bx less		—	„
Do. at L'pool, 6d.	„	—	„
CANADA, Plates	pr tn	12 0 0	
QUICKSILVER	pr bt		

Rails firmer.

Scotch Pig Iron has been very inactive during the past week, and prices remain about the same as last reported, viz., 53s. 3d. cash, f.o.b. in Glasgow, at which the market closes very flat.

Spelter dull of sale at £18 on the spot, which is about the nearest quotation. The stock is large, viz., 5,810 tons, against 4,878 tons same period last year.

Copper.—The demand has not improved to any great extent since the reduction on the 29th ult.

Lead in fair demand.

Tin.—English in moderate request. In foreign, Banca has not been quite so firm, and may be had for £122. Straits are selling at £115.

Tin Plates have been very quiet.

June 5th, 1862. Moate and Co., 65, Old Broad-street, London.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Teak	15 10	17 0	15 0	16 0
Quebec, red pine	3 10	4 10	3 5	4 0
yellow pine	3 0	4 0	3 0	3 15
St. John, N.B., yel.	5 0	5 10	5 0	5 10
Quebec, oak, white	5 0	5 10	5 0	5 10
birch	3 10	4 0	4 0	0 0
Memel	0 0	0 0	0 0	0 0
elm	3 10	4 15	3 10	4 15
Dantzic, oak	3 10	6 0	3 10	6 0
fir	2 15	3 10	3 0	4 0
Memel, fir	3 10	4 0	3 10	4 0
Riga	3 5	3 10	3 10	3 15
Swedish	2 15	3 0	2 15	3 0
Masts, Queb. rd pine	5 0	6 0	5 0	6 0
yl. pine	5 0	6 0	5 0	6 0
rd pine	0 0	0 0	0 0	0 0
Lathwood, Dantz, fm	6 0	6 10	6 0	7 0
St. Peters.	8 0	8 10	9 0	9 10
Deals, per C., 12 ft. by 3 by 9 in.				
Quebec, wht spruce	13 0	18 0	15 0	19 0
St. John, wht. spruce	13 0	16 0	15 0	17 10

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Yel. pine, per reduced C.				
Canada, 1st quality	17 0	18 10	17 10	19 0
2nd do	12 0	12 10	12 0	13 0
Archangel, yellow	13 0	13 10	14 0	15 0
St. Petersbg. yel.	12 0	12 10	12 10	13 10
Finland	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	15 0
Gothenburg, yel.	10 0	11 10	10 0	12 10
white	9 10	10 0	9 10	11 0
Gefle, yellow	10 0	11 0	11 0	12 10
Soderhamn	10 0	10 10	11 0	12 10
Christiania, per C 12 ft. by 3 by 9 in. yellow	22 0	25 0	23 0	24 0
Deck plank, Dntz per 40 ft. 3 in.	0 14	1 4	0 14	1 4
Staves, per standard M				
Quebec, pipe	70 0	75 0	80 0	85 0
puncheon	16 0	18 0	16 0	18 0
Baltic, crown pipe	160 0	170 0	170 0	180 0

The Worcester Porcelain Works.—We understand that this important sale at Worcester closes on the 24th inst. Specimens have likewise been deposited at Messrs. Kerr's Show Rooms, in Cannon-street, City, for the greater convenience of purchasers now in town. Connoisseurs should endeavour to prevent as much as is possible the higher class of these choice works of art, which are well known to equal if not to surpass the *chef d'œuvres* of Sevres and Dresden, from going abroad. Indeed, the more refined and ornate of these Ceremic works must necessarily become scarcer and of greater value every day, as the expensive nature of their reproduction precludes the slightest hope of a re-issue. The purchasers of useful articles of Worcester make should be equally on the alert.—*Globe.*

LOCOMOTIVE ENGINES IN THE INTERNATIONAL EXHIBITION.

BUILDERS.	Purpose.	Position of cylinders.	Number of wheels.	Number of coupled wheels.	Weight in working trim.	Weight on driving or coupled wheels.	Diameter of cylinders.	Length of stroke.	Diameter of driving wheel.	Diameter of boiler.	Number of tubes.	Outside diameter of tubes.	Length of tubes.	External tube surface.	Fire box surface.	Area of grate.	Length of wheel base.
					tons cwt	tons cwt	in.	in.	ft. in.	ft. in.		in.	ft. in.	sq. ft.	sq. ft.	sq. ft.	ft. in.
London and North Western Railway Co., J. E. M'Connell (late Loco. Supt.)	Express	Inside	Six	—	32 0	—	18	24	7 8	—	—	—	—	—	—	—	—
Do. do. Crewe Works, J. Ramsbottom, Loco. Supt.	Express	Outside	Six	—	27 0	11 10	16	24	7 6	—	—	—	—	915*	83	14¼	—
Neilson and Co., Glasgow, designed by Benj. Conner for Caledonian Railway	Express	Outside	Six	—	30 13	14 11	17½	24	8 2	3 10	192	1¾	11 6	1,004	96	—	15 8
Beyer, Peacock, and Co., Manchester, for South Eastern Portuguese Railway	Express	Inside	Six	—	—	—	16	22	7 0	4 2	216	2	11 0	1,236	96	18	—
R. Stephenson, and Co., Newcastle, designed by R. Sinclair for Eastern Counties Railway	Goods	Outside	Six	Four	30 6	29 15	17	24	6 0	—	—	—	—	968½	72½	—	15 1
Sharp, Stewart, and Co., Manchester, for London, Chatham, and Dover Railway	Goods	Inside	Six	Six	32 0	32 0	17	24	5 0	—	—	—	—	—	—	—	15 6
Sir William G. Armstrong and Co., Newcastle, for East Indian Railway	Pas. & Goods	Outside	Six	Four	—	—	16	22	5 6	4 1½	161	2¼	11 0	1,043	102	—	15 4
William Fairbairn and Sons, Manchester, designed by M. Kirtley for Midland Railway	Goods	Inside	Six	Six	—	—	16	24	5 2	4 3	180	2	11 9	1160		—	—
Manning, Wardle, and Co., Leeds	Light Tank	Outside	Four	Four	10 5	10 5	9	14	2 9	—	—	—	—	—	—	—	—
George England and Co., New Cross	Light Tank	Outside	Six	Four	—	—	—	—	—	—	—	—	—	—	—	—	—
Neath Abbey Company, Neath Abbey, South Wales	Light Tank	Outside	Four	Four	—	—	—	—	—	—	—	—	—	—	—	—	—
Paris and Orleans Railway Co., Ateliers à Ivry	Express	Outside	Six	—	—	—	—	—	—	—	—	—	—	—	—	—	—
J. F. Cail and Co., Paris, for Paris and Orleans Railway Company	Goods	Outside	Six	Six	—	—	—	—	—	—	—	—	—	—	—	—	—
Ernest Gouin and Co., Paris, for Northern Railway of France	Goods Tank	Outside	Eight	Eight	—	—	—	—	—	—	—	—	—	—	—	—	—
La Société Couillet (Belgium)	Goods	Inside	Six	Six	—	—	18	24	5 0	—	—	—	—	—	—	—	—
A. Borsig, Berlin	Passenger	Outside	Six	Four	—	—	—	—	—	—	—	—	—	—	—	—	—
Richard Hartmann, Chemnitz, Saxony	Passenger	Outside	Six	Four	28 0	20 16	15	22	4 6	—	—	—	—	790	70	11½	—
Austrian State Railway Co., John Haswell, Engineer, Vienna	Passenger	Outside	Six	—	32 0	—	Four cylrs each 11in	24½	6 8½	—	160	2	14 6½	1,261	84	15	—
Do. do. do. do.	Goods Tank	Outside	Ten	Ten	42 0	42 0	18	24½	3 6	—	—	—	—	—	—	—	—
Locomotive Factory at Pietrarsa, Italy	Goods	Inside	Six	Six	—	—	—	—	—	—	—	—	—	—	—	—	—

* Internal surface.

IT is a difficult matter to raise any point of interest in the discussion of locomotives, at least if interest depends upon novelty of subject and freshness of illustration. There are those—many as we believe—to whom the locomotive, as it is, wears perennial attractions, and who do not care to speculate widely upon its further development. We will not deny that our own admiration of that noble creation of genius and skill amounts to a sentiment; and that the locomotive is typical of greatness and identified with the highest pitch of commercial and political power is testified by its introduction, in the rich sculpture of Jean Goujon, among the figures and emblems which adorn the pediments of the New Louvre.

Professionally, however, our present locomotive practice, although relieved by some variety, has been, on the whole, generally conformed to a common standard. That this is the only one sanctioned by successful experience we deny, but it has answered a good purpose and is not likely to be hastily abandoned. Such differences, too, of structure, as English engines now present have existed for many years, and the arguments for and against outside cylinders, coupled driving wheels, coal burning boilers, counterweighting, feed water heating apparatus, &c. &c., have been well nigh exhausted. This circumstance, however, does not preclude all interest in the comparison of the various locomotives in the Exhibition, those from the Continent, at least, being sufficiently novel to satisfy the most revolutionary amateur (for successful practitioners are seldom remarkable for their love of dashing originality).

Let us first look at the boilers, several of which have coal burning fireboxes. That of Mr. M'Connell's engine (we had almost said the late Mr. M'Connell), has a combustion chamber extending several feet into the barrel, and a longitudinal mid-feather completely dividing the firebox and reaching nearly to the tube-plate. There are two fire-grates, two doors—practically, indeed, two fireboxes. The plan hardly needs criticism now, for its evils are so well understood that there can be very little danger of its being further reproduced. Messrs. Woods and Marshall's experiments proved that the evaporative power of each pound of good coal burnt in this firebox was but little more than 5 lb. of water; any resident in the neighbourhood of Mornington-road or Adelaide-road has the opportunity, every hour in the day, of witnessing its smoke-emitting capabilities, and the boiler makers at the Wolverton shops know well the weeping habits of the mid-feathers, ever lachrymose with percolations of which caulking cannot check nor patches dam the flow. A coal burning firebox should be so constructed, or so fitted with special apparatus, that the gas rising from the fresh coal may be thoroughly mixed with the right quantity of air, and ignited before it reaches the tubes. In the M'Connell firebox the gas and air flow in the same direction and unobstructed to the mouths of the tubes, and although the two fires are fed alternately, the communication between the two halves of the combustion chamber is so restricted that an ignitable mixture on one could hardly receive the effect of an igniting temperature in the other.

Mr. Cudworth's firebox, adopted in Messrs. Sharp, Stewart, and Co.'s engine, has a long and steeply inclined grate, and a longitudinal mid-feather. The combustion chamber formerly used by Mr. Cudworth has been discontinued. The principle of this firebox is that of gradually distilling the gas at the upper end of the grate, instead of abruptly expelling it from fresh coal thrown upon a mass of incandescent fuel. The great extent of air opening, also, afforded by the long grate admits of the right quantity of air for the combustion of the gas. The two halves or sides of the firebox are fed alternately, through separate doors, opening one on each side of the mid-feather. The ash pan can be entirely closed against the admission of air, which is regulated by a damper in front and also by two doors opening just below the fire doors and under the grate at its highest point. At the lower end of the grate, which, we are told, is 7ft. 8in. long, is a chilled plate, 18in. wide, which may be tipped as a trap door, so as to clear the firebox of any accumulation of clinker. There is provided the usual small jet of high pressure steam, or "blower," to keep down smoke when standing. The whole plan has been extensively used on the South-Eastern Railway, where it has given results with which the directors appear to be satisfied. It by no means effectually prevents smoke, it is costly and heavy in new engines, and the cost of converting ordinary fireboxes to this plan is necessarily great. We occasionally see the advertisements of the South-Eastern Company for Welsh coal, and supposing this to be the kind burnt in the locomotives in question, they should be expected to run without smoking excessively.

The express locomotive from the workshops (at Ivry, near Paris) of the Paris and Orleans Railway Company has, also, a long inclined fire-grate, but instead of a longitudinal mid-feather, as in the Cudworth firebox, it has one partly dividing the firebox into an upper and a lower portion. Thus the mid-feather, or water table, extends, from just below the tubes, backward and upward towards the upper rear angle of the firebox, and the under surface of this mid-feather deflects the rising gases into mixture with the air entering at the door. There are two or three vertical tubes connecting the highest points of the mid-feather with the water over the crown-plate. The plan may be effectual in preventing smoke, but it is objectionable on account of the liability of a nearly horizontal water table to burn out, or, at least, to leak. A slab or arch of fire clay ought, we should say, to accomplish the purpose with less trouble from leaking. The Paris and Orleans engine, it should be said, is indebted for its "*foyer fumivore*" to a M. Tenbrinck. It belongs to the class constructed since the death of the lamented Polonceau, the engineer of the line, M. Forquenot having since assumed the charge of the locomotive department.

For simplicity we like the plan adopted by Mr. Ramsbottom, in the construction of the firebox of his engine, the Lady of the Lake. Two square openings, which may be opened or closed by dampers, are made through the water space of the firebox just below the mouths of the tubes. The air taken in is deflected backward and upward, into mixture with the gas rising from the coal by an arched mass of firebrick partly dividing the upper and lower portions of the firebox. In every other respect the firebox is of the common construction where coke is burnt. This simple plan is used with good results in most of Mr. Ramsbottom's engines on the northern division of the London and North-Western Railway, and now that Mr. M'Connell has retired, and Mr. Ramsbottom taken the post of locomotive superintendent to the whole line, the firebrick arch will doubtless be generally introduced among the 975 locomotives with which the first railway in the world is now stocked.

Mr. Sinclair's coal burning goods engine, from the Eastern Counties Railway, has, we believe, a firebox of the ordinary construction. Mr. Frodsham's plan, generally adopted on the Eastern Counties line, consists merely in an air-deflecting door, and in the use of a steam pipe within the fire-box discharging jets of steam in such a manner as to mix together the gas and air for ignition. As this plan is one the value of which can be tested, at any moment, by shutting off the jets of steam, we do not suppose Mr. Sinclair would have adopted it so extensively as he has done unless there were virtue in it.

We must own that we have not looked into the firebox of the fine express engine designed by Mr. Conner, of the Caledonian Railway, and built by Messrs. Neilson and Co., of Glasgow. But the plan generally adopted by Mr. Conner is that of the firebrick arch, as used by Mr. Ramsbottom, only Mr. Conner does not, we believe, admit air through holes made through the water space, below the tubes, the admission being through the door which is provided with a deflecting plate.

The heavy Belgian goods engine, La Belgique, sent by La Société Couillet, has a long coal-burning firebox, the fire-grate being made up of thin wrought iron bars, with distance pieces rivetted between them.

The most extraordinary locomotive boiler in the annexe is that, two storeys high, of the engine made by E. Gorim and Co., of Paris, for the Northern Railway of France. This is a great tank engine with eight wheels, all coupled, or rather octupled, together. The boiler tubes discharge into a smoke-box, from which a separate set of tubes or else a single large flue (for we have not had a look inside) returns, within a large chamber above the boiler, the chimney being placed almost over the head of the engine man on the foot plate behind. We have not obtained the dimensions of this engine, but the cylinders look to be not far from 18in. in diameter and 24in. stroke, and the whole weight ready for work is probably 45 tons. The valve gear is wholly outside of the coupling rods. Upon the wall behind the engine are coloured drawings of wonderful engines with similar boilers. One appears to be designed for passenger trains, as it has a pair of large wheels at each end, with six small intermediate carrying wheels. Each pair of large or driving wheels has its pair of outside cylinders, there being four of these in all, or two at each end. Another drawing represents an engine with twelve wheels of equal diameter, six being driven by a pair of outside cylinders at one end, the others being similarly driven from the other end. We do not perceive that the separate sets of wheels are made to accommodate themselves to curves independently of each other

To return to the subject of boilers, that of Messrs. Fairbairn and Sons has thick-edged plates, and is double rivetted, as some of the others may be also. The Italian goods engine has a boiler oval in section, which is not commendable. We may even say the same of the proportions of the whole engine. A considerable number of the English made locomotives have boilers flush from end to end, or without a raised firebox crown. Nearly all the British engines have large steam domes, more commonly placed over the barrel of the boiler at about the middle of its length, although Mr. Sinclair's engine (built by Messrs. Robert Stephenson and Co.), and Messrs. Neilson's engines have their domes over the firebox. Messrs. Beyer, Peacock, and Co.'s engine, however, and that by Messrs. Manning, Wardle, and Co. have no domes. Such of the engines of the first-named firm as have been made without domes carry their steam, we hear, "as dry as a bone." It is to be remembered, however, that the boiler of Messrs. Beyer, Peacock, and Co.'s engine in the Exhibition is of great size for a 16-in. cylinder, being 4ft. 2in. in diameter, and containing 1,332 square feet of heating surface. The draught of steam from a boiler of such great evaporative power would be so slow, comparatively, that it might work dry steam where a smaller boiler would be constantly working water over into the cylinders. Some of the Continental engines have very large domes, that of the Paris and Orleans express engine being of enormous size and over the firebox. The large opening cut for it through the outer crown plate must greatly diminish the strength of the boiler, and if M. Forquenot would close this opening altogether and remove the dome, or, rather, make a smaller one 7ft. or 8ft. further forward, he would, we do not doubt, discover an advantage in the result. There is no engine in the annexe with two domes, delivering steam from each, an arrangement in great favour in the United States. There is, we believe, no superheating apparatus on any locomotive in the Exhibition, unless we except Gouin's, and no feed water heating apparatus unless Giffard's Injector be reckoned such.

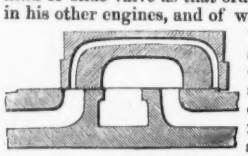
With respect to general arrangement; out of twenty locomotives, but four of English and two of foreign make have inside cylinders. Most of the outside cylinder engines have only inside or single frames, although Messrs. Neilson and Co.'s engine has outside journals on the leading and trailing axles, and the two Austrian locomotives, both having outside cylinders, have outside frames only, cranks being keyed on for driving the wheels. At the same time the inside cylinder express engine from Wolverton and the Italian goods engine have only inside framing, and Messrs. Beyer, Peacock, and Co.'s engine has only inside journals for the crank axle, an outside frame furnishing bearings for the leading and trailing axles. Sharp's and Fairbairn's six wheel inside cylinder goods engines have outside and inside frames, the crank axles having four, and the leading and trailing axles two journals. The inside cylinder goods engine by La Société Couillet has outside framing, while a stout bar extends from the firebox to the smoke-box, furnishing a middle bearing for the crank axle.

We may note that the outside cylinder express engine from the Paris and Orleans Railway has adjustable wedges on one side of the driving axle journals, and between the axle guard and axle box, to take up the wear between them. Wedges are thus used also in all American locomotives. Of the engines with four coupled wheels Mr. Sinclair's, Borsig's, and Hartmann's have equalising or compensating levers between the axles. Sir William Armstrong's has none, nor are compensating levers employed on any of the six wheel coupled engines, although they are introduced, with advantage we do not doubt, between the tender wheels of the engine from Wolverton. Upon the rough and weak permanent way of American lines, compensating levers are reckoned indispensable, and it has been found necessary to apply them to engines sent out from this country to the Canadian railways. They afford a degree of flexibility of which our overloaded permanent way already stands in need. It is becoming common to place from 14 to 15 tons on a single pair of wheels, Messrs. Neilson's engine, in the Exhibition, having 14 tons 11 cwt. on the driving wheels when loaded. It is undoubtedly the fact that compensating levers, applied as they have been in Hawthorn's engines, between the single driving and smaller leading or trailing wheels, tend to increase slipping, but when applied between coupled wheels there is no increased tendency to slip.

We believe our builders will yet discover the advantages of the truck or bogie, already used to some extent on the Great Western, Bristol and Exeter, North London, Great North of Scotland, and a few other lines. Hartmann's

engine in the Exhibition has it in one of its best forms, that devised by Levi Bissell, an American, only that, instead of inclined surfaces on which the front end of the engine should rise when the truck swivels on entering a curve, we find that the bearing surfaces on which the weight is taken by the truck are perfectly flat. It is only with the help of compensating levers and swivelling bogies that American locomotives having a wheel base of from 20ft. to 23ft. run safely around curves, where, Captain Galton states in his report on American railways, our ordinary passenger carriages at the same speed would undoubtedly leave the line. On the Canadian railways Mr. M'Kenzie and Mr. Trevithick of the Grand Trunk, and the late Mr. Brade and the present Mr. Eaton of the Great Western have adopted the bogie, not only in the engines purchased in the States, but also in English engines originally fitted with the ordinary leading wheels. The case with which the bogie adapts itself to curves is not, however, its only recommendation. It is well known to be an objection to outside cylinder engines, as commonly built, that either a very small leading wheel must be adopted, or it must be set so far back as to take too much weight, or else the cylinders must, for driving wheels of ordinary diameter, be more or less inclined. Unless the cylinders are horizontal we cannot expect the outside cylinder engine to gain great favour among engineers. Now with the bogie, the leading wheels may be placed wholly out of the way of the cylinders, and even a larger share than usual of the whole weight of the engine kept upon the driving wheels, and thus it is that, in American engines, the outside cylinders are placed horizontally, while three-tenths of the whole weight are on the driving wheels and three tenths more on the trailing wheels with which they are coupled, three-fifths of the whole weight being thus obtained for adhesion. The driving wheels, it should be said, are not placed so far forward as in English engines, and thus although about the same weight is carried upon them, a longer connecting rod is obtained. With the four-wheel bogie, each pair of its wheels bears but one-fifth of the whole weight of the engine. The two-wheel bogie, on Bissell's plan, would probably be preferable on English lines, and let us hope that, before 1872, we may see it generally adopted.

We have referred, on a former occasion, to the plan of Mr. Haswell's four-cylinder express engine from Vienna. It is the first engine of the kind that Mr. Haswell has made, and many will say that it ought to be the last. Apart from the duplex cylinders, there is little that is noteworthy about the engine, except, perhaps, its great extent of heating surface. We are not sure whether it has the same kind of slide valve as that ordinarily used by Mr. Haswell in his other engines, and of which we give a section herewith. This valve is the simplest for obtaining a double admission of steam to a single port, and it has been often re-invented. An American exhibits it in the annexe as the invention of a Mr. Allen, of New York, and it is claimed by others.



Mr. Haswell's goods tank engine is one of the most extraordinary combinations of iron in the building, and it affords a rare opportunity to the student of mechanical motions. It is the first of a class built for working the mineral traffic on the lines in the Banat, near the Danube, and does not, as most of the visitors appear to suppose, in any way pertain to the passage of the Semmerring, which occurs on the South Austrian and not on the Austrian State Railway. This engine, named the Steyerdorf, has ten wheels of equal diameter, six of which are under the boiler, while the other four are combined in a bogie under the tank behind. All the wheels (which are of cast iron, of the double-disc form, and hooped with wrought iron tyres) are connected on each side by coupling rods, and the problem in construction was to reconcile this coupling with the varying positions of the front and rear groups of axles, according to the straight or curved direction of the line passed over. This was accomplished by H. Kirchweger, of Hanover, in the following manner :—The hind axle of the front group of three axles, and the front axle of the bogie, are connected together, on each side of the engine, by a pair of jointed bars of unequal length, the position of these bars, in side elevation, corresponding nearly to the short perpendicular and long hypothenuse of a triangle, whose hypothenuse makes an angle of about 30 deg. with the horizontal. As these bars move freely around their connecting joint, like a carpenter's rule, and as freely around their bearings on the axles which they connect together, it is plain that, so far, they do not interfere with the adjustment of the front and back groups of axles to the direction of the line passed over. Now, through the upper centres or joints of the two series or pairs of these bars, on opposite sides of the engine, a shaft is carried across under the boiler, and when all the wheels are on a straight line this shaft will necessarily be parallel with the axles, all of which are then parallel with each other. To the opposite ends of this shaft are keyed cranks, corresponding to those keyed on the outer ends of the axles, all of which have outside bearings. The front group of three axles being connected together by the ordinary coupling rods, the hindmost crank in the group is coupled, by an inclined coupling rod, to the crank on the cross shaft already described, and this crank is also coupled, by a short and vertical coupling rod, to the crank on the end of the front axle of the bogie. With a little consideration it will now be seen that the front group of three axles and the pair of axles in the bogie will always work properly together, whether the engine is running on a straight or curved line. It is to be understood that spherical bearings are employed wherever they are required in the arrangement described.

We are unable to give the exact wheel base of the Steyerdorf, but it is not far from 18ft., and the engine now stands on a curve of 300ft., or 4½ chains radius.

In concluding our notice of the Austrian engines we may notice that Mr. Haswell has discontinued the use of his 12-inch safety valves, held down without levers by powerful volute springs.

The link motion is adopted, without exception we believe, in every locomotive in the building. Messrs. Beyer, Peacock, and Co.'s engine has the straight link, patented by Mr. Alexander Allan, of Perth, August 2nd, 1855, and illustrated in The Engineer of October 18th, 1861 (page 233, vol. xii.). This link has many advantages, and only the disadvantage of one or two extra joints. Some engineers have found it difficult to obtain equal lead with the straight link, but this is wholly dependent upon the adjustment of the parts. In the engine under notice we perceive that the short arms on the reversing shaft are not placed diametrically opposite one another, but at an angle of perhaps 140 deg. or 150 deg. from each other. This modification, we presume, assists in equalising the lead on both strokes. The straight link is easily fitted up and easily repaired. It requires hardly more room for vertical motion than the stationary (Gooch's) link, and as the valve rod and eccentric rods balance each other, no counterweight is required. The requisite motion for reversing is so little, also, that the engine-driver has a powerful purchase on the reversing lever. We should say that the straight link was likely to come into general use among locomotive makers. But until the common link is superseded there is no need of employing a clumsy weight as a counterpoise, inasmuch as a spring would answer every way better. There are many ways of applying either a flat coiled or a volute spring, or even an ordinary plate spring to counteract the weight of the eccentric rods and link. We do not know but the coiled wire spring (in a brass case, looking like a very large Salter's balance laid horizontally), as employed for the same purpose in the Italian engine, the Garigliano, answers equally well. At any rate we prefer it to the heavy counterweight swaying about under the engine, and straining the whole reversing gear.

Flat connecting rods have generally taken the place of the old clumsy turned bars, and in the Belgian engine and the express locomotive from the Paris and Orleans Railway, the connecting rods are channelled on both sides, giving them a section much like the character I.

We noticed, last week, the stamped wrought iron wheels generally used under the foreign locomotives, and now made in this country, under M. Arbel's patent, by Mr. Owen, of Rotherham. These wheels and steel tyres are great improvements upon the forged wheels and wrought iron tyres so long used. The visitor may see, under Cail's goods engine, Arbel's wheels with the counterweights stamped in whole. In Messrs. Neilson and Co.'s engine, with its great wheels (8ft. 2in. in diameter) a neat job is made by forging in the counterweights solid with the rim, but the stamping process is preferable to the forging. The Arbel wheels, although laid up, before stamping, in a multitude of parts, are said to be absolutely solid throughout when they leave the great hammer, and thus, too, provided it be cooled uniformly, the wheel is not left under strain in any part, as is the case after making the last weld in the ordinary forging. How far this strain diminishes the strength of the wheel we do not exactly know, but it is a fact that on the Canadian railways wrought iron forged wheels are found to be but little if any stronger, or better calculated to withstand service in severe winters than wheels properly cast in iron.

We shall now say a few words upon a minor detail, or, with more correctness, an appendage, of the locomotive. The sand box has come to be regarded as an important if not indispensable adjunct, and yet we know of but one line in the kingdom (the North London) where it is made and worked as it should be. Generally there are two small boxes, one on either side of the engine, in which a small stock of damp sand is carried. When the driving wheels begin to slip the fireman sometimes goes forward, opens the lid of one box, and with his hand scoops up some of the sand and pours it, as well as he can, into the open mouth of a sand-pipe rising within the box. Now, to say nothing of the risk which the fireman runs of slipping off the engine, nor of the very partial and unsatisfactory "sanding" thus effected, the sudden application of sand to a single wheel of a pair slipping rapidly on the rails, throws a great strain on the axle, and, with inside cylinder engines, is more or less likely to break the crank. There are in the Exhibition, it is true, a few engines, including the London and North-Western engine from Wolverton, Messrs. Manning, Wardle, and Co.'s tank engine, &c., which have sand valves in their sand boxes, worked by handles from the foot-plate. But the Belgian engine, made by La Société Couillet, is the only one shown which has a proper sand box—a single cylindrical box mounted on the boiler, and in which box the sand is properly dried by the heat beneath it, and afterwards discharged, by working a single rod on the foot-plate, simultaneously through two sand pipes, and to both wheels of the pair beneath which the sand is directed. This plan has every advantage over the miserable mode generally practised for the same purpose on most English lines.

ROYAL INSTITUTION OF GREAT BRITAIN.

Friday, May 9, 1862.

The Duke of Northumberland, K.G., F.R.S., President, in the Chair.

ON THE PROPERTIES OF IRON, AND ITS RESISTANCE TO PROJECTILES AT HIGH VELOCITIES.

By William Fairbairn, Esq., F.R.S.

We have no correct record as to the exact time when wrought-iron plates were first employed for the purpose of building vessels. It is, however, certain that iron barges were in use on canals at the close of the last century. In 1824 Mr. Manby, of Staffordshire, built an iron steamboat for the navigation of the river Seine, and this was the first iron vessel that attempted a sea voyage. She was navigated from this country to Havre by the late Admiral Sir Charles Napier, and although constructed for shallow rivers, she nevertheless crossed the Channel in perfect safety. From that time to 1830 no attempt was made to build iron vessels, and nothing was done towards ascertaining the properties of iron as a material for shipbuilding.

A series of experiments instituted by the Forth and Clyde Canal Company in 1829-30, to ascertain the law of traction of light boats at high velocities on canals, led to the application of iron for the construction of vessels, and the lightness of these new vessels, combined with their increased strength, suggested the extended application of the material in the construction of vessels of much larger dimensions, and ultimately to those of the largest class both in the war and the mercantile navy. Considerable difficulty, however, existed with regard to the navy; and, although the principle of iron construction as applied to merchant vessels and packets was fully established, it was nevertheless considered inapplicable, until of late years, for ships of war. It is true that until the new system of casing the sides of vessels, first introduced by the Emperor of the French in 1854, was established, the iron ship was even more dangerous under fire than one built entirely of wood. Now, however, that thick iron plates are found sufficiently strong, under ordinary circumstances, to resist the action of guns, not exceeding 120-pounders, for a considerable length of time, the state of the navy and the minds of our naval officers have entirely changed. We must, therefore, now look to new conditions, new materials, and an entirely new construction, if we are to retain our superiority as mistress of the seas. There yet remain among us those who contend for the wooden walls, but they are no longer applicable to the wants of the State; and I am clearly of opinion that we cannot afford to trifle with so important a branch of the public service as to fall behind any nation, however powerful and efficient they may be in naval construction. Having satisfied ourselves that this desideratum must be attained, at whatever cost, I shall now endeavour to point out such facts as in my opinion relate to the changes that are now before us, and simply endeavour to show—

1st. The description of iron best calculated to secure strength and durability in the construction of ships of war.

2nd. The distribution and best forms of construction to attain this object; and,

Lastly. The properties of iron best calculated to resist the penetration of shot at high velocities.

Properties of Iron.—If we are desirous to attain perfection in mechanical, architectural, or shipbuilding construction, it is essential that the engineer or architect should make himself thoroughly acquainted with the properties of the materials which he employs. It is unimportant whether the construction be a house, a ship, or a bridge. We must possess correct ideas of the strength, proportion, and combination of the parts before we can arrive at satisfactory results, and to effect these objects the naval architect should be conversant with the following facts relating to the resisting powers of malleable and rolled iron to a tensile strain.

The resistance in tons per square inch of—

Yorkshire iron is	24·50 tons.
Derbyshire ,, ...	20·25 ,,
Shropshire ,, ...	22·50 ,,
Staffordshire ,, ...	20·00 ,,

Strength of Rivetted Joints.—The architect having fortified himself with the above facts will be better able to carry out a judicious distribution of the frames, ribs, and plates of an iron ship, so as to meet the various strains to which it may be subjected, and ultimately to arrive at a distribution where the whole in combination presents uniformity of resistance to repeated strains, and the various changes it has to encounter in actual service.

There is, however, another circumstance of deep importance to the naval architect, which should on no account be lost sight of, and that is the comparative values of the rivetted joints of plates to the plates themselves. These, according to experiment, give the following results:—

Taking the cohesive strength of the plate at	100
The strength of the double-rivetted joint was found to be	70
And the single-rivetted joint	56

These proportions apply with great force to vessels requiring close rivetting, such as ships and boilers that must be water-tight, and in calculation it is necessary to make allowances in that ratio.

Strength of Ships.—Of late years it has been found convenient to increase the length of steamers and sailing vessels to as much as eight or nine times their breadth of beam, and this for two reasons; first, to obtain an increase of speed by giving fine sharp lines to the bow and stern; and, second, to secure an increase of capacity for the same midship section, by which the carrying powers of the ship are greatly augmented. Now there is no serious objection to this increase of length, which may or may not have reached the maximum. But, unfortunately, it has hitherto been accomplished at a great sacrifice to the strength of the ship. Vessels floating on water and subjected to the swell of a rolling sea—to say nothing of their being stranded or beaten upon the rocks or sand banks of a lee shore—are governed by the same laws of transverse strain as simple hollow beams, like the tubes of the Conway and Britannia tubular bridges. Assuming this to be true—and indeed it scarcely requires demonstration—it follows that we cannot lengthen a ship with impunity without adding to her depth or to the sectional area of the plates in the middle along the line of the upper deck.

If we take a vessel of the ordinary construction, or what some years ago was considered the best—300ft. long, 41ft. 6in. beam, and 26ft. 6in. deep—we shall be able to show how inadequately she is designed to resist the strains to which she would be subjected. To arrive at these facts we shall approximate nearly to the truth by treating it as a simple beam; and this is actually the case, to some extent, when a vessel is supported at each end by two waves, or when rising on the crest of another, supported at the centre with the stem and stern partially suspended. Now in these positions the ship undergoes, alternately, a strain of compression and of tension along the whole section of the deck, corresponding with equal strains of tension and compression along the section of the keel, the strains being reversed according as the vessel is supported at the ends or the centre. These are, in fact, the alternate strains to which every long vessel is exposed, particularly in seas where the distance between the crests of the waves does not exceed the length of the ship.

It is true that a vessel may continue for a number of voyages to resist the continuous strains to which she is subjected whilst resting on water. But supposing in stress of weather, or from some other cause, she is driven on rocks, with her bow and stern suspended, the probability is that she would break in two, separating from the insufficiency of the deck on the one hand, and the weakness of the hull on the other. This is the great source of weakness in wrought iron vessels of this construction, as well as of wooden ones, when placed in similar trying circumstances.*

Changes in Progress.—Having directed attention to the strength of ships, and the necessity for their improved construction, we may now advert to the changes by which we are surrounded and to the revolution now pending over the destinies of the navy, and the deadly weapons now forging for its destruction. It is not for us alone, but for all other maritime nations, that these Cyclopean monsters are now issuing from the furnaces of Vulcan; and it behoves all those exposed to such merciless enemies to be upon their guard, and to have their Warriors, Merrimacs, and Monitors, ever ready, clothed in mail from stem to stern to encounter such formidable foes. It has been seen, and every experiment exemplifies the same fact, that the iron ship with its coat of armour is a totally different construction to that of the wooden walls which for centuries have been the pride and glory of the country. Three deckers, like the Victory and the Ville de Paris of the last century, would not exist an hour against the sea-monsters now coming into use.

The days of our wooden walls are therefore gone; and instead of the gallant bearing of a 100-gun ship, with every inch of canvas set, dashing the spray from her bows and careering merrily over the ocean, we shall find in its place a black demon, some 500ft. or 600ft. long, stealing along with a black funnel and flag-staff on her mission of destruction and scarcely seen above water, excepting only to show a row of teeth on each side, as formidable as the immense iron carcass that is floating below. This may, with our presen impressions, be considered a perspective of the future navy o England—probably not encouraging—but one on which the security of the country may ultimately have to depend, and to the construction

* See Vol. I. of the "Transactions of the Institution of Naval Architect on the Strength of Iron Ships.

of which the whole power and skill of the nation should be directed. I have noticed these changes, which are fast approaching, from the conviction that the progress of the applied sciences is not only revolutionising our habits in the development of naval constructions, as in every other branch of industry, but the art of war is undergoing the same changes as those which have done so much for the industrial resources of the country in times of peace. It is, therefore, necessary to prepare for the changes now in progress, and endeavour to effect them on principles calculated not only to insure security, but to place this country at the head of the constructive art. It is to attain these objects that a long and laborious class of experiments have been undertaken by the Government to determine how the future navy of England shall be built; how it should be armed; and under what conditions it can best maintain the supremacy of the seas. This question does not exclusively confine itself to armour-plated vessels, but also to the construction of ships which, in every case, should be strong and powerful enough to contend against either winds and waves or to battle with the enemy. It is for these reasons that I have ventured to direct attention to the strength of vessels, and to show that some of our mercantile ships are exceedingly weak, arising probably from causes of a mistaken economy on the one hand, or a deficiency of knowledge or neglect of first principles on the other.

Now it is evident that our future ships of war of the first class must be long and shallow; moreover, they must contain elements of strength and powers of resistance that do not enter into the construction of vessels that are shorter and nearly double the depth. If we take a first-rate ship of the present construction, such as the Duke of Wellington, and compare it with one of the new or forthcoming construction, carrying the same weight of ordnance, we should require a vessel nearly twice the length and little more than half her depth. Let us, for example, suppose the Duke of Wellington to be 360ft. long and 60ft. deep, and the new construction 500ft. long and 46ft. deep: we should then have for the resistance of the Duke of Wellington to a transverse strain tending to break her back,

$$W = \frac{a\,d\,c}{l}$$

Taking 60 as the constant, and the area of the bottom and upper deck as 1,060 square inches, we have

$$W = \frac{1060 \times 60 \times 60}{340} = 12{,}223 \text{ tons},$$

as the weight that would break her in the middle. Let us now take the new ship, and give her the same area top and bottom, and again we have—

$$W = \frac{1060 \times 46 \times 60}{500} = 5{,}851 \text{ tons},$$

which is less than half the strength. From this it is obvious—if we are correct in our calculations—that the utmost care and attention is requisite in design and construction to ensure stability and perfect security in the build of ships.

Mechanical Properties of Iron.—It is necessary to give more examples in regard to strength, and the proportion that should be observed in the construction of our future navy. I have simply directed attention to it as a subject of great importance, and one that I am satisfied will receive careful consideration on the part of the Admiralty and the Comptroller of the Navy.

The next question for consideration is the properties of iron best calculated to resist the penetration of shot at high velocities, and in this I am fortunate in having before me the experiments of the Committee on Iron Plates, which may be enumerated as under:—

Specific gravity.	Tensile strength in tons per square inch.	Compression per unit of length in tons.	Statical resistance to punching in tons; 1-in. plate.
7·7621	24·802	14·203	40·1804

Remarks.—The specimens subjected to compression gradually squeezed down to one-half their original height, increasing at the same time in diameter till they attained 90 tons on the square inch.

In these experiments four descriptions of iron were selected, marked A, B, C, D: the two first and last were taken from rolled and hammered iron plates, excepting C, which was homogeneous, and gave higher results to tension and dead pressure than the others.

In density and tenacity they stood as follows:—

Mark on plates.	Density.	Tenacity in tons.	Remarks.
A Plates	7·8083	24·644	
B Plates	7·7035	23·354	
C Plates, homogeneous	7·9042	27·032	
D Plates	7·6322	24·171	

Here it will be observed that the strengths are in the ratio of the densities, excepting only the B plates, which deviate from that law.

On the resistance to compression it will be seen that in none of the experiments was the specimen actually crushed; but they evidently gave way at a pressure of 13 tons to 14 tons per square inch, and were considerably cracked and reduced in height by increased pressure.

From the experiments on punching we derive the resistance of A, B, C, D plates to a flat-ended instrument forced through the plate by dead pressure, as follows:

Mark on plates.	Shearing strain in tons per square inch.	Ratio, taking A as unity.
A Plates	19·511	1·000
B Plates	17·719	0·907
C Plates	27·704	1·168
D Plates	17·035	0·873

Here may be noticed that the difference between the steel plates of series C and the iron plates of series A is not considerable, though in all the others the steel plates exhibit a superiority in statical resistance.

Having ascertained, by direct experiment, the mechanical resistance of different kinds of iron and steel plates to forces tending to rupture, it is interesting to observe the close relation which exists between not only the chemical analysis, as obtained by Dr. Percy, but how nearly they approximate to the force of impact, as exhibited in the experiments with ordnance at Shoeburyness.

Dr. Percy, in his analysis, observes, that of all the plates tested at Shoeburyness none have been found to resist better than those lettered A, B, C, D, with the exception of C. The iron of plate E contained less phosphorus than either of the three A, B, D; and it is clearly established that phosphorus is an impurity which tends in a remarkable degree to render the metal "cold short," *i. e.* brittle when cold.

The following table shows the chemical composition of these irons:—

Mark.	Carbon.	Sulphur.	Phosphorus.	Silicon.	Manganese.
A	0·01636	0·104	0·106	0·122	0·28
B	0·03272	0·121	0·173	0·160	0·029
C	0·023	0·190	0·020	0·014	0·110
D	0·0436	0·118	0·228	0·174	0·250
E	0·170	0·0577	0·0894	0·110	0·330

Comparing the chemical analysis with the mechanical properties of the iron experimented upon we find that the presence of 0·23 per cent. of carbon causes brittleness in the iron; and this was found to be the case in the homogeneous iron plates marked C; and, although it was found equal to A plates in its resistance to tension and compression, it was very inferior to the others in resisting concussion or the force of impact. It therefore follows, that toughness combined with tenacity is the description of iron plate best adapted to resist shot at high velocities. It is also found that wrought iron, which exhibits a fibrous fracture when broken by bending, presents a widely different aspect when suddenly snapped asunder by vibration, or by a sharp blow from a shot. In the former case the fibre is elongated by bending, and becomes developed in the shape of threads as fine as silk, while in the latter the fibres are broken short, and exhibit a decidedly crystalline fracture. But, in fact, every description of iron is crystalline in the first instance; and these crystals, by every succeeding process of hammering, rolling, &c., become elongated, and resolve themselves into fibres. There is, therefore, a wide difference in the appearance of the fracture of iron when broken by tearing and bending, and when broken by impact, where time is not an element in the force of producing rupture.

If we examine with ordinary care the state of our iron manufacture as it existed half a century ago, we shall find that our knowledge of its properties was of a very crude and most imperfect character. We have yet much to learn; but the necessities arising from our position as a nation, and the changes by which we are surrounded, will stimulate our exertions to the acquisition of knowledge and the application of science to a more extended investigation of a material destined, in course of time, to become the bulwark of the nation. It is, therefore, of primary importance that we should make ourselves thoroughly acquainted, not only with the mechanical and chemical properties of iron, but we should, moreover, be able to apply it in such forms and conditions as are best calculated to meet the requirements of the age in which we live.

Entertaining these views, I cheerfully commenced with my talented colleagues the laborious investigations in which we are now engaged, and looking at the results of the recent experiment with the 300-pounder gun on the one hand, and the resisting targets on the other, there is every prospect of an arduous and long-continued contest.

From the Manchester experiments, to which I have alluded, we find that with plates of different thicknesses, the resistance varies directly as the thickness that is, if the thickness be as the numbers 1, 2, 3, &c., the resistance will be as 1, 2, 3, &c.; but those obtained by impact at Shoeburyness show that up to a certain thickness of plate the resistance to projectiles increases nearly as the square of the thickness. That is, if the thickness be as the numbers 1, 2, 3, 4, &c., the resistance will be as the numbers 1, 4, 9, 16, &c., respectively. The measure, therefore, of the absolute destructive power of shot is its *vis viva*, not its momentum, as has been sometimes supposed, but the work accumulated in it varies directly as the weight of the shot multiplied into the square of the velocity.

There is, therefore, a great difference between statical pressure and dynamical effect; and, in order to ascertain the difference between flat-ended and round-ended shot, a series of experiments were undertaken with an instrument or punch exactly similar in size and diameter and precisely corresponding with the steel shot of the wall piece ·85 diameter employed in the experiments at Shoeburyness. The results on the A, B, C, and D plates are as follows:—

Character of Plates.	Resistance in lbs. Punch flat-ended.	Punch round-ended.
Half-inch thick .. A Plates	57,956	61,886
Half-inch thick .. B Plates	57,060	48,788
Half-inch thick .. C Plates	71,035	85,524
Half-inch thick .. D Plates	49,080	43,337
Three-quarter-inch thick .. .. B Plates	84,587	98,420
Three-quarter-inch thick .. .. D Plates	82,381	98,571
Mean	67,017	72,754

These figures show that the statical resistance to punching is about the same, whether the punch be flat-ended or round-ended, the mean being in the ratio of 1,000: 1,085 or 8½ per cent. greater in the round-ended punch. It is, however, widely different, when we consider the depth of indentation of the flat-ended punch and compare it with that produced by the round-ended one, which is 3½ times greater. Hence, we derive this remarkable deduction, that whilst the statical resistance of plates to punching is nearly the same, whatever may be the form of the punch, yet the dynamic resistance or work done in punching is twice as great with a round-ended punch as with a flat-ended one. This, of course, only approximately expresses the true law; but it exhibits a remarkable coincidence with the results obtained by ordnance at Shoeburyness, and explains the difference which has been observed in these experiments, more particularly in those instances where round shot was discharged from smooth-bored guns at high velocities. To show more clearly the dynamic effect, or work done by the weight of shot which struck some of the targets at different velocities the following results have been obtained.

Target.	Weight of shot striking target; lbs.	Work done on target. Total foot lbs.	Per square foot. Foot lbs.
Thorneycroft 8-in. shield	1,253	—	29,078,000
Thorneycroft 10-in. embrasure ..	1,511	—	37,140,000
Roberts's target	946	822,000	19,726,000
Fairbairn's target	1,024	324,000	23,311,000
Warrior target	3,299	342,000	62,570,000
The Committee's target	6,410	—	124,098,780

From the above it will be observed that the two last targets have sustained in work done what would, if concentrated, be sufficient to sink the largest vessel in the British navy.

We are all acquainted with the appearances and physical character of artillery, but few are conversant with the nature of the operations and the effects produced by shot on the sides of a ship or on resisting forts and targets.

The shot of a gun—to use the expression of my colleague, Mr. Pole—is simply the means of transferring mechanical power from one place to another. The gunpowder in the gun developes by its combustion a certain quantity of mechanical force, or work as it is now called, and the object of the shot is to convey this work to a distance, and apply it to an object supposed to be otherwise inaccessible. The effect of this, according to Mr. Pole's formula, is—

W = weight of the shot in lbs.
V = its velocity in feet per second.

Then, by the principle of *vis viva*, the quantity of work stored up by the moving mass measured in pounds 1ft. high, is

$$= \frac{W\,V^2}{2\,g}$$

g being the force of gravity $= 32\frac{1}{6}$.

Thus, if we have a shot, like that recently used against the Warrior target, 156 lb., moving at the rate of 1,700ft. per second, the work done will be—

$$= \frac{156 \times (1700)^2}{64\frac{1}{3}} = 7{,}008{,}238 \text{ one foot high.}$$

Showing at once the immense power that this small body is able to deliver on every resisting medium tending to arrest its course and bring its particles to a state of rest. Or, in other words, it is equivalent to raising upwards of 3,000 tons a foot high in the air.

The Application of Iron for Purposes of Defence. — Having examined in a very condensed and cursory manner the present state of our knowledge in regard to iron, and its application to the purposes of shipbuilding, let us now consider in what form and under what circumstances it can best be applied for the security of our vessels and forts. To the latter the answer is, make the battery shields thick enough: but a very different solution is required for the navy, where the weight and thickness of the plates is limited to the carrying powers of the ship. It has been observed with some truth that we have learnt a lesson from the recent naval action on the American waters; but it must be borne in mind that neither of the vessels engaged nor the ordnance employed were at all comparable to what have been used at Shoeburyness.

To those who, like myself, have gone through the whole series of experiments, the late engagement will appear instructive, but not calculated to cause any great alarm, nor yet effect any other changes than those primarily contemplated by the Government, and such as have been deduced from our own experiments. It is, nevertheless, quite evident that our future navy must be entirely of iron; and judging from the last experiment with the Armstrong smooth-bore gun, it would almost appear as a problem yet to be solved whether our ships of war are not as safe without iron armour as with it. If our new construction of ships are strong enough to carry armaments of 300-pounder guns, which is assumed to be the case, our plating of 6in. or 7in. thick would be penetrated, and probably become more destructive to those on board than if left to make a free passage through the ship. In this case we should be exactly in the same position as we were in former days with the wooden walls; but with this difference, that if built of iron the ship would not take fire and might be made shell-proof. It is, however, very different with forts, where weight is not a consideration, and those, I am persuaded, may be made sufficiently strong to resist the heaviest ordnance that can be brought to bear against them. In this statement I do not mean to say that ships of war should not be protected; but we have yet to learn in what form this protection can be effected to resist the last powerful ordnance, and others of still greater force which are looming in the distance, and are sure to follow.

A great outcry has been raised about the inutility of forts, and the Government, in compliance with the general wish, has suspended those at Spithead. I think improperly so, as the recent experiments at Shoeburyness clearly demonstrate that no vessel, however well protected by armour-plates, could resist the effects of such powerful artillery, and instead of the contest between the Merrimac and the Monitor, and that of the 300-pounder gun being against, they are to every appearance in favour of forts. Should this be correct we have now to consider how we are to meet and how resist the smashing force of such powerful ordnance as was levelled against the Warrior target.

During the whole of the experiments at Shoeburyness I have most intently watched the effect of shot on iron plates. Every description of form and quality of iron has been tried, and the results are still far from satisfactory; and this is the more apparent since the introduction of the large 300-pounder, just at a time when our previous experiments were fairly on a balance with the 40, 68, 100, and 126-pounders. They now appear worthless, and nothing is left but to begin our labours again *de novo*.

It has been a question of great importance, after having determined the law of resistance and the requisite quality of the iron to be used as armour plates, how these plates should be supported and attached to the sides of the ship. Great difference of opinion continues to exist on this subject. Some are for entirely dispensing with wood; probably the greater number contend for a wood backing, the same as the Warrior and the Black Prince. I confess myself in the minority on this question; and, judging from the experiments, I am inclined to believe, from past experience, that wood combined with iron is inferior to iron and iron in its power of resistance to shot; and I am fully persuaded that ultimately the iron armour-plates must be firmly attached to the side, technically called the skin, of the ship. It must, moreover, form part of the ship itself, and be so arranged and jointed as to give security and stability to the structure.

The experiments instituted by the Committee on Iron Plates have been well considered and carefully conducted. They commenced with a series of plates selected from different makers of varying thicknesses, and these have been tested both as respects quality and their powers of resistance to shot. They have, moreover, been placed at different angles and in a variety of positions, and we had just arrived at the desired point of security when the thundering 300-pounder smooth bore upset our calculations and levelled the whole fabric with the ground. We are, however, not yet defeated; and, true to the national character, we shall, like the knights of old, resist to the last—

> "And though our legs are smitten off,
> We'll fight upon our stumps."

And thus it will be with the Iron Committee and the Armstrong and the Whitworth guns.

In conclusion, allow me to direct attention to a drawing of the Warrior target, with wood backing, and its compeer entirely of iron The first underwent a severe battering previous to the attack from the 300-pounder, but the other sustained still greater, with less injury to the plates, notwithstanding the failure of the bolts in the first experiment. It must, however, be admitted that plates on wood backing have certain advantages in softening the blow, but this is done at the expense of the plate, which is much more deflected and driven into the wood, which, from its compressibility, presents a feeble support to the force of impact. Again, with wood intervening between the ship and the iron plates, it is impossible to unite them with long bolts so as to impart additional strength to it; on the contrary, they hang as a dead weight on her sides, with a constant tendency to tear her to pieces. Now, with iron on iron we arrive at very different and superior results. In the latter the armour-plates, if properly applied, will constitute the strength and safety of the structure; and, notwithstanding the increased vibration arising from the force of impact of heavy shot, we are more secure in the invulnerability of the plates and the superior resistance which they present to the attack of the enemy's guns. In these remarks I must not, however, attempt to defend iron constructions where they are not defensible, and I am bound to state that in constructions exclusively of iron there is a source of danger which it is only fair to notice, and that is, that the result of two or more heavy shot, or a well concentrated fire, might not only penetrate the plates but break the ribs of the ship. This occurred in the last experiment on my own target, where a salvo of six guns concentrated four on one spot, not more than 14in. diameter, went through the plates and carried away a part of the frame behind. The same effect might have taken place on the Warrior target; and certainly 9in. of wood is of little value when assailed by a powerful battery of heavy ordnance and a well concentrated fire.*

In closing these remarks I have every confidence that the skill and energy of this country will keep us in advance of all competitors, and that a few more years will exhibit to the world the iron navy of England, as of old with its wooden walls, unconquerable on every sea.

* Since the above was written another experiment has been made on the Warrior target with the 300-pounder smooth-bore gun. From this it appears that the wood backing between the armour-plates and the skin of the ship cannot safely be dispensed with, and that some compressible or softer substance than iron and iron is necessary to deaden the blow, and absorb the fragments of the shot and the broken plates, which in this instance lodged in the wood, and did not perforate, but only cracked, the skin of the target. From this fact it cannot be denied that this experiment is more satisfactory than those on the iron on iron targets; and, however desirous it may be to realise a more effective construction as regards the strength of the ship, it cannot be doubted, in so far as the security of the ship and the lives of those on board are concerned, that a vessel with wood backing is safer in action than one composed entirely of iron. In the present state of our knowledge the experiments are therefore against iron and iron, as regards security from the effects of shot, but they are unfavourable as respects the strength of the ship.

COAL IN BORNEO.—At the annual meeting of the Labuan Coal Company Sir James Elphinstone, Bart., in the chair, it was announced that the seams now being opened have been sufficiently tested to show that they can yield 100,000 tons of coal per annum for ten years, that the two pits necessary for this rate of extractio will be completed in October, and that the entire cost of raising wi not be more than 6s. per ton. Eighty-five tons have just been supplied to her Majesty's steamer Scout, and fair quantities will regularly raised while the pits are being sunk.

LAW INTELLIGENCE.

HOUSE OF LORDS.—June 5.

The noble and learned lords present were the Lord Chancellor, Lord Brougham, Lord Cranworth, Lord Wensleydale, Lord Chelmsford, and Lord Kingsdown.

BETTS *v.* MENZIES AND ANOTHER.

This was the celebrated patent capsule case, which has been before the courts for so many years. The proceedings arose out of an action brought by the appellant against the respondent for the alleged infringement of a patent, granted in 1849, for making the well-known metallic capsules for bottles, which is effected by placing an ingot of lead one-fourth of an inch thick upon an ingot of tin one-twentieth of an inch thick, and passing them through the rollers of a flatting mill, which causes the two metals to unite, and form a tough, flexible and silvery-looking sheet. The cause was tried at the Middlesex Nisi Prius sittings after Hilary Term, 1859, before Chief Justice Erle, then one of the judges of the Court of Queen's Bench, when the respondent contended that the patent was bad for want of novelty in the invention, which had been described in a specification of a patent granted to one Thomas Dobbs in 1804. The jury found a verdict for the plaintiff on all the issues, subject to leave reserved for the defendants to move the Court above to enter the verdict for themselves on the first and second pleas. In Easter Term, 1859, the defendants obtained a rule *nisi* to set aside the verdict for the plaintiff, and to enter a verdict for themselves, which was subsequently made absolute, the Court of Queen's Bench being of opinion that Dobbs's specification was anticipatory of the plaintiff's patent. The plaintiff appealed to the Court of Exchequer Chamber, who, in July 1860, affirmed the decision of the Court of Queen's Bench. Hence the present appeal. The contention before their lordships on behalf of the appellant was that the judge at Nisi Prius was right in leaving the case to the jury, that the evidence was properly admitted at the trial, and that it was for the jury to decide what effect they would give to it in reference to the question as to the novelty of the plaintiff's patent. It was further contended that the question whether the plaintiff's patent was made void for the want of novelty by the publication of Dobbs's specification was one partly of law and partly of fact, and that, therefore, the Court alone was not competent to decide it without the facts being admitted by both sides, which was not the case in the present instance; and that before the Court could decide it must be informed of the meaning of the technical terms in Dobbs's specification, what was the nature and properties of the metal in the different states described in the two specifications, and of the effects of the operations described upon the metals in those different states. If the decision of the Court of Exchequer Chamber that the plaintiff's patent was void on account of the prior publication of Dobbs's specification was to be taken as a correct decision upon a point of pure law, then it must be so on grounds independent of evidence, and no possible evidence in addition to the two specifications could affect the correctness of that decision. So that if Dobbs himself had proved that his patent was taken out on a conjecture, and that he had never known the thing to be done, and did not know how to do it, his specification would still have invalidated the plaintiff's patent. The specification of Dobbs's patent could not invalidate the plaintiff's patent unless it were admitted by the plaintiff or found by the jury that Dobbs had specified something that could be put in practice. As to whether Dobbs's specification were practicable or not, that was entirely a question for the jury, who had decided the point in the plaintiff's favour. In conclusion it was contended that it was impossible to ascertain the meaning of Dobbs's specification, as a matter of law without evidence. The counsel for the respondent contended on the other hand that the plaintiff's invention or some material portion of it was included in Dobbs's specification, and that therefore the plaintiff's patent was bad for want of novelty; that the construction of Dobbs's specification was for the decision of the Court, who were bound to take the words in their ordinary sense; and that the plaintiff's specification was ambiguous and uncertain in not pointing out the proportions of lead and tin to be employed when the combined metal was to be used for other purposes than making capsules, and in not distinguishing between what was new and what was old at the date of the patent.

The case was argued some time ago before their lordships, assisted by the Lord Chief Baron, Justices Wightman, Williams, Byles, Blackburn, and Mr. Baron Wilde, when the following questions were put to the learned judges:—"Does it appear on a comparison of the two specifications that a material part of Dobbs's specification is claimed by Betts in his specification? If so, can the Court pronounce Betts's patent to be void simply on the comparison of the two specifications, without evidence to prove identity of invention, and also without evidence that Dobbs's specification disclosed a practical mode of producing the result or part of the result described in Betts's patent?" The judges answered both questions in the negative in February last, when their lordships postponed judgment.

The Lord Chancellor, in delivering judgment this morning, after going through the facts of the case, said, the points involved had been most learnedly and ably argued on both sides. After the decision of the learned judges upon the second question left to them the first became immaterial. The second question was to the effect whether the Court could pronounce Betts's patent void simply on the ground of similar words being used in the two specifications without the production of evidence to prove the identity of the inventions, and also without evidence that Dobbs's specification disclosed the practical mode of producing the result or some portion of the result described in Betts's patent. The answer of the learned judges was of great importance from its bearing upon the patent law. One of the conclusions involved in the answer was that, even if there were identity of language in the two specifications, if such identity consisted merely in terms of art it would be impossible to predicate what exact meaning the first patentee attributed to such terms, and whether the second patentee attributed that identical signification to them. This was very obvious, for the same terms might denote very different objects in 1804 and in 1849, as was instanced by chemical and other articles. A mere barren general description, although it might contain an important suggestion which a future inventor might avail himself of, could not be considered as anticipatory of a future patent, although the terms describing the invention might be identical. The one merely suggested the invention, while the other, by reducing the theory to practice, added to the amount of human knowledge and conferred a benefit upon mankind within the meaning of the patent laws. The conclusion that Dobbs's patent was capable of being practically carried out was negatived by the verdict of the jury. He concurred in the decision arrived at by the learned judges, and therefore the judgments pronounced by the Court of Queen's Bench and the Court of Exchequer Chamber must, in his opinion, be reversed, and the rule *nisi* must be discharged.

The other noble and learned lords having concurred,

The judgment of the Court below was reversed accordingly.

Northern of Spain Railway.—The works on this important system of railway are being pushed forward with great vigour. The object now aimed at is completion of the line through the ridge of the Guadarama, as, that effected, direct communication will be established between Madrid and the Castiles. Upon the passage of the Guadarama 13,750 men were employed in April, as compared with 5,700 six months previously. The whole line will not be carried through the Pyrenees, and also so as to effect a junction with the French southern railways before the close of 1864. The bulk of the capital required for the undertaking being supplied from French sources, French firms are now supplying the principal portion of the rolling stock and plant. Efforts are being made to organise repairing shops, &c., supplied with Spanish mechanics, so that the English element is now very little represented in the undertaking.

NEWTON'S VENTILATING APPARATUS.

FIG. 2.

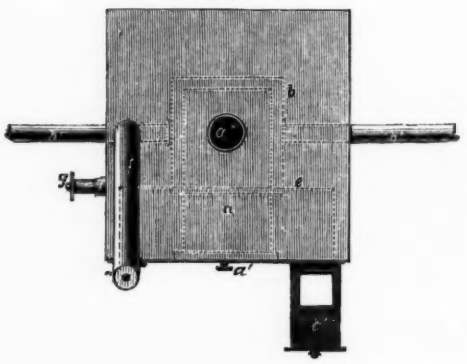


FIG. 4.

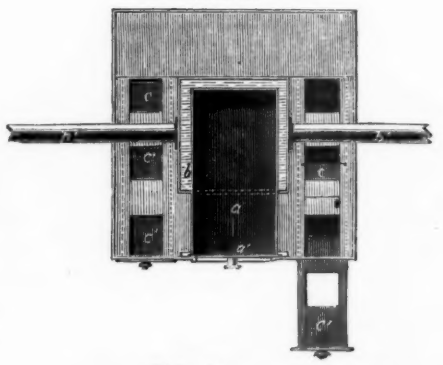


FIG. 3.

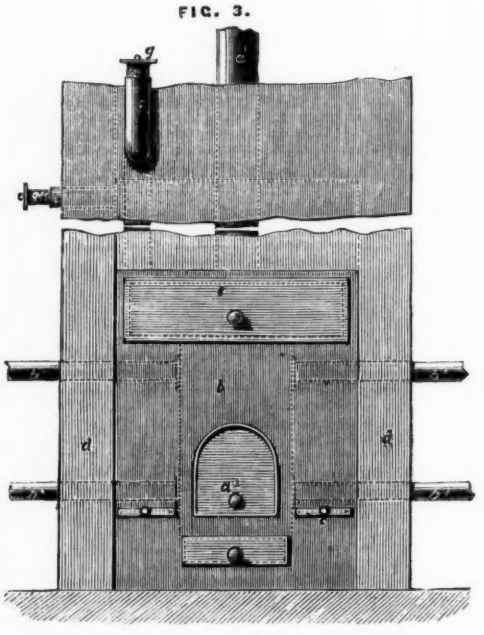
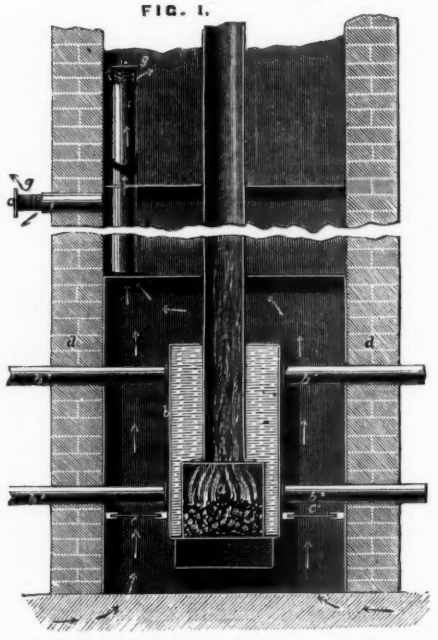


FIG. 1.



The purpose of utility to which this design, by Joseph Newton, of 30, Eastbourne-terrace, Paddington, has reference is the warming of several apartments by means of currents of heated air combined with the use of hot water, the air and water being heated by a common fire-place, which acts as a ventilator and smoke consumer.

Fig. 1 shows a vertical section; Fig. 2 a plan in section; Fig. 3 a front view, and Fig. 4 a plan of the apparatus. *a* is the fire-place, which is fed with fuel through a door a^1; air to support combustion is drawn from the apartment to remove that which has become vitiated, and the amount is regulated by the door a^3, so as to promote combustion of the smoke. The products of combustion pass away by a tube a^2, within the ordinary chimney. *b* is a boiler surrounding the fire-place, and having outlet pipes b^1 and return pipes b^2, for circulation of heated water to coils or lengths of pipe. Air to be heated passes from the exterior through passages *c*, capable of being regulated by slides c^1, and such air, when heated by the heat from the furnace *a* and boiler *b*, as contained in the setting *d*, may pass out through perforated and adjustable plates *e*, to heat the apartment in which the apparatus is placed, or it may be conducted, as required, by passages *f*, and allowed to escape into and warm the rooms through perforations under valves *g*, *g*.

The principle of this arrangement is equally applicable to ordinary fire-places, as well as to conservatories, public buildings, &c.

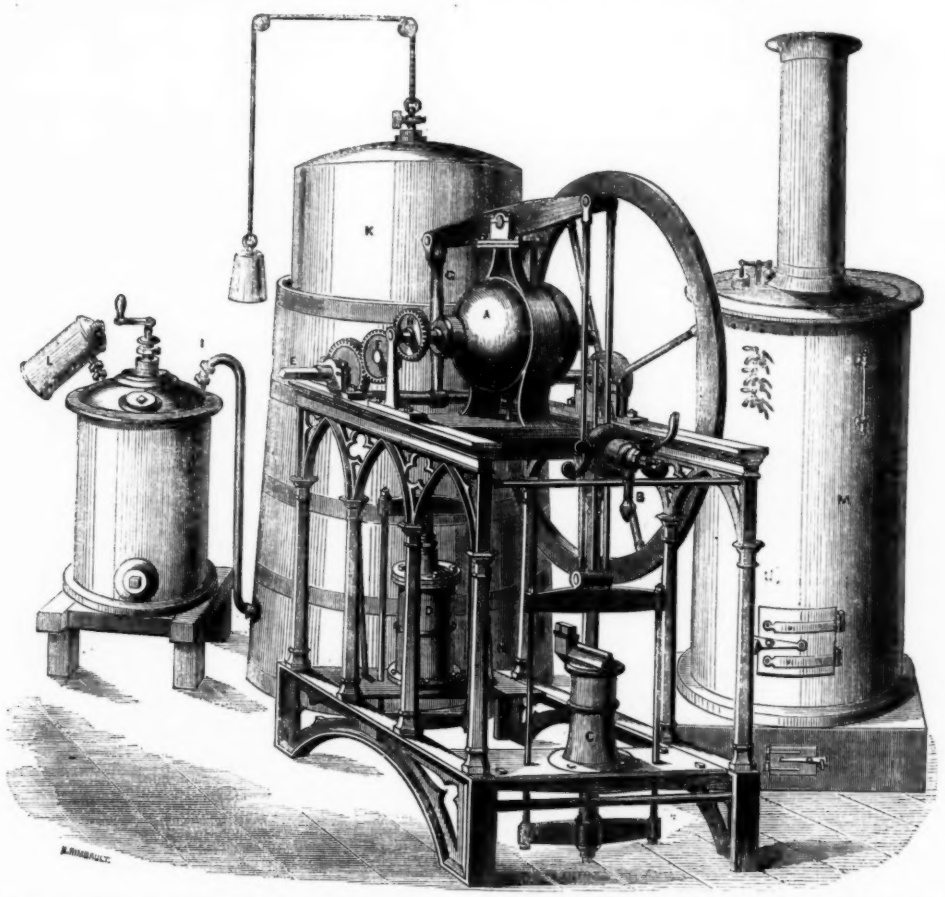
Difficulties of Direct Australian Steaming.—The coal difficulty is not yet sufficiently overcome. The consumption of fuel necessary to attain a moderate degree of speed is still too large to admit of steamers making a direct run to Australia. The Great Eastern, which was specially designed to meet this very difficulty, has been in that respect a signal failure. Her coal-consuming powers are vastly in excess of what was intended. It was Brunel's calculation that she could carry coal enough for the voyage out and home. Experience has shown that she could not do more than carry coal enough for the single voyage, and that even then she would have far less space available for cargo than is necessary for a profit.—*Sydney Herald.*

Traffic Receipts.—The traffic receipts of railways in the United Kingdom amounted for the week ending the 31st of May, on 10,224 miles, to £529,266, and for the corresponding week of last year, on 9,951 miles, to £548,947, showing an increase of 273 miles, and a decrease of £19,681 in the receipts. The gross receipts on the following fourteen railways amounted in the aggregate, on 6,629 miles, to £400,593; and for the corresponding week of 1861, on 6,489 miles, to £422,766, showing an increase of 140 miles, and a decrease of £22,173 in the receipts. The decrease on the Caledonian Railway amounted to £535; on the Eastern Counties to £998; on the Lancashire and Yorkshire to £7,376; on the London, Brighton, and South Coast to £10,017; on the London and South Western to £5,539; on the Manchester, Sheffield, and Lincolnshire to £1,028; on the North British to £40; on the North-Eastern to £4,563; and on the South Eastern to £624; total, £30,720. But from this must be deducted £1,209, the increase on the Great Northern; £208 on the Great Southern and Western; £2,026 on the Great Western; £1,266 on the London and North Western; and £3,838 on the Midland, together, £8,547, leaving the decrease, as above, £22,173. The goods and mineral traffic on those lines amounted to £196,540, and for the corresponding week of 1861 to £200,566, showing a decrease of £4,026. The receipts for passengers, parcels, &c., amounted to £204,053, against £222,200, showing a decrease of £18,147. The traffic receipts on sixty-six other lines amounted, on 3,595 miles, to £128,673, and for the corresponding week of last year, on 3,468 miles, to £126,181, showing an increase of 127 miles, and of £2,492 in the receipts. The falling off in the traffic of the past week as compared with the corresponding period of 1861 arises from the depression of trade in the manufacturing districts, and from the comparison being made with Epsom week in 1861, as shown in the passenger traffic. The traffic receipts of the past week show an increase of £13,129, as compared with those of the preceding week ending the 24th of May ult.

A Russian Manufacturing Town.—"Here," said the young man, "we are at Tver; and there," he added, laughing, "is a row of the mills wherewith our Government is going to ruin England. Tver is a promising site for general manufactures, situated, as well as Moskva, on the coal strata, and besides that on the noble Volga stream. Not only are there here many Imperial and nobles' manufactories, but all the peasants of the region are so impregnated with manufacturing notions, as well as infused with the principles of organisation and regulation, that they club together, one village, or two or three villages, to build a great cotton mill, or a samovar manufactory, for themselves; and the affairs of the mill are conducted so skilfully by a council of their old 'whiteheads,' that they run the profits of the noble's or merchant's manufactory hard by, very close; and have the satisfaction of dividing all the profits among themselves. These notions of the inhabitants of a village managing their own affairs for themselves are of a very old date."—*Three Cities in Russia. By Professor C. Piazzi Smith, F.R.SS.L. and E.*

Yanker Locomotives.—The *American Railway Times* contains the following pleasant bit of comparison of English and American locomotives, and in which, of course, our engines are "nowhere:"—"Among the dozen and a half locomotives on exhibition in London at the new Crystal Palace about opening, there will be found none of American manufacture; and yet for a first-class machine, which will haul the maximum load over the crookedest road, with the least cost of transport, and the least outlay for repairs, we feel safe in placing the engines of our leading builders in the United States not only in the first rank, but ahead of any European engine. Without a bit of brag, we believe the American engine, as built, for example, by the Rogers Locomotive Works, to be the *smartest* piece of machinery that can be produced. The English locomotive, like the Englishman, though solid, is a little too slow and heavy: it has strength, but it has not the life, nor the spring so convenient in starting heavy trains. The American engine feels to the man whose hand is on the throttle and the reverse lever like a high-mettled steed: the English engine like the draught horse, or like an ox, and the American 'engineer' stands in about the same light to the English 'driver.' The 'engineer' upon the American road, while waiting to start his train, reads the paper, and is an '*employé*;' the English 'driver' spends his spare moments in rubbing up his oil can, and is a 'servant.' The American engineers finish as master mechanics, or railway superintendents: the English driver ends where he began—a driver. The railway in the United States is a school, in England a treadmill. The American locomotive has the Bissell truck, elastic wheels, and all sorts of fixings for convenience and economy: the English engine is stiff and uncompromising, longitudinally and vertically, and upon anything except the best tracks will knock both itself and the rails to pieces. Some of our railway friends have asked us lately why we did not send out a few crack machines to the Exhibition now about to open in London. We cannot say exactly why, since no person would be afraid to place our machines in the lists with the work of the best European makers. Perhaps the trial would resemble too much that of Mr. George Francis Train. Perhaps when the English machines had made their effort, the judges would decide in their favour without wishing to trouble themselves with testing the American engines. It is hardly worth while for the American engine to cross the ocean to achieve a triumph over other locomotives. We know well enough how the Portland Company's machines have compared with the Scotch and English engines in the American British Provinces. We do not forget what we owe to the Stephensons and Fairbairns in locomotive engineering, but we can now go alone perhaps; at any rate we do not look to learn a great deal from builders who have not yet altogether adopted the truck, the cab, elastic wheels, bells, &c. No country has a greater variety of locomotive engines than ours; and this has naturally resulted from the variety of the requirements upon our different roads. No roads have demanded more varied and peculiar adaptations of locomotive power than those of the United States; and certainly no mechanics have been found better able to meet those demands than our own."

BARNETT'S STEAM SODA WATER APPARATUS.



THIS improvement, by Samson Barnett, of 23, Forston-street, Hoxton, London, N., is a combination of the soda water machine and steam engine, the same frame, crank, and fly-wheel being used for both. A long connecting rod for the steam engine is obtained by taking the motion from the cross tail under the cylinder plate.

To disconnect the soda water machine from the engine it only requires that the wheel F be shifted forward, the arm G placed over the beam, and the driving drum put on E; it is then complete in itself as a steam engine, and is available for the usual purposes to which steam power is applied.

It will appear from the above that, with the exception of the boiler, the combined machine will occupy no more space than the soda water machine alone. The foundation, drums, and shafting being entirely dispensed with, it requires no fixing. The producing power of the soda water apparatus is 6,000 bottles of soda water and lemonade per day, the consumption of fuel being, say, 1½ cwt. In the illustration A is the condenser, B the bottling nose, C force pump, D steam cylinder, E end of crank for driving drum when used for other purposes, F intermediate wheel, G beam arm, H agitator, I gas pipe, K copper gasometer, L acid bottle, M steam boiler, N connecting rods of the engine.

THE MIDDLE LEVEL DELUGE.—The last news from Lynn is that, just as the dam across the middle level was thought to have been securely made, it gave way and the water scoured out the bottom to a great depth. Of 2,000 sacks of earth thrown per day for several days upon the upper side of the dam all was found to have been washed away. The engineers state that the mishap will only throw the works back eight or ten days.

ON THE GENERAL OCCURRENCES OF TITANIC ACID IN ALL CLAYS, AND ITS FREQUENT OCCURRENCE IN IRON ORES, &c.—Mr. Riley, of Oxford-court, Cannon-street, read a paper upon the above subject before the Chemical Society a few evenings since. He pointed out that until recently titanic acid had been known to the chemist only as a rare substance, and very seldom to be met with. The metal titanium (or, more correctly speaking, the nitride and cyanide) is found more or less in the old hearths of all blast furnaces, frequently in beautiful, well-defined cubical crystals, and at times massive, like copper (a sample of the crystals quite pure, and weighing nearly a pound, was exhibited). The author had seen the old hearths of about thirty blast furnaces, and he was always able to find the crystals; in some cases they were small, but usually, where a superior quality of iron was made, the titanium occurred in large quantities, and in well-defined crystals. From the universal occurrence of the metal in the old hearths it was obvious that it must be an element pretty generally diffused, and the results of his investigations, extending over some years, had convinced him that it occurred more or less in all clays, in many soils, iron ores, &c. The following were the results of the examination of the principal firebricks used in London :—

Maker's name and locality.	Silica p. ct.	Titanic acid p. ct.
Stourbridge—Hickman	65·11	1·05
,, Rufford	63·42	1·05
Newcastle—Stephenson	60·60	·42
,, Lucas	60·49	·60
,, Ramsay	55·88	·67
Yorkshire—Wortley, Ingham, and Sons	63·96	·96
North Wales—Hawarden	62·39	·69
South Wales—Dowlais	63·02	1·04
Surrey—Yellow clay, dry at 212 deg.	64·52	·50
South Wales—Dinas	94·43	—
Surrey—Ewell	91·84	—
Devonshire—Black Alder	75·16	—

The author considered the last three bricks to be silica bricks and not clay. Besides the above, nine shales and various other clays had been examined, in which its presence was detected, but no quantitative determination made. The difficulties of estimating and detecting titanic acid were very great, and it was only recently that they had been overcome; the general reasons were its similarity to alumina in some of its properties, and to silica in others. It had hitherto been estimated with either of the above substances, and, moreover, the presence of iron in solution prevented its precipitation in the ordinary way, the titanic acid being weighed with the iron, and increasing its weight. The author then alluded to the determination of titanic acid in iron ores and products from ironworks, and the analyses of iron ores generally, and pointed out the frequent errors made, more especially in the determination of iron, from the presence of phosphoric acid and titanic acid. With some samples of English pig iron in the Exhibition, and the iron ore from which it was smelted, analyses were given in which no phosphoric acid was mentioned; this ore had been examined by pulverising about 3 cwt. taken from different parts of the mine, and found to contain 1·80 per cent. of phosphoric acid, and two samples of the pig gave respectively 1·75 and 1·80 per cent. of phosphorus. Titanic acid ought to be classed as one of the ordinary elements, as it occurs most frequently; the acid is also found in nearly a pure state. The occurrence of titanic acid in pig iron was adverted to. It had on one occasion been detected, but as to its influence on the quality of iron and steel, the author was conducting some experiments upon the subject, and could not at present speak definitely upon the matter.—*Mining Journal.*

THE BESSEMER PROCESS IN INDIA.—A new era is evidently dawning over the affairs of the East Indian Iron Company and their future prospects. Their almost unparalleled perseverance during a lengthened period of some thirty or forty years, under difficulties which would have caused the stoutest hearts to despair, is to all appearances on the eve of being rewarded with a success which even the most sanguine would have hardly dared a few years back to hope for. The first step in the right direction taken by the company was their selection of Mr. William Maylor for the post of general manager in India, and the successful introduction by that talented gentleman of Mr. Bessemer's method of manufacturing steel and iron has tended to save the concern from that ruin which all deemed inevitable, and to which it was rapidly hastening. The process just referred to, first discovered by Bessemer, and looked upon by many in England at the time of its discovery as the chimera of an overwrought imagination, is now become also familiar to the reading public of even India; but few, we are afraid, will be able to form, from the accounts before them, a correct idea of the beautiful simplicity of the operation. The saving it effects in time, labour, and fuel renders it peculiarly adapted for India, where the prejudices and ignorance of the lower classes of the natives, and their constitutional apathy and inactivity, added to the difficulties of conveyance over bad roads and unnavigable rivers, throw an amount of obstacle in the way of enterprising capitalists which no Englishman acquainted only with the capabilities of a European labour market, and accustomed to the facilities at home, can fully realise by any stretch of imagination. The present plan of converting cast-iron into malleable iron or steel, when compared with the old one, presents advantages which it is impossible to over-rate. We have recently seen some steel of a very superior quality made at Beypoor in as many minutes as it took days to make a like quantity of bad iron at the same place a few years ago. The extensive knowledge, both theoretical and practical, which Mr. Maylor possesses of the business he has undertaken to conduct has, while it saved the company a considerable amount of money which under different circumstances they might have had to spend in preliminary experiments, shortened likewise the period of doubt and suspense which preceded the solution of the all-important question whether steel and iron could be successfully manufactured in India by the "Bessemer process." So far Mr. Maylor has been eminently successful in solving this question, and it now only remains for him to prove that the business can be made a profitable one, if it be not so already. Rich magnetic ores abound in several places under this Presidency, and from the jungles in South Arcot and Malabar a more than ample supply of fuel may be obtained for a series of years to come. The daily increasing demand in our Indian market for steel and iron is, we believe, even at the present moment greater than what Mr. Maylor will be able to supply for some time yet, and as we understand that that gentleman has, by a course of judicious and economical management, already effected a very favourable alteration in the gloomy aspect of the company's affairs, we think we may safely venture to say that he will ere long succeed in fully placing the business on a sound commercial basis. By the *Excelsior*, which arrived at Beypoor about six weeks ago with a cargo of stores for the Madras Railway Company, Mr. Maylor received from England a consignment of machinery, which was required to enable him to carry on his operations in steel making on a more extensive scale. The same vessel brought in also a very able and experienced mechanic, and the din of a ponderous steam-hammer, under his superintendence, may now be daily heard at the Beypoor ironworks. On a recent occasion we had the pleasure of visiting the works, and were much struck with the perfect order and regularity with which the different operations were conducted. Several bars of hammered steel were shown to us on the occasion, which, we fully believe, would have stood comparison with any yet seen imported from "Old England."—*Madras Athenæum and Statesman*, April 15.

SOCIETY OF ENGINEERS.

June 2nd, 1862.

E. RILEY, Esq., in the Chair.

ON MARINE GOVERNORS.

By LEWIS OLRICK.

IN commencing my paper I wish to state that you might, perhaps, in the Patent List find a number of governors which will not be mentioned here to-night. I shall, however, not trouble you with a dry and uninteresting enumeration of all the patents taken out for marine governors; but, after having shortly recapitulated to you the theory of a governor, I will at once proceed to give you the history of the gradual introduction of marine governors, and in so doing mention the different governors brought more prominently before the public, and at the same time point out to you their merits and demerits, according to my experience.

The first governor ever invented for regulating the speed of steam engines was protected by an English patent, in 1784, by James Watt, and this invention has been used up to the present date in almost the same shape as Watt gave it to us (see Fig. 2). This is the common centrifugal or conical pendulum governor, which consists of two equal and similar revolving pendulums, turning about one vertical axis, which is driven by belts or gearing from the crank shaft of the engine. The only difference between this governor and a common pendulum is that the pendulums in the governor revolve round its axis in a circular horizontal plane, and the common pendulum vibrates backwards and forwards in a vertical plane. They are, however, both subject to the same laws of nature, and must be calculated in the same manner.

The length of a pendulum vibrating seconds in London is 39·1393in. The vibrations of pendulums are as the square roots of their lengths; thus, to find the length of a pendulum for any given number of vibrations in a minute, we get—

When n = number of vibrations in a minute.
l = length of the pendulum required.

$$n : 60 = \sqrt{39{\cdot}1393} : \sqrt{l}.$$

$$\text{and } \frac{\sqrt{39{\cdot}1393} \times 60}{n} = \sqrt{l}.$$

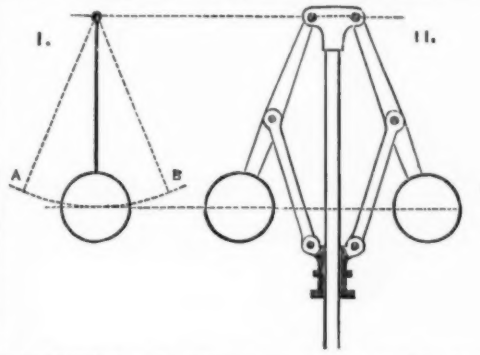
For instance, if we want to know the length of a pendulum that will make eighty vibrations in a minute, then we get in the same way—

$$80 : 60 = \sqrt{39{\cdot}1393} : \sqrt{l},$$

$$\text{and } \frac{\sqrt{39{\cdot}1393} \times 60}{80} = 4{\cdot}692 = \sqrt{l}.$$

Consequently, $l = 4{\cdot}692^2 = 22{\cdot}015$in.

The length of the pendulum corresponds exactly with the vertical height h of the governor. Thus, for every vibration from a to b



and back again to a, the governor makes a whole revolution (see Figs. 1 and 2).

We will thus see that if the vertical height of a governor is equal to 39·1393in., the governor will make exactly thirty revolutions.

From the above we get the following formulæ* for calculating the main points in a two-ball governor.

Calling h = the vertical distance between the point of suspension and the plane of revolution of the centre of balls in inches,
r = revolutions per minute,
l = length of arms in inches from point of suspension to centre of ball,
d = diameter in inches of circle in which the centre of balls revolve,

$s = \frac{d}{2}$ = radius in inches of the same circle.

$$\sqrt{39{\cdot}1393} \times 30 = 187{\cdot}68;$$

then we get $r = \frac{187{\cdot}68}{\sqrt{h}}$

$$h = \left(\frac{187{\cdot}68}{r}\right)^2$$

$$d = 2\sqrt{l^2 - h^2}$$

$$s = \sqrt{l^2 - h^2}$$

$$l = \sqrt{h^2 + s^2}$$

In the application of governors for steam engines we must always bear in mind the entirely different circumstances under which a land engine governor and a marine governor work. But although they work under different circumstances, caused by the one working on land and the other on board ship, still there is one main point which I will particularly call your attention to, gentlemen, as it must never be lost sight of in designing and constructing a governor, and this point is common for land and marine governors, viz., "*always to maintain two constantly acting forces opposing each other.*" Unless this condition is fulfilled in the apparatus I maintain it is *no* governor.

In the case of land engines we must remember that there is always a heavy fly-wheel attached to the shaft for regulating the speed of the engine, by receiving the power suddenly exerted and storing it up, only to pay it out again in the next moment, when the resistance at once is increased beyond the average. The fly-wheel is by itself a regulator, but as it only removes minor irregularities, and does not confine the engine within a certain number of revolutions—as the speed of the fly-wheel might be increased almost infinitely—a different medium is therefore required to regulate the engine more correctly. This we found in Watt's governor. From the fact, however, that the fly-wheel, with its heavy rim, resists any sudden alteration in speed on account of its inertia, and the same being the case with the balls of the governor, it will easily be perceived that this governor will not act instantaneously — as, for instance, Siemens' single pendulum governor does—but for all practical purposes it is generally sufficient, and hence its universal application.

The two constantly acting and opposing forces are in this case, the centrifugal force and the centripetal force (or force of gravity) the latter one making it necessary always to give the axis of the governor a fixed vertical position, otherwise the force of gravity will be inactive.

Having mentioned the land governor as much as necessary for the

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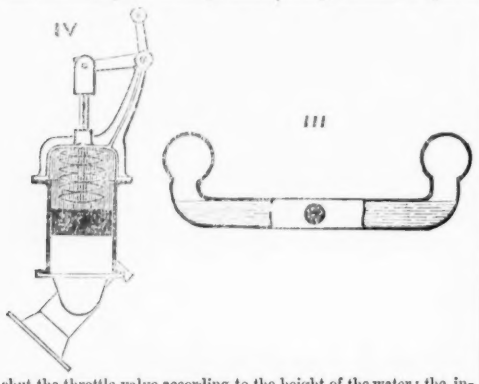
* These formulæ appeared a short while ago in a letter I addressed to the Editor of THE ENGINEER.

purpose of this paper, I shall now pass over to the marine governor and endeavour to point out the main features which constitute a marine governor.

"We must, in the first instance, always maintain, as mentioned above, two constantly acting forces opposing each other; secondly, the governor must not be affected by change of position, from the pitching of the ship in a rough sea way, as it would otherwise work, the throttle valve at times when it was not required to do so, and, on the other hand, neglect to do it when it ought to; thirdly, it should as much as possible work without friction, as the sensitiveness of the governor else will be considerably impaired; next, its action ought to be instantaneous, considering the sudden jerks and the violence with which the engines often fly round, on account of the sudden disappearance of nearly all the resistance, and having no heavy fly-wheel that would resist the sudden start or racing of the engines, and store up the power now uselessly expended. It is for such cases that we ought to provide, and consequently this point is rather important, as the instantaneous shutting of the valve might often save a break down in the engine room, which otherwise might be fatal to the ship. But equally important to this is the instantaneous opening of the valve, as the engines else might be brought to a standstill before the steam was again admitted after once shut off."

When it was found necessary to adopt some means for regulating the speed of marine engines the common two-ball governor was first applied, but it was soon found to be very defective in its action; and it being affected by change of position, from the pitching of the ship in a rough sea, it is clear, from the pendulous nature of the common governor, that it would not act properly on account of the motion of the vessel. (It was here shown by a model how the balls would work the sliding sleeve when the governor was tossed up and down, as in a ship pitching in a rough sea.) Hence various schemes have been proposed as a substitute for the common two-ball governor, amongst them one using a float or swimmer (as used in ordinary land boilers) outside the ship, intending to open or



shut the throttle valve according to the height of the water; the incompleteness of this apparatus caused it to be very quickly abandoned. Another method was a hollow tube partly filled with mercury (Fig. 3). The pitching of the ship caused the mercury to flow either to one or the other end of the tube, and thus opening or shutting the valve, simply on account of the weight of mercury depressing either end, as the case may be. The tube was placed lengthways in the ship, and quite horizontally, so as to have the mercury balanced when the ship was in a calm sea. This invention, as well as the next I am going to mention—the single pendulum governor—failed both, although theoretically correct, on account of the irregular action of the waves on the movements of the ship. For instance, it happens often in a following sea that, although the stern of the ship is down, still the greatest part of the screw is out of water, and *vice versâ*. The consequence of the screw being pitched out of the water is, of course, that the engines race or fly round at a very great velocity—sometimes even at the rate of double the number of revolutions, compared with the usual speed. It will thus be seen that these two kinds of governors cannot be depended upon, as they often open the valve in full where they ought to shut it, and *vice versâ*.

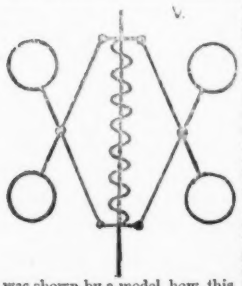
The single pendulum governor consists only of a suspended pendulum, which is at liberty to move in a plane, parallel to the keelson of the ship, and thus its action is only dependent on the pitching of the vessel, which, as I have shown above, is not satisfactory. The rolling of the ship has no effect upon it whatever.

Another invention, which might be called the hydrostatic governor (Fig. 4), is correct in principle, but its introduction has been prevented by several practical difficulties. It consists of one or two cylinders, placed at or near the stern of the vessel, in a line with the shaft, one end of the cylinder being in direct communication with the sea by means of a Kingston valve, the other end being left quite open. The action of the governor is as follows:—When the water partly leaves the stern the spring applied on the top of the piston forces the piston down, and at the same time closes the valve; and, on the contrary, when the stern is deeply immersed, the water forces the piston upwards against the pressure of the spring, and thus opens the valve in full. One of the principal objections to this instrument is the necessity of cutting one or two holes in the side of the ship, as it could hardly be expected that a shipowner would go to the expense of docking his ship for the sake of introducing a governor; it must, therefore, either be applied to a new ship, or wait till a necessity occurs for docking the ship.

The above-mentioned instruments, except the common two-ball governor, all belong to a class of regulators which work entirely independent of the engine; and perhaps this is the main reason why they have not given satisfaction practically, as, according to my opinion, nothing but what will follow the movements of the engine very minutely will be efficient or able to do its work properly.

The kind of governors I am now going to describe differ in this respect from the former, as they are all driven direct from the screw-shaft by means of gearing, belt, or rope.

The oldest of this kind of marine governors was invented by the elder Brunel in 1822. After the common two-ball governor was first found very defective in its action in ships, on account of its being affected by the pitching of the vessel, it was made use of by substituting the spiral spring for the force of gravity, and by extending the links beyond the arms of the common governor, and applying balls at the ends of these new arms (Fig. 5). The object of this arrangement was to form a balanced governor, but the inventor did not succeed in gaining this point, as the practical application of it proved to the contrary, for the pitching of the ship had the same effect upon it as upon the common two-ball governor. (It



was shown by a model how this instrument was affected by being tossed up and down like a ship pitching in a rough sea.) This governor was fitted to the Great Eastern, but since taken out again and replaced by one of Silver's balanced four-ball governors.

(To be concluded next week.)

Steam Pipes in the Exhibition.—It has been represented that there was a great back pressure in the exhaust pipes in the western annexe. An indicator diagram, however, taken from a high pressure engine near the end of the pipes shows no back pressure.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

STEAM HAMMERS.

Sir,—Relative to your article in The Engineer of the 23rd of May, will you permit me to say that we had a 15-ton hammer finished at the proper time for the Exhibition, but the space that would have been required for this hammer (the bed-plate being 30ft. by 14ft., an area of 420 square feet) was such that we abandoned the idea of sending it, and substituted a 20-cwt. double-acting hammer. There would also have been great difficulty in erecting such a mass in the Exhibition building on account of the weight of the pieces, and the height some of them would have to be raised; for instance, the cylinder with covers and gland weighs 32 tons, hammer bar 15 tons, two frames 34 tons; and there would have been besides the loss of such a machine being idle for six months. We have had this hammer at work for the last month, and I mention it here to satisfy you that there is no want of large hammers to meet the requirements of the makers of large engines. The cylinder of this hammer is 46in. diameter, with a clear fall of piston of 8½ft., and the bar, which is forged of malleable iron in one piece, with the piston and dovetail face, is 18in. diameter, and the area of the cylinder is such that we could increase the size of the face to make the falling weight 20 tons. This hammer is single acting, and worked by hand, and the attendant can work it with perfect ease at sixty blows per minute.

If not trespassing too much upon your space, I will make a few remarks upon double and single acting steam hammers founded upon my experience in the working of both kinds.

In the beginning of 1853, wishing to erect a steam hammer for my own use, and having had a good deal of experience as to the want of durability and convenience of the steam hammers then in use, I, after mature consideration, determined to make the hammer bar, or piston rod, and the piston in one piece of malleable iron, and of such a size as to form the weight of the hammer and to work through both ends of the cylinder, and bolt the cylinder between the frames, thus tying them well together, and leaving a clear space below and round the hammer for any class of work; the result was a 45-cwt. hammer, with the bar 10½in. diameter. This bar was forged by the Low Moor Iron Company, and after working night and day for nearly ten years it is now as good as the first day it was started.

Carrying the bar through the top of the cylinder guides the hammer fairly upon its work during all parts of its stroke, and prevents any undue strain upon the bottom stuffing-box and guide when drawing out by the side of the hammer face. If you will refer to the accompanying lithograph, you will find that the cylinder and top and bottom guides and stuffing-boxes are 14ft. 1½in. over all, for a stroke of 8½ft. I thus obtain a guide of 14ft. for the hammer, whatever I may have under it; whereas, if I cut off the top part of the bar above and close to the piston—if I were drawing out, say an armour plate 5in. to 6in. thick, I would be working with the side of my hammer face, and tending to angle it, whilst I would have only, when striking the iron, a guide of about 4ft. (the bottom guide and stuffing-box being 3½ft. deep)—in fact, the guide would be least efficient where it was most required, and I think when you consider the matter in this light you will agree with me that no hammer should be made with the bar working through the bottom of the cylinder only, unless guided by the frames below the cylinder, as in Nasmyth's.

I tried my first hammer in 1853 with steam on both sides of the piston, but I did not then succeed in arranging a gearing that would satisfy me. I also tried the same hammer with self-acting gear, but soon abandoned it in favour of an equilibrium valve worked by hand, which I have since continued, except for hammers from 5 cwt. to 50 cwt. for light work and puddling.

The self-acting gear hitherto in use for single and double acting hammers is actuated by intermittent blows upon the valve gear by the hammer in its up and down stroke, the result is that the wear and tear upon such a gearing is very great, and the keeping up so expensive, that it has, in many cases, been abandoned for the hand gear.

I consider that my hammer is the only one at present in use that can be worked with steam on both sides of the piston efficiently, because the size of the bar is such that it is quite rigid and will strike a solid blow, and being in one piece has no joinings to injure, for however well you may key a block upon the end of the piston rod of a steam hammer, either single or double acting, you will soon find that it will get loose, and eventually break, and certainly sooner when double acting.

As you remark in your article Mr. Rigby made use of my plan, so did Mr. Naylor, and several others, as you will see by referring to their patented plans, I presume without being aware at that time of my prior invention and claim.

After several experiments I arranged the gearing for double acting hammers (such as that on the hammer in the Exhibition) in 1858, and without claiming perfection for it I think it is free from the defects in the gearing for single and double acting steam hammers; it is a smooth, continuous motion with very few parts, at the same time quite efficient. The makers of double acting steam hammers appear to be (with few exceptions) under the impression that they are more efficient than a single acting hammer, but this is only partially so; for instance, for small hammers where rapidity of blow is of consequence, such as for smiths' shops and other purposes where hammers of from 5 cwt. to 50 cwt. are used, the double acting system answer very well, and has considerable advantages over the single acting: but for heavy work, such as shafting from 14in. to 30in. diameter, a solid mass falling by its own gravity is decidedly superior for making sound forgings. If you take a hammer with a falling weight of 5 tons, single acting, and the same hammer, with steam on both sides of the piston, the blow of the double acting hammer is not more efficient than the blow from the single acting hammer, because in the double acting hammer the steam has to be admitted under the piston before the hammer strikes the iron (to return the stroke), and thereby receive the force that is due to the pressure of the steam on the top of the piston; and the only advantage in the double acting system would be a greater number of blows in a given time, but it is very doubtful if a forgeman would be able to handle his iron under a 5-ton hammer when going more than 60 blows per minute, the usual speed with single acting hammers.

Again, if you consider a 5-ton hammer with steam on both sides of the piston, say, 40 lb. pressure (leaving the velocity out), the force due to the steam on the top of the piston would be 10 tons, to which add 5 tons, the weight of the hammer, this making 15 tons. Now, according to the usual idea, this hammer would be equal to a single acting hammer of 15 tons, dead weight; but no practical person would attempt to make so large a forging by one-half, with the double acting hammer, as he would with the single acting one, or, if he did, the result would be that the inside would be unsound. My opinion is, therefore, that the double acting hammers should only be used for light forgings and puddling; where the substance operated upon would not be large, the tendency of double acting hammers working rapidly on large masses is to consolidate the outer skin of the mass and leave the centre unsound (unless they are worked by hand, you then get the full benefit of the steam pressure on the top of the piston, in addition to the weight of the hammer, because the steam would not be admitted under the hammer until the blow was struck); but no hammer, in my opinion, is equal to a large mass falling by its own weight for the production of large and sound forgings.

Robert Morrison.

Newcastle-on-Tyne, June 9th, 1862.

MILD STEEL.

Sir,—You state it is only within the last six years that mild steel—or, as it is called by some, homogeneous iron—became known. In Mushet's papers on "iron and steel" published in 1840, page 525, its manufacture and properties are fully and clearly described as follows:—"When iron is presented in fusion to $\frac{1}{150}$th or $\frac{1}{180}$th part of its weight of charcoal the resulting product occupies a kind of middle state betwixt malleable iron and steel. It then welds with facility, and may be joined either to iron or steel at a very high welding heat. Thus combined with carbon it is still susceptible of hardening a little, but without any great alteration in the fracture. It possesses an uncommon degree of strength and tenacity; capable of an exquisite degree of polish, arising from its complete solidity (Homo.) and the purity of fracture conveyed to it by fusion. With less carbon, the same steel or iron becomes more and more red short," &c.

This process of converting bar iron into cast steel by fusion with charcoal was patented by Mr. Mushet in 1800, and since then it would appear that no improvement in the process has been made up to the present day, if we except Heath's plan of alloying metallic manganese with fluid steel in the pot, and the Bessemer process, by which mild steel may be obtained in large quantities, at a cheaper rate, when sufficiently pure pig iron can be obtained to operate upon. It has been said we are in a state of transition—from an age of iron to an age of steel; and so we should be were the Bessemer process available for the conversion of crude pig irons in general. But as its operation must be limited, as is now pretty well known, to a few favoured localities, we are nearly as far as ever removed from such a desirable consummation.

English bar iron has never been able to compete with foreign irons in the Sheffield market for the finer purposes of steel making. It is, nevertheless, quite as valuable as the very best foreign brands in the manufacture of mild steel for engineering purposes. I allude, of course, to English iron manufactured from a proper class of pig iron, which may be made from all the ores of this country, with but few exceptions. In the ordinary processes of converting pig iron into bar, the worst crudities of the former (as well as the carbon) are to a very great extent removed. This unfortunately is not the case in the Bessemer process. It would thus appear that all that is necessary to obtain a good steel for engineering purposes, in sufficient quantities, is some cheap method of bringing bar iron into the fluid state on a large scale. It is not long since the perfect fusion of plantina, even in minute quantities, was considered a matter of difficulty; now ingots of twenty or thirty pounds weight are turned out with ease and certainty. This is accomplished by the combustion of gases, such as would be too costly in the fusion of wrought iron. Carbonic oxide gas, however, may be produced very economically, and in any quantity with facility, and with this in a very highly heated state, and atmospheric air also very highly heated, I do not see why bar iron should not be brought down into the fluid state in any quantity, its fusing point being much lower than that of platinum. I think something of the kind is worth a trial, and might probably benefit some practical worker in iron were he to take the matter in hand.

June 3rd, 1862. V. S. P.

SINGLE CYLINDER AND COMPOUND STEAM ENGINES.

Sir,—In your last week's paper I find a letter from "Single Cylinder" on "Compound Engines and Difference of Indications," which I have experienced myself.

Now perhaps some of your numerous correspondents will be able to set me right in the following question:—I indicates a beam steam engine working at a pressure in the boilers varying from 25 lb. to 30 lb. per square inch; D, slide valves on the old principle, with as much lap on steam sides as will run the machinery at proper speed (not less than 25 lb. will answer); speed of piston 300ft. per minute. A very strong proportioned engine, the indicated horse power being 170. After the above indication the engine was McNaughted, new boilers put in, and worked at 50 lb. per square inch; the same amount of machinery as before, not the least alteration in the mills; but now being indicated comes up to 200 indicated horse power, the consumption of coal before alteration being 6 lb. per indicated horse power per hour. And now, if I divide by 200 for pounds consumption per hour, it gives 4 lb.; but if I divide by 170 it gives 4·75 lb. per hour. Now which must I take for reality; and, also, how much of that saving results from McNaughting, and how much from the extra pressure now carried in the new boilers to what it was before in the boilers removed; in fact, what is due to extra cylinder and what is due to extra pressure? Has it been a judicious outlay of capital? Could not an equivalent have been substituted at less outlay? And the boilers kept in were perfectly safe at 30 lb. Now, there is the extra 30 indicated horse power. Is it real? But we must allow for the extra friction some way. There are two cylinders requiring extra lubricating and attendance. Could it not all be attained by keeping the 30 lb. boilers, and applying a variable expansive motion, and getting near the boiler pressure on the piston—say, 28 lb. above atmosphere, which is often done, and speed the engine up to 400ft. per minute? The indicated horse power would not then have been more, and the consumption of coal brought down to 3 lb. per indicated horse power per hour. Some will say, by putting in the McNaught cylinder there is more regularity. But would it not be as regular by the adoption of more speed of piston and the application of variable expansion gear?

There are some, perhaps, may object to the speed of piston, and pressure the steam is put on. But what will be the difference of the shock on centres between going on at 300ft. with 20 lb., and 400ft. with 28 lb.?

There are parties applying at present as many as three cylinders or more to work up the steam one after the other. Is not this absurd, when it can be expanded in one cylinder with as little waste in condenser?

It is very important, as "Single Cylinder" very justly remarks, in having a proper person in care of engines, as there are so many without experience, and when anything gets wrong, by their incapacity and neglect, they would make it appear it is some fault in the construction or principle of the engine, instead of their incapacity for the situation. Would it not be best to have competent men, and not so much a matter of wages? One Cylinder.

June 6th, 1862.

KRUPP'S STEEL.

Sir,—Mr. Longsdon's reply to my remarks is by no means logical or conclusive. If the large ingot had been of the soft tough metal, for the manufacture of which Mr. Krupp has so long been celebrated, it would have bent before breaking, whether it received 150 or 1,500 blows. But grant, for the sake of argument, that the ingot is composed of soft tough cast steel, then since it is solid and perfectly free from honeycomb, it requires no forging to consolidate it for forming a gun block. Why, then, does Mr. Krupp persist in forging his guns when he can cast the blocks perfectly solid, and possessing the requisite degree of tenacity?

Mr. Longsdon states that the fact of there being a honeycombed gun of my metal at Woolwich is proof positive that I cannot cast sound guns. Was the bursting of Mr. Krupp's gun at Woolwich proof positive that Mr. Krupp cannot make guns which are safe to use? Neither of these proofs are in the least conclusive; but the facts remain unaltered. My honeycombed gun stood test uninjured, and Mr. Krupp's gun burst. If our Government would take up the matter on a sufficient scale, I could enable them to produce solid cast steel gun blocks, requiring no forging, at a cost not exceeding £25 per ton ready for turning and boring, and capable of standing fifty tons pressure per square inch. This would, I imagine, for ever settle the much-vexed question of ordnance material. I am not, however, one of those sanguine individuals who suppose that, because they know that a certain thing can be done, believe that it will at once be carried into effect.

On the contrary, though I can accomplish all that I advance as easily as I can write this letter, I have no doubt that many years will elapse before this plain and simple method will be adopted for casting ordnance. Robert Mushet.

Coleford, 9th June, 1862.

NITROGEN AND CARBONIC OXIDE.

Sir,—In the course of last year I sent you some communications showing that nitrogen and carbonic oxide had the same funda-

mental constitution, their atomic number, combining volume, and specific gravity being the same, and that they were very similar in many respects in their action; and I therefore submitted that it must be inferred that they are identical in substance, though in different allotropic states. You were so kind as to publish these communications, and also, at the same time, to insert certain others from an "An Atom," and from Mr. Desmond FitzGerald, in opposition to this view. You also indicated an unfavourable opinion of the position I had taken up. This opposition was based upon the difference between the action of N and CO in certain respects, and particularly that, while CO was combustible, N was not. I remarked, in reply, that differences in the action of the very same substance is a well-known and universally-recognised fact in chemistry, generalised under the name of allotropy—that the differences in action between N and CO could all be explained by the greater inertness of the former; and I specified the causes from the action of which this inertness would arise, one of these being electricity. This answer, conclusive as it seemed to me, in the way of depriving of all force any argument based upon any difference between the action of N and CO, did not appear to satisfy you, but you were so kind as to say that your columns would be open to any new facts bearing on the subject, and the matter then closed so far as you were concerned.

Thoroughly convinced in my own mind of the identity of N and C O, and also convinced that, as regarded others, I had got a clue to the unravelment of one of the greatest mysteries of nature, I have ever since been keeping in view, and, as opportunity served, have been carefully pursuing the attainment of the knowledge of a method for the complete experimental demonstration of their identity. To this end I have been examining all the chemical and electrical works that I could lay my hands upon, and I am glad to say that I think I have now attained the object in view. For in perusing last week, for the first time, the article on Electricity, in the new edition of the "Encyclopædia Britannica," written by the illustrious Sir David Brewster, I came upon an account of certain electrical experiments, performed by Dutch chemists about eighty years ago, on certain gases, and saw at once that they embodied results of a most interesting and most pregnant nature with reference to the matter now in issue.

The gases referred to were submitted to the action of electricity in the manner described in the "Encyclopædia," and I shall now quote the result as regards one of the gases experimented upon.

"Nitrous gas had its volume diminished to less than one-half. There were no red fumes when it was mixed with atmospheric air, neither was there any condensation. It would not support combustion, and it lost its usual smell. A kind of powder covered the surface of the mercury, consisting of a new combination formed from the mercury."—Vol. viii., p. 595.

From this quotation it will be at once perceived by chemists that the nitrous gas here referred to is the binoxide of nitrogen.

No. 2.—Professor Graham in his Elements of Chemistry, 2nd edition, p. 341, says:—"This gas is colourless, but when mixed with air it produces ruddy fumes of the peroxide of nitrogen." Also, "phosphorus and charcoal introduced in a state of ignition into this gas continue to burn with increased brilliancy."

The leading deduction to be drawn from these results of the subjection of binoxide of nitrogen to the action of electricity is that the binoxide becomes extremely inert. It no longer combines with oxygen (it was this combination that caused the red fumes)—it no longer condenses—it no longer supports combustion—it no longer acts on the organs of smell. These differences in the action of the same substance, before and after its being electrised, are most impressive and instructive. The very difference on which so much was made to hinge in opposition to my view of the identity of C O and N—that CO was combustible and N was not—is here seen to be displayed by the same substance, the binoxide. So superficial—so ill founded — so futile were the arguments of "An Atom" and Mr. Fitz Gerald in opposition to the inference that CO and N were the same.

It may also here be remarked, as regards the other gases submitted by the Dutch chemists to the electric action, that inertness of chemical action was thereby induced in the most of them.

Now, on the whole of these grounds, and particularly on those as regards NO^2 (NO^2 and CO being similar, in both being neutral bodies, and in both having the power of combustion), the logical and extremely strong inference is that, as the gases generally, and particularly NO^2, become, by the application of electricity, so inert in their chemical action, the same result would follow from its application to CO; in other words, CO would become N, because all the difference between the chemical action of CO and the chemical action of N consists in the greater inertness of the latter.

To sum up. It must thus be seen to be as clear as day that the same substance before, and the same substance after, being electrised, displays very great differences in its chemical action, the difference being ascribable to the inertness caused by such electrisation. Therefore the argument that N and CO cannot be the same substance because they exhibit differences in their action—differences arising from the greater inertness of N—must go for absolutely nothing. On the other hand, the sameness of CO and N in their atomic number, combining volume, and specific gravity — the essential points in the constitution of the gases, and the general sameness of their action, N being only more inert—must be held, if there be any force in facts, clearly and completely to prove their sameness in substance. This view, at once so consonant with the facts and with the laws of reason and of common sense, will, I have no doubt, be fully verified when CO is submitted to the action of electricity in the same way as the Dutch chemists submitted the binoxide of N and the other gases experimented on. There are, I regret to say, obstacles in the way of my doing so, but I shall use every effort to surmount them as far as lies in my power, so that I may establish in a way beyond all doubt, and to be comprehended by the most ordinary intellects, that CO and N are substantially the same. When I have performed the experiment I shall report the result to you.

I have abstained in this communication from alluding to the general grounds, leading to the same result, as shown in my former communications. But my confidence in these grounds, in place of being diminished, has, if possible, been strengthened by the light thrown upon the matter by the electro-chemical experiments stated and commented upon above.

Edinburgh, May 28, 1862. H. K.

[We have allowed "H. K." to state what may be a fact, and to garnish it with a large measure of illogical deduction. There can be no objection to the presumption that nitrogen and carbonic oxide *may* be identical, but it is not for "H. K.," who does not appear to have made a single chemical experiment in his life, to attempt, upon a hasty induction, to cram down the throats of men of science his dictum that these substances *are* identical. It is this only of which we complain, and for this we closed our columns to "H. K." a year ago. His tone and mode of reasoning are not those of a man of science, and can never carry the conviction which he seeks to enforce. A thousand points of resemblance between two substances can never make them the same while there is a single point of difference to separate them, unless, indeed, by the absolute conversion of one substance into the other, or into a common compound, it be shown that this difference is due to allotropy. It is only because both diamond and charcoal can be converted, by combination with oxygen, into carbonic acid, that they are believed to be identical in chemical substance. And it is only upon such evidence that the allotropic state of a body can be proved at all. Yet here is "H.K.," without a particle of proof that carbonic oxide and nitrogen are mutually convertible into each other, or into a common compound, insisting with the whole force of his vocabulary, that they are identical. We have no wish to check discovery or the spread of truth, and shall, therefore, hold "H.K." responsible, in case of any further communications on the subject, that he does not declare a thing *proved* which, at the most, is only remotely probable. At present nitrogen is a non-combustible, non-poisonous gas, while carbonic acid is both combustible and poisonous.—ED. E.]

THE ENGINEERS OF THE ROYAL NAVY.

(Continued from p. 342.)

LET any one visit a naval hospital, and ask those who they find there with chest diseases how their complaints were brought on? and we need not be surprised to find that many owe the loss of their health to such horrible accomodations. During a conversation which I once had abroad with a medical man on the nature of the employment of the marine engineer in the tropics, he said what puzzled him most was how they obtained engineers for the navy. "However," said he, "do they obtain men for such work as this?" alluding to their employment in those "coffins"—the gunboats—in China, and to the effects of which on the human constitution he had been an extensive witness. It is also probable that he knew the number in the long list of names on the engineer's tomb-stone in "the valley" at Hong Kong, and that these had nearly all died in their youth. Yes, how do they obtain men for such work as this? They are obtained in various ways—partly from "recruits," partly from applicants, young men from the country, but principally from "engineer boys" from the dockyards, "educated" for the purpose. The "applicants" and "recruits" seldom stay long after they have found out the state of things in general, excepting those who are not "workmen;" but the "boys," few of whom are able to earn a decent living in any private shop, generally contrive to put up with the treatment and stay. But you will ask how is it that anyone is induced to join the service while there are such evils existing? If we were to put that question to some poor invalid in hospital he would answer—"The evils you speak of are not so generally known as is commonly supposed, probably from the fact that when a man makes a bad bargain it is not usual for him to proclaim it to the world. I applied to join the navy, thinking that, as it was her Majesty's service, it must be good, of course guided, as I was, in a great measure to the latter conclusion by the glowing descriptions given by the Admiralty recruiting engineer, who was 'beating up' where I was employed."

Ques.: When you found out your error why did you not apply to leave? Ans.: I applied twice, but without success. I should have applied again but I got so involved in debt through my heavy expenses that I delayed, thinking to reduce it before I cast myself adrift, but my expenses increased rather than diminished, and now I am every day expecting to be "invalided." Then I shall go home with ruined health, with "less than nothing" in my pocket,—a sorrow to myself, and a burden to my friends. In frigates and smaller vessels the accommodations are usually better. But even there the sun seldom shines on, and the blue sky is seldom seen, and the pure air is seldom breathed in the intervals or after the heated labours of the day. The quarter-deck is not the place for a "blow" for the tired engineer, except sometimes at seven bells in the forenoon. He must not go "for'ard" to expand his dusty lungs, oh no. So the outcast "greaser" chats away his spare moments over the "spit-kit"—if "the officers" don't melt away one by one at his approach—or he dives down to the dark regions of his dungeon—frequently only a part of the engine-room—and changes his clothes ready for another "wet shirt," perhaps for the fifteenth time since 4 a.m.! or he again trusts his bones, his spine, and his life to the tensile strength of a hook and line in the steerage, with no other place to strip than the deck, where some 500 men and boys do congregate—about as private as any public street.

The pay of the engineers is insufficient; and on some stations their whole pay and more is often swallowed in a host of expenses, and it is next to impossible for those who have dependents to keep up a proper appearance and keep out of debt. A steady man in London, on 6s. a day, is a £1 a week better off than he would be on the same pay in the navy, where, instead of being able to save money, nearly all are over head and ears in difficulties. The pay of the "chief," though nominally more, is really less than the "engineers," on account of their ward-room expenses, and the good appearance they have to keep up. It is true all can, if they choose, have the same rations as the men, or about £1 10s. per month in lieu "and find themselves," yet, after their pay has been "sweated" by deductions for income-tax, mess entrances, subscriptions and donations, contingent, literary, and wine funds, uniforms and outfit, private servant, hammock men, cooks and stewards' allowance, navy agent, waterage, postage, washing, travelling expenses, and a lot of others, small in detail but heavy in the aggregate. After these deductions from his pay the sum that remains will be very, very small, even with the most careful management. Moreover, let the poor engineer be sent on the most expensive, unhealthy, or the hottest station—often for years together—he has no increase of pay to compensate for it, and where, from the nature of his employment, it is so necessary to live well to keep up the strength. Sometimes, however, an additional "half-gill" of rum or arrack, or a penny per day, or a cup of tea, in lieu, is given in the tropics, once in twenty-four hours, with the captain's permission and the sanction of the doctor, upon the master's certificate that the ship is in the tropics, and the chief engineer's that the steam has been up at least twenty-four consecutive hours, and even this is stopped the instant the steam goes down and the tropics left. The "ship's allowance," especially the biscuit and salt meat, which latter is sometimes hard enough to be sawn and worked like wood, is not much to support life while steaming in, or in the vicinity of, the tropics, yet hard as it is, it is harder for supernumeraries to have to pay 1s. 6d. a day for the privilege of trying to eat it.

Nothing has yet been said about the pensions to which engineers are entitled; but could we compare the numbers of those who have been discharged, with and without a court-martial, for all sorts of funny offences, those who have been discharged at their own request, and those who have been invalided and sent "adrift," and those who have died in the service, with the number of those who have lived to enjoy their retirement, we should find the less said about engineers enjoying pensions the better.

The engineer—whose position prior to 1847 was no sham—has now no acknowledged position in the navy, however it may appear to the contrary on paper. He is only spoken of as an officer—when it is convenient so to do—rarely treated as such by even the highest, and of course the lowest; even his uniform is shorn of that which distinguishes the officer. Let a present be sent, or an invitation be given, or a privilege allowed, or let some royal or notable person pay a visit to the officers, and then see who are the officers and who are "only engineers." How many are there who are now serving in ships commanded wholly or partially by a low class of men, who have "risen from the ranks," inferior in rank and social position—minus intelligence, education, manners, and all the noble qualities of gentlemen? A surgeon attached to a regiment with a non-commissioned officer as colonel would be in an enviable situation in comparison. The indignities shown to the engineers of the Black Prince, &c., in shifting their berth from "aft" to "for'ard," compelling them to sleep over the reeking condensers, and the reasons assigned for the same, adding insult to injury, the unkindest cut of all, surprises no one acquainted with the treatment which engineers receive, who, though the most useful, are the least appreciated and most abused of any class in her Majesty's service: for let the most trifling offence occur—let only a blackish footmark be seen on the deck, perhaps in a place where stokers never go, and see how the "engineer of the watch" is sent for and reprimanded in that cruel, ungentlemanly, and unnecessary way for which the service is so notorious, and the chances are he will have to get the deck scrubbed over, and superintend the operation himself, degrading him in the eyes of every one. How many a good and steady engineer has been sickened of the service at first starting by being subjected to the most irritating abuse for the breach of some strange rule in ignorance, or the most pardonable infringement of some piece of "etiquette," wholly unknown but in the navy. A very slight reproof would often be more punishment to such a man than "four dozen" would be to his reprover. In one of our first-class ships recently, on the occasion of reading the "quarterly return of courts martial," the names of all the officers—about twenty—were omitted, and none but the names of the men and engineers were exposed. Of the latter there were two, who were tried for comparatively no offence, yet they were rendered conspicuous by the absence of the name of any other officer. Bad as the engineers were thus misrepresented to be the late Admiral Pelham, one of the Lords of the Admiralty, in a private letter to an acquaintance of mine, stated, "and I have had less trouble, comparatively, with engineers than any other class of officers." No mean authority upon the subject be it remembered In contradistinction to the above instance of dishonourable partiality none of the names of the devoted little band of heroes, who bravely volunteered to cut through the chain booms stretched across the Peiho, under the concentrated fire of the Taku forts, were mentioned in the dispatches from China; yet did this "forlorn hope" distinguish itself ashore and afloat, under a murderous fire, unarmed, except with what they could find, for assistant-engineers are the only officers not allowed arms; yet the names of their equals and inferiors, whose services were of a far less distinguished character, were carefully recorded.

While engineeers are subjected to such oppressive, such ungrateful injustice from those high in power, need we wonder at the coarse treatment which all classes unhesitatingly bestow upon them? and which, increasing in intensity in geometrical progression down to the lowest, is that which stamps the class with the degradation which is the chief cause of its unpopularity: and while our public money is being wasted by tens of thousands upon "that which is not," the shadow, not the substance of mechanical ability, incompetence crawls into power! and, like a worm at the root of our national "gourd," is dangerous alike to our maritime supremacy and our position among the nations of the earth.

It would not be right to close these remarks upon the treatment of naval engineers without mentioning the name of one officer who has done much to mitigate it. I refer to Admiral E. P. Halstead. Numbers who have had the honour of serving under this talented gentleman will bear testimony to the noble examples he has set in raising the engineer to his proper level. The great amount of time and private expense, the untiring efforts he constantly devoted, are proofs of the earnestness of his endeavours, and in any man in the pursuit of an object are no bad criterion by which to estimate his zeal. The Naval Engineer's Study at Sheerness is a lasting monument which this scientific and gallant captain has unconsciously reared to himself. The eminent mathematical professor he succeeded in retaining solely for the instruction of the engineers of the "reserve" is but one proof, among others, that this experienced and accomplished officer appreciated the value of good and able engineers, and that such alone ought to belong to a service of which he is one of the brightest ornaments.

If we briefly contrast the condition of the naval engineer with that of the merchant service engineer we shall see whether it improves as our acquaintance with it extends. A steamer plying between ports, and these being only a few days apart, can scarcely be called "going to sea" in the naval sense of the term; for in the navy not only does the engineer not know to what part of the world his ship is going, but whether it is coming back in a week, a month, a year, or six years; so the necessity for skilful engineers is not so urgent in the mail service, yet are they all good and experienced men, whose abilities are tried and proved before they are sent afloat; and not only are they more skilful in the management of machinery, but all are able to "turn to" when occasion requires, and, as "many hands make light work," such a division of labour shall be better than that in which some "make" while others "break," and some work while others grunt, besides the advantage and pleasure to the young hands in having older and better men than themselves for their superiors.

The pay of engineers in the merchant service is superior, and this again is increased and nearly doubled on some stations; it also increases as he rapidly ascends the ladder of promotion, and at a greater ratio than the pay in the navy, and there are many chiefs in the mail service with better remuneration than naval inspectors of machinery. And, though merchant engineers are not entitled to pensions, there usually exists a "fund," a small payment to which entitles the subscriber to ample compensation for injury, and a comfortable annuity in old age; and even where such funds do not exist did anyone ever hear of a good old servant being cast adrift in his old age? Though few have need of such honourable treatment, their liberal pay enables them to maintain themselves respectably during life, and to provide for old age and their dependents after death.

Again: the accommodations of the mail service engineer are far superior to the naval engineer; nearly every one has a cabin to himself, and furnished for him with every necessary. He has then the opportunity of writing, drawing, or studying, or what is of the greatest consequence to those who have the night watches, a few hours of quiet sleep, a necessary wholly unknown to the naval engineer of the present day.

Again: the expenses of the merchant service engineer are much smaller. The small stock of clothes he takes with him can scarcely be called an "outfit;" he has the advantage of seeing home and friends every few days; of generally knowing to what port he is going and when he will return; and in some of the mail companies the engineers are provided with a mess, the like of which the naval engineers could not provide with all their pay; in fact, as Captain Engledue said in his evidence before a Committee of the House of Commons, "they live like princes." He has other advantages than those of a remunerative kind—he has a position not in theory alone but in reality, and the engineers are treated by all with the same respect as the deck officers of equal rank. Here they may be seen comfortably seated on the upper deck, enjoying at once their "watch off," their book, the breeze, and the society of their intelligent and gentlemanly sailor officers. How different is all this treatment to that experienced by the poor engineer of the navy! Why, then, is it surprising that so many gentlemen of position and education accept employment as marine engineers in our mail companies? Why is it that the Admiralty are unable to recruit their engineering staff from among these talented young engineers who adorn the profession, whose skill has made us the admiration and envy of the world? Because these gentlemen, after paying heavy premiums and studying hard and long at the most difficult profession in vogue, will sooner continue to work as amateurs, or go to sea in a service in which the treatment and pay is decent. It is from this class that the leading men of railway, mining, steam navigation, and engineering companies in all parts of the world are recruited. The field of operation open to the steady and enterprising man is so wide and the prospects so good that few ever think of entering the navy, not for that reason only, but for the many already stated and others that could be added.

(To be concluded next week).

PATENT TRIBUNALS.—BETTS *v.* MENZIES.

SIR,—The recent decision in the House of Lords on this well-known case appears to me to be suggestive of some points in connection with patent tribunals which it may be advisable just now to mention.

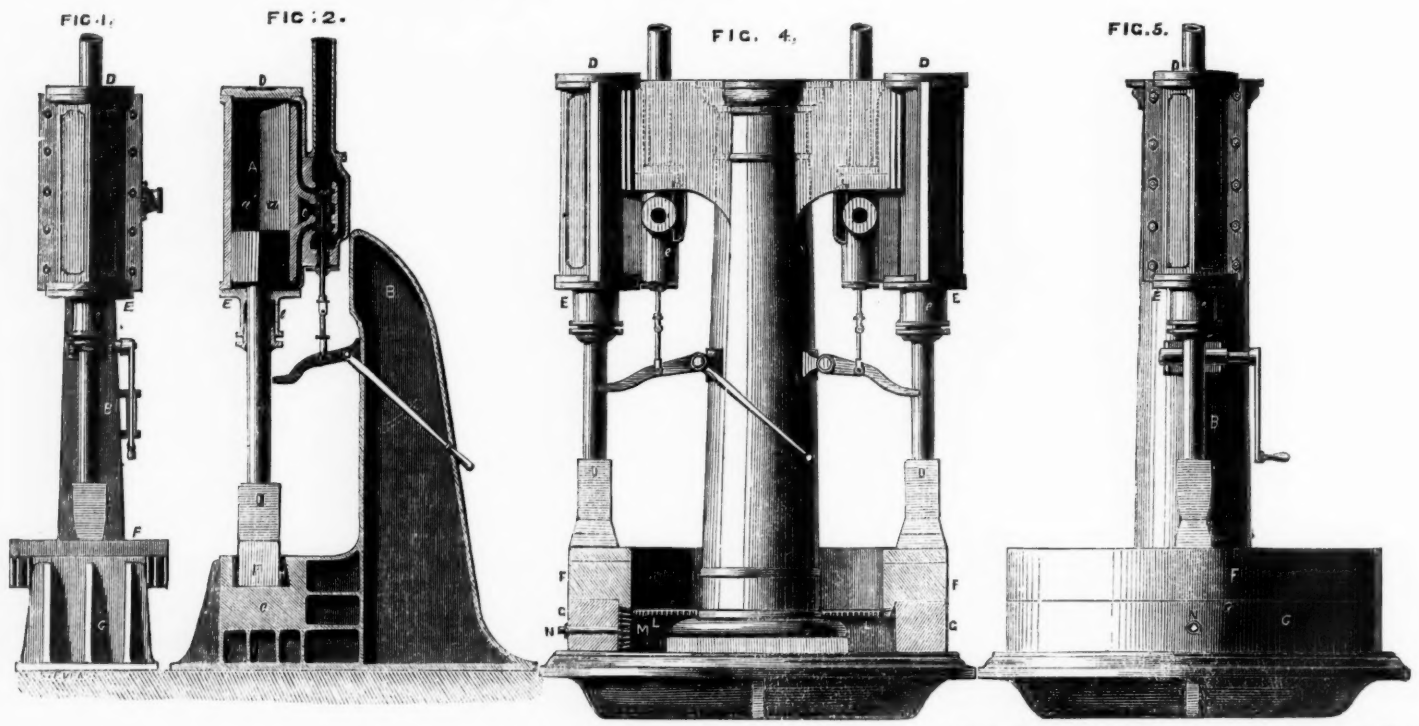
The decision tends to confirm the impression of most persons experienced in patents of the impracticability of working a preliminary examination of all applications for patents with a view to ascertaining the novelty of the inventions. It shows that the question of novelty is not so simple as inexperienced persons are apt to assume it to be.

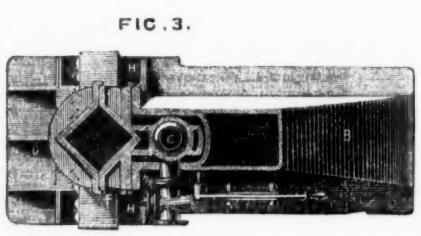
Even in comparing two complete specifications, in which the same words of science are used (as in the present case), there may be a difference of meaning if a considerable period has elapsed between their respective dates, so as to give a different sense to the allusions contained in them. And this difference of meaning to be given to the technical language of the two documents makes it necessary, in trying a question of novelty, to take into consideration not merely the language but also the facts alluded to, because patent law always involves facts of science as well as law.

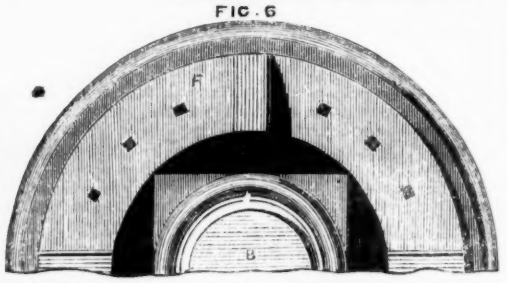
Then if the question of novelty be so large a question when applied to a complete specification, in which the invention is accurately defined and limited in express terms, how uncertain of application is it to a provisional specification, from which the description of detail and the claim are omitted, and in which only the essential nature of the invention is stated!

The ground on which Betts' patent has been held to be valid is

NORMAN'S STEAM HAMMERS.







similar to that on which Hills' patent was. And it appears to me that the Lord Chancellor (who pronounced judgment in both cases) has an unusually firm grasp of the principle of interpretation to be applied to specifications, in order to determine whether or not they contain any addition to the public stock of information, as compared with former publications. This, we all know, is the true test of novelty.

I believe Lord Stanley was quite right in asserting that, although on the first blush of the thing preliminary investigation appeared most advisable, yet on further inquiry into facts the possibility of its being satisfactorily worked became doubtful. I also believe that the remedy for abuse under the present system of granting a right on the mere allegation of the applicant, at his own risk, is to have some simple mode of challenging the validity of the right after it has been granted, as was mentioned by Sir Hugh Cairns.

Another point raised by the decision referred to may be the apparent countenance which it gives to trial by jury, since the judges decided that a question of novelty should not be settled by the Court alone on a mere comparison of the two specifications without evidence as to facts. But this only relates to the present system, in which the Court has no scientific aid, except in the form of evidence, on which a jury pronounce a verdict. The principle involved in the decision of the judges only goes the length of saying that the question of novelty is a mixed question of law and fact, not of law only; so that, if the Court were to be provided with trustworthy scientific aid, it might determine the mixed question of law and fact without a jury.

Other points might be mentioned, but these may suffice for the present. William Spence, Assoc. Inst. C.E.

50, Chancery-lane, W.C., 10th June, 1862.

NORMAN'S STEAM HAMMERS.

This invention, by John Norman, of Glasgow, comprises various improvements in hammers, such as are worked by steam, and in anvils therefor, and has for object increased simplicity in construction, facility for making repairs, and convenience in use.

The invention consists, in the first place, in making the piston chamber in two or more longitudinal parts, and square in cross section, or of other convenient form, which will prevent the turning of the piston or plunger, and so dispense with separate guides. The piston or plunger is, of course, shaped to correspond and the surfaces may either be accurately fitted and scraped to work steam-tight; or the ordinary piston packing may be adopted. The piston and rod are, by preference, made in one forging, and the bottom cover and stuffing box are passed from it below, and bolted to the piston chamber; or the cover and stuffing box may be formed in longitudinal parts, either continuations or not, of the sides of the chamber. The piston chamber may either be bolted as a whole to the standard or framing, or one part of it may be cast thereon. A single central framing or standard may serve to support two or more hammers placed on opposite sides of it, or circularly round it.

The improvements in anvils comprise several modifications, in all of which the anvil is adjustable, so that different cresses may, with facility, be brought under the hammer. These cresses may be formed on the anvil, or the anvil may be formed with sockets to receive them. In one modification the anvil block is held in a transverse bed formed for it in the stool, which is, by preference, cast jointly with the sole plate and standard of the hammer. One side of the bed and the same side of the block are grooved vertically, or formed with locking projections and recesses, and the block is held in any of its positions by means of a wedge key between its other side and the other side of the bed. In other modifications the anvil block is made so that it can be turned either about a vertical or a horizontal axis to bring a different cress under the hammer, provision being made by means of grooves and keys, or otherwise, for locking it firmly in any of its positions, and for bedding it in a solid manner. The same anvil block may further be contrived to serve for different hammers, one cress being in use under one, and a different one under another. Thus, when two or more hammers are placed round one standard, the anvil block may be arranged to shift round about the standard; or, again, it may shift about a vertical axis apart from the standard, so as to have different parts of it under hammers upon separate standards. Rack and pinion or screw gearing may be provided for shifting the anvil blocks.

Fig. 1 is a front elevation, Fig. 2 is a vertical section, and Fig. 3 is a horizontal section, of one modification of steam hammer and anvil constructed according to the invention. In this case the piston chamber A is square in cross section, and its sides consist of two castings a, a^1, the inner one a bolted to flanges b formed upon the hammer standard B, and the outer one a^1 bolted to the inner one a by flanges formed upon them for that purpose. The valve chest C is formed upon the casting a, and valves (of the piston class in this instance) are used, being arranged to admit steam to both ends of the piston chamber A. The top cover D is bolted on, as is also the bottom cover E, the latter being formed with a stuffing box e, of the ordinary kind. The anvil F is adjustable, being held in a stool G, cast in this example in the same piece with the hammer standard B, and the front of the anvil F, and the inside of the stool front G, are formed with counterpart grooves and ridges, which permit of the anvil being locked in various positions by means of a key H inserted horizontally behind it.

Figs. 4 and 5 are side and front elevations, and Fig. 6 is a sectional plan, of a third modification of the hammer and anvil. In this example, two sets of hammer details, similar to those hereinbefore described, are fitted to one central standard or pillar B, and a single circular anvil block F serves for both hammers. This anvil block F is mounted upon a circular stool G (the two being shown in vertical section in Fig. 4), and is kept in its position by an inner flange projecting slightly down inside the stool. To this flange there is attached a circular bevelled rack L, with which there gears a bevel pinion M on a spindle N, passing through the stool G, and squared at its outer end to receive a handle or key, and by turning this spindle N the anvil may be shifted round as required.

The Fountains in Trafalgar-square.—For some time past workmen have been employed in carrying out the designs of Messrs. Easton and Amos, for giving something of an ornamental character to the fountains in Trafalgar-square, and making them in some respect worthy of that "finest site in Europe," which has been so long the laughing-stock of every person of taste. The plan which has now been carried out is almost identical with that originally suggested in 1843, but which, upon the advice of the late Sir Charles Barry, was not accepted, on the ground that the simplest possible arrangement, such as that which was realised in the "dumb waiters," would be better adapted for the purpose than a variety of jets of water. The suggestion of this eminent architect was acted upon, and a sum was expended upon the carving and polishing of the granite basins far greater than would have sufficed for some approach to a pleasing distribution of jets of water. Mr. Cowper stated a few days since, in the House of Commons, that the alterations would, when completed, astonish the world by the splendid effects which they would produce. It is not necessary, perhaps, to go so far as this in our admiration of the new fountains, but, as we were present yesterday at a private display of the whole series, we have no hesitation in saying that a very great improvement has been effected upon the familiar squirt and "dumb waiters." The water is supplied to the fountains from the waterworks in Orange-street, which were constructed by Messrs. Easton and Amos in 1844, and is pumped up into a tank about 40ft. above the pavement of the square, from whence it flows to the two fountains, and the waste or overflow is conveyed back to a catch well sunk underneath the engine. It is then pumped, by means of an Appold centrifugal pump, into the tank, and thus passes over and over again. In its passage it is made use of to supply the condenser of the large 60-horse pumping-engine, so that not only does the water for supplying the fountains cost nothing, but it is actually made the means of economising fuel, by enabling the adoption of a condensing instead of a high-pressure engine, for the purpose of pumping the water from the artesian wells for the supply of the different public offices. The quantity of water which was used in the fountains before the present alteration was from 400 to 500 gallons per minute; the Appold pump is arranged to lift from 1,200 to 1,400 gallons per minute, thus affording sufficient for the increased number of jets. The wells from which the supply of water is in the first instance derived are two in number; one at the back of the National Gallery, is 300ft. in depth; and the second in the enclosure immediately in front of the National Gallery, is 383ft. in depth. A tunnel about 6ft. in diameter, and 400ft. long, connects the two wells. The water, although obtained from an artesian well, does not rise to the surface, and an engine of about 60-horse power is required to raise the water from about 90ft. below the surface. The steam engine has two cylinders, the larger being 35in. in diameter, with a length of stroke of 6ft.; and the smaller one, 22in. in diameter, with a length of stroke of 4ft. It works one double-acting pump 13½in. in diameter with a length of stroke of 3ft., for the supply to the fountains, and two 18-in. pumps, with a length of stroke of 20½in., for raising water from the springs into the tanks above the building At an average speed of 16 strokes per minute the fountain pump throws about 660 gallons, and the two spring pumps together 600 gallons per minute. In 1852 the tank tower was raised 20ft., for the purpose of giving a better supply, at high service, to the upper tanks in the river front of the Houses of Parliament The pumping of 600 gallons per minute, equal to 432,000 gallons in twelve hours, lowers the water between 20ft. and 24ft.; it then remains stationary as long as the engine is kept working. The height to which the water will stand when at a state of rest varies in wet and dry seasons; but the head does not appear to be gradually lowering. The cost of the works as completed in 1844 was £8,392, the annual working expense is £492; but the water supplied to the various public offices at the rates previously paid, amounts to £904 a-year. The Houses of Parliament, the Admiralty, the offices in Downing-street, and 28 public offices in all are supplied from this source. Up to the present time the fountains in Trafalgar-square have consisted only of a single jet falling over from an upper and lower basin. This will still remain as the centre figure of the basins, but at each of the semicircular bays there is now a group of jets consisting of a centre and sixteen surrounding it. The jet of water from the centre rises about 5ft., and those in the outside 4ft. There are, therefore, in the first instance, 68 jets, throwing 300 gallons per minute, rising from the surface of the basin. The ground plan of the basins is a square, the sides of which are about 68ft. long, and semicircular bays project from each of these sides. In the latter, as we have stated, are the circular group of jets. An outline of an octagon is formed within the square, and at each of the angles is a jet which throws the water inwards to a height of 20ft., and into the upper basin of the central fountain. These eight jets throw 200 gallons per minute, and their curve is about 30ft. in length. There are, again, two inferior squares surrounding the central group, and from each of these angles a jet is thrown outwards, crossing those from the octagon, rising to the height of 25ft., and curving about 17ft. These throw altogether 200 gallons per minute. Beyond the sides of these smaller square are eight feather jets which throw up 200 gallons per minute, each of the groups of jets forming a display resembling the Prince of Wales' feathers. The whole of these may be played at once or together, in not less than 25 different continuations or changes. When all are at full work, and the day is calm, the effect is decidedly pleasing, and is an immense advance upon the dismal failure with which the public have so long been familiar. The hoarding which has for some weeks past concealed the progress of the works will be removed in two or three days.—*Observer*.

The American Axminster Loom in the Exhibition.—The most important piece of machinery exhibited by the Americans is a power loom for weaving tufted carpets, which may be seen at work in the machinery annexe. It has already created quite a sensation among the trade, and in a practical point of view is perhaps one of the valuable novelties in the department. The great feature is that by a single throw of the shuttle it will insert, weave in, cut off, and complete one whole range of figuring tufts across the width of the fabric in less time than is required for the making of a single tuft by the hand-loom. Any medallion design can be woven in parts, which may easily be united so as to have the appearance of being woven in one piece, as the selvage produced is such that when sewed the seams are not visible. The strain on the material is so slight that common worsted or woollen yarns of any quality may be used, so that the cheapest kinds of carpets may be produced in it. The economy of time, labour, and material is so considerable that the machine will, probably, effect a most important revolution in carpet manufacture.

The Armstrongs.—The 40-pounder Armstrong gun employed for some time past in Woolwich Arsenal in testing a new species of vent pieces, and loaded with a double proof charge of powder and shot, has at length yielded to the tremendous concussion and burst, the whole of the coils behind the trunnions having been shattered into fragments. Admiralty orders have been received at Chatham for spare vent pieces to be in future supplied to all Armstrong guns on board the various ships, in the proportion of three each to the 100-pounders, 70-pounders, and 40-pounders, and two each to all Armstrong guns of a smaller size.

TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

F. M. R.—*We do not think the fact has been recorded in Engineering history.*

W. J. (Manchester).—*We have never heard of such a remedy, and cannot say how it would act.*

CALORIC.—*Wilcox's engine is patented here, but we cannot, at this moment, give the date of the patent.*

T. M. T.—*We know of no book except Humber's great work on bridges, which gives all the rules you require.*

J. E., Jun. (Houndsditch).—*Steam gauges with maximum hands have been much used. There is nothing new in the idea.*

R. A. G.—*So your pump requires but one-tenth the power of the centrifugal pump? The centrifugal pump raises a weight of water at least equal to half the force expended in driving it. Then your pump must give off five times as much in "effect" as the power required to work it. Do you ever study mechanics?*

THE MANUFACTURE OF SOAP.

(To the Editor of The Engineer.)

SIR,—In answer to a question in your paper of Saturday, the 31st of May, regarding soap boiling, I consider it would be a saving of 50 per cent. in time and fuel to use steam.

The boiler to be a double shell, 2in. or 3in. apart for steam space, according to size required, with a 9in. or 12in. vertical pipe fixed to the bottom of the boiler, and open to the steam space, and closed in on top, and to reach within 12in. of the level of the furnace, so as to form a steam space; the inlet pipe to be 2in., and entered about the top of boiler; the outlet 1½in., to be entered at the bottom, and connected to one of Weem's paragon air and water dischargers, so as to keep a uniform pressure of 20 lb. or 30 lb.

EDWARD SMITH.

ENGLISH PATENT LAW.

(To the Editor of The Engineer.)

SIR,—As the present English Patent Law is about to be inquired into, I beg to state to you a grievance which I labour under from the incongruity of it. After having paid a large sum of money to secure my patent for explosive appliances, the Lord High Chancellor of England refused to sign it, on the ground that it was one day too late. This delay of one day was caused by the final specification being detained in Dublin, on a Sunday, the 2nd of April, no mail leaving Dublin on that day for Cork. The letter of Mr. William Johnson, my patent agent, was dated the 31st March, and the Glasgow post-mark was the same date; I, therefore, received his letter only on the 3rd of April. All this was set forth in my petition, yet the Chancellor refused to sign the patent.

J. NORTON.

Howard's Hotel, Kingstown, Dublin, June 10th, 1862.

SHAW'S GOVERNORS.

(To the Editor of The Engineer.)

SIR,—By your number of the 23rd inst. I learn that the valve shown in the sketch published in No. 332 belongs to Mr. Paton, also on referring to a vol. of THE ENGINEER for 1859, I find that provisional protection was granted him for "Improvements in Valves," see No. 207, p. 433.

I by no means desire to figure as a piratical mechanic, and, therefore, beg to call the attention of Mr. Paton and other patentees to "Grant of Provisional Protection," No. 1215, dated April 25th, 1862, which, in addition to the cylinder arrangement referred to, relates to a governor and speed indicator, in order that I may avoid infringing on any one's rights, it being my intention to patent in Spain as much of the invention as may be left me; meanwhile, I beg to apologise to that gentleman for having, unknowingly, attempted to appropriate what, "on the faith of his letter," I must consider as his valve.

JOHN SHAW.

Ferrol, May 29th, 1862.

A NAVAL STEAM RAM.

(To the Editor of The Engineer.)

SIR,—In your publication of yesterday your correspondent, "Mr. J. R. G. Grundy," submits a plan for destroying ships by means of a steam hammer working through the bows of a small coated vessel.

This plan was submitted by me to the Admiralty in April last.

I first sketched it as he has done through the bows of the ship, but on further reflection I considered it would be better to have two steam hammers, one coming through each side of the ship, about midship, for two reasons: the first was that the force of the blow would sooner make the attacking vessel recoil from the object attacked than if placed at the sides; the second was that I think all war, as well as other ships, should be furnished with two rudders, one fore and one aft, connected together by a crossed band of strong wire rope, so that the pressure of the water which comes on the fore rudder, when turned aside, gives out power to pull up the aft one, forming an equilibrium which enables any boy to turn out of its course a large ship in double quick time by moving either rudder, or, in other words, by the force of its own momentum.

EVAN LEIGH.

Collyhurst Ironworks, Manchester, June 7th, 1862.

THE STRENGTH OF SHAFTS.

(To the Editor of The Engineer.)

SIR,—I should be obliged if you would furnish me with a rule for the strength of wrought iron shafting. That given by Templeton appears to me to be unsatisfactory; it is given for cast iron, and wrought iron is supposed to be in the proportion of 1 to 1·12.

In my case I have a 10 (nominal) horse power engine. I wish to know the diameter of the main shaft, which is 48ft. long.

Templeton's rule is this:—Multiply the radius in feet of the pulley by the weight in pounds, applied at the extremity of the radius end by the length of the shaft in feet, and divide by 55 × the number of degrees in the angle of torsion (which he puts down as 1), extract the biquadrate-root, and for wrought iron divide by 1·12.

In my case, to apply this rule, suppose the engine exerted 15 actual horses power and made 50 revolutions per minute, the pulley in the flywheel shaft 6ft. diameter, that on the main shaft 3ft., the radius of which is 1ft. 6in. Then if a horse power be 33,000 lb., raised 1ft. high per minute, and the speed of the shaft being 100 revolutions per minute, then 110 l. at 300ft. per minute is equivalent to 1-horse power, which multiplied by 15 = 1,650 lb. = the whole power which would be applied at the extremity of the radius of the pulley, applying the rule we have

$$\frac{1650 \times 48. \times 1.5}{55 \times 1} = \frac{118800}{55}$$

=2160 extracting the biquadrate-root = about 6½in. for cast iron, for wrought iron, say 6in. It appears to me that 3in. would be ample; the question then is how many degrees in the angle of torsion ought to be allowed per foot in length for wrought iron.

W. C.

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THE ENGINEER.

FRIDAY, JUNE 13, 1862.

TRACTION AND SELF-PROPELLING FARM ENGINES IN THE EXHIBITION.

Is it possible that steam was applied on common roads just upon eighty years ago! Is it really so long since, while Watt had actually patented a road locomotive, with a *wooden* boiler, his assistant, Murdoch, completed a veritable steam-propelled carriage, which, breaking loose late one evening in an unfrequented lane, nearly frightened a Cornish parson out of his wits! History gives the year 1784 as the period of this event—a time when our great grandfathers were but middle-aged men. It would be hardly allowable, however, to compare Murdoch's toy locomotive, which he could easily carry off under his arm, with the steam elephants of the present day. Trevithick, too, although he constructed a steam coach just sixty years ago, did little for the practical introduction of steam on common roads, nor did Evans, the American, who was even before Trevithick in the practical application of the high pressure engine. The tubular boiler, or one giving a corresponding proportion of heating surface, was the first practical step towards a successful road locomotive, just as it was for the railway engine. But thirty years ago, steam road locomotives were running from Paddington to the Bank, from London to Southampton, and, soon afterwards, from Glasgow to Paisley. Notwithstanding, however, that their performance was for the most part successful, and that a committee of the House of Commons reported in their favour, the turnpike proprietors succeeded, by imposing prohibitory tolls, in stopping road locomotives altogether. The superior results attained by locomotives on railways also led many to suppose that steam, once raised for locomotive purposes, ought not properly to be expended at all under the disadvantages of common road traffic. We will not stop to inquire how far the road locomotives of 1832 were comparable, in respect of efficiency and working qualities, with those of the present day, but our impressions of the former are certainly favourable even yet.

In the Exhibition of 1851, however, there were no road locomotives, and the general belief was that none could be contrived to answer any commercial purpose. In 1862, however, we have at least nine in the Exhibition. These include Bray's, Boydell's, Taylor's, B. D. Taplin and Co.'s, Aveling's, Carrett, Marshall, and Co.'s, Tuxford's, Yarrow and Hildritch's, and Clayton, Shuttleworth, and Co.'s. The essential peculiarity of Bray's, Boydell's, Aveling's, and Clayton, Shuttleworth, and Co.'s is in the construction of the driving wheels, Tuxford's has a single broad roughened drum for a driving wheel, while the others named have plain wheels, acting by their ordinary adhesion to the ground, just as those of railway locomotives adhere to and advance upon smooth rails.

The inhabitants of London have already become somewhat familiar with the appearance of Bray's traction engine, by its frequent trips through the principal streets until the issue of an official order that it should henceforth work only at night. Before this order was passed some of the heaviest pieces of machinery in the western annexe were taken to South Kensington by one of Bray's engines, and the one now exhibited was built for Government for permanent service in Woolwich Dockyard. The driving wheel, as is generally known, has a number of metal studs which may, at the will of the engine driver, be protruded through or drawn within the rim of the wheel, so that, when necessary, the "bite" of the wheels upon the ground may be greatly increased. Mr. D. K. Clark, consulting engineer to Bray's Traction Engine Company, aptly terms this the "feathering wheel." Formerly Bray's engines were made with only inside bearings for the axles, and they were unprovided with springs. The engine now exhibited has outside bearings and stout springs. The horizontal boiler is still retained, although we understand that Mr. Clark is contemplating the use, in future engines, of the kind of upright boiler so successfully used by Mr. Chaplin, of Glasgow. It is well known that the water level in ordinary boilers with horizontal tubes is liable to considerable variation when the engine is working over uneven ground. On the other hand, upright boilers are disposed to prime, and much of the heat escapes into the chimney without expending itself in heating the water. Mr. Chaplin, therefore, contracts the tubes, by a gradual taper, from the lower tube-plate nearly to the water level, the rest of the tube being left of the full original diameter. The inclined sides of the tube under water, and the contracted opening for the escape of heat, favour the impartation of the latter to the water to a greater extent than in the ordinary upright boiler. Mr. Chaplin also, in certain cases, gradually increases the diameter of the upper part of the boiler, so that, as the water rises by foaming, a greater area of water level is afforded, and this is said to sensibly check the tendency to priming.

Bray's engines, like most others for the like purpose, have double cylinders, and have gearing for both slow and quick speeds. The steering gear is such that the steersman cannot lose control of it in consequence of sudden lurches, &c.

Mr. Burrell's engine with Boydell's endless railway was illustrated in THE ENGINEER of 9th ult. It has two 6¾in. cylinders of 12in. stroke, single geared, in the ratio of 1 to 8 to the driving wheels. Its weight is given as 7 tons, which we presume is without coal and water. Its draught is stated to be 20 tons on a level or 10 tons up an incline of 1 in 20. The wheels have only inside bearings and the axles have no springs. The working parts of the engine are highly finished, but a less number and greater simplicity of parts would be desirable.

Messrs. B. D. Taplin and Co.'s traction engine, we are informed, weighs 10 tons when loaded, and has taken 15 tons besides its own weight up a gradient of 1 in 8. The makers express their belief that it could draw 20 tons up the same gradient, an effort equal to at least 4¼ tons, or over 10,000 lb. of tractive power, and to more than one-half the weight on the driving wheels, the tyres of which are plain. The engine is priced at £590. The axle of the driving wheel of this engine is placed under the centre of the body part of the boiler, and a strong cog wheel 5¼in. on the face is keyed on to it. One of the driving wheels is also keyed fast upon the end of the axle, the other being made fast or loose by means of a clutch which is made to fit into the nave of the wheel, and slides in and out upon two keys let into the axle. The cog wheel gears into a pinion, which is cast on to a cog wheel twice the diameter of the pinion, and this large wheel gears into a small pinion fitted on to the end of the crank shaft of the engine. The intermediate wheels which connect the engine to the driving axle work upon a wrought iron case-hardened stud or pin, 3½in. in diameter. A wrought iron bush, case-hardened, is also driven into the boss of the intermediate wheels, and ground out with a lead lapped mandril to fit the pin. The stud or pin is screwed into the bracket that supports the crank shaft, and immediately under that shaft. The crank shaft, which is 3in. diameter, is made of mild cast steel by Marriott and Atkinson, of Sheffield, and bent by Messrs. Taplin's patent crank bending machine. All the working parts of the engine are case-hardened. The front wheels are supported by short axles working in vertical sockets close to the nave and have levers welded on to them, which are connected to the steering gear, and are wound with ease in any direction required. In the centre of the front bed is a nut through which a screw is made to work, and by the raising and lowering of this screw the boiler may be wound out of its straight line from 4in. to 6in. either way. The driving wheels are made of wrought iron with cast naves, and are 6ft. 6in. in diameter by 10in. surface; provision being left on the rims to put clips on when upon soft ground. The large wheels being placed under the body part of boiler in the manner shown, allow the front wheels to have sufficient momentum when drawing heavy weights to turn sharp corners without requiring the clutch so as to make one wheel loose. The makers have found in practice that it is unnecessary to do so, except in extraordinary cases, when they remove it by hand. The engine, we are informed, moves itself upon a level hard road with 10 lb. of steam—its speed is 3½ miles per hour.

The traction engine from Mr. Taylor, of Birkenhead, is said to weigh 8 tons, which, we presume, is the weight empty. It has a pair of 6-in. cylinders, with 12in. stroke, and is stated to have taken a load of 23 tons exclusive of wagons, and exclusive of its own weight, up an incline of 1 in 19, and a load of 7 tons up an incline of 1 in 12. The wheels have only inside bearings, but large india-rubber springs are employed to relieve shocks. The tyres of the wheels are plain. The gear for driving the large wheels has internal teeth and is bolted to the wheel itself.

The engines already described are all of those in the Exhibition especially designed for the general purposes of traction engines. Mr. Aveling's and Clayton, Shuttleworth, and Co.'s engines are more particularly intended to work as farm engines, having self-propelling gear chiefly for the purpose of moving themselves, with a threshing machine, from one estate to another. The engine sent by Messrs. Aveling and Porter, of Rochester, is said to weigh 8 tons, and a printed card attached to one of its sides states that it can draw 10 tons, which, of course, must mean in addition to its own weight, up an incline of 1 in 6. We hope Mr. Aveling will furnish the particulars of so extraordinary a performance, giving the pressure of steam, character of road, length of run, and speed attained. The engine has a single 10-in. cylinder, with 12-in. stroke, and is geared in the ratio of 1 to 9 to driving wheels 5ft. 6in. in diameter, which support nearly the whole weight of the engine, and which are provided with the clips used by Mr. Aveling for increasing the bite on marshy ground. The boiler is made flush from end to end, or without an angle at the junction of the barrel and the crown plate of the outside firebox. The firebox is made of Bowling plates, and the stay bolts are spaced 5in. from centre to centre. A couple of long stay rods also connect the front and back tube plates together, just below the tubes. The boiler has no steam dome. The cylinder is bolted to it near the chimney, and a steam jacket is cast around the cylinder. A number of holes are made in the barrel of the boiler, admitting steam to the steam jacket just mentioned, whence the steam is taken into the valve box. The use of the steam jacket ensures full protection against condensation in the cylinder. The top of the firebox is carefully lagged to prevent the radiation of heat. The engine is counterweighted, so as to run with the utmost steadiness at all speeds. The driving wheels, which have only inside bearings without springs, are made so as to be capable of ready disconnection from each other, and from the propelling gear in turning corners. There is also a powerful friction brake on the driving shaft. The steering gear is of the kind described in THE ENGINEER of February 22nd last (page 120, vol. xi.). The steersman sits in front, and controls the motion of the engine with the greatest nicety with scarcely the least effort. This engine is priced at £420. Mr. Aveling has recently run one of the same class of engines from Rochester to Bath, 170 miles, accomplishing the distance in sixty-two hours, with an expenditure of 45 cwt. of coal, or rather less than 30 lb. per mile.

Messrs. Clayton, Shuttleworth, and Co., of Lincoln, who have attained so great a reputation for the production of portable engines, have turned their attention to self-propelling engines. Their first attempt is not promising. It has no tank upon its own frame, but is, we understand, to have a two-wheel tender. Unless this has separate steering gear it will, we apprehend, be found difficult to back it. The steersman, too, is to stand upon the foot plate, where there is none too much room for the engine driver, and as the double cylinders occupy a raised position above the smoke box in front, there will be no opportunity of seeing the road ahead. The steering gear contains no less than one hand wheel, four bevel gears, three shafts with two bearings to each, an endless worm and a worm wheel, and is, on the whole, about as complicated and unmechanical a contrivance as could be devised. The reversing gear is by a screw, which would require to be turned many times to change the direction of the engine. The driving gearing is badly proportioned, and the bearings are likely to be covered with mud and dust brought up by the driving wheels. The latter have only inside bearings without springs. The steam dome is not lagged. Altogether there is much to reform in this engine before it can fairly represent the well known ability of its makers in other classes of machinery.

Messrs. Carrett, Marshall, and Co., of Leeds, exhibit a 5-ton steam pleasure carriage made by them for George Salt, Esq., of Saltaire. The same carriage was exhibited by the same makers, last summer, at Leeds. It has a pair of 6-in. inside cylinders, 8-in. stroke, geared, in the ratio of 1 to 5, to a pair of driving wheels, 4ft. 1½in. in diameter and 6in. wide, and capable of driving the engine at fifteen miles an hour. The horizontal boiler has 58 solid-drawn copper tubes, 2in. in diameter and 2ft. 6in. long, is understood to bear a test of 350 lb. pressure, and works at 150 lb. per square inch. The driving wheels have springs, the firebox has Clark's steam jets for preventing smoke, the tank holds 140 gallons of water, and the whole machine is exceedingly compact, too much so, we fear, for convenience of examination and repair. Besides, 5 tons is far too great a weight for carrying half a ton of passengers at from 7 to 15 miles an hour.

Another complicated toy of much the same kind is

Tuxford's double 7-in. cylinder engine, weighing 6½ tons empty, intended to drag 18 tons behind it, and priced at £400.

Messrs. Yarrow and Hilditch send a diminutive steam carriage, made by Cowan, of Greenwich, having outside and slightly inclined cylinders, coupled directly to cranks keyed on outside of the bearings of the driving wheels. The boiler is upright. The work is light, and represents, we are led to believe, an experiment rather than a commercial undertaking.

Steam traction on common roads is, we apprehend, a long way yet from its general introduction. Complication and excessive weight appear to be the characteristics of some of the larger engines for this purpose, while the smaller ones are hardly better off yet. We shall return to this subject.

THE FATHERS OF MODERN SCIENCE.

With all their brave and courtly qualities, we can never admit that our ancestors—those of a century ago—occupied a position at all comparable to our own. We may admire their valorous spirit, their philosophy, their literature, and their manners, but in our plenitude of scientific power we are conscious of a superiority hardly less than that which our own Western civilisation bears over the superstitious and indolent existence of the nations of the East. In the age in which our great grandfathers lived modern science had hardly dawned; it had not certainly received that practical application which has so elevated mankind in all the material relations of life. Little was known, beyond what ordinary observation and experience could teach, of the properties and uses of the commonest substances and readiest powers in nature. Artificial production was almost wholly dependent upon personal drudgery or manual dexterity; patient fingers were required for spinning and weaving, and the working capacity of the forge was just in proportion to the number and strength of the brawny arms urging the bellows and wielding the hammer. For transport the horse furnished the only motive power on land, and the fickle wind was the sole dependence of the mariner at sea. The arts were few, and their practice was shrouded in a mystery which would now appear ridiculous. Books were scarce, and even had they been plentiful there were few who could have read them. Intelligence circulated slowly, and a well mounted rider was the swiftest courier.

The splendour of modern scientific discovery is most apparent in the contrast between the present state of commerce and the arts, and that to which we have adverted. The first knowledge of the steam engine, the spinning mule, and the power loom, and that of the wonderful truths of chemistry, fell hardly short of revelations. That the general tendencies to inquiry, in the latter part of the last century, were favourable to the disclosure of great truths must be admitted, yet those who first opened the way deserve no less admiration because of the probability that others might have arrived at the same results sooner or later after them. Of the great men who have thus revolutionised science and the arts, many have long since passed away, and although their names and works will never die, their personal history and portraiture, full of interest to so many admirers, exists, in many cases, only in obscure quarters, and, in but few instances, in a really popular and accessible form.

Impressed with these considerations, Mr. Walker, one of our foremost engravers, some years ago conceived the idea of bringing together, in an historical picture, the distinguished men of science living in England in the years 1807-8. For this purpose he cast diligently about for materials, and at last succeeded in bringing to light a number of authentic portraits, little known, if not neglected, and in collecting valuable biographical accounts of many of the men whose scientific labours have rendered such inestimable service, not to England alone but to the whole world. John Gilbert, whose fame as a designer needs no remark, consented to undertake the grouping, and thus, beyond mere fidelity of portraiture, to ensure that pictorial merit which the interest of the subject demanded. The working drawing, if we may so term it, being then made by Mr. Skill and Mr. Walker, jun, Mr. Walker, the elder, and Mr. George Zobel set themselves down to the task of engraving the whole upon steel. The result of this work, which has extended over a period of five years, has just been made the subject of a private view by a few friends, and will soon, we learn, be published. It is an engraving 41in. by 20½in., exclusive of margin, executed in the best style of stipple and mezzotinto, and representing fifty distinguished men of science assembled in the upper library of the Royal Institution. The figures are arranged in groups, including respectively engineers, chemists, inventors and mechanicians, and astronomers and men of general science. The engineers certainly have the post of honour, Watt, sitting beside a table, occupying a prominent position in the foreground, while around him, and apparently listening to his description of a plan of his steam engine, lying outspread before him, are Rennie, Telford, Boulton, Maudslay, Sir Samuel Bentham, Bishop Watson, Captain Huddart, Count Rumford, Murdoch, Mylne, Chapman, and Jessop. Rennie's powerful figure, his face expressive of great intellectual and physical energy, and, withal, full of mingled kindliness and shrewdness, is an especially striking feature in the composition. To the right of this group Earl Stanhope is seated, and apparently explaining his invention of stereotype printing to Ronalds, who first inculated a telegraphic wire, Cartwright, the inventor of the power loom, Tennant, of Glasgow, Crompton, the inventor of the spinning mule, Sir William Congreve, Bryan Donkin, Troughton, Dr. Thomas Thomson, Symington, and Miller, of Dalswinton, and Alexander Nasmyth, while behind are Bramah and Trevithick.

To the left of the engineers are seated Dalton, to whom we owe the atomic theory, and the illustrious Cavendish. Standing near are Sir Humphrey Davy, Drs. Henry and Wollaston, Hatchett, William Smith, "the father of English geology," Howard, the inventor of the vacuum pan, and William Allen. To the left are Herschel, Maskelyne, Jenner, Baily, Frodsham, Sir John Leslie, Professor Playfair, Rutherford, Dollond, Dr. Thomas Young, Robert Brown, D. G. Gilbert, Sir Joseph Banks, and Captain Kater. The grouping of the figures is natural and pleasing, while the portraits would appear to have been rendered with great care from undoubted originals. Mr. William Walker, jun., has prepared a volume of biographical sketches of the eminent men thus represented. This, while intended to accompany the engraving, is of itself an interesting work, and will form the subject of an early notice in our columns.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

1116. Alfred Krupp, Essen, Prussia, "Certain improvements in the manufacture of screw propellers."—*Petition recorded 17th April*, 1862.

1247. John William Caley and Frederick Goodman Caley, New Windsor, Berkshire, "An improved textile fabric."—*Petition recorded 29th April*, 1862.

1299. Richard Archibald Brooman, Fleet-street, London, "Improvements in apparatus for superheating steam."—A communication from Pierre Antoine Delafond and Joseph Corrade, Marseilles, France. —*Petition recorded 2nd May*, 1862.

1387. George Frederick Greiner and James Henry Carr Sandilands, Golden-square, London, "Improvements in the construction of pianofortes."

1388. Thomas McIlroy, Oxford-street, London, "An improved invalid bedstead."

1391. William Eddington, jun., Chelmsford, Essex, "Improvements in portable grinding, chaff-cutting, and corn-crushing machinery."

1392. Francis Frederick Burdett Mayall, Warrington, Lancashire, "Improvements in dyeing mixed or plain fabrics or yarns."—*Petitions recorded 9th May*, 1862.

1443. William Clark, Chancery-lane, London, "Improvements in apparatus for generating motion in fluids, applicable for raising and forcing water, propelling, and otherwise in the distribution of motive power."—A communication from Henry Louis Felix Worms de Romilly, Boulevart St. Martin, Paris.—*Petition recorded 13th May*, 1862.

1451. Henri Charles Rene Joubert, Maddox-street, London, "Improvements in raising music chairs, stools, or seats."—*Petition recorded 14th May*, 1862.

1486. Frederick Bonaparte Anderson, Birmingham, "Improvements in watches and other timekeepers."—*Petition recorded 16th May*, 1862.

1512. Felton Charles Kirkman, Crouch End, Hornsey, and Richard Swift, Hounslow, Middlesex, "A new and improved joint for uniting or fixing posts and rails of bedsteads and other articles of furniture, posts, and rails in fencing, in the construction of framework for conservatories, emigrants' and other portable houses."—*Petition recorded 19th May*, 1862.

1541. Eugene de la Bastida, Hart-street, Bloomsbury-square, London, "A new process for the production of designs in relievo, and in deepening on sheets of india-rubber of any length whatever."—A communication from Messrs. Albert Cohen and Charles Vaillant, Harbourg-on-Elbe, Hanover.

1544. Joseph Needham, Piccadilly, London, "Improvements in breech-loading fire-arms, and in cartridges for such fire-arms."—*Petitions recorded 22nd May*, 1862.

Invention Protected for Six Months by the Deposit of a Complete Specification.

1646. Joseph Bettelley, Liverpool, "Improvements in shipbuilding, and in rendering ships shot-proof."—*Deposited and recorded 31st May*, 1862.

Notices to Proceed.

143. Thomas William Jobling, Point Pleasant, Northumberland, "Improvements in the adaptation of locomotive engines to traction or haulage in mines."—*Petition recorded 20th January*, 1862.

229. John Henry Brierley, Aldermanbury, London, "An improved clasp or fastener for reversible belts, bands, or straps."—*Petition recorded 29th January*, 1862.

253. David Littlehales, Brearley-street West, Birmingham, "An improved plastic compound as a substitute for papier-mâché."

254. Horatio White, Mornington-place, Hampstead-road, London, "Improvements in shirt collars."

257. Hermann Schatten, Hesse Cassel, "Improvements in the manufacture or construction of gas meters."

262. Pierre Scheurweghs and Alexandre Joseph Aurele Henry de Boisserolle, Paris, "Certain improvements in treating fatty and oily matters for obtaining their acidification, and in the apparatus employed therein."—*Petitions recorded 31st January*, 1862.

270. Leon Fauvel, Paris, "Improvements in apparatus for indicating the existence of escapes in gas tubing, and for stopping the continuance thereof."

278. Thomas Cook, Coburg-road, Old Kent-road, Surrey, "Improvements in machinery for folding envelopes."

280. Francis Riesbeck and William Becker, Aldermanbury, London, "Improvements in locks or fastenings for bags, portmonnaies, and other like articles having metal frames."—*Petitions recorded 1st February*, 1862.

284. Charles William Lancaster, New Bond-street, London, "Improvements in strengthening cast iron ordnance."—*Petition recorded 3rd February*, 1862.

295. John Greenwood, Portland Mills, Bradford, Yorkshire, "Improvements in means or apparatus for preparing and combing wool and other fibres."

297. James Webster, Birmingham, "Improvements in gas fittings."—*Petitions recorded 4th February*, 1862.

299. Daniel Gallafent, Stepney Causeway, London, "Certain improvements in the mode or modes of generating or producing elastic vapours to be used as a motive power."

304. Henry Ashworth, Littleborough, Lancashire, "Certain improvements in machinery or apparatus employed in spinning cotton and other fibrous substances."—*Petitions recorded 5th February*, 1862.

316. Michael Henry, Fleet-street, London, "Improvements in obtaining and applying motive power, and raising and forcing fluids, and in apparatus employed therein." — A communication from Louis Coignard, Boulevart St. Martin, Paris.

320. John Tonkin, jun., Pool, Illogan, Cornwall, "Improvements in the manufacture of gunpowder."—*Petitions recorded 6th February*, 1862.

322. Richard Archibald Brooman, Fleet-street, London, "Improvements in stereoscopic albums, books, and cases." — A communication from Louis François Sangrin, Paris.

330. William Hamond Barthlomew, Warwick Villas, Leeds, Yorkshire, "Improvements in barges or vessels suitable for the navigation of canals and rivers."—*Petitions recorded 7th February*, 1862.

349. William Clark, Chancery-lane, London, "Improvements in refining cast iron, wrought, and other malleable iron, and in the cementation of iron."—A communication from Louis Joseph Frédéric Margueritte and Alfred Lalouel de Sourdeval, Boulevart St. Martin, Paris.—*Petition recorded 10th February*, 1862.

367. James Brickhill, Stepney Causeway, Commercial-road East, London, "Improvements in the cylinders and pistons of steam engines."—*Petition recorded 12th February*, 1862.

491. William Clark, Chancery-lane, London, "Improvements in apparatus for feeding or supplying steam boilers with water."—A communication from François Théobald Wahl, Boulevart St. Martin, Paris.—*Petition recorded 24th February*, 1862.

517. Alexander Stephen, jun., Glasgow, Lanarkshire, N.B., "Improvements in the construction of ships or vessels."—*Petition recorded 26th February*, 1862.

539. Thomas Bray, Dewsbury, Yorkshire, "Improvements in ornamenting wood in imitation of inlaid work."—*Petition recorded 27th February*, 1862.

560. Maurice Gabriel and Arnold Gabriel, Ludgate-hill, London, "Improvements in the bases of artificial teeth."

565. Samuel Godfrey Reynolds, Bristol, Rhode Island, U.S., "Certain improvements in power spading machines."—*Petitions recorded 1st March*, 1862.

662. George Davies, Serle-street, Lincoln's-inn, London, "Improvements in attaching artificial teeth to plates and to each other, and in moulds for forming artificial teeth."—A communication from Abraham Merritt Asay and Jacob Lambert Asay, Philadelphia, Pennsylvania, U.S.—*Petition recorded 11th March*, 1862.

697. William Edward Newton, Chancery-lane, London, "An improvement in armour plates for vessels of war." — A communication from Edward Cox, Covington, Kentucky, U.S.—*Petition recorded 13th March*, 1862.

866. Eugene Theodore Nouailher, Paris, "An improved ventilator."—*Petition recorded 28th March*, 1862.

928. Alfred Vincent Newton, Chancery-lane, London, "Improvements in bits for taming or subduing vicious horses and breaking colts."—A communication from Aurelius Longdon Weymouth, Boston, Massachusetts, U.S. —*Petition recorded 2nd April*, 1862.

1023. George Dibs Mertens, Royal Crescent, Margate, Kent, "Improvements in the preparation of materials to be employed in the making of beer, and in the machinery or apparatus employed therein."—A communication from Charles Theodore Aulhorn, Dippoldswalde, Saxony. —*Petition recorded 10th April*, 1862.

1146. William Rose, Hales Owen, Worcestershire, "Improvements in the manufacture of tubes, more especially applicable to the barrels of fire-arms and ordnance."—*Petition recorded 19th April*, 1862.

1185. John Henry Johnson, Lincoln's-inn-fields, London, "Improvements in apparatus for taking deep sea soundings and for recording the speed of ships."—A communication from William Trowbridge, Bowling Green, New York, U.S.—*Petition recorded 23rd April*, 1861.

1455. Henry Deacon, Appleton House, Appleton, Lancashire, "Improvements in the manufacture and production of certain colours, and in the apparatus employed therein."—*Petition recorded 14th May*, 1862.

1547. Augustus Bryant Childs, New Oxford-street, London, "Improvements in wringing machines."—A communication from Francis Adam Cushman, Lebanon, New Hampshire, U.S.—*Petition recorded 22nd May*, 1862.

And notice is hereby further given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days next after the date of the Gazette (and of the Journal) in which this notice is issued.

Patents on which the Stamp Duty of £50 has been Paid.

1354. Samuel Wood and John Wood, Manchester, and Philip Billington, Rusholme, near Manchester.—Dated 2nd June, 1859.

1383. James Ferrabee, Phœnix Ironworks, Stroud, Gloucestershire.—Dated, 6th June, 1859.

1466. John Combe and Robert Smallpage, Leeds, Yorkshire.—Dated 17th June, 1859.

1384. Willoughby Green, Victoria-street, London.—Dated 6th June, 1859.

1400. Alfred Vincent Newton, Chancery-lane, London.—A communication —Dated 8th June, 1859.

1407. Michael John Haines, Dursley, Gloucestershire.—Dated 10th June, 1859.

1425. Arthur Smith, Stafford-terrace, Loughborough-road, Brixton, Surrey. —Dated 13th June, 1859.

1431. William Brown, jun., and Simeon Bathgate, Selkirk, N.B.—Dated 14th June, 1859.

1423. Henry Lee Corlett, Inchicore, Dublin, Ireland.—Dated 13th June, 1859.

1394. John Henderson, William Henderson, Thomas Bagley, and Samuel Holdsworth, Durham.—Dated 8th June, 1859.

Patents on which the Stamp Duty of £100 has been paid.

1292. George Hopper, Houghton-le-Spring Ironworks, Durham.—Dated 6th June, 1855.

1294. James Robertson, Ardrossan, Ayrshire, N.B.—Dated 6th June, 1855.

1299. John Ramsbottom, Longsight, near Manchester.—Dated 7th June, 1855.

1309. John Buncle, Springfield, Linlithgow, N.B —Dated 7th June, 1855.

1318. Cromwell Fleetwood Varley, Charles-street, Somers Town, London. —Dated 9th June, 1855.

1315. John Sutton Nettlefold, Edward John Nettlefold, and Joseph Henry Nettlefold, Holborn, London.—Dated 9th June, 1855.

1321. Joseph Robinson, Poplar, Middlesex.—Dated 9th June, 1855.

1274. George Green, Mile-end-road, Middlesex.—Dated 4th June, 1855.

List of Specifications published during the Week ending 7th June, 1862.

2632, 7d.; 2633, 5d.; 2634, 8d.; 2635, 1s. 8d.; 2636, 6d.; 2637, 4d.; 2638, 1s. 6d.; 2639, 6d.; 2640, 7d.; 2641, 3d.; 2642, 6d.; 2643, 1s. 1d.; 2644, 3d.; 2645, 3d.; 2646, 7d.; 2647, 3d.; 2648, 3d.; 2649, 10d.; 2650, 1s. 4d.; 2651, 3d.; 2652, 1s.; 2653, 3d.; 2654, 1s. 2d.; 2655, 3d.; 2656, 11d.; 2657, 6d.; 2658, 3d.; 2659, 3d.; 2660, 5d.; 2661, 4d.; 2662, 7d.; 2663, 10d.; 2664, 1s. 1d.; 2665, 3d.; 2666, 6d.; 2667, 3d.; 2668, 9d.; 2669, 9d.; 2670, 3d.; 2671, 2s. 5d.; 2672, 3d.; 2673, 3d.; 2674, 6d.; 2675, 7d.; 2676, 1s. 6d.; 2677, 3d.; 2678, 9d.; 2679, 3d.; 2680, 10d.; 2681, 3d.; 2682, 5d.; 2683, 8d.; 2684, 1s. 5d.; 2685, 9d.; 2686, 6d.; 2687, 3d.; 2688, 3d.; 2689, 3d.; 2690, 3d.; 2691, 6d.; 2692, 7d.; 2693, 5d.; 2694, 3d.; 2695, 3d.; 2696, 3d.; 2697, 3d.; 2698, 10d.; 2699, 3d.; 2700, 3d.; 2701, 3d.; 2702, 3d.; 2703, 6d.; 2704, 3d.; 2705, 3d.; 2706, 5d.; 2707, 3d.; 2708, 9d.; 2709, 3d.; 2710, 11d.; 2711, 5d.; 2712, 9d.; 2713, 3d.; 2714, 7d.; 2715, 7d.; 2716, 3d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for The Engineer, *at the office of her Majesty's Commissioners of Patents.*

Class 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2928. W. E. Newton, *Chancery-lane, London*, "*Rotary engines.*"—*A communication.—Dated 21st November*, 1861.

This invention relates more particularly to that class of rotary engines whose main shaft, and the rotating cylindrical drum to which the pistons are attached, are arranged eccentrically to the outer cylinder. The First part of the invention consists in the employment, for the purpose of controlling and directing the compound radial and oscillating movement of the pistons of engines of the above-mentioned class, of segment-shaped pieces of metal fixed to the faces of the pistons, and to bearings provided for them in the drum, and also of arc formed pieces attached to the inner ends o the pistons, and working in grooves in the cylinder heads. The Second part of the invention consists in the employment of packing rings of peculiar construction, and applying the same within the cylinder heads, and in combination with the piston drum, piston packing, and cylinder abutment, whereby the steam is prevented from passing the piston drum and pistons. The Third part of the invention consists in a novel construction of, and means of pressing out to proper contact with their opposed wearing surfaces, the aforesaid packing rings or other packing pieces employed in rotary engines, whereby the steam or other fluid is prevented from passing the rings or pieces after they have been allowed to be pressed out by the wear of their faces. The Fourth part of the invention consists in the arrangement of a valve partition and passages in combination with a steam jacket round the cylinder of a rotary engine, for the purpose of providing for the warming up and expansion of the cylinder by steam from the boiler before starting the engine, and for keeping the cylinder, during the operation of the engine, warmed and expanded, partly by steam from the boiler, and partly by the exhaust steam from the cylinder; and it further consists in the arrangement of exhaust valves, in combination with the steam jacket and its appurtenances above mentioned, to provide for the free exhaust of the steam in whichever direction the engine may be rotating. The Fifth part of the invention consists in an improved construction of, and mode of applying and securing the cylinder heads to, the cylinder, whereby facility is afforded for the adjustment of the heads in such manner as to compensate for any unequal expansion of the cylinder, and to prevent the piston drum and pistons from binding in the cylinder.

2933. R. De Clercq *and* E. Chazelles, *Brussels*, "*Apparatus for raising and supplying water to boilers, &c.*"—*Dated 22nd November*, 1861.

This invention relates to certain improved arrangements of automatic apparatus for raising and supplying water to boilers, or for other purposes. Instead of employing, as at present, the same vessel or receiver for drawing up water by the condensation of steam, and forcing the water into the boiler or vessel by the introduction of fresh steam, the patentees employ two separate vessels, one as a supplementary vessel for supplying the water for condensing the steam in the other, and both acting simultaneously for drawing up the water, so that the supplementary vessel may always remain full when the steam forces the water from the other vessel into the boiler or reservoir. The aforesaid condensing vessel has in its interior a float, and also on the outside, at the top or other convenient part, a box or case containing the slides or valves for the admission of steam and water. The movements of the said slides or valves are regulated by a float in another vessel fixed to the condensing vessels, and the lower parts of the two vessels communicate with each other by means of a syphon pipe, which is an important part of the invention, as it causes the float in the lower vessel to work the slides or valves only when the apparatus is full of water. The supplementary vessel has a pipe communicating with the water of supply and pipes leading to the valve-box and condensing vessel, and the valve-box has also another pipe for the discharge of air. Before commencing the automatic working of the apparatus, it is filled with water from a funnel or reservoir, the pipe having been opened for the discharge of the air; then the float in the lower vessel closes the slide, which causes the admission of water, and opens the slide, which admits steam, and the cock is turned to allow the discharge of water into the boiler or reservoir. The steam acts upon the float in the condensing vessel, and forces the water through the syphon pipe and through the pipe leading to the bottom of

the boiler or reservoir. When the water is discharged from the condensing vessel, the float in the lower vessel has descended by its own weight, and closed the slide which admits the steam and opened the other slide, so that the water may pass from the supplementary vessel into the condensing vessel and cause a vacuum throughout the apparatus. The atmospheric pressure acts on the water of supply and fills the entire apparatus with water, and it is at this moment that the syphon becomes useful, for the water in the condensing vessel can only pass into the float vessel through a tube when the water has risen to a certain height, unless forced through the syphon by pressure, and therefore the float is only raised to act on the slides or valves when the apparatus is full of water. When the said float has been raised, the slide for the admission of steam is again opened, and the water is forced out of the condensing vessel into the boiler, and at the same time the other slide is opened for the admission of water to form a vacuum, and then the water rushes from the supplementary vessel into the condensing vessel, and thus the operations continue self-acting.

2939. W. EVANS, *Commercial-road East, London*, "*Obtaining motive power.*"—*Dated 22nd November*, 1861.

This invention is carried into effect in the following manner:—To a horizontal bar the inventor connects at each end a rod, each of which rods is connected to a crank on a toothed spindle, upon the axes of which fly-wheels are fixed. The toothed spindles drive toothed wheels, upon the axes of which spindles carrying tappets are fixed. Then from the horizontal bar he suspends a pendulum or heavy weight, and at each end of the course of the pendulum he places a hammer or spring. The action is as follows:—The horizontal bar is caused to rock and set the pendulum in motion; through the connecting rods the crank spindles and fly-wheels are made to revolve, and through the toothed wheels the tappet wheels are also made to rotate, and the motions are so calculated that, upon the pendulum reaching the end of its course first in one direction and then in the other, the tappets release the hammers or springs, which, falling or pressing down on the pendulum, keep up its action. The motive power is taken from the fly-wheel shaft, or from the rocking bar, or from both.—*Not proceeded with.*

2942. M. A. F. MENNONS, *Paris*, "*Apparatus for the multiplication of motive power.*"—*A communication.—Dated 23rd November*, 1861.

This invention consists in the construction and application to motive engines of an auxiliary lever apparatus, the object of which is to multiply the working power by correcting the too feeble radius of the cranks, and the reduced effort exerted thereon by the direct action of the driving pistons. This invention cannot be described without reference to the drawings.—*Not proceeded with.*

2951. V. PENDRED, jun., *Bully Curron, Kilkenny*, "*Surface condensers.*"—*Dated 25th November*, 1861.

This invention consists, First, in a particular mode of attaching the tubes of such condensers to the plates through which their ends pass, and by means of which the said tubes are supported. Secondly, in the adoption of diaphragms for regulating the course both of the steam passing into the condenser, and also for regulating the course of the water used for causing condensation. Thirdly, in the materials of which the condenser or parts of it are composed. Fourthly, in the modes of arranging and fixing the tube plates so that any section or stack of tubes can be readily removed for repair, the condenser being still left in a state more or less complete, and fit for use.—*Not proceeded with.*

2953. J. MACKINTOSH, *North Bank, Regent's Park*, "*Obtaining and applying motive steam and liquid power.*"—*Dated 25th November*, 1861.

The First part of this invention has for its object improvements in obtaining power for propelling vessels and carriages, by means of the momentum or impulsive force of jets or blasts of steam, conveyed through pipes from the boiler or boilers, issuing through orifices or injectures, alone or in combination with fluids or liquids impinged against inclined surfaces. The vessel or carriage may be propelled in any direction required by altering the position of the inclined surfaces. When injectures are used, the steam and water orifices are fixed at the position suitable for projecting water, or it may be other fluids, against the inclines. The Second part of the invention for obtaining power consists in attaching a series of plates in an inclined position on a hollow shaft mounted on bearings and furnished with stuffing boxes; the steam is conveyed from the boiler to the shaft by pipes issuing through orifices under the inclined plates, causing the shaft to revolve, the whole being enclosed in an outer casing through which the waste steam passes. The Third part of the invention consists in fixing a series of metal plates or boards on a long shaft with bearings, and secured with a frame, which may be wholly or partly immersed in running water, which impinges against the inclined plates or boards, causing the shaft to revolve, from which power is obtained. In water running at a low velocity, the frame containing the shaft may be enlarged at the ends to increase the flow of water.

2961. A. V. NEWTON, *Chancery-lane, London*, "*Removing and preventing the formation of calcareous and saline deposits in steam boilers.*"—*A communication.—Dated 25th November*, 1861.

The patentee claims the employment of tobacco, or a decoction or extract of the same, for the purpose of preventing the incrustation of steam boilers, or of removing the scale therefrom.

2982. G. RYDILL, *Dewsbury*, "*Cornish or other steam boiler.*"—*Dated 27th November*, 1861.

This invention consists of an improved steam Cornish or other boiler, with smoke consumer and condenser. According to one part of the invention the inventor cuts a hole through the tubes or flues of a Cornish or other boiler, so that the grate bars are fixed at the bottom of the tubes or flues, by which means the whole area of the fire-box becomes heated, shutting up the whole of the space which is now used to admit cold air. The fire receives its air from the bottom or sides of the boiler, which is so formed that a culvert or subterranean passage conducts the air to the fire, by which means a powerful blast draught is obtained, enabling the proprietors of steam boilers to save a vast amount of fuel, and also enabling them to consume the worst of coal. He fixes a draught ash box to admit air to the grate bars where the culvert or air passage is not fixed. Instead of the brick wall now in use he constructs the bridge at the end of the grate bars of boiler plates to form a water space, so that the fire has heating surface on all sides. As machinery to work a fan might at times be inconvenient, he finds that by setting the boiler inner flue with fire-brick, with a chequered roof or plain invert, the ash place or box with bricks, and a tongue and groove fitting into each other at the bottom, top, and ends, will give every satisfaction. He places in the flue any kind of open work of iron, copper, brickwork, or stone. The brickwork fixed round the fire forms a retort which gives a steady heat to the boiler.—*Not proceeded with.*

3011. S. TONKS and J. BROOKES, *West Bromwich*, "*Improvements in steam boiler furnaces, and in setting certain kinds of steam boilers.*"—*Dated 29th November*, 1861.

This invention consists in building steam boiler furnaces with the fire bars or fire-place in front of or on the side of the boiler, so that the fire of the furnace does not strike directly on the bottom of the boiler. Beyond the bars or fire-place is a wall or bridge, rising a short distance above the level of the said bars or fire-place, and still further protecting the boiler from the action of the fire. The furnace is covered in over the fire place with an arched top. In setting according to this invention such steam boilers as have large internal flues, the inventors build in the front ends of the said flues a lining of fire-brick so as to defend the said flues from the injurious action of the fire.—*Not proceeded with.*

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2929. H. C. MEYER, *Ashford-street, Hoxton*, "*Stopping or retarding railway and other carriages.*"—*Dated 22nd November*, 1861.

In carrying out this invention the inventor uses the weight of the carriages or their motive power as brake power. To this end he shifts or turns the axles or bearings, and uses eccentric axles or eccentric bearings; or he lowers or raises the bearings by any other motion; or he reverses the eccentric axles or eccentric bearings generally, thus forcing the wheel towards a brake fixed on the body of the carriage; or he lowers the body of the carriage (with fixed stay and brakes) on to the rails or roadway.—*Not proceeded with.*

2931. A. F. YARROW and J. B. HILDITCH, *Barnsbury, London*, "*Locomotive steam carriages for common roads.*"—*Dated 22nd November*, 1861.

This invention consists of an arrangement of outside cylinders (cylinders arranged to work outside cranks being generally known as outside cylinders), the connecting rod being coupled on to the crank of the driving axle. The cylinders are bolted to the framing which runs the whole length of the carriage. The bearings of the axle are supported by springs, and on the inside of the bearings are the driving wheels, and on the outside is fixed a crank to which the connecting rod is coupled; or the driving wheels and crank may be both placed outside the bearings. To each bearing is attached one or more links, the other extremities of which are connected to the main framing of the carriage, or to the steam cylinder itself, by which means the proper distance between the driving axle and cylinder is maintained, and also play allowed to the springs. The Second part of the invention consists in the general arrangement of the said steam carriage. The patentees employ a vertical tubular boiler, which is placed at the back of the main driving axle, and between the driving wheels. The seats for passengers and luggage are arranged upon the framing between the boiler and the fore part of the carriage, where suitable steering gear is also provided. At the back part of the carriage, behind the boiler, room for the stoker is provided, as also coal bunkers and water tanks, &c. The eccentrics are keyed on the driving axle, between the boiler and the framing of the carriage. Rods may be continued from the reversing gear and steam cock to the front part of the carriage, so as to place the carriage under the control of the steerer. If a horizontal boiler is used it is placed as nearly over the driving axle as convenient.

2937. C. BARTHOLOMEW, *Broxholme, Wheatley, near Doncaster, and* J. HEPTINSTALL, *Masborough, Rotherham*, "*Making circular blooms, such as are used for the manufacture of tyres, &c.*"—*Dated 22nd November*, 1861.

In making a circular bloom of iron, after the iron is made and rolled into a puddled bar, it is then cut into segments or radial pieces, that is to say, the puddled bar is divided into pieces of equal and comparatively short lengths by cutting it across at an angle, the cuts being made to slope alternately in either direction, and in such a manner that, if the pieces be laid round in a circle, their longer sides outwards and shorter sides inwards, they will butt accurately end to end, and make up a complete polygonal ring. The mode in which the pile is made for the bloom from these segments or radial pieces is as follows:—A smaller bar of iron of sufficient length is coiled round a mandril, so as to produce a flat coil of sufficient width to form the top and bottom of the intended pile. Upon the bottom coil a circle of the pieces of flat bar above mentioned is placed, and upon that circle another circle of pieces is built, so as to break joint with the pieces below, and then another circle of such pieces of iron is placed, likewise breaking joint, until a sufficient thickness is obtained. Upon the whole a top coil, similar to the bottom coil, is placed, and the pile is then completed ready to be placed in the ball furnace, and when it has attained sufficient heat it is then placed in a die of the requisite form for producing the bloom of the required outside shape, when it is struck by a steam or other hammer of the requisite power and weight to thoroughly weld the pile into the requisite form. The die is formed of a circular hoop of iron of requisite strength and depth and cross section, according to the intended form. After the bloom has been struck in the die a punch of wrought iron is struck into the middle of the bloom to form the inner surface, according to the inner shape desired, and to consolidate the iron laterally, and the whole is sufficiently hammered for thorough consolidation.—*Not proceeded with.*

2956. J. GONDIE, *Hartlepool*, "*Reefing and stowing the sails of vessels.*"—*Dated 25th November*, 1861.

The inventor proposes to perform the aforesaid manœuvres from the deck of a ship or other vessel. As an example, the improvements, as applied to the main top sail of a ship, will be understood from the following description:—In or near the centre of the sail he proposes to place, longitudinally and parallel to the main and top sail yards, a boom or extra yard; on each end of this boom he places a casing, to protect and guide the operation of the rolling tackles and down haul, hereafter described. The rolling tackles passing through blocks or sheaves at the ends of the top sail yard descend to the ends of the boom before mentioned, round which they wind; the down haul leads thence to blocks or sheaves at the ends of the main yard, thence to blocks attached to and under the centre of the top sail yard, from whence the down haul descends to the deck to be belayed in the usual manner in any convenient position.—*Not proceeded with.*

2966. C. G. BRAXTON, *Portsea, Hampshire*, "*Apparatus for propelling and steering vessels.*"—*Dated 26th November*, 1861.

For the purposes of this invention the inventor proposes to run a shaft from the engine-room under the beams and through the stern post; also one from the engine room forward through the stern about two feet under water, and working in contrary directions. On the outer ends of the shaft he fixes a paddle, with two blades, in form like the blade of an oar, in such manner that it may be taken on and off very easily by the crew, as he does not intend the one at the stern to be used except in light winds, and in a calm, or when the stern one is used for other purposes; in such cases he intends it to steer the ship alone. The engineer is to work it and steer the ship in the engine-room, receiving orders from the officer of the watch by means of a tube from the deck. In case the ship is short of coals, and in a calm, the inventor unships the stern paddle, and puts on a screw to propel the ship, and steers by the bow paddle alone. And for the purpose of driving this screw he attaches several winches to the upright under each beam, driving the shaft both above and below, so that any number of men may heave by several handles to take off and on at any part of the ship. This he intends, principally, for sailing ships and transports. Boats may also be propelled by the same means, the handle working between each thwart.—*Not proceeded with.*

2998. W. COOKE, *Spring-gardens, and* F. SQUIRE, *Fleet-street, London*, "*Paddle wheels.*"—*Dated 28th November*, 1861.

This invention consists in so adjusting the floats that, instead of entering into and rising from the water at certain angles, they have a perpendicular action, and thus avoid the usual surge or back-water.—*Not proceeded with.*

3000. J. M. ROWAN, *Glasgow*, "*Railway wheels.*"—*Dated 28th November*, 1861.

This invention cannot be described without reference to the drawings.

3007. E. FUNNEL, *East-street, Brighton*, "*Self-acting indicator signal for railways.*"—*Dated 29th November*, 1861.

This invention cannot be described in detail without reference to the drawings.—*Not proceeded with.*

3009. T. ELLIS, *Swindon*, "*Rails for permanent ways.*"—*Dated 29th November*, 1861.

This invention consists in making the rail, as regards transverse section, of a peculiar form, the rail being made hollow, or what is termed a bridge rail, but rolled in such manner that the base on each side of the rail will meet, or nearly so, in the vertical centre line or plane of the rail, thereby making a more solid bearing on the longitudinal timbers, the object being to prevent the sides of rail collapsing—a defect which the patentee in some cases obviates by introducing a flat bar of iron between the bridge of the rail.

3014. R. A. BROOMAN, *Fleet-street, London*, "*Safety buffer, or apparatus to be used in railway trains.*"—*A communication.—Dated 29th November*, 1861.

This invention consists of one or more air-tight cylinders, fitted as hereafter described, mounted upon a truck or carriage to form a compressed air buffer. It is proposed that two trucks, carrying the buffers, should form part of every train, one in front and the other at the rear of the ordinary carriages; but more or less than two such trucks may be used. The cylinders are fitted with two pistons, the rods or trucks of which extend beyond the cylinders at each end, and carry buffer heads, and with one or more safety valves to prevent explosion, and also to allow of the escape of compressed air after a given pressure has been attained, in order to prevent the rebound or forcing back of the pistons, or either of them. Sometimes the inventor fixes a rail or rails on the bottom of the cylinders, on which the pistons are supported on grooved wheels or pulleys, and he provides friction rollers for the piston rods to run on.—*Not proceeded with.*

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2882. J. BOOTH and T. W. and J. CHAMBERS, *Bury*, "*Looms.*"—*Dated 16th November*, 1861.

The patentees claim, First, in the taking up motion, the employment of curved or straight inclines acting in combination with eccentrics. Secondly, in the letting off motion, the umaxular warp beam and rail, for the purpose of maintaining a uniform tension of the warp at all diameters of the warp on the beam, without the moving of the weights. Thirdly, the prolongation of the connecting rod or crank arm and the bracket, terminating with a downward hook, and also the bracket attached to the loom side, for the purpose of making the reed fast and loose as required. Fourthly, the employment of an arm pointed to the front part of each end frame of the loom, and projecting towards the back, and also causing the rotary motion of the tappet shaft to turn in the same direction as the crank shaft, for the purpose of bringing the picking stick forward, and propelling the shuttle by a downward stroke of the picking tappet. Fifthly, the concave and convex wheels, for the purpose of causing the healds to have a temporary suspension of motion during the traverse motion of the shuttle.

2892. W. and E. CLIFF, *St. Quentin, France*, "*Lace.*"—*Dated 18th November*, 1861.

This invention consists in the production of a peculiar mesh for the garnishing of figures in lace made in lace machines, which mesh is formed of one or more warp threads, and not by the combined use of warp threads and bobbin threads, as heretofore.—*Not proceeded with.*

2894. F. C. PAETOW, *Manchester*, "*Apparatus for raising and finishing fabrics.*"—*A communication.—Dated 18th November*, 1861.

This invention consists in an apparatus for raising the pile or surface of fabrics transversely, that is to say, in the direction of the weft. For this purpose the patentee uses two or more cylinders covered with teazles, brushes, cards, or other suitable raising materials, which receive a rotary motion in such a manner that half of them turn in the opposite direction to the other half, and have at the same time a reciprocating motion transversely to the motion of the fabric, or in the direction of the weft of the fabric. As the fabric is delivered from the ordinary raising machine, it passes over or in contact with the aforesaid cylinders in a direction parallel with their axes, and is thereby raised and stretched from the middle to the selvages, or from one selvage to the other. There are adjustable guide rollers for the purpose of placing the fabric in or out of contact with the cylinders. Or, instead of the aforesaid covered cylinders, one or more bands or straps covered with teazles, brushes, cards, or any other suitable materials, may be employed for the same purpose. The apparatus may be used independently, or in connection with an ordinary raising machine.

2899. A. J. MUNDELLA and W. ONION, *Nottingham*, "*Apparatus for the manufacture of looped fabrics.*"—*Dated 18th November*, 1861.

The needle bar (with its needles) is, according to this invention, capable of sliding horizontally in a backward and forward direction, and above it is an adjustable falling bar, which also acts on a locker bar; on the top of the falling bar lie the jacks, which have projections on the under side, the projections being just behind the heads of the sinkers, which are rivetted to the jacks. The jacks lie in two sleys placed behind the falling bar. Between and above these sleys lies the slur cock bar, the cocks sliding on the top of the jacks. Where the jacks and sinkers are rivetted together the patentees do not connect them as heretofore, by slitting the head of the jack and placing the sinker in the slit and rivetting it there, but they make the upper end of the sinker somewhat longer than will reach to the top side of the jack, and turn it down on one side to form a slot for the jack head, by which they can make use of a fine steel jack, and they are able to make a frame with an inside of a much finer gauge than can be made on the old method. The back or tail end of the jack is somewhat enlarged, and forms a hook on the under side, which hooks on the rounded top edge of a bar, which acts as an axle or centre for the jacks to rise and fall upon; above the jacks over the locker bar there is a false rim bar carrying a spring bar, the springs holding the jacks up until forced down by the slur cocks. At the back of the jacks, and below them, is a spindle bar moved by a cam on the main cam or other suitable shaft; to the spindle bar are secured brackets which carry the jack bars and sleys, the falling bar, slur cock bar, false rim bar, and spring. This spindle bar can be moved as required horizontally for the purpose of setting the face. The jack bars are also each capable of being set as required, independent of the spindle bar. On the top of the enlarged back end of the jacks is a bar which holds the jacks down. On the axle bar in front of the sinkers is a presser bar connected by arched brackets to a presser spindle bar, above which is a carrier bar and thread carriers, and suitable connections to the slur cocks. To the spindle bar referred to is affixed an arm carrying a truck capable of being moved to the right or left on the cam by which it is worked. This truck is of other different sizes in the direction of its width, so that, as it is moved to the right or left, it will operate to cause a common course, a tight course, or a slack course to be made. For the drawing tackle there is a small bevel wheel keyed fast on the main cam or other suitable shaft, to gear into a similar but larger wheel on another shaft, on which is the drawing cam, which revolves between trucks on two levers which work on a pin at one end of each lever, the end of one lever being secured to two chains, each of which passes over two pulleys on each end of the frame, the chains being attached to the carrier bolt bar, the carrier bolt bar being connected to the slur cock bar by a fork; the main cam shaft can be moved a little endwise by a hand lever to take the small bevel wheel out of gear from the wheel on the drawing cam shaft when a narrowing is being put in, the several trucks being thrown on another set of cams.

2927. E. BROOKS, *Bradford*, "*Machinery for combing wool, &c.*"—*Dated 21st November*, 1861.

This invention consists in the adaptation to machinery for the combing of wool and other fibrous substances of screw gill apparatus, which is worked in successive sets of fallers. These sets of fallers are carried forward in one and the same set of screws by the rotation of the same, and are made to drop from or pass out of the fibre by the usual tappet apparatus.—*Not proceeded with.*

2932. W. AMBLER, *Keighley*, "*Loom pickers.*"—*Dated 22nd November*, 1861.

This invention consists in forming loom pickers of metal adapted to receive a padding of sizing, or other suitable material, combined sometimes with an india-rubber back, for the purpose of elasticity, where they strike the end of the shuttle. The inventor forms the part where this elastic material to strike the shuttle is applied as a sort of chamber formed by a lip or other holding means at the front or other striking end to prevent the padding being forced through, and a screw or other suitable means at the back to press upon the padding, and thereby regulate the amount of elasticity to it, as well as to give facility for the replacement of a fresh pad when one is worn.—*Not proceeded with.*

2943. C. H. J. W. M. LIEBMANN, *Huddersfield*, "*Textile and felted fabrics.*"—*Dated 23rd November*, 1861.

This invention consists in the application of felt to textile or woven fabrics, or in combining felted fabrics with woven fabrics, either by the process of felting fibrous substances on to or into the surface or surfaces of woven fabrics, or by laying a felted fabric and a woven fabric together, and causing them to adhere by the process of felting or other suitable means.—*Not proceeded with.*

2954. G. LOWRY, *Salford*, "*Machinery for carding and hackling flax, tow &c.*"—*Dated 25th November*, 1861.

The First part of this invention is applicable to carding engines having working and stripper rollers or carding rollers, and it consists in a peculiar combination, application, and adaptation of parts for removing the fibrous and other impurities from the rollers, for collecting them in suitable receptacles, and for removing them therefrom. The Second part of the invention is applicable to sheet hackling machines, and it consists of certain improved arrangements and combinations of parts for stripping the loose tow from the hackles and from the stripping rods. The invention cannot be described in detail without reference to the drawings.

2955. J. RONALD, *Lancashire*, "*Machinery used for spinning hemp, flax manilla, wool, and other fibrous material, and for the manufacture of 'topped-up,' 'formed,' or 'laid' thread, twine, cord, line, cable, &c.*"—*Dated 25th November*, 1861.

The patentee claims, First, the peculiar arrangement and use of a pair of drawing or nipping rollers, mounted parallel and in close proximity to each other, within a revolving frame, when applied to spinning machines. Secondly, giving a reciprocating motion to the flyer of the take-up yarn bobbins of the spinning machines, as described, and the peculiar arrangement of parts for accomplishing the same. Lastly, the use of the horizontal revolving drawing roller frame, and its adjuncts, for putting in the first part of the lay when applied to topping machines having the yarn or strand bobbins and the take-up bobbin arranged vertically.

2980. F. A. CALVERT, *Manchester*, "*Apparatus for burring, carding, and combing wool, &c.*"—*Dated 27th November*, 1861.

The nature of this invention of improvements in machinery and apparatus for burring wool and other fibrous substances consists in conveying the currents of air, by which the impurities are removed, from the under side of the toothed drum and retaining roller, instead of from above, as described in the specification of letters patent granted to the present patentee on the 19th of September, 1860 (No. 2276). The nature of the invention of improvements in carding engines consists in stripping the main cylinder by the "licker-in." In order to accomplish this he makes the "licker-in" in the manner described in the specification above referred to, and causes it to revolve at a much greater velocity than the main cylinder; the fibres are taken up from the "licker-in" and given to the main cylinder by a retainer or stripping roller. In compound engines a cylinder similar to the "licker-in" above described is placed under the main cylinder, with a retainer or stripper, thereby dispensing with the fancy in woollen cards. The nature of the invention of improvements in machinery for combing consists in the combination of a comb, belt, or chain with a carding engine, similar to the one described in the specification above referred to. The fibres upon being carded are deposited on the comb, belt, or chain, which travels at a suitable speed along the face of the main cylinder; the fibres are straightened by a close fitting shell underneath the cylinder, and are finally drawn off by a pair of draw rollers in the usual manner. Another part of the invention consists in making cylinders of sheet iron, to be covered with card clothing or with iron elastic teeth. In fastening the sheets or fillet of card clothing to the cylinder he takes a strip of metal with hooked teeth on their edges, and punches holes in the edges of the card sheets corresponding to the teeth; they are then hooked on the teeth and drawn tight, the straps being then bolted to the cylinder.

2983. W. LECK, *Glasgow*, "*Weaving, printing, and otherwise treating certain ornamental fabrics.*"—*Dated 27th November*, 1861.

This invention relates to ornamental woven fabrics resembling what are known as crimped goods, in which crimped or full stripes running the long way of the cloth are alternated with scant or plain stripes. In weaving such fabrics according to the present invention the scant or plain parts (otherwise termed the band part, where the fabric is to be subsequently made into fullings) are made single fold, instead of two fold as heretofore. The warps for the band parts are drawn off a beam separate and distinct from the beam supplying the warps for the crimped or full parts, and the two sets of warps are differently placed, and are actuated by different beddle leaves, as is well understood. But to make the band single fold and scant, or short as compared with the crimped parts, the warps composing it are shed so that two or more weft threads are laid in each shed, each shed being kept open or being repeated for two or more shots, while the shed of the warps for the crimped part is changed at each shot.—*Not proceeded with.*

2995. W. ROWAN, *Belfast*, "*Machines for heckling and scutching flax, &c.*"—*Dated 27th November*, 1861.

This invention consists in forming on or in fixing to the ends of the beaters, and of the bars which carry the pins for heckling, and the beaters or combs for scutching, spindles or trunnions, which spindles are received in bearings fixed on the circular frame cylinder or drum of the machine. The invention also consists in fixing adjustable guards in front of the heckle pins when the machine is used for heckling, in order that the depth to which the pins enter the fibre may be regulated according to the nature thereof. While play is allowed to the beaters and heckles or comb bars they are prevented from revolving.

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

2943. W. BRAY, *Deptford*, "*Locomotive apparatus particularly applicable to agricultural purposes.*"—*Dated 23rd November*, 1861.

This invention consists in supporting or carrying the boiler or boilers and machinery, consisting of one or two engines combined with gearing, &c., of locomotive carriages upon or over one axle, which thereby supports or sustains the entire weight thereof; and in making the main axle in two parts, but connected in a box the width of the carriage, so that, when put together, it shall act as a solid axle; and in arranging the upper carriage body in such manner that the front portion thereof may be moved by steer-

ing apparatus, and be turned from its straight position, with regard to its hind portion, by a suitable locking plate; and in arranging the entire upper carriage body upon an under carriage or frame reaching from end to end, and on and by means of which under carriage, and its toothed gearing and the locking plate, the front portion of the upper carriage is caused to be steered, or turned from its direct course, by the main or driving wheels and axle. Also in furnishing the main axle with cranks close to or near the main wheels, so that the axes of these wheels are removed from the centre of the main axle, in order that the position of the wheels may be changed in relation to each other, according to circumstances, by varying the position of the cranks, on the axes or centres of which they are caused to turn by means of the driving rim or wheel. Also in the arrangement of the driving rims or wheels in connection with main wheels, whether on cranked axles, as just referred to, or on other axles, by causing such rims or wheels to be detached from the main wheels, and to operate upon fixed hollow axles or bearings, whereby their position remains unchanged, whatever be the position of the main wheels, although in some cases the rim wheels are to be bolted to the cranked main wheels, in which cases, when the patentee wishes to change the vertical position of the cranks—which is their ordinary working position—he removes the bolts and allows the rim wheel to work resting on four or five rollers, and he propels the main wheels by means of a driver. The invention also consists in improved methods of attaching agricultural implements to locomotives.

2957. W. Burgess, *Newgate-street, London*, "*Reaping and mowing machines.*"—*Dated 25th November*, 1861.

This invention consists, First, in means of narrowing reaping and mowing machines to facilitate their passing along narrow lanes and through gateways. To effect this the patentee supports a frame containing the gearing upon two wheels, and he attaches to the lower part of this frame one or more bars, on which he places one or more travellers. To this traveller, or these travellers, is connected, by means of a hinge joint, a shoe, to which is fixed the finger beam, as also a standard for supporting the end of the reel next the frame above mentioned. In order to prevent the traveller from shifting, when the machine is at its full width, he makes a hole through the back carrier, and a corresponding hole through the frame immediately above it, and passes a bolt through both holes. To the end of the finger beam farthest from the said frame the usual wheel and the support for the reel are fitted. The object in connecting the finger beam and traveller by a hinged joint is, that the finger beam, reel, and delivery apparatus may be free to follow the irregularities of the ground. The invention consists, Secondly, in a mode of communicating motion to the reel. This is effected in the following manner:—Upon the axis of the main wheel or wheels is fastened a bevel wheel, and by means of a collar, on and through which the said axis is free to revolve, he fixes a standard, fitted with two brackets, to carry a vertical shaft; the lower of these brackets is fixed, but the upper bracket may be raised or lowered at will, according to the height of the reel. At the lower extremity of the said vertical shaft is fastened a bevel wheel, which gears into the wheel on the main axis. Higher up on the said vertical shaft, and supported by the upper bracket above mentioned, is a bevel wheel, so attached to the shaft as to revolve with it, but at the same time capable of sliding up and down on it, according as the bracket which supports it is raised or lowered. The bevel wheel communicates motion to another bevel wheel keyed on to a horizontal shaft, supported at one end by the said movable bracket, and connected at the other with the reel shaft, to which it imparts rotary motion. The said horizontal shaft is formed with a tube or tubes, in which one rod, or more, fitted with universal joints, is free to slide, for the purpose of allowing the shaft to contract or extend, according to the lateral movements of the reel in going over uneven surfaces. The standard attached to the axis is capable of being moved more or less out of a vertical position by turning it on the said axis, and by this means, together with an appliance to the standard which supports the end of the reel shaft next the frame, the reel may be raised or lowered, or placed either forward or backward, as required.

2960. J. H. Johnson, *Lincoln's-inn-fields, London*, "*Apparatus for shelling and cleaning rice and other grain.*"—*A communication.—Dated 25th November*, 1861.

According to this invention it is proposed to employ two horizontal surfaces, one of which surfaces is made to rotate in close proximity to the other, while the other surface is held stationary. The rotating surface is intended to be covered with india-rubber, gutta-percha, or other equivalent material, and the stationary surface is composed of stone; provision is made for adjusting the distance between the two surfaces, so as to suit the grains of different sizes. The grain to be treated may be introduced between the rubbing surfaces from above through an aperture in the upper rubbing surface, or in any other convenient manner, and the two surfaces are surrounded at proper distances with a perforated plate or wire gauze, for the purpose of withdrawing the dust or meal produced by the passage of the grain through the apparatus.

2981. A. V. Newton, *Chancery-lane, London*, "*Mowing and reaping machinery.*"—*A communication.—Dated 27th November*, 1861.

This invention relates to certain novel arrangements of parts in reaping and mowing machines, whereby their action will be more completely under command, and their transfer from field to field will be facilitated. The frame which has the gearing of the mower attached thereto is suspended upon trunnions secured upon the sides of a collar or box working on the axle-tree of the propelling wheels, for the purpose of making the cutters secured to the lower end of the frame self-adjustable, and causing them to adapt themselves to the surface of the ground, whether the inner or outer end of the cutter lid be lifted or depressed in passing over slight inequalities in their track. For transmitting the motion from either of the travelling wheels to the cutter bar a compound or double-acting coupling box is used. This coupling box is so combined with the driving wheels and gearing of the machine that each driving wheel, through the agency of clicks taking into ratchet teeth within the box, may act thereon independently of the other, to operate the gearing which transmits the motion to the cutter bar crank, and thus permit the machine to be worked to the right or left, to cut the grass or other standing crop. The main frame, by being suspended upon trunnions, as above mentioned, will preserve the gear wheels in their relative working positions with regard to the vibrations of the frame, and without reference to the rigid motions of the axle of the travelling wheels. In combination with the main frame and travelling wheel axle guide boxes are used for the purpose of holding the frame at right angles to the axle, and at the same time allowing it to have a rocking motion on the trunnions before mentioned.—*Not proceeded with.*

3019. J. Cooper, *Ipswich, and* C. Garrood, *Penge*, "*Cultivators, horse hoes, and horse rakes.*"—*Dated 30th November*, 1861.

This invention has for its object improvements in cultivators, horse hoes, horse rakes, and harrows. For these purposes, in arranging cultivators, two or more axes carrying tines are mounted in a frame; and in order to fix the tines to the axes each axis has a bar fixed parallel to and at a short distance from it. The stem or upper part of each tine is placed against the axis and its bar, and is secured thereto by a strap (through which the stem or upper part of the tine passes) and a key or wedge, which is driven through the strap on the side of the axis and bar opposite to that against which the tine is held. The axes are geared together in such manner that, on one of the axes being turned, the other axis or axes and tines are similarly acted on; this is accomplished by gearing them together with cog wheels. For the purpose of turning the axes when required a suitable lever or handle is employed, which is fixed to one of them; or a connecting rod may be employed connected at one end to a prolongation of the handle beyond the axis, and at the other end with an arm or arms on the other axis or axes.—*Not proceeded with.*

Class 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

2916. W. P. Bayliss, *The Lloyd's, Madeley, Shropshire*, "*Improvements applicable to buildings, in order to facilitate the extinguishing of any conflagration which may happen therein.*"—*Dated 20th November*, 1861.

This invention consists in constructing buildings, with each apartment or compartment into which the building may be divided with an aperture or opening, apertures or openings, at the upper part of the apartment or compartment, the said aperture, or opening, apertures or openings, being in (or communicating with) a tube or channel, tubes or channels, opening into the nearest chimney or flue, chimneys or flues. Or the tube or tubes, channel or channels aforesaid, may, instead of being carried into the said chimney or flue, be continued and opened into the external atmosphere. Hence, if a conflagration should take place it will only be necessary to close the apartment or compartment, and the smoke and fire will find vent by the said channels, flues, or tubes. Also, for the purposes aforesaid, the patentee provides a cistern or receptacle at the upper part of the building, from which pipes descend which reach from the said cistern to the basement of the building, and may form supporting columns or pillars to it. The tops of the said pipes, where they open to the cistern, have proper valves, and from these pipes at every floor of the building other pipes or channels branch out in such manner that valves may be applied to stop the first-mentioned pipes at the level, or nearly so, of such branching pipes, causing such flow of water from the cistern to run into the said branching pipes or channels, and thence, through suitable apertures, into the apartment or compartment, or any two immediately adjoining or contiguous apartment or compartments, and this without allowing the entry of the water into any other apartment or compartment. The floors and roofs should be fireproof.

2953. J. B. Hulard *and* L. G. Poupel, *Paris*, "*Hardening stones, &c.*"—*Dated 25th November*, 1861.

The composition which the patentees prefer for their indurating liquid is composed of the following ingredients in certain proportions:—Borax, white lead, sulphate of alumina, acetate of lead, sulphate of zinc, silicate of soda or of potash, kaolin, linseed oil, and water.

2963. G. Clarke, *Gresham-place, Camberwell-lane, London*, "*Fire escape.*"—*Dated 25th November*, 1861.

This invention consists in the formation of a balcony of sheet iron, and the application thereof to a window, in such manner that it shall be capable of containing a few persons, and lowering them to the ground safely in case of fire. The balcony is furnished with an ornamental railing for the purpose of security to plants or for other purposes, and beneath its floor a receptacle of sheet iron is attached by bolts and a framework of angle iron; the floor consists of two lids hinged to the sides of the balcony, and meeting together when closed so as to form a floor. The whole apparatus is kept in position by means of two chains, to which it is suspended, and which pass over pulleys, and down to the lower part of the building, where counterweights are attached to them.—*Not proceeded with.*

2968. J. Davies, *Larkfield Nursery, Wavertree, near Liverpool*, "*Roofs for dwelling houses, horticultural erections, &c.*"—*Dated 26th November*, 1861.

The inventor constructs the roofs of dwelling-houses, warehouses, sheds, and other buildings where the outer coverings consist of slates, tiles, stones, or other opaque materials, or mostly so, by forming the outer edge of the rafts, or of, say, every alternate rafter, with one or more grooves or channels, which he covers with sheet lead or other suitable metal. Over these, without the interposition of battens, he places the said slates, tiles, stones, or other materials, made of sufficient size that in their vertical course their edges shall abut against each other, just over the grooves or channels, to allow these latter to convey any water that might pass between the outer coverings down to the eaves. In their longitudinal course each succeeding one overlaps the other, and carries the water downwards in the ordinary way.—*Not proceeded with.*

2985. A. Whibley *and* T. Lumley, *Old Brompton*, "*Ventilators.*"—*Dated 27th November*, 1861.

This invention consists in constructing the louvres of ventilators of oiled skin, cotton, cloth, or other suitable flexible material, instead of wood or metal as heretofore commonly practised.—*Not proceeded with.*

3004. W. A. Von Konig, *Brompton-road, London*, "*Stoves or open fire-places.*"—*Dated 28th November*, 1861.

This invention consists in adapting to ordinary stoves or open fire-places the following parts, viz., in the back of the stove the inventor forms a hole, say, for example, three inches in diameter, into which he fits an elbow pipe, and connects thereto behind, and at the back of the stove, an upright pipe, the top of which is open; around the said upright pipe he places and fits another larger pipe, so as to leave space between the two pipes, and he forms branches right and left from the top of the larger pipe leading to gratings or openings at the front of the stove under the mantel-shelf, or over same, as may be found most desirable, and fitted with ventilators for opening and closing or regulating the passage of heated air at will. He also adapts a slide to the front of the pipe fixed in the back of the stove for the same purpose. At the bottom of the hearth of the fire-place or other convenient part he adapts a pipe for the admission of cold air into the space between the two vertical pipes aforesaid, situate behind the back of the stove. The effect of this arrangement is as follows:—As the heat from the fire passes along the inner pipe inserted in the back of the stove, the cold air passing in the space around same becomes heated, and passes through the openings under or over the mantel-piece into the room, instead of passing up the chimney, as heretofore.—*Not proceeded with.*

3017. W. Cooke, *Spring-gardens, London*, "*A wind-guard for curing smoky chimneys.*"—*Dated 30th November*, 1861.

This invention consists of an upright tube or shaft, of a size suitable to the chimney shaft, having at the top a cone, the side of which cone forms an angle of 45 deg. with the base line of the upright tube, and placed in such position that the apex of the said cone is on a level with the top of the tube; the area of the base of the cone is of the same size as the area of the tube, such tube or shaft having surrounding it at the upper part a larger tube or outer casing, so fixed and of such size that an annular space is left between the outer tube and the inner tube and cone equal in area to the area of the inner tube. The said outer tube is constructed of a tapering form, the area at top being equal to the area of the said tube or shaft. Another portion of the invention consists in such an arrangement of the outer and inner tube or tubes as effectually allows the emission of the smoke without admitting a downward current of air, the same object being also effected by another arrangement of the funnel or shaft, having in it horizontal or other shaped divisions, openings also at certain distances being made in the sides of the said shaft or funnel.—*Not proceeded with.*

Class 6.—FIRE-ARMS.

Including Guns, Swords Cannons, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

2852. Sir W. G. Armstrong, *Newcastle-upon-Tyne*, "*Firing or igniting explosive projectiles.*"—*Dated 13th November*, 1861.

These improvements consist in a modification of the method of causing a shell to burst upon striking an object, as described in the specification of a patent granted to Sir W. G. Armstrong the 10th day of April, 1858, and bearing the same title as above. In that specification the method in question is described as consisting of a weight or striker contained in a cylindrical case placed within the shell, and in which the striker was fixed by a pin which passed through it, and which was cut or broken by the shock received by the projectile at the instant of being fired from the gun. The striker, being thus liberated by the act of firing the gun, would recede to the bottom of the case, and there remain until the velocity of the shell was checked by striking an object. The striker would then advance in the case, and cause a patch of detonating composition to be carried against a point by which it was ignited. In the modification now to be specified the pin for holding the striker is dispensed with, and the striker is secured by a metal hoop resting at the lower end on projections from the striker, and abutting at the upper end against the cover of the case. In this position the striker is held down and prevented from moving forward by the hoop, but when the gun is fired the *vis inertiæ* of the hoop causes it to shear off the projections on the striker, which then becomes at liberty to run forward in the case when the shell strikes an object, and in so doing it ignites a patch of detonating composition by impact against the cover of the case, or a point projecting therefrom.—*Not proceeded with.*

2856. J. Vaughan, *Birmingham*, "*Bayonets.*"—*Dated 13th November*, 1861.

In carrying out this invention the inventor stamps the blank for the blade in dyes operating upon either a portion of the length or the entire length at one time. These dies are formed with sinkers suitable for producing the shape or sections required for the blank, so that, when this blank is subsequently grooved, no trimming is required, and the dies remain uninjured, any surplus metal being forced out endways by the regulating dies, instead of forming a fin.—*Not proceeded with.*

2908. R. A. Brooman, *Fleet-street, London*, "*Breech-loading fire-arms.*"—*A communication.—Dated 19th November*, 1861.

This invention consists, First, in a manner of opening and closing the breech, and, Secondly, in the introduction of a peculiar self-adjusting clearing and gas-stopping plate within the rear opening of the barrel. The improvement in the mode of opening and closing the breech consists in a combined revolving plug and shear plate, whereby the opening and closing of the breech, and the shearing off of the end of the cartridge, are accomplished by a semi-revolution performed twice, or of a whole revolution once performed of the said plug. The breech plug is a cylinder of larger diameter than the bore of the gun; it is fitted in a socket formed in the stock, and immediately in the rear of the barrel. The invention cannot be described in detail without reference to the drawings.

2918. L. Thomas, *Union-street, Berkeley-square, London*, "*Wrought iron ordnance.*"—*Dated 20th November*, 1861.

This invention consists in making guns of coils of sheet iron wound upon a staff or core bar, or upon each other, in such manner as to avoid, as much as practicable, the necessity for having welded joints or surfaces at right angles, or nearly so, to the axis of the bore of the gun, as in the usual mode of manufacture.

2978. G. L. Purchase, *Bedford-row, London*, "*Sight apparatus and sight for fire-arms and ordnance.*"—*Dated 26th November*, 1861.

This invention consists, First, in improved apparatus which can be attached to a fire-arm near its muzzle, and removed at pleasure, without necessarily involving or effecting any alteration to the fire-arm itself. The apparatus is composed of a frame by which it is attached to the fire-arm, and a sight mounted on the frame. The sight serves as a foresight to the fire-arm, in addition to, or instead of, any sight it may be usual to put to a fire-arm near its muzzle. The sight may be made to move on the frame in a direction transverse to the axis of the barrel of the fire-arm. Occasionally the inventor uses a packing when the part of the apparatus that should fit the fire-arm is too large, or from other causes does not fit the fire-arm. The aforesaid invention consists, Secondly, of an improved sight to fire-arms, and to serve as such on apparatus used with fire-arms. The peculiar feature of this sight is, that it is wholly supported and retained in a required position by a bar or rod which passes through the block of the sight, and whose length is transverse to the axis of the barrel of the fire-arm, and also in a horizontal position, supposing the fire-arm to be pointed or directed.—*Not proceeded with.*

2992. J. H. Soller, *St. John-street-road, London*, "*Cases for holding and supplying caps to the nipples of rifles, &c.*"—*Dated 27th November*, 1861.

In carrying out this invention the inventor constructs a flat box, adapted to hold a number of percussion caps, which are all introduced in one position, and, though loose and free to move about in it, cannot become inverted, which is usual in such boxes. It is tapered and constructed at one end, where they are delivered, so that only one can pass out at a time; at the orifice are two spring pieces which embrace the body of the cap, and grip it slightly, the one curling round so as to prevent the cap moving beyond it in a direct line; this extremity of the case also takes somewhat the same form, being semi-cylindrical, and having an opening at the side for the cap to pass out. Suitable slots are formed in it for the passage of the flanch of the cap. An opening is made in the flat side, at the exit passage of the entrance of the nipple, in the direction of the axis of the cap, which opening unites by a suitable slot with that before stated for the passage of the cap, which permits the cap to pass out on the nipple; this it does in a direction at right angles to that in which it passed from the box to the position it takes in readiness for capping between the spring pieces.—*Not proceeded with.*

3018. J. W. Gibson, *Dublin*, "*Ordnance.*"—*Dated 30th November*, 1861.

This invention relates to that class of ordnance or arms in which the projectile to be employed is intended to be inserted or charged in at the breech, and consists in substituting for any of the ordinary means hitherto employed for closing the breech end of the bore a vent-piece or flat plug slightly tapered to cause proper fitting and allow for wear, which vent-piece or plug is made to fit into a suitable slot or opening having parallel sides or grooves for its reception and guidance.—*Not proceeded with.*

Class 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

2357. C. E. Wilson, *Monkwell-street, London*, "*A new article of female apparel to be worn on the leg.*"—*Dated 13th November*, 1861.

This new article is designed to be worn above the boot, and to protect the leg between the ancle and the calf. The article consists of what the patentee terms a "leglet," in contradistinction to gauntlet, and is made by preference of waterproof or glazed cloth, lined or not with flannel, or other textile material; it is made to button round the leg, or it is secured by elastic webbing, which unites the two ends or sides of the leglet. This new article not only keeps the leg warm, but protects it from dirt and wet at that part where mostly the dress comes in contact with it in walking. Although he prefers forming it of the materials above named, yet it can be made of any suitable materials.

2887. R. T. Worton, *Kentish Town, London*, "*Pianofortes.*"—*Dated 16th November*, 1861.

This invention cannot be described without reference to the drawings.

2922. J. Parkinson *and* C. H. Minchin, *Manchester*, "*Safety-lamps for miners.*"—*Dated 21st November*, 1861.

In carrying out this invention the inventors place in the interior of the wire gauze chimney of the safety-lamp an extinguisher working in guides or otherwise, and supported by solder that fuses, or other material that yields or gives way, at a certain temperature. When from fire damp or other cause the flame of the lamp rises above the proper height, the excess of heat will melt the solder, or break the connection, and thereby release the extinguisher, so that it will descend upon the wick and extinguish the flame before the wire gauze becomes of a dangerous heat, and thus prevent explosion from fire damp or other cause. To prevent the lamp from being opened with too great facility, they place a screw or fastener through or above the part which connects the chimney with the bottom of the lamp, which screw or fastener firmly locks the lamp, and must be removed before the lamp can be opened. They also cause the ordinary light from the wick to be extinguished before the lamp is opened by placing in the interior of the chimney a second extinguisher in connection with a catch held when the lamp is shut. When the lamp requires to be opened, the screw or fastener is removed, and at the same time the catch is released, which allows the extinguisher to fall upon and extinguish the light before the chimney is removed from the bottom part of the lamp.—*Not proceeded with.*

2923. J. H. Jeffs, *Tottenham-court-road, London*, "*Manufacture of collars, shirt-fronts, cuffs, hats, bonnets, vests, &c.*"—*Dated 21st November*, 1861.

In carrying out this invention the patentee pastes or fastens together two sheets of common calico, or other suitable thin fabric, either white or of any desired colour or tint, by means of starch gum, and an article known more especially to paper makers as "patent size," after which they are to be passed between cold rollers either engraved or plain, which will give them the desired external pattern, together with the necessary glaze and appearance of a starched and ironed material.

2984. J. Cook, *Glasgow*, "*Pendent lamps.*"—*Dated 27th November*, 1861.

This invention relates to the class of pendent lamps in which three, four, or more burners project outwards "star fashion," or in different radial directions from the lower part of the pendent pipe in the case of gas lamps, or of the central oil vessel in the case of oil lamps, and consists in arranging within the burners, and so as to overhang them, a series of three, four, or more segmental reflectors. These reflectors are shaped so as to present, in both horizontal and vertical section, curved lines, which are hollow and concave outwards and downwards towards the burners. The reflectors are made to overhang, in order to reflect the light chiefly in a downward direction, to render the lamps suitable for overhead or elevated positions in shops, and railway stations and similar situations.—*Not proceeded with.*

3013. P. Tigliacozza, *St. Mary-at-Hill, London*, "*Improvements in lamps and utensils therefor.*"—*Dated 29th November*, 1861.

This invention consists in the following arrangements of parts:—The dome or cone apparatus of the burner, either with or without the chimney gauge and globe supporter attached to it, will be made to open and shut by a hinge or similar plyer, instead of removing it. The fastening and unfastening of the same apparatus will be effected by catch, latch spring, screw, or similar fastenings. The rack and pinion to raise and lower the wick will have a sharp edged broad wheel, instead of the usual pointed or toothed wheel or wheels. The utensil for trimming the wick will be similar to a pair of small tongs, the nipping edges of which, being furnished with india-rubber or similar material, representing more or less the action of the fingers.—*Not proceeded with.*

3020. E. Prince, *Cheapside, London*, "*Collars.*"—*Dated 30th November*, 1861.

This invention consists in the insertion of a gusset, or a number of gussets, of a thin material into the bands of collars, the object being to prevent the bands from creasing when being worn with a scarf, thereby giving greater ease to the wearer, and allowing for the contraction or expansion of the band, according to the thickness of the cravat worn.—*Not proceeded with.*

3022. J. Wakenell, *Hitchin, Herts*, "*Incalid bedsteads.*"—*Dated 2nd December*, 1861.

This invention cannot be described without reference to the drawings.

Class 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

2844. L. F. Davil *and* L. A. Beaudet, *Paris*, "*A new process of tanning.*"—*Dated 12th November*, 1861.

The patentees claim, First, the preparing of solutions of tannin or tannin liquors in such manner that, while being prepared, they are kept from all contact with atmospheric air or with oxygen; and they especially claim the so preparing them, and, in addition thereto, subjecting them to the action of neutral gases, having neither alkaline nor acid properties, and exerting no prejudicial action on the tannin or on the hides and skins, preferring to use for such purpose, under pressure or otherwise, hydrogen gas, or its gaseous compounds, or azote or nitrogen gas, or both hydrogen and azote. Secondly, they claim the tanning of hides and skins in hermetically closed pits or vessels from which atmospheric air is excluded, but into which pits or vessels is or are admitted, under pressure or otherwise, a neutral gas or gases (having neither alkaline nor acid properties, and exerting no prejudicial effects on the tannin or on the hides or skins), so that the tannin is performed in the presence and under the action of such gas or gases. Thirdly, they claim the employment of hydrogen in hermetically closed pits or vessels, in the manner and by the means described, or in a manner and by means similar thereto. Fourthly, they claim the application or combination of the arrangement known as "Woulfe's" apparatus to or with tanning pits or vessels, for the purpose of bringing them into communication with each other. Fifthly, they claim the combination of means constituting the improved process of tanning described.

2846. T. L. Holt, *Brentford*, "*Making paper from cochlearia armoracia or horse radish.*"—*Dated 13th November*, 1861.

The inventor takes the stem of the leaf of the horse radish, and, using the same means as are used with hemp or flax stems, renders it into fibre by boiling or steeping. The ordinary means for making paper are subsequently adopted.—*Not proceeded with.*

2855. W. H. Balmain *and* J. Hean, *St. Helen's, London*, "*Manufacture of flowers of sulphur, and roll and other forms of sulphur.*"—*Dated 13th November*, 1861.

This invention consists in supplying the pots with brimstone or sulphur in a liquid state, without admitting air or interrupting the process.

2863. G. T. Bousfield, *Loughborough Park, Brixton*, "*Soap.*"—*A communication.—Dated 13th November*, 1861.

The patentee claims, First, saponifying the fatty acids generally, and more particularly the "red oil" of commerce, whether singly or admixed among themselves, or with resin, by the use of sal-soda, or other crystallised carbonate of soda, reduced to a fluid state by fusion in its own water of crystallisation, with or without the addition of effloresced sal-soda, or finely powdered soda ash, and finishing the resulting soap paste, substantially as described. Secondly, manufacturing soap from the above-mentioned fatty acids, whether singly or admixed among themselves, or with resin, by saponifying them by the use of sal-soda reduced to a liquid state by fusion in its own water of crystallisation, and finishing the resulting soap paste by treating it with "liquid quartz," or with the aqueous solution of any of the chemical or commercial varieties and forms of silicates of soda or potass, substantially as described, the silicates serving as an aid in the saponification

and not as a mere diluent or adulterant of the soap. Thirdly, manufacturing soap from the above-mentioned fatty acids, whether singly or admixed among themselves, and with resin, by saponifying them by the use of soda ash in fine powder, and afterwards treating the resulting soap paste with sal-soda, or other crystallised carbonate of soda reduced to a fluid state by fusion in its own water of crystallisation, and finishing the soap paste by further treating it with liquid quartz, "soluble glass," or with the aqueous solution of any of the chemical or commercial varieties and forms of silicate of soda or potassa, substantially as described.

2864. J. LESLIE, *Conduit-street, Hanover-square, London*, "*Manufacture of gas.*"—*Dated 13th November*, 1861.

For the purposes of this invention, in order to manufacture gas more advantageously from hydrocarbon fluids, the following are the means employed:—The hydrocarbon fluid is caused to flow or drop down a tube or series of tubes, by preference in an upright position, within an outer vessel or retort which is heated externally; this may be conveniently done by a furnace below the lower end of the vessel or retort, together with a spiral flue around the exterior of the retort or vessel. At the lower end of this retort or vessel is a smaller retort or chamber, which may be separate from or form part of the retort or vessel first mentioned. From the upper part of this smaller retort or vessel rises an outlet pipe through the first-mentioned vessel or retort, up which pipe the gas passes from the smaller retort for use. The hydrocarbons descend by the tube or tubes nearly to the outer surface of the smaller retort, and the products thus caused to be evolved from these fluids will ascend to the other end of the first-mentioned retort, from whence such products then descend through another tube or series of tubes, which at their lower ends are connected to the smaller vessel or retort, and, consequently, the products evolved external of the smaller inner retort are conducted by such tubes into the smaller retort or vessel, by which the hydrocarbons and the products evolved therefrom will be caused to pass through very extensive heated surfaces before the gas thus obtained is conducted away and out of the apparatus for use by the outlet pipe rising from the smaller retort or vessel.—*Not proceeded with.*

2871. F. R. HUGHES, *Borrowstounness, and* T. RICHARDSON, *Newcastle-on-Tyne*, "*Improvements in treating certain natural saline compounds to fit them for agricultural use, and in order to obtain potash and other salts.*"—*Dated 14th November*, 1861.

This invention consists in treating those natural compounds of alkaline and other salts which are found at Strassfurth, in the Duchy of Magdeburg, which compounds are there known as Dungsalz or Abraumsalz, and which natural compounds are also found in other places, in such a manner that they may be used for manuring land, and to separate the potash and other salts therefrom. These natural compounds contain a deliquiscent salt (muriate of magnesia), which the inventors separate by steeping them in a small quantity of cold water, by which the greater part of this salt is dissolved out; or they heat these natural compounds with or without steam, so as to decompose the greater part of the muriate of magnesia; and the residual mixture of salts from either process, having by these means lost its deliquiscent properties, is suitable for application as a manure. The mode of separating the potash salts may be varied.—*Not proceeded with.*

2879. L. A. SOUFART, *Brussels*, "*Preparing and subsequently tanning hides or skins.*"—*Dated 15th November*, 1861.

This invention consists in the use of certain apparatus within which the skins or hides to be operated upon are stretched or suspended, and a continual current and motion is produced in the tanning solution which facilitates and accelerates the operation. The apparatus consists of three tubs, vats, or chambers of suitable size, according to the kind of skins and the quantity to be operated upon. Within the first tub, vat, or chamber the inventor introduces the solution of tan obtained by steeping oak in water, or by any other process; a communication is made, by means of a cock and tube, with a second vat or chamber, within which is a frame or box on which are stretched and suspended the skins to be operated upon. The tube from the first vat enters this about the middle, and conveys to it the tanning solution. On the opposite side of the vat is an opening communicating with another tube, which may be called the discharge tube, which conducts the solution into a third vat or chamber called the receiver; the discharge tube leaves the central vat at a point whose level is the same as the supply tube. The skins are suspended transversely to the direction of the tubes, and by means of this arrangement a continuous current of the liquor passes through the skins.—*Not proceeded with.*

2893. P. ANDRE, J. F. PLINEPAURIE, *and* J. P. RICHARD, *Bordeaux, France*, "*Apparatus for preparing or manufacturing fuel.*"—*Dated 18th November*, 1861.

This invention cannot be described without reference to the drawings.

2903. T. REDWOOD, *Montague-street, Russell-square, London*, "*Improvements in the manufacture of starch and of a vegetable sizing powder.*"—*Dated 19th November*, 1861.

This invention relates, First, to the improvement of the process commonly adopted for the manufacture of starch from rice, by the use of a caustic alkaline solution; and the improvement consists in adding oxide of zinc to the solution of caustic soda, or other alkaline solution, in which the rice is macerated. The invention also relates to the treatment of starch, so as to impart properties to it which increase its value as a material to be used in sizing paper, and for other similar purposes. This part of the process consists in adding to the starch an acid solution of chloride of zinc, then drying the starch with the solution which has been added to it, and lastly treating the dried starch in an oven at a temperature of about 240 deg. Fah.

2900. G. PARRY, *Ebbw Vale Ironworks, Monmouth*, "*Manufacture of iron and steel.*"—*Dated 18th November*, 1861.

This invention has for its object the production of a superior bar or wrought iron to that obtained in the ordinary manufacture of iron, as well as the production of cast steel in large masses, of a superior quality to that obtained by the direct decarbonisation of crude pig iron, as now carried out. To accomplish these objects the patentee takes wrought iron which, from previously having undergone the puddling process, has been purified by the expulsion of sulphur and phosphorus; or he takes wrought iron scrap and introduces it, together with coke or other fuel and proper fluxes, into a blast furnace similar in form to that ordinarily used for melting pig iron, but so arranged with respect to the tuyeres as to insure the maintenance of a much higher temperature in the furnace than is required for merely melting the iron. By this means he is enabled to effect the rapid and economical carbonisation of the wrought iron under treatment. When thus carburetted he runs out the iron from the converting or blast furnace into any suitable form, and submits it to the puddling process, by which means a further portion of sulphur and phosphorus is removed, and the iron is increased in strength and value. This iron may, if thought desirable, be again carboni-ed and puddled again for the third time. In the manufacture of cast steel direct from crude pig iron, as lately introduced, by removing a portion of the carbon, sulphur and phosphorous remain behind, and it is difficult to get crude pig iron from these injurious elements. In this process for manufacturing cast steel, by adding carbon to wrought iron (which had previously been puddled), nearly all the pig iron produced in this country becomes available for the manufacture of cast steel in this converting furnace, the greater proportion of the sulphur and phosphorus originally contained in the iron having previously been eliminated in the puddling process.

2911. G. GWILLIAM, *Savoy, Strand, London*, "*Plate glass.*"—*Dated 20th November*, 1861.

According to this invention the inventor proposes to rub smooth or flatten the upper surface of the newly cast plate by passing to and fro over the same a suitable rubber composed of a bar of wood, metal, or other suitable material, a long handle being fitted to such rubber for the purpose of facilitating the working or the operating of the same by the attendant workmen.—*Not proceeded with.*

2913. E. F. SMITH *and* T. SWINNERTON, *Dudley, Worcestershire*, "*Manufacture of coke.*"—*Dated 20th November*, 1861.

In manufacturing coke from coal containing sulphur the inventors make coke heaps of the ordinary kind, the said coke heaps being covered as usual with coke dust or other dust. On the summit of the coke heap they fix a pipe or tube of iron, the lower end of the said tube opening just above the top of the coke heap, and being luted by a clay or sand lute to the said top of the coke heap. The said tube is connected with a stack or tall chimney, or with the furnace of a steam boiler, or other furnace, and a strong draught is thereby determined through the said pipe and coke heap, the air passing from all sides on the exterior of the coke heap into the interior, and up the pipe or tube into the stack or furnace. By the method described of directing the air in the coke heap the sulphur contained in the coal being coked is wholly or partially removed, and coke is produced from sulphurous coal which is fit for use in blast furnaces, or foundry cupolas, and for other purposes for which coke free from sulphur is required.—*Not proceeded with.*

2925. J. GITTOES, *jun., West Bromwich, and* G. HINTON, *Oldbury*, "*Cupolas and furnaces for smelting or reducing ores, and for the remelting of pig iron.*"—*Dated 21st November*, 1861.

This invention consists in constructing cupolas with an outer casing or jacket extending up from the bottom about 12ft., more or less, as may be found most efficient, leaving an opening around the cupola, between the jacket or case and the brickwork of the cupola, of about 6in., but which opening or chamber the inventors divide into two parts, so that one shall have no connection with the other, and to each of these recesses they convey the blast from two distinct blast ways, admitting the blast at or near the top of each recess, and into each blast they propose applying suitable valves, so that they may be able to stop or control the blast in either of them at pleasure. At the bottom of this air-way separate vertical air-ways are formed for conducting the air down to the tuyeres, which tuyeres are arranged, appropriating about four, more or less, to each recess or air chamber before mentioned. The tuyeres enter the cupola in the ordinary position at or near the bosh, which tuyeres may or may not be of the kind known as water tuyeres; if of the latter they connect each series with an external reservoir, so as to freely supply them with water to protect them from burning when in use. At the top of the blast ways, where the blast enters the recesses or air chambers, they apply a stop-cock, or other convenient means for opening or closing the blast way at that part. Above the recesses or air chests the charging door is placed, which may be fitted with a suitable state in the ordinary way, and above this the cupola is carried up with brickwork to the ordinary height and proportions.—*Not proceeded with.*

2950. F. DE WYLDE, *Great College-street, Camden Town*, "*Paper making machinery.*"—*A communication.*—*Dated 23rd November*, 1861.

This invention consists in certain new forms and dispositions in the engine or machinery used for that purpose, that is to say, in the pounding or pulping mill. The First improvement of this invention consists in forming the channels of the plates in the segmental bed in lines running diagonally across the same, and at an angle (greater or less) with the axis of the cylinder; and, in place of rounding or fluting the edges of the grooves, square or slightly angular projections are substituted for rough or half stuff—an angle of about 45 deg. is preferred—and for fine stuff the channels are cut or the projections formed at an angle of about 22 deg. The Second improvement consists in forming the rubbing surfaces, between which the raw materials are triturated, chased in one or both directions, similar to the surface of a single cut file, making the chase in a zig-zag line across the length of the plate. The Third improvement consists in placing the blades on the periphery of the cylinder in an oblique line, so that the edges of the blades form a curved and slightly spiral line; or by forming the said blades in a series of parallel curves or zig-zag series, the rubbing surfaces being either chased or plain and square or slightly angular.

2972. C. STEVENS, *Charing-cross, London*, "*Indelible anti-corrosive ink.*"—*A communication.*—*Dated 26th November*, 1861.

The object of the present invention is the production of an ink capable of resisting any chemical reagent, forming no deposit on the inkstand or bottle in which it is held, is not acted on detrimentally by heat or cold, does not rust or clog the pen, and preserves its colour better than any ink at present known. The colouring matter principally used in the preparation of this ink is obtained from the new alkaloid prepared from coal tar, and known under the name of aniline, whose formula is C^{12} Hy A_z. Three colours are at present known, viz., violet, red, and blue; these the patentee employs singly or combined, or mixed with other colouring matters, according to the shade he wishes to obtain. The other ingredients used in preparing the ink are acetic acid, water, and gluten; the acetic acid can be replaced either by chlorhydric, tartaric, malic, citric, or gallic acid; and instead of the solution of gluten a solution either of fibrine, albumen, caseine, proteine, leiocome, or any sort of animal glue, can be used; he gives the preference, however, either to gluten or to gum.

2986. H. BAMBACH, *Cologne*, "*Manufacturing gas for illuminating purposes.*"—*Dated 27th November*, 1861.

This invention consists in passing hydrogen gas, prepared in the usual manner from sulphuric acid diluted with four or five times its bulk of water and fragments of zinc or iron, through a vessel containing some easily volatilised hydrocarburet, such as benzine, or the essence of turpentine. The hydrogen combines with a portion of the carbon of the hydrocarburet, and thus forms a gas suitable for illuminating purposes, which gas may be either passed into a receiver or direct to the place where it is required for illuminating.—*Not proceeded with.*

2994. M. HENRY, *Fleet-street, London*, "*Soap.*"—*A communication.*—*Dated 27th November*, 1861.

In the manufacture of soap considerable portions of the oil or fat, consisting principally of glycerine, will not combine with alkali, and hence cannot be saponified, but become refuse, whereby considerable waste of material is occasioned. Now acids, and sulphuric acid especially, have the property of attacking or acting on the glycerine of oil and fat, rather than on the oleine and margarine thereof. And the principal object of the present invention is to treat materials intended for the manufacture of soap in such manner that every part of the oil or fatty matter shall be used or rendered available in producing the soap, that is to say, shall enter into the composition of the soap. For this purpose the oil, tallow, or fat, which is to be employed in the manufacture of soap is first treated with sulphuric acid, or other acid, whereby the glycerine contained in such oil or fat is rendered fit for or converted into a matter capable of combining with alkalies, and hence of being saponified, or, in other words, of entering into the composition of the soap. This process may be described as converting the glycerine into a matter assumible to oleine and margarine, thereby bringing it into a condition in which it will combine with alkali. The soap is then manufactured by combining alkaline leys with the oil, tallow, or fatty matter which has been treated with the sulphuric or other acid acting on the glycerine, in the manner and for the purpose above described. A hot process may be used; this accelerates the mutual action of the bodies, but being more expensive it is not recommended for oils. Sulphuric acid is the agent mostly preferred for the purpose of this invention; this acid transforms the glycerine into sulpho-glyceric acid, which is a substance especially capable of combining with alkalies.

3002. P. SPENCE, *Newton Heath, near Manchester*, "*Treatment of ores for the manufacture of sulphuric acid.*"—*Dated 28th November*, 1861.

This invention relates to the extended application of a method of treating sulphurous ores, for which a patent was granted to the present patentee, bearing date the 3rd June, 1861 (No. 1695). According to the specification thereof only copper ores containing sulphur were proposed to be treated. The patentee has since found that he can also apply the principle of the said improvements to the treatment of iron pyrites, ores of lead, or of zinc, or to other ores containing sulphur, but which do not contain copper in such quantities as to cause them to be classed as copper ores. The present invention, therefore, consists in submitting such substances as aforesaid to the action of heat in batches, which are successively moved on from one end of the furnace to the other, and in causing a current of air to pass over them. And he now, as in the former instance, proposes to employ a furnace of considerable length, furnished with several doors, or with other apparatus by means of which the material may be advanced along the frame. According to the specification above mentioned the current of air proceeded in an opposite direction to the course of the material; but he now finds that it may be varied, and proposes its application in either direction; and, as a special improvement upon the previous invention, he proposes the use of a current of air passing in the same direction as the material under operation. Another part of the invention consists in the employment of the furnace above described for roasting or calcining ores, either with or without other substances, and from which it is desired to extract metals, the advantage being that he can continue the treatment for a lengthened period with a modified heat.

3021. A. SCHULTZ, *Paris*, "*Manufacture of certain colours for printing and dyeing fabrics.*"—*Dated 2nd December*, 1861.

This invention consists in the employment of a decoction of logwood, combined with caustic soda, for producing different shades of black, chocolate, olive, and other colours upon cotton, wool, silk, and other fabrics, or upon fabrics made of a combination of cotton, wool, silk, and other fibres.—*Not proceeded with.*

CLASS 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

2991. W. CLARK, *Chancery-lane, London*, "*Improvements in the construction of parts of electric telegraph bell apparatus, and in apparatus used in making the same.*"—*A communication.*—*Dated 27th November*, 1861.

This invention cannot be described without reference to the drawings.

2997. H. WILDE, *Manchester*, "*Improvements in magneto-electro telegraphs, and in apparatus connected therewith.*"—*Dated 28th November*, 1861.

The First part of this invention cannot be described without reference to the drawings. The invention consists, Secondly, in certain improvements in the method of submerging juninsulated metallic cables, which greatly diminishes the risk and loss when by any accident such cables break in deep water and cannot be recovered, and which method also renders the cables less liable to injury after being submerged. In this improvement the uninsulated cable to be submerged is divided throughout its entire length into a suitable number of longitudinal sections, which form separate cables; each section is then separately submerged, and the extremities of all the sections are collected together at each shore end and joined so as to form one conducting cable.

3015. E. TYER, *Old Jewry Chambers, London*, "*Electric Telegraph.*"—*Dated 29th November*, 1861.

This invention has for its object improvements in electric telegraphs, and relates to an improved arrangement of magnetic armature and electro-magnets, which arrangement is applicable to numerous useful purposes in electro telegraphy. Now in this improved arrangement the permanent magnet or magnets are stationary, and, consequently, may be made much larger and more powerful than when movable on an axis. An iron ring is mounted on an axle, and placed in close proximity to the permanent magnet, so as to become magnetic by induction. Two openings or notches are made opposite each other on the periphery of the iron ring about half way through, and two very fine saw cuts through the remaining metal, thereby separating the ring into two distinct portions, but with the extremities almost in contact; the full effect of the induced magnetism is thereby concentrated at these openings, it being well known that, the closer the poles of a permanent magnet are brought together the greater will be the attractive force exerted. The horns or projections usually fixed to the electro-magnets are made in such form as to fit between the openings or notches made in the soft iron ring—in fact almost filling them up again, the distance or space left being regulated by the amount of oscillation required to work the particular instrument to which this arrangement is to be applied. Thus the full and combined effect of the permanent magnet and the electro-magnet is obtained, a very feeble current being sufficient to produce the oscillatory or vibratory motion required. Another part of the invention relates to certain arrangements of wheel work, whereby the oscillatory movement of electro-magnetic apparatus imparts a rotatory movement to a wheel, the axle of which, carrying an index or hand, points in succession to the letters of the alphabet or other signs engraved on a fixed dial plate, the object contemplated being greater rapidity in the working this class of instrument without tripping or overrunning. For this purpose there is mounted on the axle carrying the index of a "step-by-step" or dial telegraph, two discs, pierced near their peripheries with a number of small holes arranged in a circle; an arm, carrying two inclined or conical-shaped pallets oscillates between the two discs, the apex of one cone entering one of the holes, say, in the right hand wheel, while the opposite cone leaves the hole of the left hand wheel; by the repetition of this movement of the pallet the two wheels are caused to revolve on their own axle, and the pallets and holes are so proportioned that, for each movement of the electro-magnetic apparatus, the index or pointer makes a step forward of a certain fixed length. Another part of the invention relates to improved arrangements of commutators or communicators for step-by-step, or dial, or other telegraphs. For this purpose, in constructing a battery commutator, the patentee arranges the alternate contact surfaces in a circle in the following manner:—Two rings of metal are employed, one placed above the other, and insulated therefrom; one pole of the battery is connected with the upper ring, the other with the lower. The upper ring is pierced with half as many holes as there are signs to be indicated on the dial plate (if the instrument is to be used with a step-by-step or dial telegraph), and within these holes, but not touching their edges, are placed metal studs screwed into the lower ring, and so formed that their upper ends come flush with the surface of the upper ring; a series of alternate contact surfaces will thus be presented, the studs representing one pole of the battery, and the intervening metal spaces the other pole. An upright shaft is fixed in the centre of the rings, and two insulated springs are caused to revolve round this centre over the upper ring, and to press on the alternate contact surfaces below. During the revolution of the springs the current from the battery is constantly being inverted, and, passing along the springs, enters the telegraphic circuit and instruments in connection therewith. Another improvement in the commutator or communicator of step-by-step dial telegraphs relates to the arrangement of the stops or finger keys which, when acted on, arrest at the proper time the flow of the electric currents into the telegraph's circuit, and consists in arranging them in two sets, one at each end of the commutator, and in parallel rows across the face thereof, instead of in a circle or in one longitudinal row, as heretofore. By this arrangement both hands can be employed with greater facilities, and the letters or sign engraved on or near the finger keys formed with great accuracy by the manipulators. Another improvement consists in a modification of the commutator described by the present patentee in the specification of a former patent, dated 21st December, 1855 (No. 2805). The commutator therein described is so arranged that the outgoing current is directed through one instrument or indicator, and the incoming current through another instrument or indicator; the whole arrangement is there shown mounted on a base board, forming one complete instrument. Now, in the present improved commutator, whilst the principle before described is retained, the constructive details are much altered, and additional advantages secured. The improvement consists in mounting those commutators in two separate portions, the arrangement for the incoming current, together with the battery connections, forming one portion, and the pistons and connecting plates for the outgoing current the other portion. He prefers mounting the former on the back of the instrument case, and the latter on the door of the case, in such manner that, whenever the door is opened for the purpose of examining the instrument, the line circuit for the incoming current remains undisturbed, and signals can be received on the instrument or indicator; and upon closing the door of the instrument case the pistons and connecting plates attached, forming the second portion of the commutator, come into position in order to transmit the outgoing current. Another part of the invention relates to improved arrangements of magneto machines especially applicable to dial telegraphs. For this purpose he mounts two nearly semicircular permanent magnets upon a framework, so as to form a wheel, of which the magnets are the periphery; in this periphery, however, two breaks or spaces occur, the two magnets not being allowed to come in contact the one with the other. This magnetic wheel is capable of turning freely round a fixed shaft as a centre, and it has four horns of soft iron fixed to the poles of the magnet, so as to project radially from the wheel; these horns, as the wheel revolves, pass over the ends of the iron cores of a series of electric coils, arranged in a circle, and mounted on an iron ring, which couples them all together. As the horns pass in succession over the poles of the electric coils, induced currents, alternately positive and negative, are thereby generated, and flow into the telegraphic circuit and instruments, short springs and contact pieces being employed in order to shut out of circuit those coils not in use at any given time during the revolution of the magnets. Another part of the invention relates to improved arrangements for supplying ink to printing telegraphs. For this purpose he employs a strip of metal having a channel with under-cut grooved sides along its entire length; this is mounted on a pivot in a slightly inclined position near the periphery of the ink roller, which serves as the marker of the printing instrument. Within the grooves is inserted a piece of cloth, saturated with ink, one end hanging over and resting on the ink roller; the other end likewise hangs over and serves as a reserve, so that, when the first end becomes dry and clogged, by simply sliding the cloth along the groove, and cutting off the clogged end, a new surface is presented to the roller. Another part of the invention relates to improvements in galvanic batteries, and consists in placing a flat saucer-shaped vessel at the bottom of each of the cells of a battery; a gutta-percha covered or otherwise insulated wire is fixed to the saucer, and the point of it from which the insulating material is removed is caused to project about one-sixteenth of an inch to the interior of the saucer; the wire is bent up, taken out and over the top of the cell, and connected to the negative metal of the next cell, passing through a bar of wood, to which the negative metal is attached by a dovetailed wedge; a plate of zinc is laid at the bottom of the saucer, and a small quantity of mercury poured in, so that the zinc floats on the surface of the mercury; the mercury preserves perfect contact between the zinc and the wire connected with the negative metal, and all binding screws, terminals, and clamps are dispensed with, and local action prevented.

MR. TOWLE AND THE GREAT EASTERN.—Mr. Hamilton E. Towle libelled the Great Eastern for salvage during her last stay at New York. The libellant, who is an American, and civil engineer by profession, was a passenger on board the Great Eastern on her attempted voyage from Liverpool to New York, in September, 1861. The libel states that on the 12th day of September, the ship being then about 300 miles west of Cape Clear, she was overtaken by a violent storm, which carried away the side wheels, disabled the rudder, and did other serious damage. That the officers of the ship endeavoured, by means of various devices, to steer the ship, but failed, and she remained from the afternoon of Thursday, the 12th, until Sunday evening, the 15th of September, in the trough of the sea, entirely at the mercy of the storm; that on Friday the libellant devised a temporary steering apparatus, and asked permission of the captain to apply it to the broken rudder, which request was declined; that on Saturday evening, at the solicitation of the passengers, the captain consented to allow the libellant to construct his steering apparatus, and placed men and material at his disposal to enable him to complete his design; that on Sunday evening the temporary apparatus was completed, and was found to be sufficient to steer the ship, and with it she was brought safely to the harbour, reaching the Cove of Cork on Tuesday, September 17th. The libellant claims for services in the nature of salvage 100,000 dols.

THE EXHIBITION.—It may appear strange, but it is undoubtedly the fact, that the annexe for machinery in motion not only draws, but always keeps, a much larger audience than the picture galleries. It is scarcely possible to pass through this portion of the building on a shilling day. The paths are blocked, not by people coming and going, but by visitors who seem to spend the whole day there, and who stand almost by the hour at a time opposite a single intricate machine. Those which are neither new nor intricate, but which in their motion seem mere illustrations of gigantic power, are always crowded round about, so that it is very difficult indeed to get near them. But the interest of all, whether high or low, seems to concentrate on Maudslay's exquisite working models of steam engines. They seem, as infant engines, to appeal to every one for notice and approbation amid their colossal brethren, and they take the hearts of ladies at once, who look upon them as a kind of iron nurseling walking alone for the first time. Just opposite them are portions of the stupendous engines which Mr. Penn is making for the Achilles, than which there is nothing in the whole annexe more astonishing for their tremendous concentration of power, their wonderful union of strength with lightness and almost beauty of form. These gigantic masses of iron are finished with a neatness which will literally bear comparison with watchwork, but they don't attract the attention which Maudslay's miniature engines command as they go through their mimic duty—perfect models of some of the most powerful engines in the world, moving in the space of a lady's workbox. We do not affect to account for the change in taste, but the fact itself is worth recording that these models excite greater interest in this Exhibition than the Koh-i-noor, or all the other jewellery put together.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(*From our own Correspondent.*)

Northern Matters: *The Cleveland Iron Trade: New Steamer for the Newcastle and Leith Trade: Testing Anchors and Chains: Strike at the Elswick Ordnance Works*—State of Trade at Sheffield—Clyde Shipbuilding.

The annexed statement shows the position of the blast furnaces of the Cleveland district at the commencement of the present month:—

	In.	Out.	Total.
Eston—Bolckow and Vaughan	9	—	9
,, Clay Lane Company	2	1	3
,, Samuelson and Company	3	—	3
Cargo Fleet—Jones, Dunning, and Co.	2	—	2
,, Cochrane and Company	3	1	4
,, Gilkes, Wilson, Pease, and Co.	4	1	5
Middlesborough—Bolckow and Vaughan	2	1	3
,, Hopkins and Co.	2	—	2
Port Clarence—Bell Brothers	5	1	6
Norton—Warner, Lucas, and Barrett	2	1	3
Ferry Hill—Morrison	2	—	2
Stockton—Holdsworth and Co.	3	—	3
Thornaby—Whitwell W. and Co.	2	1	3
Darlington—South Durham Company	2	1	3
Witton Park—Bolckow and Vaughan	3	1	4
Stanhope—Weardale Iron Company	—	1	1
Towlaw—Weardale Iron Company	4	1	5
Consett—Derwent Iron Company	4	14	18
	54	25	79
All furnaces May 1, 1858	43	20	63
,, ,, 1859	56	11	67
,, ,, 1860	53	16	69
,, ,, 1861	50	26	76

It will be readily admitted, on an examination of these figures, that matters are, on the whole, in a tolerably satisfactory state. As regards other northern topics we may note the arrival of the Britannia, a steamer built by Messrs. Barclay, Carle, and Co., of Glasgow, specially for the Newcastle and Leith trade. The Britannia is an iron paddle steamer of 275 tons, and to facilitate the loading and unloading of the vessel, she has been fitted with two steam winches. At the last monthly meeting of the North Shields and Tynemouth Chamber of Commerce, some discussion took place as to whether the manufacturer of ships' chains and anchor, or the shipowner should be liable to penalties for using improperly tested anchor and chains on board ships. The following resolution was adopted:—"That the chamber petition Parliament in favour of the clause proposed by Sir J. Elphinstone, to be inserted in the Merchant Shipping Amendment Act, to make it compulsory that ships' chains shall all be publicly tested, with a view to save the lives of seamen, and to secure shipowners from a needless loss of their property, consequent on having on board their vessel chains of an inferior quality and workmanship. A strike which has taken place among a portion of the men employed at the Elswick Ordnance Works has excited some interest in the district. The cause of disaffection is a proposed reduction in wages to the extent of 2s. per week, but an intimation having been received to the effect that the new arrangement was intended to apply only to the labourers, the mechanics who were at first disposed to join in the movement have since expressed their satisfaction, and resolved to return to their work. A large meeting of the workmen was held in Newcastle, when four of their number were appointed to prepare a petition for presentation to the owners of the works, having for its object an amicable settlement of the dispute, the limits of which are now, happily, of comparatively narrow dimensions. Captain Noble, one of the managers, was waited on by the deputation, and stated, in regard to the night-shift system which formed the main subject of dispute, that the proposed arrangement had been rendered necessary by the nature of the contract with Government; but with respect to skilled artisans engaged either temporarily or permanently in that department, they would be paid according to the rates usually recognised in the district. A meeting of the workmen's committee was subsequently held, when a resolution approving of the step which had been originally taken was adopted. It is believed that the dispute will soon be settled, if indeed it has not been already adjusted.

As was to be expected, the staple trades of Sheffield continue depressed, but, as usual, there are some exceptional bright spots in the general gloom. Thus the steel trade is tolerably brisk, and there is some improvement also to notice in the file trade, considerable orders having been received from India and Russia. The foreign houses generally are fairly employed. In connection with Scottish matters, we may note the launch from the yard of Messrs. Tod and Macgregor, of Partick, of an iron paddle steamer named the Briton, intended for the Stranraer and Belfast station, in connection with the various railways on either side. Messrs. Tod and Macgregor are about to build two screw steamers for the Belfast Steamship Company, each about 750 tons old measurement, and one for the Inman line, as sister ship to the City of New York, to be called the City of London. Her burthen will be 2,560 tons old measurement. Messrs. Barclay, Curle, and Co. have just launched a screw steamer of 850 tons, named the Oder, from their yard at Stobcross. The Oder has been built for the Leith, Hull, and Hamburgh Steam Navigation Company, and is intended to run between Leith and Stettin.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(*From our own Correspondent.*)

Continued Good Demand for Finished Iron: *Large Order for the Southern States*—Good Sales of Pigs: *Increasing Prices*—Coal Trade: *Tolerably Active*—The Accident at the Bradley Colliery: *The Verdict Condemning the Ground Bailiff*—The General Hardware Trades: *Decreasing Demand*—The Labour Market: *Not Inundated.*

The finished iron makers of South Staffordshire are doing a steady and gradually improving trade. Among the orders of the week is one for 1,800 tons of boiler plates, the ultimate destination of which there is reason to conclude will be the Southern States of America. The order is split up between two firms, one of whom takes 1,000 tons. The prices at which the specifications have been accepted, although not those which are supposed to be first-class, yet leave a tolerable margin for profit. The Federal States continue to send across small orders for general merchant iron, but to no very large amounts. A little disappointment continues to be expressed that the orders for the 1-in. thick plates for American naval purposes have not yet appeared in the shape of *boná fide* specifications. The home demand continues to supply much work, and the descriptions in demand are now of a somewhat more general character than they were. The sheet are now sharing a little of the activity of the plate mills, large quantities of merchant bars are being produced at some works, and a few hoop mills are in brisk operation. At some works there is a press of orders. To so large an extent is the demand in such cases that offers have to be rejected, even to the extent of hundreds of tons, and at the ordinary prices of the firms, which are all of the highest class. Such firms are now producing more iron than at any former period in their history. The instances referred to are, of course, exceptional. Still they reveal a very different state of things here to those which prevailed three months ago. On account of the holidays the attendance of masters on 'Change in Birmingham yesterday (Thursday), and in Wolverhampton the day before was not numerous. A good feeling, however, prevailed, and numerous sales of pig iron were reported as having taken place during the week. The largest quantities changed hands at last quarter's prices, and the remainder at the recent advances upon those rates. The Workington company having signified their intention of making another advance in the prices of their commodity (hematite iron) to the extent on some numbers of two shillings a ton, that description has been sold in unusually large lots, and with more than the customary rate.

Although the actual demand for coal for domestic consumption has perceptibly fallen off, yet there is a disposition on the part of some buyers to increase their stocks. For coal to be used in manufacturing purposes, especially those having reference to the production of iron, the demand has kept up pretty well, notwithstanding the advance of the season; and the prices are tolerably firm. Still the summer weather must, unless there is a greatly increased demand for iron, occasion a reduction in the demand on this account also, inasmuch as the puddlers and furnace-men will not be able, in the present and the two succeeding months, to continue the exertions they were making when June set in.

The official inquiry into the circumstances connected with the late painful accident at the Bradley Colliery, belonging to Messrs. G. B. Thorneycroft and Co., terminated on Tuesday last. It was shown that if the 15th section of the Mines Inspection Act had been complied with the accident would have been prevented. That section requires that a sufficient number of bore holes shall be kept open by the use of boring rods, both in advance of and behind men engaged in driving a headway to release water. Such rods had been used some five weeks before the accident, and a large quantity of water came away from the gutters which were supposed to communicate with a "jackey" pit into which the upper workings of the thick coal were supposed to have been drained; but this was the only time that they were used. The ground bailiff is held by the Act responsible for the use of these rods. In this case Harvey, the ground bailiff at the Bradley Colliery, saved himself from a verdict of manslaughter, by having, as he deposed, given instructions to the "doggy" to cease driving the heading and proceed only with the bricking of the portion at that time driven. After these instructions should have been carried out it was Harvey's intention, he told the jury, to use the rods. This intention he said that he expressed to the "doggy." This poor fellow, however, was among the deceased, and the jury expressed their inability to test the accuracy of the bailiff's assertion. They, therefore, after two hours' deliberation, returned the following verdict: "That the death of the seven deceased was caused by a rush of water into the pit in which they were working, the cause of such rush arising from the gross neglect of John Harvey, senior, in not making use of proper means to prevent the same; but the jury do not consider that there is sufficient evidence to criminate him."

In the hardware trades generally there is scarcely so much to be done as there was a week or a fortnight ago. So far as actual work is concerned, the holidays have of course lessened the quantity of goods to be removed by the carriers, few of the works having resumed operations in earnest before Wednesday afternoon or yesterday (Thursday) morning. Nor has the slight total cessation occasioned an accumulation of orders to any considerable extent. For tin goods in general use in most families the demand keeps up, as has been the case throughout the greater part of the depression. But for japanned goods the demand is very slight. So light is it that at the leading works many of the operatives cease to work for the week on Fridays, and do not resume till the following Tuesday. At the hollow-ware houses there is still a tolerably good demand, "as times go," and the foundries are much better employed than they were a fortnight ago. In the edge-tool trade the demand is still only light. The great activity displayed for some time, up to within a fortnight ago, in the tube trade of Birmingham and Wednesbury is not now, as a rule, observable; and there are some works at which full employment cannot be found for the customary staff of operatives. As a partial consequence the rolling mills are not affording the usual amount of employment to the hands employed at them. The lock trade, as a whole, continues slightly to mend, both in Wolverhampton and Willenhall; but among the military firms at Darlaston there is not now much doing. In the anvil and chain and cable trades of Stourbridge and Brierley-hill, as also in the nail trades of the same places, including Dudley, there are universal complaints of depression. At the same time the amount of unemployed labour of the class required in the large manufactories of South Staffordshire and East Worcestershire is not so large as might be reasonably expected.

Society of Engineers.—This flourishing society held its annual *conversazione* on Tuesday evening in the Lower Hall, Exeter Hall. A most interesting and instructive collection of models, drawings, photographs, and general engineering appliances was made, certainly not inferior in interest and value to the annual display of the Society of Arts at their house in John-street. Mr. J. Strachan, the engineer of the Reading Gasworks, contributed a complete working model of a small gaswork, in which, with the assistance of glass slides, the gas could be seen bubbling up into the hydraulic main, and the motion of all the parts of the station meter could be plainly seen, as could also the interior of the gas-holder. Mr. Ashton contributed a model of the travelling stage used for placing the main girders in the Exhibition building, as well as an extensive series of photographs taken by himself during the period of his superintendence of a considerable portion of the construction. Mr. Lewis Olrick, of 27, Leadenhall-street, contributed an improved steam indicator made by Hannan, of Glasgow. The spiral spring is made in two halves, connected together end to end. One-half is coiled to the right and the other to the left, so that the coiling or uncoiling of one spring, a source of so much error in ordinary indicators, is exactly compensated. Mr. Olrick also exhibited a very convenient frame for working up indicator diagrams. Crowley and Co's malleable iron castings, twisted like pieces of lead, attracted much attention. Mr. E. Riley, president, contributed fractures of Bessemer's steel crossings, and a portion of a Bessemer rail twisted cold. Mr. Riley had also in the room a rare sample of titanium crystals procured by himself at much pains, from the hearths of the Welsh blast furnaces. Mr. Riley, in corroboration of Mr. Mushet, has found titanium in the hearths of many blast furnaces making the better qualities of iron, and we understand that through his (Mr. Riley's) influence an experiment is now being made in Sheffield, with promise of success, in the employment of titanic acid, as a flux in steel-melting. This titanic acid, we may as well state, is a heavy mineral and not a liquid. It is found in Norway and Sweden, and may exert an important influence on the future of steel-making. Mr. Louch, of 69, Fenchurch-street, contributed some samples of Heap's joints for connecting all kinds of pipes, an improvement in much repute among practical men. Mr. Roberts, the manager of Messrs. Brown, Lenox, and Co.'s works, at Millwall, contributed a model of his parallel vice and fire engine pumps. Mr. White's "Vesta lamp," in which an annular current of air is directed, from above, within the flame from an annular wick, attracted much attention. With rectified spirits of turpentine (camphine) it was impossible at any height of the wick to produce smoke. Mr. White also contributed his apparatus for feeding grates so as to prevent smoke. The fresh coal is brought forward gradually beneath the burning fuel, by means of a right and left Archimedian screw at the back of the grate. Clegg's new water meter, with a floating drum, was represented, as was also Anderson's governor for the exhausters of gasworks. According to the variation of the pressure (from a fixed standard), upon an elastic diaphragm, loaded vibrating pawls are raised or lowered, so as to engage with toothed wheels which are arranged so as to turn on or turn off steam to or from the engine driving the exhauster. Mr. Davidson, of London-street, sent a series of beautifully drawn sections of Messrs. Allsopp and Son's new brewery at Burton-on-Trent. Messrs. Ordish and Le Feuvre, of 18, Great George-street, sent their patent railway chair, in which the natural elasticity of the cast iron is simply and ingeniously taken advantage of in keeping the rail in its place. Mr. Treppass' "Charimorphoscope," an ingenious modification of the kaleidoscope, and displaying an infinite variety of beautiful combinations of patterns (which can now be photographed for the use of pattern draughtsmen and designers), was much patronised. Mr. Beck's stop valves, Mr. White's self-cleansing kitchen cistern, the Turner rifle, Tucker and Reeves' lock, &c. &c., all claimed a share of attention.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£	s.	d.	Dis. p. ct.
IRON, English Bar and Bolt:—					
in London	pr tn	5	15	0	3
in Wales	,,	5	0	0	,,
in Liverpool	,,	5	10	0	,,
Deliv. into boats at works: Staffordshire Bars (Nom. rates last qr. day for favourite brands)	,,	7	0	0	1
Sheet, Single	,,	8	10	0	,,
Dbl.	,,	10	0	0	,,
Hoop	,,	8	0	0	,,
Rod, round	,,	7	0	0	,,
Nail Rod, sq	,,	7	5	0	,,
SHIPPING IRON, Staffordsh. Bars (Delivered in Liverpool 10s. per ton less)	,,	7	0	0	2
Sheet, Single	,,	8	15	0	,,
Double	,,	10	5	0	,,
Hoop	,,	8	5	0	,,
Rod. Round	,,	7	0	0	,,
Nail Rod. Square	,,	7	5	0	,,
IRON, Rails, in Wales, cash	,,	5	5	0	nett
,, ,, 6 months	,,	5	7	6	,,
Old, to cut up	,,	0	0	0	,,
Railway Chairs, in Wales	,,	4	0	0	,,
,, in Clyde	,,	3	15	0	,,
Pig No. 1, in Clyde	,,	2	13	0	,,
3-5ths No. 1 & 2-5ths No. 3		2	13	6	,,
No. 1, in Wales	,,	3	10	0	,,
No. 1, in Tyne and Tees	,,	2	12	0	,,
Ditto, Forge	,,		0	0	,,
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	,,	3	10	0	,,
Welsh Forge Pig (all Mine), at the Port	,,	3	5	0	,,
Acadian Pig, Charcoal	,,	7	10	0	,,
Scotch Pig, No. 1, in London	,,	0	0	0	,,

		£	s.	d.	Dis. p. ct.
IRON, Swedish, Indian assortments	pr tn	11	5	0	2
Russian C C N D to arrive	,,	16	0	0	,,
STEEL, Swedish Keg, ham.	,,	15	10	0	2½
Ditto, rolled	,,	16	0	0	,,
Fagot	,,	17	0	0	,,
SPELTER, on the spot	,,	17	17	6	nett
To arrive	,,	18	0	0	,,
Hard, remelted	,,	17	0	0	,,
ZINC, in sheets	,,	24	0	0	,,
COPPER, Tile, 14 to 28lb.	,,	94	0	0	2
Tough Cake	,,	94	0	0	,,
Sheathing and Bolts	pr lb.	0	0	10½	,,
Sheet	,,	0	0	10½	,,
Bottoms	,,	0	0	11	,,
Old	,,	0	0	8¾	,,
Yellow Metal	,,	0	0	8¼	,,
Burra	,,	96	0	0	,,
Russian do.	,,	0	0	0	,,
LEAD, British Pig	,,	20	15	0	,,
Spanish	,,	19	15	0	,,
W. B.	,,	21	10	0	,,
Sheet	,,	21	0	0	,,
TIN, English Block, nom.	,,	114	0	0	,,
Bar	,,	115	0	0	,,
Refined	,,	119	0	0	,,
Foreign Banca	,,	121	10	0	,,
Straits	,,	114	0	0	,,
TIN PLATES, Char coal, IC	pr bx	1	9	0	
Ditto IX	,,	1	15	0	
Coke, IC	,,	1	2	6	,,
Ditto IX	,,	1	8	6	,,
Do. at Newport, 1s. pr bx less		—			,,
Do. at L'pool, 6d.	,,	—			
CANADA, Plates	pr tn	12	0	0	
QUICKSILVER	pr bt				

Rails.—More inquiry this week, and the market firm at prices quoted.

Scotch Pig Iron.—But little business has been done during the past week in Warrants, which have given way about 6d. per ton, the market closing in Glasgow at 52s. 9d. cash for Mixed Nos. f.o.b. there; No. 1 Gartsherrie, 57s.

Spelter is a little easier, and may now be had for £17 7s. 6d. on the spot

Lead in good demand, and prices quoted higher.

Copper in moderate request.

Tin.—English in request. Foreign a little lower than last week, viz., Banca £121 10s., and Straits £114, rather dull.

Tin Plates firmer.

June 11th, 1862. Moate and Co., 65, Old Broad-street, E.C.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Teak	15 10	17 0	15 0	16 0
Quebec, red pine	3 10	4 10	3 5	4 0
yellow pine	3 0	4 0	3 0	3 15
St. John, N.B., yel.	5 0	5 10	5 0	5 10
Quebec, oak, white	5 0	5 10	5 0	5 10
birch	3 10	4 0	4 0	0 0
Memel	0 0	0 0	0 0	0 0
elm	3 10	4 15	3 10	4 15
Dantsic, oak	3 10	6 0	3 10	6 0
fir	2 15	3 10	3 0	4 0
Memel, fir	3 10	4 0	2 10	4 0
Riga	3 5	3 10	3 10	3 15
Swedish	2 15	3 0	2 15	3 0
Masts, Queb. rd pine	5 0	6 0	5 0	6 0
yl. pine	5 0	6 0	5 0	6 0
rd pine	0 0	0 0	0 0	0 0
Lathwood, Dantz, fm	6 0	6 10	6 0	7 0
St. Peters.	8 0	8 10	9 0	9 10
Deals, per C., 12 ft. by 3 by 9 in.				
Quebec, wht. spruce	13 0	18 0	15 0	19 0
St. John, wht. spruce	13 0	16 0	15 0	17 10

Per load—	1861. £ s.	£ s.	1862. £ s.	£ s.
Yel. pine, per reduced C.				
Canada, 1st quality	17 0	18 10	17 10	19 0
2nd do	12 0	12 10	12 0	12 0
Archangel, yellow	13 0	13 10	14 0	15 0
St. Petersbg. yel.	12 0	12 10	12 10	13 10
Finland	9 0	10 0	9 10	10 10
Memel	10 0	15 0	10 0	15 0
Gothenburg, yel.	10 0	11 10	10 0	12 10
white	9 10	10 0	9 10	11 0
Gefle, yellow	10 0	11 0	11 0	12 10
Soderhamn	10 0	10 10	11 0	12 10
Christiania, per C 12 ft by 3 by 9 in. yellow	23 0	25 0	22 0	24 0
Deck plank, Dnts per 40 ft. 3 in.	0 14	1 4	0 14	1
Staves, per standard M				
Quebec, pipe	70 0	75 0	50 0	55
puncheon	16 0	18 0	16 0	18
Baltic, crown pipe	160 0	170 0	170 0	180 0

SCOTCH PIG IRON REPORT.

	s.	d.	
No. 1 Gartsherrie	57	6	f.o.b Glasgow.
,, 1 Coltness	57	6	do.
,, 1 Calder	54	0	do.
,, 1 G.M.B.	52	3	do.
,, 3 Do.	50	9	do.
M. Nos. Do.	51	6	do.

WARRANTS.

		s.	d.	
3-5ths No. 1 and 2-5ths ,, 3 .. G.M.B.	Cash prompt	53	0	per ton.
	1 mo. open	53	3	do.
	2 mos. ,,	53	6	do.
	3 ,, ,,	5	9	do.

MANUFACTURED IRON.

	£	s.	d.	
Bars, Govan	7	0	0	
,, Common	6	10	0	
Drumpeller, Common	6	10	0	
Do. Best	7	10	0	
Cramond Scrap Bars Delivered in London	10	5	0	less 5 per cent.
Plates and Sheets	9	0	0	to £9 10s.
Rails	6	5	0	
Pipes	4	17	6	
Chairs	3	15	0	

Glasgow, 11th June, 1862.

The market has been weak, with more disposition to sell than for some time past. The slackness of orders, both for shipment and consumption, will likely lead to a reduction in price before long. Speculation is, however, still active, and holders are confident of an advance.

Exports last week were 10,829 tons, against 15,313 tons same week last year.

Naval Gossip.—The Admiralty have concluded the first portion of their bargain with Captain Coles by handing him a draft for £5,000.—The Defence Committee, in their report, advocate shore batteries of iron and stone, chains across the entrance to harbours, and floating batteries.

The Royal Agricultural Society.—The annual show will commence on Monday, the 23rd inst., in Battersea Park, under the presidency of Lord Portman. On the first three days the implement yard will be open from eight in the morning until eight in the evening; and on Thursday, the 26th, the general show of cattle, horses, sheep, and pigs will be open at eight o'clock, the judges having inspected the live stock and made their awards on the previous day. On the 26th, 27th, and 28th inst., there will be a public exhibition of steam cultivators at work near Farningham station, in Kent, a distance of 24 miles from the Victoria terminus of the London, Chatham, and Dover Railway. Lord Eversley will succeed Lord Portman as the President of the Society.

Naval Engineers.—The following appointments have been made since our last:—Jas. Campbell, acting second-class-assist.-engineer, to the Victory for the Sprightly; George Weight, acting second-class-assist.-engineer, to the Victory for the Fire Queen; Thomas Ponton, acting second-class-assist.-engineer, to the Cumberland for the Wildfire; James Murray, acting assist.-second-class-engineer, to the Asia; James Redgrave and Thomas Combes, acting second-class-assist.-engineers, to the Cumberland; John James White, acting second-class-assist.-engineer, to the Asia for the Echo; W Pitt, chief engineer to the Sanspareil; Jeremiah P. Lloyd and Geo. W. Robins, first-class-assist.-engineers to the Sanspareil; J. K. Weatherley, in the Snap, confirmed as second-class-assist.-engineer; George R. Beer, in the Hawke, for the Advice, confirmed as second-class-assist.-engineer; and William Hair in the Magpie, confirmed as second-class-assist.-engineer; Thomas Jeans, first-class-assist.-engineer, to the Rifleman; John Rice, first-class-assist.-engineer, to the Asia, for the Swinger; W. H. Lowman, additional in the Fisguard, for the Rapid, promoted to engineer; John Spinks, in the Scylla, promoted to acting engineer; C. Lawrence, in the Asia, confirmed as second-class-assist.-engineer.

SOCIETY OF ENGINEERS.

June 2nd, 1862.

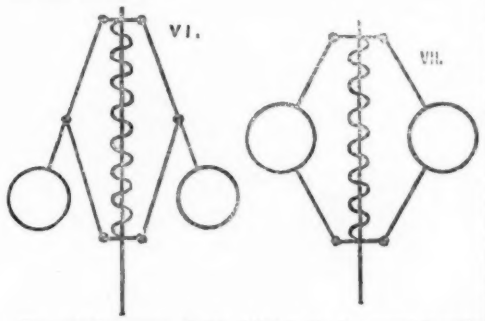
E. RILEY, Esq., in the Chair.

ON MARINE GOVERNORS.

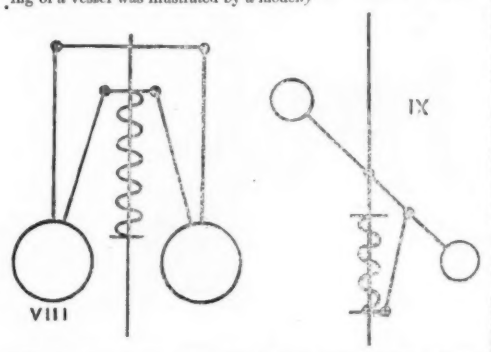
By LEWIS OLRICK.

(*Concluded from page 354.*)

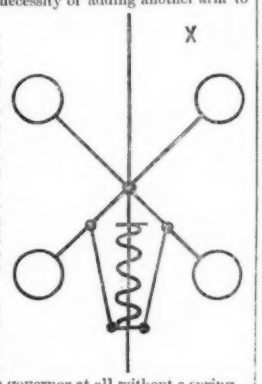
I NEED hardly say that several parties have tried the common two-ball governor (see Figs. 6 and 7), substituting a spiral spring for the force of gravity, which was lost by placing the instrument horizontally; the pitching of the ship, however, affected the action of the instrument so seriously at the time when it was most wanted that it was soon abandoned.



The principal cause of this defect in the instrument is easily accounted for by the governor not being balanced, in which case it would not be affected in any way by the motion of the ship. The latest application of a two-ball governor, which is identical in principle with the last illustration (Fig. 7), is Porter's governor (Fig. 8), which has been patented in this country under another name. I shall, however, afterwards come back to this instrument in its proper turn. (The liability of this instrument to be affected by the pitching of a vessel was illustrated by a model.)

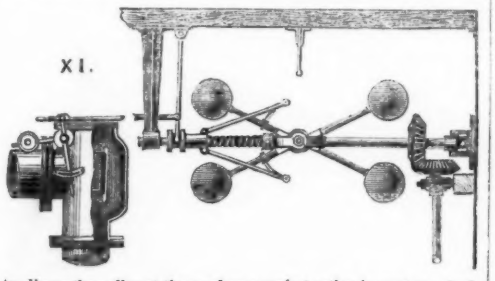


The first governor which was balanced was invented by Mr. Silver, whose name is so well known in connection with marine governors. This governor (Fig. 9) had only one arm, extending equally on each side of the spindle, with a heavy ball on either end. When at rest the spring forces the arm in the same direction as the spindle, but being set to work the centrifugal force drives the balls out and tends to place the arm at a right angle with the spindle. Thus far the instrument is right enough as a governor; but the fact that the balls when in motion continue rotating in the same plane, while the spindle alters its position, makes it unfit for marine purposes, because by any alteration in the position of the spindle the governor will work the throttle valve without any reference to the change of speed of the engine; hence the necessity of adding another arm to balance the first one, each correcting the other one's motion. This improvement perfected the governor thus far that any variation of speed of the engine was followed by a change in position of the throttle valve, and here we have the first balanced marine governor which was practical, so well known amongst marine engineers as "Silver's four-ball governor" (Figs. 10 and 11). Being entirely balanced the pitching of the vessel has no effect whatever upon it, either placed vertically or horizontally, the latter position, however, being the one usually adopted.

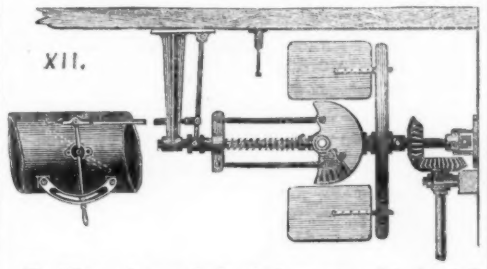


The great difference between this governor and Brunel's is that the last one, placed vertically, is still a governor without a spring, although not a marine governor, whereas Silver's is no governor at all without a spring.

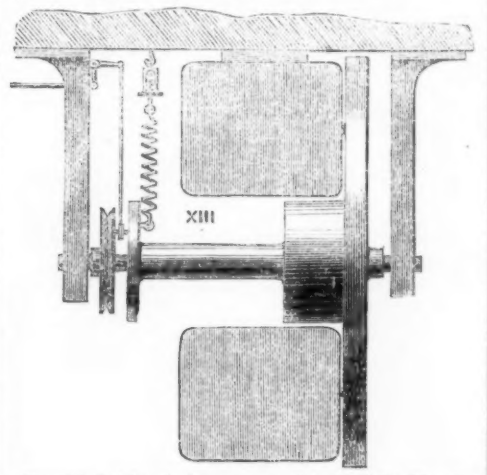
Although the difficulty of making it perfectly balanced had been overcome in this governor, and it was thus far completed, another difficulty, not thought of before, arose. When the racing of the engines is very abrupt the inertia of the balls of the governor resists the sudden start, and causes the gearing to break or the band



to slip on the pulley at times when a perfect action is most required, and in either case failing to shut the valve at the moment it ought to be done. This is the principal objection to this otherwise perfect marine governor. In later instruments, invented by the same gentleman, this difficulty has been avoided. The first of these is the well-known "fly-wheel governor," in which the balls are replaced by a fly-wheel turning loosely on the spindle within limits (Fig. 12). By this arrangement the inertia of the fly-wheel will resist any sudden change in speed, and thus allow the spindle to turn in advance of the main or heavy portion of the instrument, and by its direct connection with the throttle valve, close the latter to whatever extent the nature of the case may require, the inertia or retarding tendency of the body or heavy part of the instrument being in this case, by resisting the sudden start of the engine, the direct and efficient cause of action; and we will thus find that the inertia of the heavy part, which in the four-ball governor was a fault or vice, becomes in this governor a virtue. The momentum of the fly-wheel in combination with the force of the spiral spring are the means through which the instantaneous shutting of the valve is attained. Various means have been adopted for transmitting the differential speed of the spindle and the fly-wheel, but in this case before us the motion is usually given to the wheel by the use of a spring, and through the means of two quadrants and a small bevel wheel fixed to the fly-wheel. It will thus be seen that any sudden start of the engine acts instantaneously on the valve and shuts it, at the same time that all the force of the sudden jerk is taken up by the spring, and thus the breaking of gearing and slipping of the belt is entirely avoided in this instrument. The spring being thus loaded it gradually gives off this load to the fly-wheel by increasing its velocity. The wheel, however, needs some means of limiting its speed and balancing its *vis viva*, as it would otherwise run anyhow, and lose entirely all its power as a regulator. This is acquired by placing four fans of a suitable size in a radial position to the spindle. As now the *vis viva* of the fly-wheel increases as the square of the velocity, and the resistance of the fans to the atmosphere also increases as the square of the velocity, it will thus be seen that those two forces balance each other.

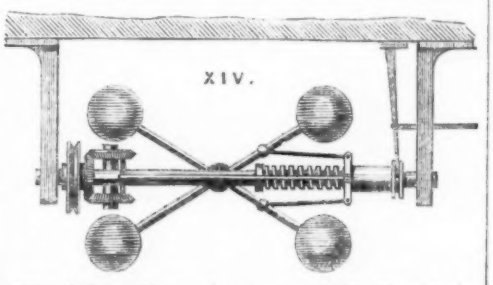


The difference between the fly-wheel governor and the four-ball governor is, that the last one limits the position of the throttle valve *directly* by keeping its position according to the centrifugal force, whereas the fly-wheel governor does it *indirectly* by limiting the speed of the fly-wheel by using the fans.



Since this first fly-wheel governor was introduced Mr. Silver has made several others, differing only in the mechanical contrivances for transmitting the motion of the spindle to the fly-wheel, but all of them maintaining the features necessary for a perfect marine governor. The one illustrated by Fig. 13 is, however, superior to any of the others, because it is here within the power of the engineer to regulate the speed of the engine under full speed, by either tightening up or slackening the spring. In the first case the speed is increased by the spring keeping the valve more open, and in the latter the speed is diminished by the spring allowing the valve to be more readily shut. All the other governors must be thrown out of gear and stopped before the engineer can tighten or slacken the spring, and thus regulate the speed of the engine.

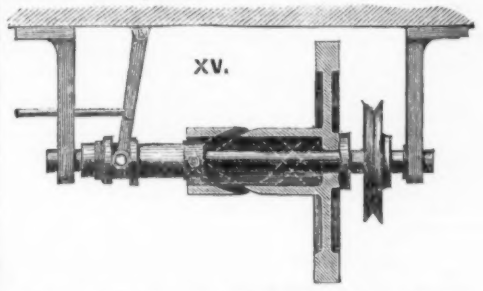
The next marine governor I shall mention is Mr. Silver's improved four-ball governor (Fig. 14). The improvement consists in introducing a loose pulley on the spindle, by which the sudden start of the engine is transferred direct and instantaneous through bevel wheels to the throttle valve, and thus the inertia of the balls, which in the first one caused the gearing to break or the band to slip, is not only no fault here, but even a virtue in assisting to shut the valve in combination with the centrifugal force of the balls.



Other similar combinations have been used by Mr. Silver—for instance, the combination of centrifugal force and the inertia of the balls, resisted by a spring, in which case the balls rotate constantly in the same plane, at right angle with the spindle. This governor has, however, only two balls. The patent for this invention combines also the use of a fly-wheel. Another governor with four balls, by Mr. Silver, contains the combination of centrifugal force and the inertia of the fly-wheel in resistance to a spring.

All of these governors, however, fulfil the conditions for perfect marine governors, pointed out at the commencement of this paper, and they have been largely introduced in the mercantile navy of this country. One fly-wheel governor, patented in 1857, was soon abandoned on account of the amount of friction to be overcome in working it, and consequently the sensitiveness of the instrument was greatly impaired, and the tendency was only to act properly when a sudden start occurred. It consisted of a fly-wheel loose on the spindle, and attached to the fly-wheel were two inclined V-shaped planes, against which worked two corresponding inclined planes, provided with friction rollers; but although it was a true marine governor in all other points, and the planes were supplied with friction rollers, still the action of the instrument was so imperfect, on account of friction, that it was not thought advisable to apply it.

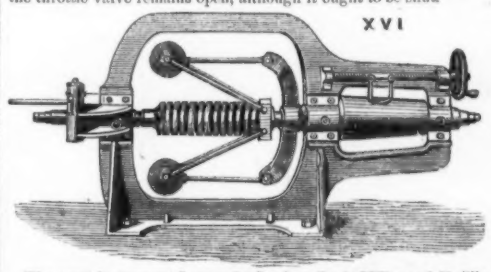
Besides the above-mentioned centrifugal and fly-wheel governors, Mr. Silver has invented two kinds of marine governors on entirely different principles. The first kind consists of a pulley worked by the large engine, and turning loose on the spindle of the governor. On this spindle is fixed a cylindrical boss, provided with spiral grooves, by which means the throttle valve is worked. At the end of the spindle is a fly-wheel and a crank, which is worked by a small steam cylinder. It is by this small cylinder that the speed of the large engine is regulated, because as soon as the large one will overrun the speed of the small one, the valve is immediately shut by the spiral groove forcing the sleeve back, and *vice versâ*. Another modification on exactly the same principle has also been patented by Mr Silver, and differs only from the former in the mode of working the throttle valve. Thus it will be seen that the large engines can be regulated to any speed by the mere turning of the cock admitting steam to the small cylinder.



The second kind of governor is the so-called "pulsating governor. It consists of a common conical valve, placed in the steampipe in such a manner that the pressure and velocity of the steam entering the cylinder tend to shut it, and the spring on the reverse side tends to open it again. As the speed of the engine increases the valve closes more and more, and *vice versâ*, and thus effects the regulation of the engine.

Besides these governors invented by Mr. Silver, the last two years have brought several others before the public, which I am now going to describe.

The first one is a fly-wheel governor invented by Mr. Meriton (Fig. 15). It consists of a fly-wheel to which is attached a small cylindrical boss with two spiral grooves cut one in each side, and in these grooves work two studs fixed on one end of the sliding sleeve, which follows the movement of the spindle, driven, as usually, by a band from the screw shaft. Now as the fly wheel is allowed to turn loose on the spindle, so as to act by its inertia, any sudden start of the engine will immediately shut the valve, and thereby carry the studs to the farthest end of the groove. When once arrived there it would require some contrivance or the other to replace them in their first position, and thereby open the valve again; but this is left out in this governor, and thus it will be seen that the inventor has left out one of the main points so essential in governors, viz., always to maintain two constantly acting forces opposing each other. Another point which I have mentioned above has been omitted in this instrument, viz., a counterbalance to the *vis viva* in the fly-wheel, because if there is not a resistance that increases equally as much as the *vis viva* of the fly-wheel does, the fly-wheel can be made to increase its speed anyhow by a gradually increasing force, and thus the governor loses all its regulating power, because the throttle valve remains open, although it ought to be shut.



The next instrument I am going to describe is Miller and Knill's governor. It consists of a fly-wheel, to which is attached one-half of a cylindrical boss; the other half of this boss, which also forms the sliding sleeve, is allowed to move longitudinally on the spindle, but follows its rotating motion, whereas the fly-wheel with the first half of the boss is loose on the spindle. The boss is cut in two halves at an angle of about 60 deg. to the direction of the spindle. The fork lever, which is worked by the sliding sleeve for the purpose of opening and shutting the throttle valve, is provided with a weight, intended to force the one-half of the boss up against the other half attached to the fly-wheel, so as to replace it in its first position, when pushed back by the action of the governor. The objection to the application of any weights for such a purpose as this, is, that the pitching of a ship will often interfere with the force of gravity of the weight, and thus open the valve when it ought to be shut, and *vice versâ*. The action of this instrument is the following:—As the fly-wheel resists by its inertia any sudden change of motion, the one-half of the boss will be forced back by the other half attached to the fly-wheel, and thereby cause the valve to be shut; it is afterwards opened again by the weight. This is the case when any sudden starts occur, but when the increase of speed is gradual the weight on the fork-lever will press those two slanting surfaces of the boss together, and thus fail to shut the valve when it ought to. In this governor a counterbalance to the *vis viva* of the fly-wheel has also been omitted, and thus the regulating power of the instrument is greatly impaired by being at times allowed to run away anyhow.

A governor lately introduced is Porter's, illustrated by Fig. 16. This instrument is simply a common two-ball governor, placed horizontally, with the links turned upwards instead of, as usually, downwards, and provided with a spring as a substitute for the force of gravity resisting or balancing the centrifugal action of the balls. Being a two-ball governor, and not in any way balanced, it will, to a certain extent, be affected by the pitching of the ship, and thus its true action as a governor be impaired. Another fault in this governor is the inertia of the balls resisting any sudden start of engines, and thus causing the gearing to break or the band to slip at times when most required, and, in either case, failing to shut the valve as prompt as it ought to, to prevent the engines from racing. This objection becomes more serious with a governor that is intended to run at the rate of 300 to 400 revolutions per minute.

Another governor has lately been brought out by Mr. Weir in Scotland, who, in a paper he read before the Institution of Engineers in Glasgow, describing his invention, said that it contained all the beneficial features of Silver's four-ball and fly-wheel governor. Now as Mr. Silver's marine governors are marine governors in every sense of the word, it is difficult to see why this should not be one, and one cannot help, at the same time, admiring the *naïveté* with which this gentleman acknowledges the appropriation of another man's invention.

Having now mentioned all the governors that have come under my notice I will call your attention to the benefits to be derived from the application of a perfect marine governor in a ship.

In the first instance, it allows the engineer, in a gale of wind and

rough sea, to attend properly to the working of his engines, which he must necessarily neglect if he is obliged to stand by the throttle valve, without being able to move from his post, as he might otherwise cause a break-down; and, though he may try and do his best, it is impossible for him to shut off and open the valve as prompt as the governor does it, in fact it only allows so much steam into the cylinder as can be usefully applied by the engine.

The next point to be considered is the utter impossibility for the engines to race when the screw or paddles get out of water, at which times the engines, supplied with a governor, do not exceed their usual number of revolutions by more than one or two. The saving by preventing racing is acquired in different ways; thus, it will be observed that, during the racing of the engines, the parts are often so overstrained that they break down, and, at any rate, the wear and tear is enormous. Likewise the saving of steam is considerable, sometimes about 10 per cent. in a heavy gale, which will be evident when we remember that all the revolutions made while the engines are racing and the screw out of water are merely a waste of steam, as they do not propel the ship.

All these evils can easily be avoided by applying a perfect marine governor, the cost of which will be repaid to the owner of steamships in less than six months by the decrease in his coal bill, and his bill for repairs in the engine room, and likewise by saving of time in which the ship will make its voyage.

As a proof of the correctness of my last assertion I may fairly mention the Tasmanian, belonging to the Royal Mail Packet Company. This screw steamer has often been obliged to lay to in a heavy gale, for fear of breaking her machinery on account of racing, but since she was fitted with one of "Silver's fly-wheel governors," she has been able to continue her voyage undisturbed, as the engine maintained almost the same number of revolutions, whether the screw was out of water or deeply immersed. Many similar cases have come under my notice in regard to other ships, where a couple of days have been saved on a voyage of ten to eleven days' duration in a heavy gale of wind, by the application of a properly-constructed marine governor.

After this paper was finished, and only a few hours before I was going to read it to the society, I was favoured by Mr. Atwood with a model of Sergeant's governor, but regret to say that want of time has prevented me from going fully into the question, and giving a detailed description of the instrument. It consists of two spindles, one driven by the large engine and the other by a small engine, and both connected by gearing in such a manner that the difference in speed causes the throttle valve to be opened or shut as the case may be.

DE BERGUE'S RAILWAY CHAIRS.

THE object of the present improvements, by Charles De Bergue, of 9, Dowgate Hill, is to obviate certain objections to the hitherto systems of iron permanent way, which generally may be stated when in cast iron to be too heavy, and consequently too rigid, and to make too great a mass at the points of support, thus acting objectionably as an anvil under the rails or otherwise; if cast of less weight have been too liable to fracture or otherwise, the rails have been inefficiently secured.

The invention comprises the casting or forming sleeper chairs with a dished or curved and hollowed or flatly tapered base or bottom (to be used with the convex or projecting side downwards) with cross ribs or webs, or with one or more circular or other ring-like ribs or webs, or with a rib or ribs in addition to such ring-like rib or ribs within the upper or concave side of such bed plate (base or bottom.

The invention also comprises the casting or forming sleeper chairs as above set forth with parts of the ribs or webs fashioned for forming a seat for the rail on which the rail may be firmly bedded, and so that the rail and sleeper chair may be secured together by one fastening only.

FIG. 2.

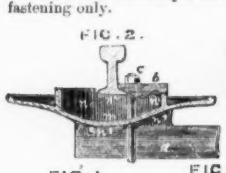


FIG. 3



FIG. 1.

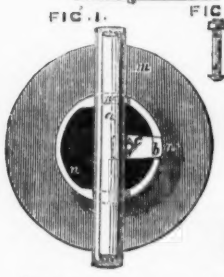


FIG. 5.

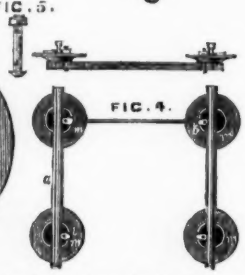


FIG. 4.

The invention also comprises the casting or forming sleeper chairs as above set forth, with ribs or webs or projections from the convex or lower side of such sleepers, so as to admit of the adaptation and fastening of the tie bar to the under side of the sleeper, and securing it thereto by means of the same bolt or fastening which secures the rail above.

Fig. 1 is a plain view of improved sleeper chair, showing also a rail *a* fixed in its seating by means of a clip piece *b* and bolt *c*, the clip piece and bolt forming the one fastening as above set forth; Figs. 2 and 3 are corresponding views in section and elevation, showing also a tie or gauge bar *d* (held to the sleeper by the same fastening); Fig. 4 is a general plan, showing the improved sleeper chairs as used in combination for a system of permanent way; Fig. 5 is an elevation of a plain bolt to be substituted for the link bolt represented in Figs. 2 and 3, in the positions where there is NO tie or gauge bar employed. In Fig. 4 *m* denotes the sleeper chair; in Figs. 1, 2, 3, *m* denotes its dished bed plate or base or bottom, and *n* a circular or ring-like rib or web upon and within the upper or concave side of the bed plate; n^1, n^1, the parts of the rib or web fashioned for forming rail seats; n^2 is a seat for the clip *b*; n^3 is a projection on the under side for fitting into a corresponding seat or recess in the tie bar *d* for preserving the gauge; and n^4, n^4, ribs or webs also on the under side for obtaining a firm seating on the tie bar, so as to prevent the sleeper chair from canting laterally. The clip *b* is similar, or somewhat so, to the clips specified in pursuance of letters patent previously granted to Mr. De Bergue.

LISTER AND MYERS' HOISTING APPARATUS.

THESE improvements (by J. Lister and D. Myers, of Bradford,) in apparatus for arresting the fall of the cage or bucket in a mine, or while being otherwise hoisted, relate, first, to a combination of parts connecting the rope or chain with the article to be lifted.

Fig. 1 represents in elevation a perspective view of hoisting apparatus arranged and constructed according to the invention. *a*, *a*, is the cage or platform on which anything is hoisted, and *b*, *b*, the guide rods on which it is guided in its ascent and descent in a pit shaft or other positions where hoists are required. The upper and lower cross bars *c*, c^1, of the cage embrace the rods *b*, *b*, as seen, and form the necessary guides; in the upper cross bar is fixed the slotted plate *d*, on which the weight of the cage hangs in ordinary, being suspended from the hoisting rope or chain by links *e*. The links *e*, *e*, are attached to the ends of levers *f*, *f*, which, by the weight of the cage, are held up against the top ends of the slots in *d*. The levers *f*, *f*, are mounted on pivots *g*, *g*, fixed in the cranked pieces *h*, *h*, which are pivotted at the lower part on a pivot or pin *i*, in the boss of *d*, while the upper and outer ends are double, and embrace the rods *b*, *b*, up and down which they are guided, and slide freely when the cage is suspended by the rope *x*. The double or open limbs or parts of *h*, *h*, also receive the levers *f*, *f*, which are so disposed that their ends abut against the rods *b*, but the abutting ends being rounded off at the upper part as seen dotted, when raised by links *e*, *e*, are constantly pulled down by strong springs *k*, *k*, affixed at one end to the parts *h*, and at the other to levers *f*, *f*, as seen. These springs are not, however, strong enough to sustain the weight of the cage *a*, and therefore the levers abut against the upper ends of slots in *d*, and are thereby kept from exerting any friction on the rods *h*. The links *e*, *e*, are connected by a cross pin with the piece *l*, which is placed in connection with the rope or chain *x*, in manner according to another part of the invention to be hereinafter described. From the above description it will be seen that the cage will ascend and descend without impediment on the guide rods *b*, *b*, when in ordinary working, but that when the rope breaks, or any part of the hoisting machinery is deranged and the cage so detached, the levers *f*, *f*, being liberated, will at once be drawn downwards by the springs *k*, *k*, causing their ends to abut hard against the rods *b*, and at the same time causing the loops of *h*, embracing the rods, to be driven hard against *b*, thereby producing a friction on those rods, which will suspend the cage and prevent its descent; the friction produced on the ends of *f*, *f*, by the tendency of the cage to descend, assist to tighten their hold on the rods. Thus a hoisting cage will be suspended at any point of its ascent or descent, and be then rendered perfectly safe, notwithstanding the breakage of the hoisting rope or chain.

FIG. 1.

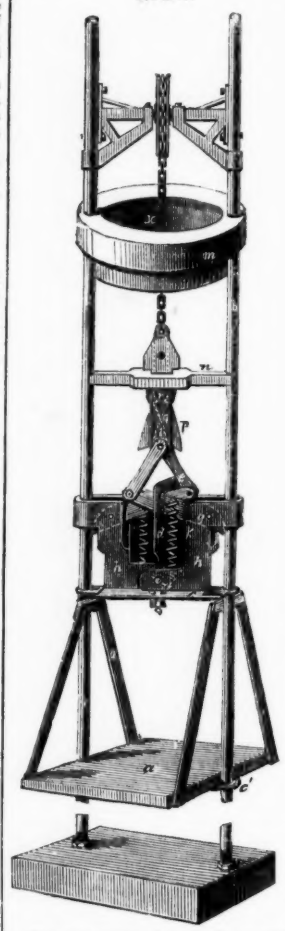
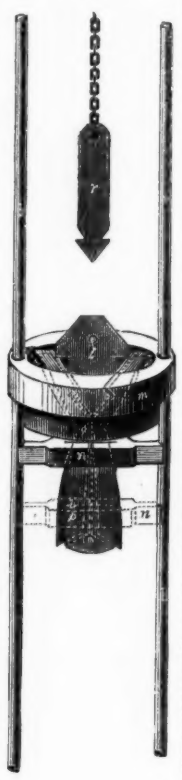


FIG. 2.



The next part refers to the overwinding of hoists, to prevent accidents from which the rope or chain *x* is connected to the cage by apparatus that will let go its hold when carried too high. For this purpose, at the top of the hoist there is fixed a ring *m*, through which the socket piece and cross bar *n* cannot pass; this socket piece is fitted to embrace and slide very stiffly on the part *l*, to ensure which, and at same time to prevent it setting fast, a strong spring may be introduced to create necessary friction. The part *l* is formed of two parallel plates suitably connected, and confining between them two catch levers *p*, *p*, mounted on fulcra *q q*; the upper ends of these are so formed that, when in the closed position, they fit and embrace the barbed end of piece *r*, fixed on the end of the chain *x*, and they are held thereon by the bracket or cross-bar *n*, that being slid upwards to embrace and collapse the upper ends of levers *p*, and so securely connect and hold the part *r*. In the event of the hoist being overwound, the bar *n* strikes against the ring *m*, and is drawn down on *l*, so that it releases the upper ends of *p*, *p*, which immediately open, and release their hold of *r*, and so frees the cage from the chain *x*; at same time, however, that the ring and bar *n* releases the part *r*, it is driven down on the lower and projecting end of levers *p*, causing the upper ends to spread, at which time the ends are above the ring *m*, and being thus extended beyond its internal diameter they hold thereon and suspend the cage, as seen at Fig. 2.

MINES IN CHILE.—A Chilean Government Commission has published a very interesting report upon the state of the mines in Chile, all of which they had lately visited. There are 119 mines in operation, worked at 609 different places, 304 of which are yielding very profitable returns. Water is very scarce at the mines, and is obtained at a great cost. Wood commands an average price of about 1c. a-pound.

PRESERVATION OF FOOD.—One of the most curious and valuable illustrations of preservative methods as applied to meats is shown in the Exhibition by Messrs. Jones, who exhibit under common glass shades legs of pork, lamb, salmon, &c., and, in short, all the viands which are the most difficult to keep from tainting. Some of these specimens have been in the annexe since a week before the opening of the Exhibition, and the portions removed within the last few days to be cooked and tasted by the jury were found to be absolutely perfect in their freshness. The process, we believe, simply consists in exhausting as much as possible of the air from the case in which the meat is placed, and then completing the vacuum by the introduction of sulphuric acid in minute quantities, after which nitrogen gas is allowed to fill the case, to the total exclusion of oxygen, without the presence of which no decomposition can go on. Chemical truths are almost as infallible as mathematical truths, and there is no known reason why meat thus protected should not remain good for years as well as months.

NELSON'S MACHINERY FOR PUNCHING WASHERS FOR THROSTLES.

THIS invention, by Henry Nelson, of Manchester, consists of two rollers or cylinders revolving in suitable bearings, between which the cloth or material to be punched passes. On one of the said rollers or cylinders are one or more projecting cutters, so that, as the material to be perforated comes in contact with each cutter, the requisite hole is punched; and, to cause the material to pass through or between the rollers regularly without slipping, one or both of them are grooved or fluted, and at the front of the apparatus any suitable guides may be fixed to keep the material in a straight direction. The required distance of the perforations is regulated by the diameter of the roller, and consequently the distance of the punches asunder. Motion may be given to the rollers either by hand or power. In the illustration the two rollers or cylinders between

FIG. 1.

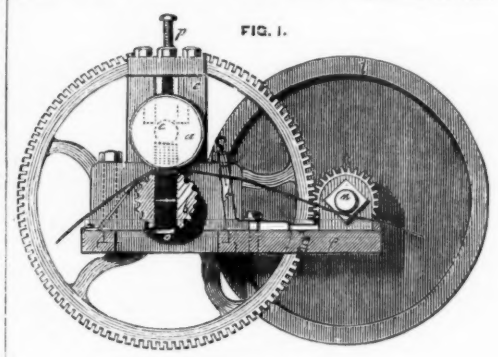
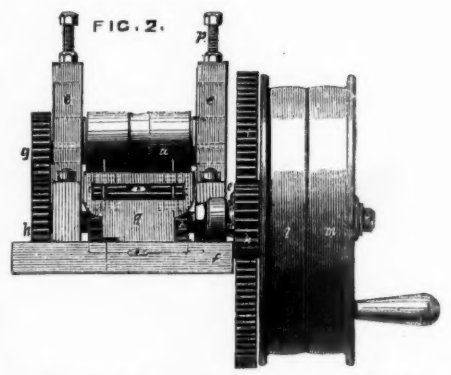


FIG. 2.

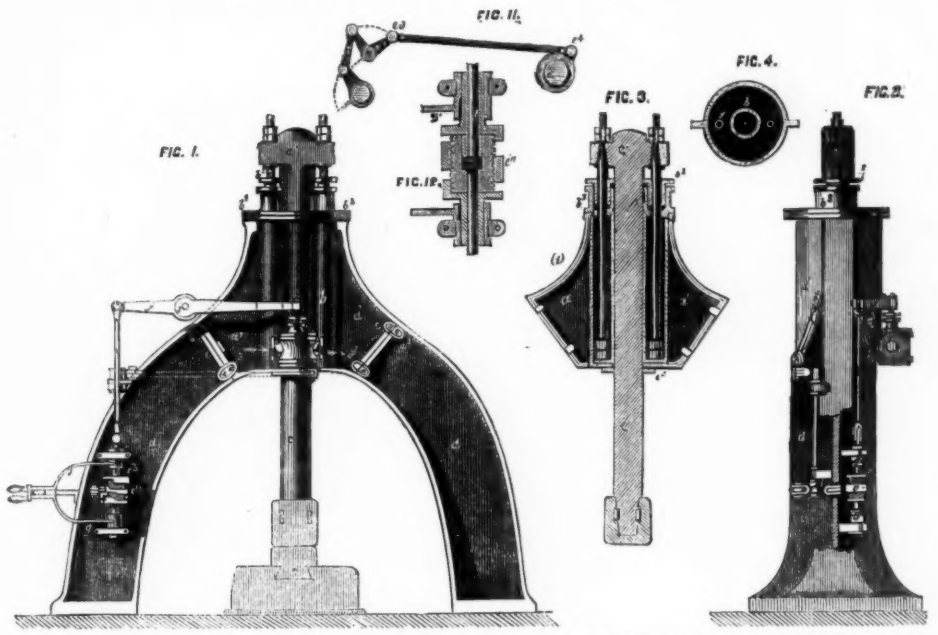


which the cloth to be punched passes are shown at *a*, *b*, having shafts or pivots *c*, *d*, which work in the bearings *e*, attached to or forming part of the small frame or table *f*. The shafts *c*, *d*, of the two rollers have at one end the toothed wheels *g*, *h*, gearing into each other, in order to give simultaneous motion to the rollers, and at the opposite end of the lower roller there is a toothed wheel *i*, gearing into the toothed wheel or pinion *k*, fixed to the driving pulley *l*, which, with the loose pulley *m*, work loose on the stud *n*. The bottom roller *b* is fluted, and has fixed to it the punches or cutters *o*, at the required distance apart. The top roller *a* is made of soft metal, so as not to injure the cutters when they project through the cloth or material, and the top roller is adjusted to its proper distance from the bottom roller by the set screws *p*. At the front of the rollers there is a guide *q*, for maintaining the cloth or material in a straight direction. The rollers may be made of any desired diameter, and driven at any suitable speed, and they may also be reversed, so that the soft metal roller shall be below and the roller with the cutters above.

NAVAL ENGINEERS.—The following appointments have been made since our last:—W. Lowman, engineer, to the Rapid; J. Patterson, first-class assistant-engineer, to the Rapid; G. O'Brian, second-class assistant-engineer, to the Rapid; William T. Goldie, confirmed as second-class assistant-engineer in the Cumberland; Josh. Manley, confirmed as second-class assistant-engineer in the Shannon; James M'Gregor, confirmed as second-class assistant-engineer in the Doterel; James Sheil, acting second-class assistant-engineer, to the Asia; Henry Lanckester, acting second-class assistant-engineer, to the Dauntless, for the Leveret, vice Smith; Thomas Smith (B), acting second-class assistant-engineer, to the Euryalus, as supernumerary, vice Lanckester, and Richard Dobson, supernumerary in the Euryalus, confirmed as second-class assistant-engineer; William Read, acting second-class assistant-engineer, to the Asia; William M. Chambers, in the Cumberland, for the Pylades, confirmed as chief-engineer; and Edward Taylor, supernumerary in the Fisgard, promoted to engineer.

COPPER WORK IN THE EXHIBITION.—Messrs. Newton, Keates, and Co., of Liverpool, Manchester, and Glasgow, have a stand in the eastern annexe (Class 8), containing articles of much interest to engineers, machinists, coppersmiths, calico printers, bleachers, wire workers, &c., the principal of which are a large copper boiler-plate, for a locomotive engine, 16ft. 6in. long by 4ft. 5in. wide, and weighing over 15 cwt.; a tube plate, hammered and flanged, 5ft. 7in. by 4ft. 3in., and weighing over 8 cwt., also for a locomotive engine. With these plates may be mentioned copper bolts, for making boiler stays, &c., of various diameters, and drawn to a length of 21ft. each. There is also a large sheet of copper, 15ft. by 4ft. 6in., and weighing 140 lb. only, being remarkably thin for so large a sheet. A large wrought brass plate is also exhibited, measuring 5ft. 2in. by 5ft. 9in., $\frac{1}{16}$in. thick, and weighing over 10 cwt. 1 qr.; these plates of brass are now being made by this firm for the tube plates of patent surface condensers for marine and other engines; also specimens of the tubes used in fitting up these condensers, being made of brass, and seamless, or without a joint or soldering, of $\frac{1}{2}$in., $\frac{5}{8}$in., and $\frac{3}{4}$in. in diameter. A wrought brass air-pump rod, of large size; its total length is 10ft. 7in., diameter of body 6$\frac{3}{4}$in., its weight being over 11$\frac{1}{2}$cwts.; and, to show the excellent quality of the metal of which it is made, a piece of it is exhibited in the form of a string of fine wire, two miles in length, and weighing only 3 lb. Some fine specimens of tubes, both of copper and brass, all being seamless, or without a joint, and of various diameters up to as much as 5in., intended for tubing locomotive and marine steam boilers, steam fittings, sugar refining, and brewery and distillery apparatus. Drawn yellow metal bolts, 21ft. long and of various diameters. A copper pan, 4ft. 9in. diameter and 2ft. deep. Several copper and brass printing rollers, copper singeing plates, and copper cylinders, of various sizes, the largest copper roller being 38in. long, and with the very large circumference of 47$\frac{3}{4}$in.; with these rollers is also a brass mangle bowl for calendering cloth, 4ft. 2in. long and 23$\frac{1}{2}$in. diameter, weighing 11$\frac{1}{2}$ cwt. The strings of wire exhibited are very long, there being one of copper 20,000ft. in length, and another of 13,000ft.; there are also some fine strings of brass wire.

FEARNLEY'S STEAM HAMMERS.



THESE improvements in steam hammers are by Thomas Fearnley, of Manningham, near Bradford. He forms the steam cylinder annular, in order that the ram may pass through the inner or central part of such cylinder, and thereby have increased guiding surface in its motion, as also to reduce the height of it; and he forms the piston annular, with rods passing through the head of the cylinder to a crosshead affixed to or formed upon the ram, or through the bottom of the cylinder direct to the hammer above the head. He also forms the "tup" or hammer to surround the cylinder, the piston-rod being keyed into the hammer just above the head. In this case the cylinder is fixed to the upper part of the framing, and the framing below is bored to receive and guide the "tup" or hammer in its motion, while the inside of the "tup" or hammer is bored true to slide on the cylinder. He also gives motion to the valves of steam hammers by means of a spiral groove or feather cut or formed in the "tup" or hammer, acting upon a pin or stud in connection with the valve or valves.

Fig. 1 shows a front view, and Fig. 2 a side view, partly in section, of a steam hammer, with parts arranged according to the one part of the improvements; Fig. 3 is a vertical section of parts; and Fig. 4 shows a horizontal section through the line (1), (1), of Fig. 3. *a*, *a*, and a^1, indicate the main framing of the hammer; *b*, the steam cylinder, which is formed annular by there being an inner case or lining b^1, within which the upper part of the "tup" or hammer bar or ram *c* slides. The inside of the inner case or lining b^1 is turned truly, as is also the outer surface of the bar or ram *c*, that it may serve to afford increased guiding surface to such ram; *d* is the piston, and d^1, d^1, the piston rods passing through the stuffing boxes b^2 to the cross head c^1 formed on the upper part of the ram *c*. The use of two piston rods serves to keep the ram *c* from turning round. The interior portion b^1 of the steam cylinder is by preference formed as shown, so that the bottom portion may be bolted to the bottom part of the outer case *b*, while the upper portion is formed somewhat conical to enter corresponding conically-formed recesses in the cylinder cover b^3. The cylinder *b* is cast on the part a^3 of the framing, which part, for convenience of construction, is formed as shown, adapted to be connected to the parts *a*, *a*, by bands of metal a^3, a^3, passed over the projections a^4, projecting from the respective parts *a* and a^1; such bands being applied so as to fit closely when hot, will, in shrinking, as is well understood, draw the parts in the closest contact.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

Thursday, June 12th, 1862.

C. G. GUMPLE, Vice-President, in the Chair.

ON THE VARIOUS METHODS OF APPLYING STEAM POWER.

By ARTHUR CHAPMAN.

THE endless variety of processes in which steam power is now employed to supply the inhabitants of the earth with the necessaries and luxuries of civilised life of necessity involves the application of the steam engine in many different phases; and, besides, varieties of construction are also adopted in similar cases, in accordance with the opinions or experience of the engineer to whose care the arrangement of the machinery may be confided. And thus we see that constant deviations from the beaten track are being made, such deviations being usually styled "improvements," a term which may now be regarded as technical, for although numerous instances occur in which alterations are introduced with very successful results, yet, in the majority of cases, the term proves a misnomer, and the engine to which it is applied is, after numerous experiments, suffered finally to remain in *statu quo*. I now propose to direct attention to the main points worthy of consideration, relating to the varieties of the steam engine in actual use, avoiding, however, as much as possible, involving them in the tangled web of mechanical contrivances with which so many of our modern engines are loaded.

First, let us consider the relative advantages of using high or low pressure steam, considered *per se*, the engine being supposed to work without any expansion of the steam in the cylinder, the steam being allowed to escape into the air after doing its work in the cylinder. Let two cases be taken as samples, and calculate the efficiency. Suppose we have a steam cylinder 2ft. in length and 144 square inches or one foot in area, let us calculate the relative efficiencies at 30 lb. and at 100 lb. per square inch steam pressure.

Before proceeding further we may here observe that the total heat, that is to say, the sum of latent and sensible heats of steam, is constant or very nearly so at all pressures; hence the quantity of fuel required to generate at a given weight of steam is constant at all pressures, hence the consumption of fuel is proportionate to the weight of steam used. The total heat of steam may be taken at 1,212 deg. Fah., as the boiling point of water at atmospheric pressure is 212 deg., and the latent heat of the steam formed is about 1,000 deg., hence, to find the latent heat at any pressure, we have only to subtract the sensible temperature from 1,212 deg., the pressure of the atmosphere averages 14·7 lb. per square inch, but we will call it 15 lb. per square inch. Let us now calculate the work done by a cubic foot of water in the above cylinder when raised into steam at 30 lb. pressure: the pressure upon the piston will be 144 square inches × 30 lb. = 4,320 lb., from this we must, however, subtract the atmospheric pressure, which reduces that on the piston to one-half, or 2,160 lb. Steam at 30 lb. occupies about 837 times the volume of the water from which it is raised, hence one cubic foot of water will suffice for about 417½ strokes, which gives for the work done—

2160 lb. × 837ft. = 1,807,920 lb. raised 1ft.,

or, 1,807,920 foot lb. for one cubic foot of water used, which would require for its evaporation nearly 6·579 lb. of Welsh coal capable of evaporating about 9·5 lb. of water per lb. of fuel.

Now, let us consider the work done by the steam at a pressure of 100 lb. per square inch, which, when the atmospheric resistance is deducted, leaves 85 lb. per square inch for efficient pressure, so that the gross effective pressure on the piston will be

144 square inches × 85 lb. = 12,240 lb.

Steam at 100 lb. pressure per square inch occupies about 270 times the space of the water from which it is generated, hence one cubic foot of water will supply steam enough for 134½ strokes, and the work done will be

12,240 lb. × 270 ft. = 3,304,800 foot lb.,

or about 1 5-6ths of the work obtained from the same quantity of steam at 30 lb. If the steam, however, acts against a vacuum a difference will occur, then the work at 30 lb. will be per cubic foot of water

3,615,840 foot lb.

and at 100 lb. pressure per square inch the work per cubic foot of water will be

3,888,000 foot lb.,

the difference between the two quantities being about 7 per cent.

The latter is, of course, the correct method of examining the case if we wish to determine the relations existing between the degrees of economy obtained by the use of high and low pressure steam, but in the practical view of the question we must not forget any point, and the smaller the ratio of the prejudicial resistances to the whole pressure the more economy will be secured, as there will be a greater per centage of power to be employed as useful effect.

The next question—and a very important one it is—is what is the advantage or disadvantage attending the use of expansion? This question has, of late years, been brought forward and discussed as a moot point, though it appears to me to have been practically settled years ago.

Let us suppose we have steam at 50 lb. per square inch generated in a steam boiler, and acting on an engine of which the piston has an area of 144 square inches and a stroke of 2ft. One cubic foot of water will generate about 518 cubic feet of steam at 50 lb. pressure. We will, in the first place, suppose the engine is working without expansion, the one cubic foot of water will suffice for 259 strokes, so that the work done will be

50 lb. × 144in. × 2ft. × 259 strokes = 3,729,600 lb.

raised one foot high; and if we use coal that will evaporate 9 lb. of water per pound of coal consumed, the quantity of coal consumed would be 6·844 lb., but as 1-horse power is 33,000 lb. raised one foot per minute, or 1,980,000 lb. raised one foot per hour, the theoretical consumption of coal, supposing no loss of heat, would be about 3·6 lb. per horse power per hour. This is, of course, much below the practical quantity, but will suffice for comparison with the following calculations, as it is at present merely necessary to determine the ratios of economy. Let us now suppose that the steam is cut off at half-stroke, then the mean pressure will be about

42 lb. per square inch,

and one cubic foot of water will suffice for 518 strokes, so that the work done by it will be

42 lb. × 144in. × 2ft. × 518 strokes = 6,265,728 lb.

raised one foot, corresponding to a consumption of fuel equal to about

2·16 lb. of coal per horse power per hour,

showing a saving of forty per cent. by cutting off at half stroke. This is, however, theory only, and it is necessary to consider the cases of actual engines, and it is very necessary to scrutinise carefully the manner in which the experiments, the results of which we adopt, are carried into execution, for otherwise anything may be called proved; and we very frequently see results of very anomalous character obtained, or rather, I should say, published; for the authors of such experiments do not always invite special attention to their mode of arriving at results, and thus experimental philosophy is sometimes disgraced by the publication of results unfairly procured and designated facts. Much has, of late, been said against the practical utility of expansion, although its value has been most practically shown twenty years back, and before that period there was sufficient presumptive evidence of its efficacy.

I will now draw attention to two classes of engines—the rotative engines and the Cornish pumping engines. It is, I presume, well known that the latter have always been celebrated for doing about twice the duty of the former, and, if so, it surely becomes important to inquire into the cause of such difference.

I will take the results of trials of some of the vessels of the British Navy, and compare these with the duties of some modern pumping engines. The fuel consumed by the former was as under:—

The Chesapeake, cutting off at	¼-stroke ..	3·1 lb.	coal per H.P. per hour.
,, Colossus	do.	½-stroke .. 4·4 lb.	do. do.
,, St. George	do.	¼-stroke .. 3·5 lb.	do. do.

This shows a marked saving resulting from the use of a high degree of expansion. I am here speaking comparatively, as the highest expansion is but ¼ of the stroke.

The Colossus cuts off at ½-stroke, the St. George and the Chesapeake at ¼-stroke; the former thus effects a saving of about 20 per cent., and the latter 29 per cent. over the Colossus.

The Victor Emmanuel at sea, when cutting off at about 0·65 of the stroke, consumed from 2·3 lb. to 5·5 lb. of coal per horse-power per hour, the consumption being 4·9 lb. per horse-power per hour, when good Welsh coal was used.

From the performances of some of the merchant vessels I select the following, not, however, being acquainted with the amount of expansion employed.

The Cambria ..	5·7 lb.	coal per indicated H.P. per hour.	
,, Lima	2·6 lb.	do.	do.
,, Valparaiso	3·1 lb.	do.	do.
,, Leonidas ..	3·2 lb.	do.	do.

These are fair samples of the most efficient vessels. It is true that the Thetis engines required, according to the published accounts, only 1·018 lb. of coal per horse power per hour, but it was stated that the coal used would evaporate 15 lb. of water per lb. of coal, an incredible quantity, and taking this into consideration the Lima was very nearly as economical.

Let me now call attention to the performances of some of the pumping engines, and I here may remark that the results are not of mere short trials, but records of long working, so that the results can be relied upon.

West's engine	2·3 lb. coal per horse-power per hour.
Taylor's do.	2·0 do. do.
Average of mining engines ..	2·1 do. do.
The Wicksteed engine at the East London Waterworks	2·0 lb. Welsh coal per effective horse-power per hour, so that the consumption per indicated horse-power would have been less.

The last named engine cut off at one fourth the stroke; it appears to be inferior to none of the Cornish engines, and superior to all the others I have quoted, and they are good for their class; the best was the Lima, which consumed 2·6 lb. coal per horse-power per hour, let us compare this with the Wicksteed engine. The coal with which the Lima was supplied would evaporate about 8·3 lb. water per lb. of coal, hence with the best Welsh the consumption would have been about

2·3 lb. coal per horse-power per hour.

In order to reduce the Wicksteed to the same standard we must allow for the quoted quantity being for useful effect, and to bring it to indicated power would probably reduce the consumption of coal about 15 per cent. per horse-power; but I will take it at 13 per cent. for safety, then the consumption will be about

1·7 lb. coal per horse-power per hour;

hence the saving in this case of the Cornish engine over the best case we quote of marine engines will be about

24·3 per cent.

Let us now compare it with the stated results of the trial of the Thetis, of which the engines consumed 1·018 lb. per horse power per hour of coal, stated to be capable of evaporating 15 lb. of water per lb. of coal. The best Welsh will evaporate about 9·5 lb. water; hence, had this been used, the consumption would have been 1·6 lb. of coal per horse power per hour for a short trial.

I will now proceed to investigate the causes of the advantages possessed by Cornish engines in general over rotative engines, considering, however, only the consumption of coals.

First, let us consider the rotative engine. This class is usually required to have an uniform motion, hence a certain portion of energy is destroyed by the vibration of the various masses of matter which have to be suddenly stopped, and their motion reversed, such energy being expended in creating greater friction on the bearings, &c., although the actual work thus lost may be small at each moment when the motion of any element is reversed, yet the reversing occurs so often that the gross loss becomes very considerable. Again, there is not much time allowed for the exhaustion of the steam, whether high or low pressure, and in the former case we therefore sometimes find a back pressure of 8 lb. per square inch above the atmospheric pressure, thus making a total back pressure of 22·7 lb. per square inch in some instances, which, even when working with an initial pressure of 100 lb. per square inch, is very considerable. In low-pressure engines the want of time prevents such perfect condensation as might otherwise be obtained. Again, it is very common to case cylinders insufficiently, or not at all; and steam jackets are dispensed with, and the crown of the boiler left exposed to a current of air.

In the Cornish pumping engine the cylinder is steam jacketted and thoroughly cased; the boiler is well covered; all the pipes are clothed; the doors of the engine house are kept closed to exclude cooling currents of air, and yet the engine houses are not oppressively hot. Again, the engine works slowly, so that ample time is allowed for condensation. With regard to mechanical arrangements, we find also great advantages, the engine moving in the manner best suited to the development of the greatest effect. Thus the engine starts, and its velocity accelerates towards the centre of the stroke, when it gradually diminishes until it comes to rest by the expenditure of all the energy of the steam, the weight on the pump rod having been thus lifted to the top of its stroke; then the engine returns, the weight drawing the piston up and forcing the water out of the pump, the velocity increasing to the centre of the stroke, after which there is a pause until the cataract again releases the steam valve, and another down or indoor stroke is made; thus the whole energy is in each stroke expended upon work, and none is lost by percussion; and, lastly, the Cornish engines work with a high degree of expansion. I have mentioned the loss of vacuum in rotative engines, and will here quote the vacuum in the condensers of the vessels before mentioned:—

Chesapeake	24 to 26 inches of mercury.
Colossus	26½ ,,
St. George	24½ ,,
Cambria	24·5 to 27 ,,
Lima	28 ,,
Valparaiso	27 ,,
Leonidas	22 ,,

With good Cornish pumping engines a vacuum equal to 28½in of mercury may always be readily obtained, and may be taken as the actual working vacuum. Comparing this vacuum with that of the Lima, which is 28in., the best in the above table, we find a gain of 1·78 per cent. from this source alone. The average vacuum in the above cases is 25¼in. of mercury, and the superiority of the pumping engine in this case is equal to 10·7 per cent. from improved vacuum.

Having already adverted to the remaining sources of economy in the Cornish engine, namely, steam jackets, clothing, expansion, &c., I will now conclude these remarks, in which, though necessarily very brief, I have endeavoured to call attention to the practical means of improving the economy of steam engines, and I hope that fresh interest in this important subject may be awakened, and lead to the publication of more statistical information, for it is to experiment we must look to improve our knowledge of the steam engine.

THE CAPE COLONY.—We learn, by private advices received by the last African mail, that Mr. Garwood Alston, civil engineer of Cape Town, has just completed surveys for a proposed new line of railway from the D'Urban-road station on the Cape Town and Wellington Railway to Mahnesbury, a distance of twenty-eight miles. The surveys occupied five weeks. The line, if carried out, will open up a beautiful and fertile district.

ARMSTRONG ORDNANCE.—A few nights ago Sir F. Smith asked the Secretary of State for War whether any steps had been taken towards the construction of a 600-pounder Armstrong gun, or any other gun of greater calibre than the 150-pounder smooth-bore gun with which experiments had been made at Shoeburyness; and, if so, when it might be expected to be finished and ready for proof. Sir G. C. Lewis said that a 200-pounder Armstrong rifled gun had been constructed. It had been proved within the last week, and experiments would be immediately commenced with it. A 600-pounder Armstrong gun is now in course of construction, and it is promised that it shall be ready for proof in three months. A wrought-iron rifled gun is now being constructed by Mr Lynell Thomas, to throw a projectile of 400 lb. weight, which it is expected will be ready in three months.

LETTERS TO THE EDITOR.

We do not hold ourselves responsible for the opinions of our Correspondents.)

ROTATORY ENGINES.

SIR,—Mr. Scott Russell says, in his "Treatise on the Steam Engine," when speaking of rotatory engines, "that such an elementary machine, if constructed, could give forth any more of that power than is now rendered effective by the common steam engine in every day use, is a fallacy arising in ignorance and ending in disappointment."

That this is the opinion correctly held by the best engineers of the present day there can be no reasonable doubt, still when we find men eminent for their scientific skill, mechanical genius, and keen perception of what I may call the propriety of machinery, spending their time, talents, and money in the attempt to construct a machine which will produce rotation, by the direct action of steam on a piston, we must naturally be led to the conclusion that something more is sought for than a mere increase in economical effect over the reciprocating engine.

It is certain that up to the present all such attempts have met with very partial success, due to the almost insuperable mechanical difficulties we encounter in every attempt to depart from the original cylinder, piston, and its appurtenances; the record of such attempts is a record of failures, of disappointed hopes, and pecuniary losses, so that even the most ardent advocates of the rotatory engine must admit that there is not one in existence which can for a moment compete in economy, trustworthiness, and general efficiency with a good direct acting engine of the ordinary construction; the great number of joints, the large increase of surfaces in motion on one another, and the great difficulty of constructing efficient and simple valves must always stand in the way, and bar every attempt at perfection. Theoretically right, the rotatory is practically wrong, and must remain so until some new form with which we are not yet acquainted is introduced.

Watt, Dundonald, Barrie, and a host of others have invented rotatories, none of which have come into general use; the object all these men endeavoured to attain was simply a machine which would not be exposed to the loss of power and injurious strain due to the rapid reciprocation of the heavy masses of iron constituting the piston, connecting-rod, &c., of the ordinary engine. A reduction of space, a high speed of piston, and an especial adaptation to the expansive use of steam, was also sought for with more or less success; but although, in careful hands and for short spaces of time, these various forms of engine fulfilled to a certain extent the purposes for which they were intended, they have never yet been found suitable for sea-going steamers, pumping mines, or, indeed, any purpose which required them to remain a long time in action without intermission for repairs. We well know that many objectionable forms of engine are used for such purposes, the employers being willing to give up a certain amount of economy of fuel, &c., in order that they may have a perfectly trustworthy machine, which may remain in motion for weeks together without stoppage for repairs or adjustment. Some of the Cornish engines have worked for three months at a time without intermission; and although a little beside the subject, I may mention a water engine, built at the Butterly Ironworks for the Alport mines, with a 50-in. cylinder and 10-ft. stroke, which at one time was going constantly for seventeen weeks without any person even seeing it during that time. Australian and American liners have their engines constantly going for ten days and a fortnight without intermission, and I could bring forward many other instances of the same thing were it necessary; but I challenge "J. S." to mention a single instance where an effective rotatory is doing the same; they must be stopped for repairs and new packing so often, and many of them are, besides, so complicated, and the expenses for repairs so great, as to outweigh every advantage which could possibly be derived from them.

Still I am so alive to the very great defects due to the rapid reciprocation of heavy masses of iron, and so convinced of the theoretical fitness of the rotatory engine for expansion in its fullest sense, that, far from discouraging adventures on this path of invention, I would give them every encouragement in my power; but it is quite certain that, without the utmost simplicity of form, success can never attend on their path. Many rotatories are absurd in the extreme, and could never result in anything but disappointment to the makers and users. Simple as it may appear, it will be found, on careful examination, that a more difficult problem does not exist than the construction of a good rotatory; its very simplicity, and the ease with which we can construct a rotatory which will work, are the very quicksands into which the inventor is sure to flounder, unless he has an accurate perception of what he actually requires, and a profound knowledge of the various expedients resorted to by engineers to obtain the greatest possible effect from the employment of a given quantity of steam in an ordinary engine. Nothing can be more simple in principle than a reciprocating steam engine; a child of common intellect could almost be made conversant with its principle and mode of action in a few hours; but compare this elementary machine with a pair of screw engines, of the most improved construction, and what a difference we find—what beautiful inventions! what select expedients we find resorted to to obtain a horse power from a handful of coals! We see in such engines the result of years of study, years of experience; we find nothing superfluous, nothing wanting—"a place for everything, and everything in its place;" and when we turn from such a triumph of skill to some of the crude inventions put forward by persons who know little or nothing of their subject, we no longer wonder at the want of success of the rotatory engine.

"J. S." has referred to an engine designed for driving a flour mill. He seems to labour under two misapprehensions: he considers me to say that my engine is at work. This is not the case; neither the mill, nor the engine designed for it by the writer, ever went beyond the designs, from causes not necessary to enter on here. "J. S." also thinks that I say my rotatory is the best possible. I never said so. I only said that, for the purpose for which it was intended, my rotatory was as good a design as could be. The purpose intended was a perfectly equal speed; and, in order to assure this, the steam would never have been off the piston, and there would have been absolutely no dead points, either while passing the valves, or at any other time; and, consequently, the pressure of the steam on the piston would have been constant with a good governor. The valves work without friction, the piston never crosses a port or touches a valve, every precaution has been taken against unequal wear, and therefore I think I am justified in what I have said.

Rotatory engines may be divided into three classes—those which work on the principle of Barker's mill, by the reaction of steam flowing through suitable orifices in hollow metallic arms; those on the same principle as Branca's; and those in which a piston moves round in a suitable case. Now the two first of these varieties are so obviously defective in principle that we may pass them without further comment, and proceed to the last, of which there are so many varieties that a large book might be written on them. I will just glance at a few of them. Watt proposed a rotatory having a piston moving round a circular channel connected with the boiler and condenser, by suitable valves which were opened and shut by the steam and piston; but the valves failed, and the piston was injured by passing the ports.

Hornblower's rotatory had two movable pistons alternately moving round a circular channel, and acting as abutment valves to one another; a tuppet valve in each piston was opened as it came in contact with the abutment one, which was then also set at liberty, and the other arrested by sliding levers behind, and so on alternately.

This engine, I believe, contains the principle to which we must look for ultimate success; and I would recommend the following modification as likely to give good results. Let one of the pistons be fixed to the case, the other to a disc which will fit the edges of the case steam-tight by metallic packing rings; this disc will be fixed on a horizontal shaft, mounted in suitable bearings, and covering an eccentric cogged wheel, something like those used in silk mills. The case will carry a similar wheel, bolted to its side in such a way that both wheels can gear into two other wheels fixed on a second parallel horizontal shaft, which will carry the fly-wheel and drive the machinery. It is evident, from this arrangement, that neither piston will ever come completely to rest; each will move faster and slower, at different parts of its revolution, the distance between the pistons alternately increasing and diminishing as each piston successively overtakes the other. By a suitable arrangement a perfectly equal speed may be communicated to the fly-wheel shaft, notwithstanding the variable speed of the piston; and it is obvious that none of the evils resulting from change of direction of motion in the piston can attend this form of engine; frictional gearing may be used instead of cogged wheels, and thus a very elegant engine might be constructed suitable to many situations.

Bramah proposed a rotatory with a piston moving round a cylinder divided into two ports by slide valves, alternately pressed against the piston by an eccentric motion. The engine I have referred to in my former letter is a modification of this principle, being fitted with two slide valves working at opposite sides of the case or cylinder; the piston is fixed to the edge of a disc suitably turned and faced up; this disc works in a slot made in the inside ring of the case, and made steam-tight to it by a metallic packing ring; the edge of the slide comes against the edge of the disc, and, touching it only at the narrow edge, is easily made steam-tight: there are no ports in the case, the steam entering and exhausting through opposite sides of the piston; the steam enters continuously, the abutment slide valves being worked by a cam with a suitable face cut in it, consisting of a part of a circle and the cord of the remaining part, so that each valve will remain closed during half a revolution, and will open and close during the other half, to permit the piston to pass, the steam in the meantime reacting on the other valve which is closed. This will make its construction quite plain enough without taking up your valuable space with a sketch.

An immense number of rotatories have been invented by Maudslay, Clegg, Turner, Owens, Witty, Beale, and a host of others, of all of which, suffice it to say, that none of them answer the purpose for which they were intended, namely, to compete successfully with the steam engine in ordinary use; this arises from the immense and unequal friction, and the leakage at the joints, which are in general numerous, extensive, and difficult to make a good job of; the abutment valves in particular offer many obstacles. If a flap valve, or any modification of a flap valve is used, it can never be made tight at the sides: besides that, it cannot close until the piston has passed, when, of course, a clearance space is left between it and the piston equal to the length of the valve. Another great defect consists in attaching the piston directly to the shaft, instead of to a disc, as in mine.

I am much pleased to find that "J. S." agrees with my letter of Feb. 17th; he so thoroughly endorses my opinions in the seventh paragraph of his present letter, that it requires very little comment from me, except to say that I do attach importance to dirt; nothing is more disgusting than a filthy engine-room and filthy engineers, but how this is to be avoided with some of the present direct-acting engines I know not. They are perfect gluttons as far as tallow is concerned, which they not only evaporate, but scatter in every direction.

I cannot see why geared engines should be dirty; nothing is easier than to box the spur wheels, so that no grease can be scattered, or frictional gearing might be used.

"J. S.'s" elastic piston is a step in the right direction, but I fear it may cause trouble by steam getting between the plates, the springs giving way, &c; besides the first shocks of the steam at the end of the stroke is certain to compress the piston flat, even though the springs may be of ample strength for the full pressure a moment afterwards, just as we see the heads of large Cornish engine cylinders spring at every stroke, unless heavily ribbed, and I fear that this might lead to serious results. I recollect once having much anxiety for the upper sunk ring of one of the pistons of a pair of 90-horse oscillating paddle engines getting loose so as to permit the cast iron packing ring to play up and down about an eighth of an inch on the body of the piston at each change of motion; the piston remained, strange to say, pretty tight, but it ground and groaned in a way to startle the weak nerves of many of the passengers, nothing keeping it quiet but the immoderate use of tallow until we got into port in a few hours. I much fear something of the same kind may take place in "J. S.'s" piston after it is in use some time. His second plan is decidedly the best, and I think that flexible plates of corrugated iron, made on the same principle as an aneroid barometer, and fitted to each cylinder end, would be found a far better and more elegant arrangement. The spaces between these plates and the cylinder covers should be kept in constant communication with the steam in the boiler, and then the piston, being properly cushioned, may come right up to their plates. I think "J. S." will see, on reflection, that this is a far better arrangement than making the piston elastic. It is far cheaper; it supplies the best possible jacket for the cylinder end, and it can scarcely get out of order.

"J. S." must, of course, be well aware that there is nothing very new in his arrangement for working tuppet-valves by cams, instead of slides by an eccentric, inasmuch as the same plan was adopted long ago in the engines of the Penelope and Orinoco, and, if I am not mistaken, the Sidon steam frigate is so fitted still; the Adriatic has a modification of the same arrangement, and his valves have already been used in steam hammers. Still I consider the whole arrangement meritorious, and likely to give good results. V. P.

June 10th, 1862.

SINGLE AND DOUBLE ACTION STEAM HAMMERS.

SIR,—"Logic," in your paper of the 6th, is desirous of knowing if I am aware of the fact, as he puts it, that before my double-action hammer strikes the blow the steam is always full on the underside of the piston: and he is also desirous of knowing whether I consider it necessary for the steam to escape from the underside of the falling piston of a double-action steam hammer, as well as of one that is single-acting; and, also, whether the resistance will not increase with the greater velocity of the falling piston. From the tenor of "Logic's" letter it is very evident that his sympathies, and possibly his interest also, are with what he calls "a good strong single-acting hammer with hand gear;" and he goes further, and says, "which, for ordinary heavy forgings, is quite quick enough." From such a finish to his letter we may presume he considers himself an authority on such matters. After that it is a pity he did not attach his name to his letter, that your readers might judge as to the worth of his opinion so positively given; or whether he was not too much in the "old school." In your last paper of the 13th appears a letter from Mr. Morrison, giving a description of his heavy hammer, and his opinion of hammers generally; also, he makes a comparison between single and double action. He is not wanting of confidence in his hammer, for he writes, "I consider that my hammer is the only one at present in use that can be worked with steam on both sides the piston efficiently;" and he also defines the limit as to what his double-action steam hammers should be made to, which he fixes at "5 cwt. to 50 cwt." Why he admits double action at all is a puzzle, as, in drawing your attention to the comparative merits of single and double action hammers, he writes, "If you take a hammer with a falling weight of 5 tons, single-acting, and the same hammer with steam on both sides the piston, the blow of the double-acting hammer is not more efficient than the blow of the single-acting hammer, because, in the double-action hammer, the steam has to be admitted under the piston before the hammer strikes (to return the stroke), and thereby receive the force that is due to the pressure of the steam on the top of the piston." Of course Mr. Morrison is writing the result of his own experience with his own double-action steam hammer, and I cannot, under such circumstances, argue the point with him. "Logic" will, no doubt, agree with him. A part of the next paragraph in Mr. Morrison's letter I wish to lay before you. He says, "Again, if you consider a 5-ton hammer with steam on both sides the piston, say 40 lb. pressure (leaving the velocity out), the force due to steam on the top of the piston would be 10 tons, to which add 5 tons, the weight of the hammer thus making 15 tons. Now, according to the usual idea, this hammer would be equal to a single-acting hammer of 15 tons dead weight; but no practical person would attempt to make so large a forging by one half with the double-acting hammer as he would with a single-acting one, or, if he did, the result would be that the inside would be unsound." Mr. Morrison here gives his opinion clearly and distinctly. "Logic" could not desire anything more; especially, also, when it comes from a gentleman who, in the same letter, has written, "I consider that my hammer is the only one at present in use that can be worked with steam on both sides the pistons efficiently." But "Logic," as well as your readers generally, must not be carried away too far by Mr. Morrison. He has done very little with double-action steam hammers; and if he has succeeded so indifferently, as he states he has, it must not be concluded that others, who have led the way, have been so unsuccessful also. But I must turn my attention now to "Logic." He has asked if I am aware that the steam enters the underside of my piston before the blow is struck? I answer it may, or it may not. For instance, if the sliding wedge be held on the bar, so that the roller in the hammer block operates against it and changes the position of the valve before the hammer strikes the blow, the steam will, in that case, be admitted under the piston. It is used so when giving light blows single acting. It would be used so if employed cracking nuts for "Logic," and the blow that it gives never varies under these circumstances. But if heavy blows are wanted, and more than the hammer as a single-acting hammer is capable of dealing, and the steam be admitted above the piston, say the full pressure of the steam in the boiler, then if the sliding wedge be held upon the wedge-bar, so that the roller in the hammer block glides down the curvature of the face of the wedge, so as to have moved it half way when the hammer strikes, the friction of the valve is so little that the motion imparted to the valve gear carries it to its full stroke, and in that case the steam is actually admitted under the piston after the blow is given, but so soon after that it does not allow the cold hammer face to rest upon the hot iron or steel, nor to waste its time, but goes up again for another blow.

"Logic" also wants to know if I consider it necessary for the steam to escape from the underside of a falling piston of a double-acting steam hammer? I assure him I consider it highly necessary, and in my hammers I have arranged ample means for it when the valve is full open. Now, here I must try to draw "Logic's" attention to his favourite single-acting hammer with hand gear, which means, of course, that the valve for letting the steam under the piston to raise the hammer, and then moving the valve to let the steam out so that the hammer shall fall, those movements shall be given by the hand of the attendant. It is a monotonous job, to say the least of it, and if the man gets weary, or careless, he may move his valve but part way, not opening the exhaust port full, but sufficient to let the hammer fall; the throttling of the exhaust must in that case very much retard the fall of the hammer, and impair the useful effect of the blow. In my hammer, which is self-acting, the valve is moved by the self-acting gear, which neither tires nor gets weary. I may here observe that in a single acting hammer, whatever resistance it meets with, whether from the friction of two large piston rods working through stuffing boxes at each end of the cylinder, as in Mr. Morrison's hammer, described in his letter, or from the resistance of the atmosphere to the steam escaping from below the falling piston, or from both together, such friction and resistance is positive loss to the effective power and efficiency of the hammer. Mr. Morrison discards the use of steam above the piston, and he cannot add to the gravity of the hammer by any other means. In my hammer, if when working single-acting, the force of the blow from the gravity of the hammer alone is not sufficient to give due effect to the object on the anvil, any amount of steam can be admitted above the piston, from the mere breathing upon it to the full pressure of the steam in the boiler. This can be applied instantly, and as instantaneously prevented from getting upon the piston.

I must now say a little, with your permission, on the subject of a double-action steam hammer as I find it, or "Logic" would say that mine was no better than Mr. Morrison has said his is, in these words: "the blow of the double-acting hammer is not more efficient than the blow of a single-acting hammer." This being as he has found it in his hammer, I cannot question it, but I may fairly question his logic as applied to my hammer, wherein he writes, "Again, if you consider a 5-ton hammer, with steam on both sides the piston, say 40 lb. pressure (leaving the velocity out.") Why leave velocity out of the question? Can there be a blow without velocity? I take it that a body moving, and in its movements meeting with an obstruction, the contact at meeting constitutes a blow. How can we separate this from a hammer which is made specially for the purpose of giving blows? And yet we are asked to leave the only element out of the question that produces the blow, namely movement, and there cannot be movement without velocity.

Is velocity so insignificant that we must leave it out of the question when considering the effect of a blow? Mr. Morrison may have his opinion and I may have mine, and to change the scales from their balance let us throw in Sir William Armstrong's arguments, extracted from his letter to the *Times* of April 10th, 1862. He says:—"The force of a projectile is equal to its weight multiplied by the square of the velocity;" and not only that, but in another part of the same letter Sir William says:—"In short, both theory and practice show that the battering effect at close quarters is pretty nearly proportionate to the quantity of powder used, and that very little is either gained or lost by rifling the gun or increasing the weight of the projectile." The increased quantity of powder does not increase the initial weight of the shot, but it increases its velocity which, Sir William says for battering effect, and I say for hammering effect, is the one thing needful; and yet Mr. Morrison would leave it out of the question, but I cannot, nor can I see how it is that a shot moving at a high velocity shall, by its velocity, with its trifling initial weight, penetrate through a considerable mass of cold iron, and a steam hammer moving at a comparatively high velocity to have no penetrating effect into a mass of hot iron. I cannot see the difference; but let us examine Mr. M.'s argument a little further, for it contains an idea. He takes a 5-ton hammer with steam upon its piston of 10 tons, to which he adds the 5 tons, the weight of the hammer making 15 tons, and then he says, according to the usual idea, this hammer would be equal to a single acting hammer of 15 tons dead weight. Here he appears to be looking at 5 tons of a solid mass of iron, with 10 tons of elastic vapour or steam upon it, and he looks at this as pressing upon the iron, but just as it is about to exert its force the 10 tons slips from the top side the piston to the under side: the velocity, and consequently momentum (for we cannot separate them), being left out of the question, how is it possible for the 5 tons ever to get down to the anvil? Of course it could not; it might play near the surface, but there could not be contact.

That is not my idea of how the blow is obtained from a double-action steam hammer on my patent principle. My idea is that which I put forth in your paper three weeks ago—that if the propelling force be three times greater in one case than in the other the velocity at the end of the stroke will be as if it had fallen three times the distance; and that the effect of the blow will be its initial weight multiplied by the square of the velocity. And, with all due deference to Mr. Morrison, I believe that the inside of the shaft made with my 5-ton hammer would be as sound as that made under his of 15 tons. Mine would not only strike it as heavy, but much quicker, and iron, being forged, should be struck while it is hot, to make sound work.

Mr. Morrison informs you that his 15-ton hammer is at work; that it is single-acting and worked by hand, and that the attendant can work it with perfect ease at sixty blows per minute. I do not

doubt the power of the man, but what will be the length of the blows when dealing out sixty per minute? I am of opinion he will do very well if he gets sixty blows per minute with a stroke of 3ft.; his full stroke is 8½ft.

But we must not forget "Logic," and we may imagine from his inquiry he does not like quick strokes, and yet there are some that do, and on that account have retained and still use the old metal helve hammer, notwithstanding the great variety of steam hammers that are in the market. Some very heavy and sound forgings have been made under helve hammers, awkward things as they are, and giving from 80 to 90 blows per minute, for there is no meeting them with a cushion of steam under the piston before the blow is struck; if they fall they fall, and there is an end of it; they must put up with its full force, for it deals its initial weight at every blow. Perhaps in that "Logic" and I shall so far agree, that they are not the best thing to use; but no doubt he would like to replace them with his good strong single-acting steam hammer with hand gear; and that they have all along refused, because it did not go quick enough. And I dare say, if they were asked to give an order for a Naylor hammer, they would say, "the times are so bad just now that we don't like to lay out more capital, and the old helve must still keep its station."

If "Logic" should see this letter, and still be an unbeliever in the power of a blow given by a double-acting steam hammer, I will arrange for one of mine to be made to strike upwards with three or four times the force of blow that can be given by his single-acting hammer, of the same weight, working downwards. I should like to satisfy his inquiring mind. If I should have such a hammer arranged I should not be able to let "Logic" know; but, as you will know his name and address necessarily before you would publish his letter, a note sent to you, to direct to him, would, perhaps, not be considered to be giving you too much trouble.

Allow me, sir, to say a word or two as to the bringing forth of these letters.

In your paper of the 23rd ult. you expressed a disappointment at seeing 800-horse power marine engines and 32-ton locomotives that there had not been a 10 or 12-ton steam hammer in the Exhibition. I knew that the Kirkstall Forge Company had applied for space to fix one of mine of 9 tons, but it could not be granted. I thought it was only right that you should be made aware of what they had a desire to do (regardless of the expense) to support the dignity of the International Exhibition.

This does not appear to have been exactly the case with Mr. Morrison, for he says he had a 15-ton hammer finished at the time; but, looking at the great expense of carriage up and fixing in the Exhibition, and the loss of such a machine being idle for six months, important considerations looked at commercially, that I am sure no one can say that he did not use a wise discretion. For "Logic's" information as to whether the 9-ton hammer which the Kirkstall forge company were desirous of sending to the Exhibition (without that consideration that Mr. Morrison had given in his case), is at work or not, I really cannot say, for I am not the manufacturer; but if "Logic" will write to the Kirkstall Forge Company, Kirkstall, near Leeds, Yorkshire, I have no doubt they will give him all the information he asks for. Of course he need not say he is "Logic," but if he does I have no doubt they will attend to his communication. If you will kindly insert this letter I shall feel much obliged, and at the same time assure you that I shall not feel myself called upon to trouble you to insert my replies to all logical inquiries for such information.

W. NAYLOR.

London, June 17th, 1862.

TURBINE WATER WHEELS.

SIR,—Referring to your notice of Schiele's turbine in the Exhibition, as we apprehend from your remarks on the formulas employed for calculating the efficiency of the turbines that you have misunderstood the extent to which the formulas have been made use of, we beg to say that they were only used for measuring the quantity of water which was flowing from the turbine, the power exerted by the turbine having been ascertained by correct indications, and not by mere calculations. The measurement of water was made by fixing a board across the tail-race, so that all the water leaving the wheel had to pass over it. The depth from the edge of the board to the water level, and the breadth of the overflow having been ascertained, the quantity of water was calculated by the formulas referred to. Of course such a measurement is entirely independent of the construction of the turbine on the circumstances under which it works. We merely gave the results from three different formulas because opinions are so varied as to which of them is nearest the truth.

You also remark on the sudden turn given to the water as it enters the wheel. You will find, however, on examining the construction more particularly, that such is not the case, and that the water is not deviated any more from the direction given to it by the guide-vanes than in a Jonval turbine. It flows through the guide-vanes in a horizontal plane, and is, in passing through the buckets of the wheel, gradually, and not suddenly, deviated from this direction into a vert cal one. In a Jonval turbine the water also leaves the guide-vanes in a direction nearly horizontal, while it leaves the wheel in a vertical direction, so that there is the same deviation; in fact it is theoretically impossible to transmit all the power contained in the water to a turbine wheel without deviating its direction at least 90 deg.

We consider the guidance of the water through the guide-vanes and the wheel in Schiele's turbine much superior to that in the Jonval turbine, and we may also remark that the peculiar construction of the buckets of the wheel in Schiele's turbine prevents the water from striking against them as it enters, when the speed of the wheel differs from the correct one, as is the case in the Jonval or any other turbine, and which must, of necessity, diminish their efficiency.

We claim, of course, as one of the principal advantages in this construction of turbines, that the footstep is relieved entirely from all the pressure of the water, and it can even under most circumstances be so arranged that the weight of the shaft and wheel is also balanced. At the same time every one must admit that this construction is much plainer, more compact, and in all parts easier of access than any other turbine. It also admits of an adjustment much superior to that of any other; for instance, the adjustment in the Jonval turbine consists generally of valves shutting the guide vanes at the top, thereby leaving a space between the valves and the wheel, where the water gets disturbed, causing much loss of effect. On the other hand the slides applied in Schiele's turbine, when shutting off the guide-ports, leave no corners or openings where the water can be obstructed. Another advantage we claim is the considerably smaller diameter of the wheel for the same power than in the Jonval turbine, through the water flowing towards both sides of the wheel.

Oldham, June 17th, 1862. THE NORTH MOOR FOUNDRY COMPY.

THE ENGINEERS OF THE ROYAL NAVY.

(Concluded from p. 355.)

THE following extract from an article on "Naval Promotion" in the *United Service Magazine* will be read with interest. "The youngest, but not the least important class in the navy, remains to be treated upon. It must not be forgotten that ships of the British navy are no longer sailing vessels. Each ship is moved by engines nearly as costly as the ship, and in order to save the nation from heavy loss and extravagant expenditure for fuel, and to prevent injury to the costly machinery, as well as to render the ship efficient in action or other services, it is necessary to procure the services of competent officers, skilled in this particular work, and ready to devote their lives to a perilous duty. Before being eligible to join the navy as assistant-engineers they must (ought to) be twenty years of age, and be competent to pass a very strict examination in all matters connected with steam engines, and produce good certificates of character and general fitness. After joining the navy the second-class assistant must serve at least three years before being allowed to pass for a first-class assistant, and two years more before he can pass for the rank of 'engineer;' but even these long periods of probation are commonly disregarded, and, though qualified for a higher grade, they remain unnoticed for months, and sometimes years. The number of 'engineers'—not chief engineers, for that is still a higher rank—taking the Navy Estimates for our guide, is 219, but so much is this invaluable class underrated by the Admiralty that their names are not suffered to appear in the Navy List. The first-class assistants are estimated to number 635, and the second-class assistants 272; yet, notwithstanding these formidable figures, only twenty-one obtained promotion to the rank of chief-engineer in 1859, nineteen in 1860, and twenty in 1861—about one in fifty-nine. In order to induce a proportion of the 'engineers' to slide out of the line, a position of 'engineer in charge' has been provided, with a small additional rate of pay (and the forfeiture of all future promotion); yet so dear is promotion to the human heart that, notwithstanding every drawback and discouragement, coarse treatment and wretched accommodation, these officers decline to accept present advantages with the certain loss of their prospects. Certain attempts have been made to reconcile these neglected but indispensable officers to their lot by increasing their pay, giving a shilling a day additional to those in charge of machinery, and making engineers and first assistants commissioned officers, but the promotion they covet is as far removed as ever, and unless they should meet a violent death in the service—no uncommon thing for officers of this class—their widows will be left penniless. It seems that no one has had sufficient grasp of intellect to devise, or, at least, to carry out means for the reform of this dangerous evil, for dangerous it is to our position as a maritime nation. Were the different factories throughout the country—at which alone a really sound, practical, and theoretical knowledge of marine engineering can be acquired—to act as the medical schools and colleges did not many years ago, and taboo the navy, the supply of young engineers would soon fail, and the Admiralty would be driven to the expensive makeshifts which brought so much loss and discredit on the service in 1854 and 1855."

For the reform of the dangerous evil here referred to all that is required is a course of purgatives and restoratives, the principle by which the sick man is relieved and cured; accordingly, let incompetence be banished from this department of the navy above all other branches of the service, and that immediately. Let all the engineers at present serving be subjected to a proper theoretical and practical examination of their fitness to hold their situations, to say nothing of those which they must be shortly called upon to fill; let those who are able to pass the examination be placed in stations for which they are competent, and let those who are unable to pass the simple ordeal be "sent ashore;" and the numbers of all ranks who would be found fit for nothing else would be incredible. For when iron ships of war have superseded those of wood, and when steaming shall be the rule and sailing the exception, when it is discovered that there is sufficient power in a steam ship to set or furl all her sails simultaneously, besides steering, propelling, &c., requiring only the aid of man to direct, when the artillery, small arms, and munitions of war shall consist of patterns upon which the whole mechanical genius of the nations have been concentrated, when engines of enormous power, and cost, and increasing complexity shall have taken the places of the things of the present, when these floating fortresses will have to be self-reconstructing, self-renovating, adapting internal and external arrangements to any change of circumstances — results obtainable by mechanical ingenuity alone—when all these mighty changes already taking place, and many that are uncontemplated shall have been completed, then it will be found that the present engineering staff is inefficient in quality, that the revived practice of passing little boys into the navy as engineers must again cease, for two or three years, and the principal part of that time spent in connecting and disconnecting, &c., old engines will not make a steam engine maker, and a lad with this amount of practical knowledge only is a labourer and nothing else. Those who have the care of costly and intricate machinery thousands of miles away from home should, in an emergency, be able to remake any part of it; and "he who does not know that which it is necessary for him to know is an ignorant man whatever he may know besides." Then it will be found that engineers must be engineers, who, in passing, must give practical proof that they are what they are stated to be on their "certificates of servitude in a factory," and able either to direct or work, not only in matters of steam engine making, iron shipbuilding, construction of artillery, small arms, &c., but also in designing and carrying out military works and fortifications on shore, and be to a naval brigade what the corps of Royal Engineers is to the army, namely, the "sharp edge" of it.

The navy will then be independent of such assistance as it had to apply for in the Crimea, in India, and lately in China.

That an immediate reformation of the engineering branch of the navy is wanted is evident from the results of the late American naval contests, the advanced state of the iron fleets of our neighbours, and the black clouds in our horizon. In vain will vessels "haul off to repair damages" in future naval actions. If the engineering staff is not put upon an efficient footing it will be "haul" in vain, for if the "iron enemy" has a sufficiency of mechanical dexterity—the only weapon now for contending nations—the chances are he will be able to bear down on and sink his retreating opponent as well as our national prestige and safety. The naval fight subsiding into a contest of mechanical ingenuity, the amount of success being inversely as the amount of engineering skill applied beautifully illustrates how "knowledge is power." Let, then, the despised class of useful men termed stokers be taught something more than the use of the shovel, let the waste field be cultivated, and let them be men skilled in every necessary trade. A class of men and of warrant officers raised from men of this description, who might be termed "assistant engineers," the present class dropping that prefix, would be a most useful auxiliary to the "corps of naval engineers," which, besides inducing enterprising young mechanics to seek employ in the service, would enable the engineer to maintain his proper position as an officer by relieving him of having to serve under officers of lower rank than himself, and of losing "caste," and wasting often valuable time in doing what his subordinates ought to be able to do, and this while dozens of them are at best only "going through the form" of working, called "cleaning;" but, like leading men in well organised factories, employ their time and abilities in designing and superintending the work. A "steam reserve" of such skill would be sufficient to do all that is now done by the dockyard factories: and who is more adapted for overhauling a steam ship's machinery than those who, by years of management, have noted, and can strike at the root of every defect? Besides "keeping their hands in," and having a "spell at home," they would save the nation the double expense of paying for those who mend and those who break. And who is better adapted to superintend the factories connected with such steam reserves than inspectors and "assistant inspectors" selected from the engineers themselves? Not limiting their age to "25 or 30 years"—very young shoulders for carrying such "old heads" required—not selecting by mathematical test only; for a man may be a good mathematician and yet unable to trace a simple defect in an engine to its source. The most experienced theoretical and practical men alone are suitable for filling stations of vast responsibility.

Again: let that dismal den, the engineers' berth, be abolished, and let the space now occupied, or rather wasted, by it, be taken into the bunkers, and made proper use of; let each one have a properly situated cabin, and associate with those with whom, after a "weeding," they would be equal to in either "wit, money, or manners." The objection to engineers being gun or ward room officers, "because the atmosphere in which they are employed smells of tallow," is not a weighty reason; it must indeed be an "anti-tallow nose" which, after sniffing paint and tar, gunpowder and tobacco smoke all day, could turn itself up at the presence of an engineer as clean as warm water, soap, and clean clothes can make him. It must indeed be a curious taste that could object to such society, and at the same time sit down and dine with a surgeon fresh from a "post-mortem" or two, or attendance upon a dozen or so of such cases as are found in abundance on most men-of-war. Again: let engineers be entered more nearly at an uniform age, and at all times let the passing examination be conducted with the strictest impartiality (so that the dockyard and the private factory engineer may have equal chances) by naval inspectors of machinery instead of the present imperfect method, and let it be something more than a mere theoretical affair. Let each one not only have his promotion so soon as he has served for it, "passed" for it, earned it, and it is due, like "the officers'," but offer it and other rewards to be occasionally competed for, to encourage all to keep themselves "up to the mark," and to give the really steady and accomplished a chance of rising to the elevation they would if they were on shore. Again: instead of the pay of the engineers being totally insufficient it must, at least, be remunerative. Every good workman knows that the quantity and quality of his work depends upon the excellency of his tools; that good tools in the hands of bad users are soon spoiled; every employer of skilled labour knows that to obtain and to keep good workmen he must pay them a fair price and treat them fairly, so let not only the pay, accommodations, and treatment of naval engineers be as good as the nature of their employment and position demands, but let the latter be acknowledged by those in authority, and the underlings will follow suit then as now. The "stoke-hole mob" will then cease to be a butt for the annoyance of the navy, and the "civilians" will get civility. Let these few and simple, yet necessary changes be made, and mighty will be the improvements resulting. "Engineers of the navy" will then be engineers, the most useful, intelligent, and respectable class of officers, not only in the navy, but in any department of H.M.'s service. The Admiralty will not then have to employ recruiting agents to canvass the engineering works of the United Kingdom for "a better class of men for the navy," but the situations, as they become vacant, will be sought and contested for, and the appointment of "engineer in her Majesty's fleet," instead of being the lowest, will be the highest point to which the engineering student can attain.

C.

Normandie Cottage, Woolstone, near Southampton.

GIFFARD'S INJECTOR.

SIR,—Perhaps you or some of your correspondents could explain the invention described in the following passage which I discovered by chance in a work on the steam engine, written thirty years ago:—"The high pressure boiler employed in Mr. Trevithick's engines is supplied with water previously heated, in a separate vessel by a small force-pump worked by the engine. In some of the improved, however, another and more ingenious mode has been adopted, the water being driven in by the action of a volume of highly expansive steam."

Now the concluding passage would seem plainly to denote that an instrument similar to Giffard's Injector was used. If so we may well say that "there is nothing new under the sun." V. P.

June 10th, 1862.

MAIN DRAINAGE OF THE METROPOLIS.—It having been intimated to the Metropolitan Board of Works that several members of both Houses of Parliament are desirous of viewing the main drainage works, we understand that the board have had under their consideration the most convenient arrangements for affording such opportunity, and that it is proposed that after inspecting the construction of the extensive pumping station near Deptford-creek, and the several sewers in conjunction therewith, they should cross the river to the northern outlet near Barking-creek, and follow the course of the outfall sewer to the junction of the high and low level sewers at Bow-creek. The whole of these works are now in a sufficiently advanced stage to show the magnitude of this great undertaking, and the unprecedented character of the very ingenious arrangements for freeing the metropolis and the Thames of the rivers of sewage which at present defile them.

SUSPENSION BRIDGE AT LAMBETH.—Another bridge, designed to accommodate the traffic between Westminster and Lambeth, will soon be completed and added to the list of those which now span the Thames. The Lambeth Bridge, though a suspension bridge, will differ essentially from that at Hungerford, inasmuch as the roadway will be hung from wire cables of extraordinary strength, instead of chains, and will also provide for carriage as well as passenger traffic. Four arched towers of iron (the three spans between which are each of 280ft.) support the cables, the height of the two land towers being 28ft. each, and of those in the river 33ft. These last rest upon iron cylinders, 54ft. deep, 17ft. of which are sunk beneath the bed of the river. Over the iron grooves at the summit of the towers are being carried the wire ropes which will compose the cable. There are no less than twenty-eight of these ropes, being fourteen to each side of the bridge. Each of the ropes is 2¾in. in diameter, composed of seven strands, each strand being made up of seven wires of a quarter of an inch in diameter. The two suspporting cables will each be formed of fourteen 2¾-in. ropes bound together, and from these the bridge will depend. The length of each rope, allowing for sag in the spans, is, in round numbers, about 985ft., and the weight upwards of five tons. One of the cables has been tested with a weight of 21 tons, and showed but a slight deflection. The width of the roadway is about 34ft., the centre being set apart for carriage and the sides for foot traffic.—*Globe.*

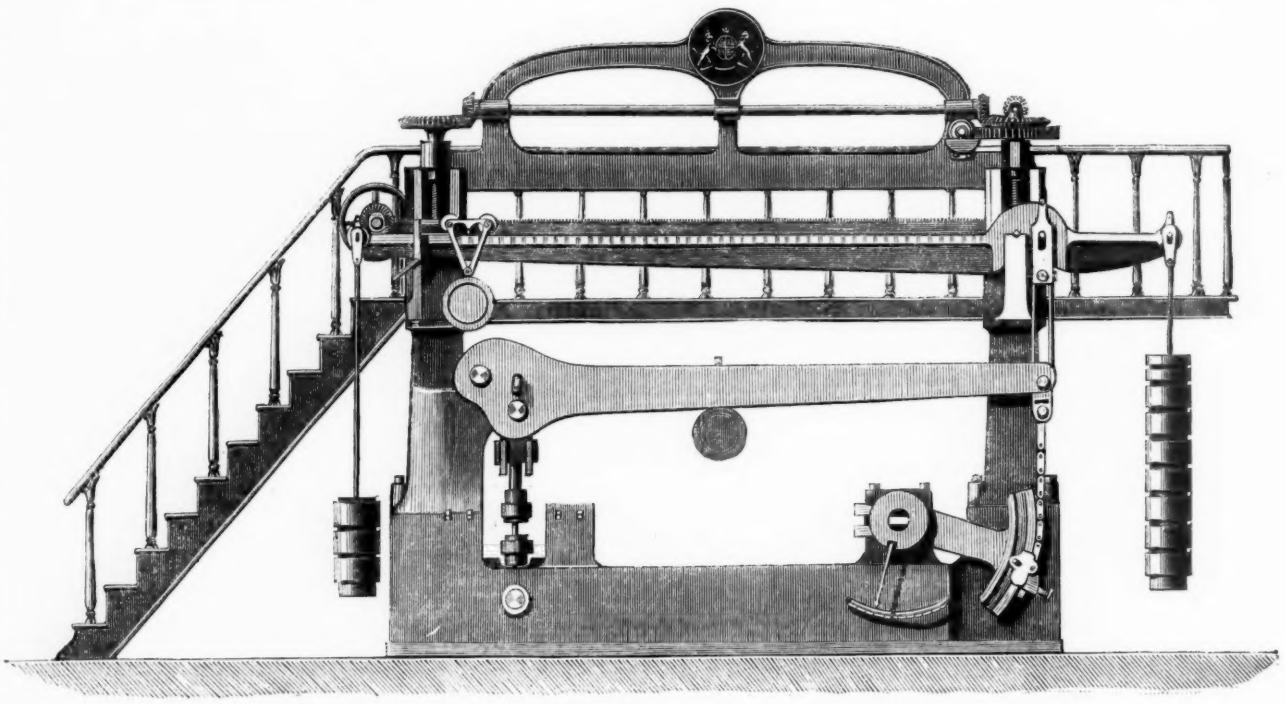
HISTORY OF COLUMBIADS.—Benton, in his work on "Ordnance and Gunnery," gives the following history and description of columbiads:—The columbiads are a species of sea-coast cannon, which combine certain qualities of the gun, howitzer, and mortar; in other words, they are long, chambered pieces, capable of projecting solid shot and shells, with heavy charges of powder, at high angles of elevation, and are, therefore, equally suited to the defence of narrow channels and distant roadsteads. The columbiad was invented by the late Colonel Bomford, and used in the war of 1812 for firing solid shot. In 1844 the model was changed by lengthening the bore and increasing the weight of metal, to enable it to endure an increased charge of powder, or one-sixth of the weight of solid shot. Six years after this it was discovered that the pieces thus altered did not always possess the requisite length. In 1858 they were degraded to the rank of shell guns, to be fired with diminished charges of powder, and their places supplied with pieces of improved model. The changes made in forming the new model consisted in giving greater thickness of metal in the prolongation of the axis of the bore, which was done by diminishing the length of the bore itself; in substituting a hemispherical bottom to the bore, and removing the cylindrical chamber; in removing the swell of the muzzle and base ring, and in rounding off the corner of the breech. From the fact that all the trial pieces have successfully endured very severe tests, it is to be inferred that the defects of the previous model arose from the presence of a cylindrical chamber, and a deficiency of metal in the prolongation of the bore.* In 1860 the model proposed by Captain Rodman was adopted for all sea-coast cannon. The following are the principal dimensions, &c., of the new columbiads:—

Length of bore	8-in., about 14 diameters. 10 in., about 12 diameters. 15-in., about 11 diameters.
Weight	8-in., 8,500 lb. 10-in., 15,000 lb. 15-in., 50,000 lb.
Charge—shot and shells	8-in., 10 lb. 10-in., 15 lb. 15-in., 40 lb.

The great disparity in the diameters of the reënforce and muzzle renders it impracticable to fix an artificial sight to the muzzle; a small projection is therefore cast on the upper side, between the trunnions, as a seat for the front sight.—*Scientific American.*

* Six trial pieces (three 8-in. and three 10-in.), made at different foundries, endured successfully upwards of 1,000 service rounds. Two 10-in. pieces (one cast hollow and the other cast solid) were 2,500 rounds with solid shot, and 14 lb. of powder, and 1,632 rounds with 15 lb. of powder and solid shot. The only injury sustained was the enlargement of the bore by the cutting action of the gas as it passed over the shot. The expansion of the bore of the cast solid piece was much greater than in the hollow one.

MACHINE FOR TESTING IRON AND STEEL.



The illustration represents the machine in the International Exhibition, in the Sheffield Court, for testing the tensile, compressive, and torsional resistance of iron and steel. It was made by Messrs. Greenwood and Batley, of Leeds, for Messrs. Charles Cammell and Co., of the Cyclops Works, Sheffield, and is by far the most complete instrument of the kind of which we have any knowledge. It tests upon sections of a full square inch, and up to fifty tons, or more.

Ordnance.—We extract the following from Captain Fishbourne's lecture, of May 19th, at the United Service Institution:—"Comparing an elaborately finished gun with a nicely adjusted and accurately fitted projectile, with the old smooth bore, is obviously incorrect, and still more incorrect to compare them only at ranges the most unfavourable for the smooth bore. High charges and high velocities are uniformly valuable in naval warfare, where the constant changes prevent the distances from being known, and the varied motions of the gun-platform prevent any trial shots from ascertaining them, so that accuracy is best obtained by a flat trajectory and rapidity of flight of the shot. High velocity is, however, rendered indispensable by the introduction of iron-clad ships, and from the high velocity of the round ball the effect of the old smooth bore 68-pounder at 200 yards is double that of the nicely adjusted Armstrong 110-pounder, as shown by the indentations in Fairbairn's target; by increasing the powder charge 5 lb. the effect of the 68-pounder was four times that of the Armstrong 110-pounder. The friction and consequent increase of tension prevents the powder charge from being increased in the present (Armstrong) rifle guns, so as to attain a like effective velocity. To the extent that rifled guns have been adopted, to the exclusion of smooth bores, we have given up the substantial advantages of low trajectories, strait ricochet, smashing force, simplicity, and economy, for the very occasional advantages of long range, and, therefore, unless a mode of rifling can be found which will continue the advantages of the round shot with that of the elongated, in one description of gun, we must have smooth bore and rifled guns in numbers proportionate to the relative value of each. The system of rifling of Captain Scott, R.A., which has been adopted by Captain Blakely, who abandoned his own plan for it and used that of Captain Scott, in the guns he has supplied to foreign governments, possesses the strongest claim to be adopted as a naval gun, for his rifling admits of the use of the round ball with less increase of windage than that of any other proposed system. His rifling takes little surface from the bore, as shown, and his projectiles are simple, strong, and little liable to injury." To sum up our impression upon the whole lecture we can hardly do better than quote the impromptu summary of a distinguished naval officer: "First, lead coated shot are inadmissible on board ship; the result being always injurious galvanic action. Secondly, long range is rarely required in naval battles. Thirdly, a shot of large diameter and high initial velocity is necessary, not to pierce, so much as to knock off, armour plates. Fourthly, no gun is fit for a ship which cannot be subjected to the conditions of occasional immersion in salt water during gales, or when thrown overboard. Therefore the gun most desirable for the navy will be one which can throw spherical shot as the rule and rifled bolts as the exception, and which will not suffer from the causes above spoken of. Lastly, the Armstrong gun does not fulfil these conditions."

The Fleet Sewer.—Great excitement prevails in Ray-street and Saffron-hill, Clerkenwell, in consequence of a falling in of a portion of the Fleet sewer at those spots. The first alarm was given on Sunday afternoon between the hours of two and three, when about twenty feet of the roadway fell in, the old sewer having given way. The cause of its breaking away is attributed to the late heavy rains; but it may be mentioned that some years back, near the same spot, another portion of the same sewer fell in.

The Paper Manufacture.—Mr. Bertram, of Edinburgh, the well-known maker of paper-making machinery, and who lately constructed a 70-in. paper-making machine for E. Lloyd, Esq., proprietor of *Lloyd's Weekly Newspaper*, is now engaged upon a 90-in. machine, to be erected at the same works at Bow-bridge. These machines are run at a speed of 100ft. per minute, and will both be employed in making paper from common oat-straw. The straw is first chopped, much as it would be for fodder, and its silica is then removed by boiling it, along with caustic soda, in a boiler intended to carry steam of 100 lb. pressure per square inch, the steam being admitted only to a steam jacket surrounding the boiler, the latter being made, furthermore, to revolve on trunnions at the rate of, perhaps, 20 turns per minute. Mr. Bertram is also erecting extensive paper-drying machinery for Mr. Joynson, of St. Mary's Cray. One of the machines there for making writing papers has no less than thirty steam drying cylinders, each 3ft. in diameter. The paper is thence conducted through a sizeing apparatus, whereby it is covered with animal gelatine, which is afterwards pressed into the paper; thence it is to be taken over a succession of no less than 272 drying drums, occupying a space of 90ft. in length, and 50ft. in height. Such is the extent of surface developed by these drums that, although the web of paper moves at the rate of 50ft. per minute, its passage over the whole series of drums occupies one hour. It is well known that, after writing paper has once passed the sizeing apparatus, it ought not to be exposed to the heat of steam drying cylinders. Slowly-dried writing papers—those, for instance, made by hand—have great strength; but machine-made papers, quickly dried, are apt to be brittle and generally weak. Mr. Joynson anticipates, with the aid of Mr. Bertram's new machinery, that he will be able to turn out machine-made papers equal in strength to those made by hand. One of Mr. Joynson's present drying machines has 130 drums, a number which will be more than doubled in his new machine. We may here mention another of Mr. Bertram's machines, one erected by him for Charles Collins, Esq., of the Hele Mill, near Exeter. It is 88in. wide, and has sixteen drying cylinders, each 3½ft. in diameter. It runs at the rate of 110ft. per minute, and makes 25 tons of paper weekly.

New Steam Ships for the Hamburgh and American Trade.—Messrs. Caird and Co., engineers and shipbuilders at Greenock, on the Clyde, have just received from the Hamburgh and American Packet Company, an order for a large iron screw steam ship of 2,500 tons burden and 500 nominal horse-power. Her dimensions will be nearly similar to those of a steamer Messrs. Caird are now building for the North German Lloyd's Company, of Bremen, and, like her, is to be fitted with surface condensers, superheaters, Krupp's steel shafts, and all the newest improvements in machinery. The following are some of the principal dimensions:—Length over all, 360ft.; beam, 40ft.; depth of hold, from upper deck, 33ft. 6in. Two of her four decks will be fitted to accommodate 80 first, 130 second, and 450 third-class passengers. The berths for the latter class of passengers are to be of iron, and to be made movable, in order that, if necessary, the space may be made available for carrying cargo. The engines will be inverted direct acting, with cylinders 72in. in diameter, and a stroke of 4ft. The whole of the screw shafting is to be of steel from Messrs. Krupp's manufactory at Essen. She will have four tubular boilers, with five furnaces in each; the pressure of steam will be 20 lb. to the square inch. The bunkers will contain 900 tons of coals, and on a draught of water of 17ft. coals and passengers' baggage must be on board. Her speed at this draught is specified to be 13 nautical miles per hour. This is the seventh large vessel by this company, from Messrs. Caird and Co., ordered for their Atlantic line.

Bank-Note Printing.—In the north-east end of the English gallery, devoted to printing in all its various processes, are specimens of books and bookbinding, stationery, lithographs, chromo-lithographs, engravings and prints, and printing of every kind, from common bill-heads up to the most carefully printed Bank of England notes. There is a large case of the latter shown by the Governors of the Bank, containing samples of all their notes, from £5 up to £1,000. In place of the usual signature is printed the one word "cancelled," but as, of course, in all other respects the notes are perfect, an official comes every day from the Bank to keep an eye on the case, for if any of the larger notes were stolen it would be easy to erase the lightly-printed word "cancelled" and substitute a signature, when its payment at any foreign bank might follow as a matter of course. To have one stolen for presentation, however, is not what the Bank would fear, but if some of the larger ones were stolen for imitation the affair would be serious. To the means of preventing or detecting forgery the Bank always has its vigilance incessantly directed, more especially to the improvements in photographic art, from the progress in which, unless the tint of the present note paper is changed, as has been done in America, the troubles of the Bank will surely come at last. The mere printing of the bank-note offers no very great difficulties to forgers. Even Maclise's little vignette in the corner has been so copied in lithograph as to be scarcely capable of detection by the Bank inspectors, and the case of the servant girl who, with a pen and ink, copied her one £5-note on tissue paper with such perfect fidelity that she passed several, shows how easily the mere text can be reproduced. It is the paper and its watermark which are the forger's great difficulties, and though in £5-notes he can reproduce these so as to deceive the general public, he never succeeds in imposing upon the Bank, which is the great object always aimed at, for, if once attained, the forger might issue his notes as liberally as the Federal Government itself. The paper for the Bank-notes is made entirely by Mr. Portal, the member for Hants, and the manufacture is, of course, conducted under as careful supervision as the printing of the notes themselves, for, if once the forgers could get a supply of the true paper, all the rest would be easy enough. The watermark they imitate to perfection by a kind of embossing, so perfect as to deceive the most practised eye, and, in fact, there is only one method of detecting it, but that fortunately is simple, and perfectly infallible in its results. If the note is doubtful a part at the back should be wetted with the tongue. If genuine the watermark shows out brighter than ever; if a counterfeit it instantly disappears. The paper for bank-notes is only made in small sheets, each sheet large enough to print two notes laid side by side, and not a fraction more. The paper where they join has what is technically called a "deckle edge," and in the manufacture certain slight flaws in the paper are caused by this edge or margin line being put into the substance of each note, so as to be barely perceptible and to look like an accident. These minute imperfections vary in their position according to the value of the note itself, and are, no doubt, subsequently reversed and varied by the Bank authorities according to the months in which they are printed. In like manner also are varied the little and scarcely noticeable spot above some one or other "0" in the figures of the large notes, and these private marks always correspond on the two notes, which are printed side by side on the small sheet as we have mentioned. Thus a forger must always have two notes of following numbers to make a good counterfeit. In the case of £5-notes this is easily done; but in the instance of £1,000-notes it is almost impossible, and therefore it is that the Bank keeps such a watch on those they exhibit in the building, and which, though marked 'cancelled," would be as valuable as ever to the skilful forger. There are several printing presses for printing notes at the Bank, each of which can turn out 3,000 notes an hour.

A large cotton mill has been completed at Coventry. It is the property of the Coventry Cotton Spinning Company, Limited, and is the first erected in that neighbourhood. The steam engines, of 140 collective nominal horse-power, having 45in. cylinders and 7ft. stroke, were made by Messrs. John Musgrave and Sons, of Bolton, and were to have been started yesterday.

The Thames Embankment.—On Friday last the committee agreed to a clause vesting in the Metropolitan Board of Works the execution of the act, and the entire control of the undertaking. Clauses were also agreed to, giving power to the board to grant building leases of ground not wanted for the purposes of the act, and forbidding the erection of houses in front of the gardens of the Inner and Middle Temple. Provisions were also inserted relative to the raising of money for the purposes of the works, and for its repayment; and a protective clause was inserted in favour of the Duke of Northumberland, to the effect that the Board of Works should not take any more land belonging to the duke, except with his consent, required for the formation of the streets in continuation of Northumberland-street and Whitehall-place, unless for sewerage purposes, or the erection of public monuments and fountains.

Steel Gun Barrels.—In the Exhibition Messrs. Hawksworth and Harding, of Linlithgow (No. 143, Class 1), exhibit gun and rifle barrels made by a peculiar process, which is worthy of attention. They make steel gun-barrels without joint or weld. Their patent specifies a mode of manufacturing them by a process of cold drawing and rolling as follows:—We take a properly-prepared piece of steel, from 6in. to 1ft. long, by 2 to 6 in diameter, through which a hole of a certain size is drilled, and afterwards by a series of drawings through a "wordle" and over a "mandril" (both of peculiar construction), the metal is elongated and highly polished at the same time, and also is wrought to the required shape and size, internally as well as externally. One machine, worked by six men, will turn out 600 barrels per week, and by this cheap and simple process cast-steel barrels can be sold at little more than ordinary iron ones. The principles of this patent are also applicable to many other purposes.

The Smeatonians.—The Smeatonian Society of Civil Engineers gave, on Thursday evening the 12th inst., a dinner, at the Ship Hotel, Greenwich, to several of the distinguished foreign engineers and others connected with science now in London. About 50 gentlemen sat down, and Mr. Charles Hutton Gregory, the president for the year, took the chair. Among the foreign visitors were Dr. von Steinbeis, Chevalier de Burg, General Cavalli, Signor Cabral, Dr. Ruhlmann, Herr Meier, Daubrée, Hubbé, Koch, Kraft, Bergeron, Delesse, Mille, Faure, Tresca, Ofenheim, Altglet, Dr. Karmash, Dr. Hery O'Phil, Adolphe Meyer, &c. Among the English visitors were Colonel Walker, General Sir Andrew Waugh, Dr. Rankine, Dr. Percy, Mr. Wheatstone, Professor Donaldson, &c. Several of the eminent members of the society were present, and after dinner the standard toasts of the society were given. The president, in giving the toast of "Foreign Engineers," gave a sketch of the history of the society, which was instituted in 1795, and, after alluding to its early members, Brindley, Goulburn, Watt, Priestly, Rennie, Mylne, &c., and to the general condition of English and foreign engineering, coupled the toast with the name of M. Tresca, President of the Institution of Civil Engineers in Paris. M. Tresca, in an interesting speech, replied in French, and proposed "the Smeatonian Society," to which Sir John Rennie returned thanks on behalf of the society. M. Vignoles, in French, proposed "the Foreign and English Visitors," coupling the names of Dr. von Steinbeis and Professor Donaldson, who both replied. The company broke up at a late hour, evidently much pleased with the complimentary hospitality of the society.

Steamship Economy.—The *Northern Daily Express* gives an account of the trial trip of a new screw steamer, the London, built by Messrs. Leslie, of Hebburn Quay, Newcastle, for Western Wood, Esq., M.P., of London, and intended for the Spanish trade. The London is 250ft. in length over all; 31ft. breadth of beam; depth of hold, 25ft.; tonnage, 1,300; and her engines are 150 nominal horse-power. The ship is fitted up with Spencer's surface condensing engines, built by Messrs. R. and W. Hawthorn. Although the engines are nominally 150-horse power, they can be worked up to from 480 to 550 indicated horse-power, and the consumption of fuel will not exceed 11 cwt. per hour. Engines on this principle, to the amount of 6,000-horse power, have been already applied to various vessels, and the plan of surface condensation has been adopted by various eminent shipbuilding firms. Messrs. Hawthorn, of Newcastle, were among the first to adopt the system, and notwithstanding the difficulties incidental to all new arrangements, and the objections made to the new plan, the employment of surface condensing engines has of late made rapid progress. It is expected that the average revolutions of the engines will be at the rate of seventy-six per minute, with a speed of 10½ knots an hour. On the trial trip the ship made nine knots an hour, with the engines working at 68 revolutions per minute. During the trip the steam pressure varied from 25 lb. to 30 lb. to the square inch, with a steady vacuum of 27in. The diameter of the cylinders is 43in., with a stroke of 2ft. 9in., and they are fitted with separate expansion valves and steam jackets.

TO CORRESPONDENTS.

*** *Covers for binding the volume can be had from the publisher price 2s. 6d. each.*

ERRATA.—*In our notice, last week, of the locomotive engines in the Exhibition, the name of the firm of E. Gouin and Co. was erroneously printed "E. Gorim and Co" In our notice of the* Conversazione *of the Society of Engineers "Mr. White" was inadvertently written in place of Mr. William Young, exhibitor of the Veata lamp and patent smokeless grate.*

H. B. C. D. (Cleckheaton) —*Please correspond with the publisher.*

C. H. R. (Bristol).—*You should have sent your plan at once to Mr. Hawkshaw —not to us.*

G. F. (Farnham-place).—*We are unable to refer you to makers of such apparatus.*

RT. (Openshaw).—*What is the object of twisting the pile? Is it to destroy the grain of the iron?*

JUNIOR.—*Buy M. Giffard's specification at the Patent-office. It is dated July, 1858. We do not recollect the number at this moment.*

M. W.—*We do not recollect your writing before over this signature. Captain Coles' address is Somerset Cottage, Ventnor, Isle of Wight.*

E. D.—*About what time was Mr. Valentine's patent obtained? We must have some clue before setting out upon so extensive a search for an anonymous correspondent.*

A CONSTANT READER.—*Captain Engledue, at Southampton, has charge of the P. and O. Service. Captain Vincent, at the same port, occupies the same position in relation to the Royal Mail Company.*

W. A.—*You risk very little in taking the negative on the question, "Is vacuum power?" Vacuum is not power, although by having a vacuum in a steam engine you may be able to save the power of steam which would otherwise be lost.*

A. B. (Dropsden).—*For the first address James Forrest, Esq., Secretary Institution of Civil Engineers, 25, Great George-street, Westminster; for the second address E. Hunt, Esq., St. Enoch-square, Glasgow; for the third the Secretary of the Institution of Civil Engineers in Ireland, Dublin: and for the last W. P. Marshall, Esq., Newhall-street, Birmingham.*

J. E.—*We know of no objection to maximum hands on steam pressure gauges, and we believe them to be of advantage. Their extra cost, trifling as it is, is all, we must suppose, that prevents their universal use. It is our impression that most of the steam gauge makers furnish them with the maximum hand. We have for several years had in our office one of Bourdon's barometers, identical in principle with his steam gauge, and having a maximum hand.*

W. C. (Cornwall).—*We really cannot well spare time to go fully into the matter. Many makers curve the link to a less radius than that from the centre of axle to centre of link at half throw, and from your description we should suppose this might be needed in your case. Is your valve spindle long enough? A very cheap diagram model might be made in a few hours from which you could find the centres by experiment. This is the way we should prefer finding them.*

NITROGEN AND CARBONIC OXIDE.

(To the Editor of The Engineer.)

SIR,—A mistake has occurred in the printing of my communication in last week's ENGINEER. In mentioning that the nitrous gas therein referred to was binoxide of nitrogen, I added its chemical symbol, "NO $_2$." This has been converted into "No. 2," besides being somewhat erroneously placed.

H. K.

STEAM ON COMMON ROADS.

(To the Editor of The Engineer.)

SIR,—In your interesting article on "Traction and Self-Propelling Farm Engines in the Exhibition," in THE ENGINEER of the 13th inst., you remark that "history gives the year 1784 as the period" when steam was applied on common roads.

While in Paris a few months since I saw, at the "Conservatoire des Arts et Metiers," the second road engine that ever was made, which was made in 1769 by one Cuquot, a Frenchman, and is still in good condition. An interesting account of this engine, with engravings, may be seen in Young's "Economy of Steam Power on Common Roads" by any one interested in the subject.

London, June 14, 1862. CHRONOLOGY.

FRAUDULENT USE OF THE WORD "PATENT."

(To the Editor of the Engineer.)

SIR,—As the subject of patent law reform is now under discussion, I beg to call attention to a point which demands legislation. I have been appointed agent here for a foreign patented invention, which is an improvement upon previous inventions *unpatented*, but to which the vendor affixes the word "*Patent*." In consequence I am unable to make sales, as people are afraid to purchase lest they should be involved in some legal proceedings. My case is not singular, as many are suffering in the same way, and I am informed that there is no legal remedy. Is not this grossly unjust to me and others, as well as a fraud upon the public at large? Again: Is it fair that a man should be allowed to continue affixing the word "Patent" on articles manufactured after the expiry of his patent?

JASPER.

THE STRENGTH OF SHAFTS.

(To the Editor of The Engineer.)

SIR,—In reply to the inquiry of your correspondent "W. C.," I beg to refer him to "Weale's Engineer's Pocket-Book," where he will find, at page 272 (in the edition for 1847), the following:—

"Hick's Rule for Calculating the Strength of Shafts.—Multiply the horses power by the assumed number (300), and divide the product by the revolutions per minute; the cube root of the quotient will be the diameter required."

This rule gives very good practical results with wrought iron shafts. For the case mentioned by "W. C." this rule would give

$$\frac{15 \text{ horses power} \times 300}{100 \text{ revolutions.}} = 45$$

and

$$\sqrt[3]{45} = 3{\cdot}55 = \text{diameter of shaft.}$$

P.S. In the new edition for 1862 of "Lockwood's Pocket-book" the above occurs at page 206.

June 17th, 1862. J. MACKENZIE.

(To the Editor of The Engineer.)

SIR,—In THE ENGINEER of yesterday, at page 357, "W. C.'s" correspondence on the strength of shafts is not very clear. He commences: "Sir,—I should feel obliged if you would furnish me with a rule for the strength of wrought iron shafting," and concludes by—"the question then is, how many degrees in the angle of torsion ought to be allowed per foot in length for wrought iron?" After (as you see) complaining of Templeton's rule being unsatisfactory in appearance to him, if "W. C." would say whether the constant 55, or the angle of torsion 1, is incorrect, it would then be a matter that might bear investigation; but, in order to explain the matter in hand, I will here furnish you with not only Templeton's rule, but also his result of experiments, which, I have no doubt, will solve "W. C.'s" problem to his satisfaction.

On page 85, 10th edition, of Templeton's "Millwright and Engineer's Companion," we have the following:—"In case of revolving shafts for machinery, &c., the strength is directly as the cubes of their diameters and revolutions, and inversely as the resistance they have to overcome. Hence from practice we find that a 40-horse power steam engine, making 25 revolutions per minute, requires a shaft (if made of wrought iron) to be 8in. diameter. Now, the cube of 8 multiplied by 25 and divided by 40 = 320, which serves as a constant multiplier for all others in the same proportion." Note: these are intended for first movers only, and 160 for second movers, as in "W. C.'s" question of main shaft, whence the following solution,

$$\sqrt[3]{\frac{15 \text{ horses power} \times 320 \text{ constant number}}{50 \text{ revolutions per minute}}} = \sqrt[3]{96} = 4{\cdot}57\text{in.}$$

diameter of fly-shaft. And—

$$\sqrt[3]{\frac{15 \times 160}{10}} = \sqrt[3]{240} = \sqrt[3]{24} = 2{\cdot}88\text{in. diameter of main shaft.}$$

Perseverance Ironworks Kirkstall-road, Leeds,
June 14th, 1862. W. W. F.

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THE ENGINEER.

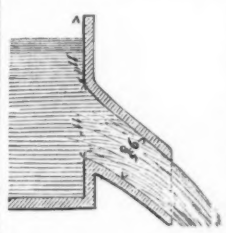
FRIDAY, JUNE 20, 1862.

CENTRIFUGAL PUMPS.

WE have, on a former occasion, noticed the large centrifugal pumps in the Exhibition, one by Messrs. Gwynne and Co., forcing to a height of 21ft., and the other, an Appold pump, made and exhibited by Messrs. Easton, Amos, and Sons, and working to a height of 6ft. It has been a matter of considerable interest to engineers to know, not merely the relative powers of the rival pumps on exhibition, but, generally, the actual per centage of efficiency of this class of hydraulic machines, an efficiency variously estimated at from 10 to nearly 100 per cent. of the power applied. On Saturday last an attempt was made to ascertain the power expended upon, and the work done by, Messrs. Gwynne's pump, but the means at hand for measurement and estimation proved inadequate, and nothing beyond imperfect conclusions could be arrived at. The makers had requested that their pump might be made the subject of a series of conclusive experiments by the jurors in Class 8, but that body, including Professor Rankine, Mr. Hawkshaw, Mr. Hick, and others eminent for their hydrological attainments, expressed their willingness to witness privately any experiments that might be made, but declined to take part in them officially. On Saturday, therefore, Messrs. Bateman and Beardmore attended to note the working of the pump, which it had been said would, at its usual speed, force upwards of 100 tons of water per minute to a height of 21ft. The pump works on the main shaft of a pair of high-pressure engines intended to make 210 revolutions per minute, and which ran at from 180 to 210 revolutions per minute during the trial. At this speed, however, it was found difficult to take indicator diagrams, and hence no accurate determination of the power exerted could be made. The Bourdon steam gauge showed from 25 lb. to 30 lb. pressure per square inch in the slide valve-box of the engines, 26 lb. being the ordinary pressure. The steam was admitted for nearly the whole stroke of both pistons. The indicator did show, moreover, that there was an average back pressure of about 5 lb. per square inch on the pistons, and as the revolutions were as rapid as those of a 6ft. locomotive driving wheel, running at 45 miles an hour, this would be about the back pressure which might be expected in a cylinder, the steam from which was exhausted over 400 times a minute, or seven times a second, through narrow ports. It had been supposed that a considerable back pressure existed in the exhaust steam pipes under the floor of the western annexe, but indicator diagrams, taken from non-condensing engines running at a moderate speed, and nearly half-way down the annexe, have shown that the steam in these pipes does not rise perceptibly above atmospheric pressure. The 5 lb. back pressure, therefore, in Messrs. Gwynne and Co.'s engine was entirely local, and was indeed to have been expected at the working speed. The average effective pressure on the pair of 18-in. pistons was, probably, 19 lb. per square inch, and, as the average number of revolutions was about 190 per minute, the speed of pistons (14-in. stroke) was 443ft. per minute. The engines, therefore, gave out, as near as may be, 130 indicated horse power, and inclusive of the friction of the engine itself. The water was forced 21ft. high through a pipe 30in. in diameter, the friction in which may be taken as an additional resistance equal to 2ft. head of water, making the whole effort equal to a lift of 23ft. Supposing there were no loss of efficiency by the pump, the utmost quantity of water which could be raised per minute, to this height, by 130-horse power would be $130 \times 33{,}000 = 166{,}520$ lb. or rather more than 83 tons.

$$\frac{}{23}$$

In order to have accurately measured the discharge of the pump, a measuring tank would have been necessary. Unfortunately there was none, the water, as it was discharged by the pump, being allowed to fall back into the same tank from which it had been taken. Mr. Beardmore brought with him an ingenious little current-measuring apparatus, on the principle of Massey's ship's log—a small two-bladed screw, formed like a screw propeller, and connected by worm wheels to a registering index. This was secured to a stave, and held from above in the column of water rising in the 30-in. discharge pipe. The force of the current was such, however, as to twist off the miniature screw in an instant, and so no indications could be obtained by its help. The only other resource was to infer, from the dimensions of the cascade of water falling over from the upper tank, its quantity per minute. At the top of the 30-in. discharge pipe the water rises in a tank, about 10ft. square, and 3ft. deep, flowing out at one side through an opening of which the annexed sketch is an approximate section, the opening being 10ft. long and $9\frac{3}{4}$in. deep at its narrowest part, the whole area of the opening being 1,155 square inches, or almost exactly 8 square feet. The water occasionally rose to the top of the tank, flowing over its upper edge, but the general water level was from 4in. to 6in. above the opening from the side of the tank, the mean head to the centre of the opening being, say, 10in., the theoretical velocity of outflow being 7·3 feet per second, and the actual velocity being, we must believe, something less than 5ft. At this velocity (5ft. per second) 2,400 cubic feet, or $66\frac{2}{3}$ tons of water, would be discharged per minute, equal to 80 per cent. of the full theoretical effect of 130-horse power. As, however, the co-efficient of the actual velocity (compared with the theoretical velocity of discharge) cannot be exactly known without the aid of experiments as complete as that required to measure the actual bulk of water thrown by the pump, the result to which we have arrived is only inferential. Knowing very nearly the actual power exerted in the engines, the quantity of water raised would certainly appear to be upwards of 70 per cent. of that due of the full power applied.



Messrs. Easton, Amos, and Sons' Appold pump was afterwards run for some time, and an average depth of 7in. of overflowing water maintained over a weir, the total length of which was 42ft. This length was made up of seven sections of 6ft. each, three of which discharge their water to the north, two to the east, and two to the west, the line of overflow presenting four external and two internal angles of 90 deg. each. The section of overflowing water being $24\frac{1}{2}$ square feet, the calculated velocity would be about 2·2 feet per second, equal to 90 tons of water per minute. This discharge, however, was obtained with but 48 revolutions of the engines per minute, their proper speed being 50. When they were driven to their full speed an average depth of overflow of 12in. was obtained, and the water was thrown violently out over the curb of the tank upon the floor. The discharge in this case was probably above 100 tons per minute, the lift being 6ft. The power exerted was not measured, no indicator diagrams being taken. The engines, as we have mentioned on a former occasion, have 20-in. cylinders, 24-in. stroke, and work steam of 50 lb. pressure, cut off at one-fourth stroke, and condensed, their working speed being 50 revolutions per minute, that of the pump being 118 revolutions. The pump is 4ft. 7in. in diameter, that of Messrs. Gwynne's being 4ft.

It was formerly said that centrifugal pumps were applicable only to low lifts, but, very lately, Messrs. Easton, Amos, and Sons have applied a centrifugal pump, in connection with the Trafalgar Square fountains, which is forcing water to a height of 57ft. This is probably the highest lift to which pumps of this class have been applied.

FIRE ENGINES.

ON Tuesday a trial of the hand-worked fire engines in the International Exhibition was made in Hyde Park, on the south bank of the Serpentine. The trials were conducted under the direction of Captain Shaw, of the London Fire Engine Establishment, and were witnessed by the Duke of Sutherland, and by a large number of gentlemen interested in fire-extinguishing apparatus, although by but one or two of the jurors in Class 8 of the Exhibition. Three engines were first brought out to be tried together, one a London brigade engine, with 7-in. pumps and 8-in. stroke, by Merryweather and Son, of Long Acre; another, with the same size of pumps and length of stroke, by Shand and Mason, of Blackfriars-road; and the third, with 7-in. pumps and 8·1-in. stroke, by Mr. Rose, of Manchester. The engines were manned each by 28 of the Grenadier Guards. The first trial was made to ascertain the quantity pumped into a tank close to the engines. Merryweather's took its water through a 3-in. suction, and had a $2\frac{1}{2}$-in. delivery; and these, we believe, were the sizes of the suction and delivery of the other engines. The trials were for 30 seconds each.

	No. of strokes.	No. of gals. discharged.	Quantity which should have been delivered, or product of capacity of pumps into number of strokes.	Gain gals.	Loss gals.
First Trial.					
Merryweather's	34	79	75·48	3·52	
Shand and Mason's...	27	62	59·94	2.06	
Rose's	31	65	68·82	—	3·82
Second Trial.					
Merryweather's	38	82	84·36	—	2·36
Shand and Mason's...	33	70	73·26	—	3·26
Rose's	33	68	73·26	—	5·26
Third Trial.					
Merryweather's	31	78	68·82	9·18	
Shand and Mason's...	30	64	66·60	—	2·60
Rose's	30	60	66·60	—	6·60

The fact of fire engines throwing more water than that theoretically due to the capacity of the pump and length of stroke has been observed in many engines, and is due to the fact that the valves do not quite shut after the water passing through the engine has acquired a certain momentum, which momentum assists to increase the delivery.

The engines were next made to discharge through a short length of hose, and through a $\frac{7}{8}$-in. branch, the jets being directed each into a large canvas hood held in position 20ft. above the ground, and 20ft. horizontally from the branch, each hood having at its back a long pipe through which the water received was conducted into a measuring box on the ground below. This apparatus was intended to show what quantity of water could be discharged by the respective engines upon a point a short distance off, as in the case of a burning building. It was found, however, that a considerable quantity of the water was deflected backward and downward upon the ground, on striking, with great force, against the upper part of the open mouth of the canvas hood, and hence the quantity of water received into the tanks could not have represented the quantity actually thrown. On the first trial, which occupied three minutes, 28 men working each engine as before, Merryweather's engine made 180 strokes and left 314 gallons of water in the tank; Shand and Mason's made 180 strokes and left 324 gallons in the tank, and Rose's made 167 strokes and left 282 gallons in the tank. On the next trial the canvas hoods were placed 20ft. high and 30ft. horizontally from the branches. Merryweather's engine made 183 strokes in three minutes, and left 325 gallons of water in the tank, Shand and Mason's 195 strokes and 365 gallons, and Rose's 192 strokes and 287 gallons. In the first trial the man holding the branch of Merryweather's engine lost a few seconds in getting his jet into the receiving hood, and his jet, being on the windward side, produced a certain amount of spray, part of which must have been carried, by the wind, into the other measuring tanks. For these and other reasons Messrs. Merryweather and Son have protested, to the jury in Class 8, against the admission of the results of the trials made with the canvas hoods. The jet of Merryweather's

engine was the steadiest of the three, and its large delivery into the tank in the previous experiments certainly warranted the expectation that its discharge into the canvas hood would be correspondingly greater than that of either of the other engines. It had been at first proposed that, instead of adopting the same length of time for the trial of each engine, all should be limited to the same number of strokes. The objections to this course are so obvious that they need not be repeated, and Captain Shaw decided promptly against it.

The handsome fire-engine recently presented to F. Hodges, Esq., by the inhabitants of Lambeth, was then tried. Owing to the improvements which have been introduced into the working parts of this engine by Messrs. Merryweather and Son, the builders, a more compact and solid jet was obtained from this than from any other engine tried during the day; and, in the trial for height, the stream thrown by this engine was carried upwards in one unbroken steady line beyond the other jets. The chief improvements in this engine are that the water passages are easier than heretofore, and that, by this arrangement of water passages, no water can lay in the valve-box when at rest, and, consequently, can never get frozen; and an air vessel of much larger capacity is introduced. There is also placed in the air vessel an india-rubber ball containing air under pressure, whereby the absorption of air is prevented, and a more steadying influence is exerted on the water. A valve is also introduced beneath the suction end of engine (more accessible than in the ordinary engines) for drawing water from the cistern when required.

Messrs. Shand and Mason's large engine, with 9-in. pumps, and worked by 45 men, was also tried, and, as was to have been expected, threw its stream higher than any of the others.

Among the other trials made were a series to ascertain the exact quantity thrown, through a 2¼-in. opening, into a tank, by the engine of Mr. Roberts, of Millwall, Shand and Mason's military (Captain Fowke's) engine, and Merryweather's county brigade engine.

Mr. Roberts' engine has a single double-acting pump 9½in. in diameter and 6⅞in. stroke. In one trial of 1 min. it made 57 strokes, and threw 114 gallons, or 14¼ gallons more than the theoretical discharge. In the next trial of 1 min. it made 66 strokes, and threw 117 gallons, or 12 gallons in excess. The engine was attended, in each case, by 20 men, although the work, we believe, was actually performed by 12 men.

Shand and Mason's "military" engine has 6in. cylinders and 8in. stroke, and was worked with 12 men. In one trial of 1 min. it made 63 strokes, and discharged 109 gallons, or 6½ gallons in excess of the quantity due to the capacity of the cylinders and length of stroke. In the next trial of 1 min. 65 strokes were made and 110 gallons discharged, or 4 gallons in excess of the theoretical discharge.

Merryweather's engine, with 6in. cylinders and 8in. stroke, was then worked with 12 men, and in 1 min. made 76 strokes and overflowed the tank, the capacity of which was 120 gallons. The theoretical discharge was 123 gallons, and this was probably a little exceeded. On the next trial of 45 sec. 56 strokes were made, and 96 gallons discharged, or an excess of 4¾ gallons. The next trial extended over 1 min., and although but 55 strokes were made, 113 gallons of water were discharged, or no less than 23⅓ gallons above the calculated quantity due to the capacity of cylinders and number of strokes.

Some of the smaller engines were afterwards tried, and we now learn that the steam fire engines will be tried on Tuesday, July 1st.

Foreign Locomotive Building.—Foreign engineering firms seem to have it more and more their own way in supplying the great continental railway systems with rolling stock. The workshops of Creuzot, Brussels, and Graffenstaden, have now orders on hand for 91 locomotives required for the Madrid, Saragossa, and Alicante Railway, which, by February next, will have upwards of 700 miles of line in operation. The same firms are also executing considerable orders for general plant required for the same system.

A new prospectus has been issued of the Continental Company for boat-building by machinery, in which the proposed capital is limited to £50,000, in consequence partly of Mr. Nathan Thompson, the inventor, having consented to allow the amount to be paid to him to consist entirely of shares, on which no dividends are to be paid until a profit of at least 10 per cent. shall have been distributed on the ordinary shares. The patents to be made over to the company are those for France, Austria, Belgium, Sweden, Holland, Denmark, Sardinia, Spain, and India, and it is stated that negotiations are in progress with a view to a sale of some of them.

Six-Bladed Screws.—The sixth experimental screw trial of the Shannon frigate, Capt. Wainwright, took place on Monday, at the measured mile, in Stokes Bay, under circumstances of wind and weather equally favourable with those experienced on the five preceding trials. Six runs were made at the measured mile with the following results:—1st run—Speed of ship in knots, 11·356; revolutions of engines, 49. 2nd run—Speed, 10·682; revolutions, 49½. 3rd run—Speed, 12·2·3; revolutions, 49½. 4th run—Speed, 10·055; revolutions, 50. 5th run—Speed, 12·500; revolutions, 49½. 6th run—Speed, 9·574; revolutions, 50. The mean speed of the whole was 11·244 knots; the pressure of steam 20 lb.; and the vacuum in the forward and after engines 25in. The draught of water by the ship was as nearly as possible the same as on the former trials—20ft. 2in. forward and 21ft. 9in. aft. The screw tested on Monday was of a precisely similar character to the four-bladed one tested on the 31st ult., with this difference, that the one of Monday carried six blades attached to the boss, instead of four, as on the former occasion. The boss or sphere to which the blades are affixed is a Griffiths', while the blades are cast on the pattern of the Mangin. They are, however, twice the width of the Mangin, owing to their being placed separately round the circumference of the boss, instead of being set in parallel pairs, as is the case with the Mangin. The face of each blade is like the French blade—flat, and its back is also convex. They differ otherwise a little from the Mangin, inasmuch as they taper in their width slightly from root and edge to their centre. The speed gained by the ship on Monday contrasts very unfavourably with the former trials, and more particularly so when compared with the trial on the 31st, with four blades, the speed of the ship on that occasion having been 11·553 knots. The vibration on Monday, however, as on the 31st ult., was *nil*, as far as the screw was concerned, the only movement exhibited by the hull of the ship being that given to it by the movement of the machinery. The ridge of water raised across the ship's stern by the action of the screw, and the following current over the screw itself, was greater than with the four blades on the 31st, and a considerable body of water was thrown up against the fore part of the after sternpost.

MISCELLANEA.

A system of sewers, to cost £30,000, is about to be adopted at Brighton.

The City of London Gas Company last year carbonised 51,758 tons of coal, and produced 481,000,000 cubic feet of gas.

The Viceroy of Egypt has purchased Messrs. Sharp, Stewart, and Co.'s locomotive in the Exhibition, and with it six more of the same pattern

The advices from Paris mention that the Lyons Railway Company have announced an issue of 340,000 new 3 per cent. obligations of £20 each, at the price of £12. The sum thus required will be £4,080,000.

We understand that arrangements are being made by some of the Exhibitors in Classes 5, 7, 8, and 10, International Exhibition, to present Mr. D. K. Clark, C.E., superintendent of those classes, with a testimonial.

Mr. Train was, on Friday last, fined £500, in the Court of Queen's Bench, for causing a nuisance, in the form of a tramway, in the Westminster Bridge-road, and the sheriff was ordered to remove the tramway forthwith.

The Belgium "minium," or iron paint made at Auderghem, is a pure iron oxide mixed with about one-fourth its weight of silicious clay. It is said to contain no acid, and is now extensively used in this and other countries for painting ship's iron work, gas-holders, &c.

Krupp's new rolling mill, for rolling steel-armour plates, will have rolls 5ft. in diameter, and 15ft. in length between the standards. The new armour-plate rolls in course of erection by Messrs. John Brown and Co., of Sheffield, are 3ft. in diameter and 12ft. long.

A capital of £35,000 has been privately subscribed for an undertaking to be called the Hongkong and China Gas Company, in 3,500 shares of £10 each. The privileges of the company have been accorded by the Governor of Hongkong, and confirmed by the Duke of Newcastle as Colonial Secretary.

Besides the ordnance lately noticed in The Engineer as being exhibited in the Exhibition, there is a large Cavalli gun from Italy, a breech-loading gun on Engström's principle, from Sweden, and a 7-in. cast-iron gun, hooped on Captain Blakely's plan, from the Spanish ordnance factory at Trubia.

The South-Eastern, Eastern Counties, Lancashire and Yorkshire, Newcastle and Carlisle, North British, Caledonian, Edinburgh and Glasgow, and some other railways, now test all their locomotives with hydrostatic pressure up to twice the regular working pressure. The old boilers are tested as well as the new, in some cases as often as twice a year.

Griffiths' *Iron Trade Circular* says:—"It is now ascertained, beyond question, that Bessemer is making steel from the hæmatite pig iron of the North infinitely superior to anything ever produced on the old converting principle from the most expensive brands of Swedish iron, which has given an impetus to the demand for hæmatite pigs, which well-informed parties believe will continue unabated, and no doubt will accelerate a further advance in the rates of this extraordinary metal."

The Royal Agricultural Society of England will hold their great agricultural show in Battersea Park, commencing Monday next, the 23rd of June, and continuing open to the public until the 2nd of July. On Thursday the 26th, Friday the 27th, and Saturday the 28th of June, a public exhibition of steam cultivators at work will take place, under the auspices of the society, near Farningham station, in Kent, to which place cheap return tickets will be issued by the London, Chatham, and Dover Railway from the Victoria and London Bridge termini.

THE GREAT EASTERN.

The Great Eastern is now in the Mersey, where she is an object of much public interest. Annexed is the engineer's log, showing the performance of the big ship in her recent run from New York:—

Date each day, ending at noon.	Paddle Engines. Revolutions of engines each day.	Paddle Engines. Average revolutions per minute.	Paddle Engines. Average pressure of steam in engine-room.	Paddle Engines. Tons of coals used each day.	Screw Engines. Revolutions of engines each day.	Screw Engines. Average revolutions per minute.	Screw Engines. Average pressure of steam in engine-room.	Screw Engines. Tons of coals used each day.	Total quantity of coals used each day.	Number of knots run by paddle engines.	Number of knots run by screw engines.	Distance run by ship, in knots.	Latitude.	Longitude.	Course.	Barometer.	Observations on rolling of ship. Inclination to windward.	Observations on rolling of ship. Inclination to leeward.	Observations on rolling of ship. No. of oscillations per minute.
			lbs.	tons.			lbs.	tons	tons.							In.	deg.	deg.	
May 31				18				26	44										
June 1				34	6 910			20	84										
" 2	15,669	10·7	22	112	51,530	36·6	17	142	255	376	377	360	40·33 N.	66·14 W.	E. 1° N.	30·26			
" 3	15,726	11·1	22	131	53,690	38·0	17½	152	283	385	387	350	41·56 "	58·33 "	E. by N. ¼ N.	30·30	1	1	2
" 4	15,650	11·2	22	128	53,100	38·0	17½	151	279	390	383	348	43·18 "	50·42 "	E. by N. ¼ N.	30·30	2	2	3
" 5	15,363	11·0	21½	129	51,570	37·0	15½	141	270	381	373	345	45·50 "	45·54 "	N.E. by E. ½ E.	30·20	2	2	3
" 6	15,279	10·7	20	121	52,050	36·5	15½	150	271	380	375	312	47·30 "	39·12 "	E. by N. ½ N.	29·95	3½	5	6
" 7	15,055	10·7	18	132	52,460	37·6	15½	179	311	376	377	325	49·4 "	31·39 "	E. by N. ¾ N.	30·00	3	5	6
" 8	15,623	11·1	18	132	54,230	38·5	16½	179	301	385	391	335	50·13 "	23·38 "	E. by N.	30·30	5	7	6
" 9	15,931	11·4	18	132	51,020	38·4	15½	161	293	402	392	324	50·38 "	15·24 "	E. ¼ N.	30·30	1½	2½	4½
" 10	16,223	11·5	17½	139	53,910	38·2	15¾	170	309	402	390	328	51·46 "	7·52 "	E. ¼ N.	30·60	2	2	3
" 11	9,378	11·4	16	89	32,070	38·0	16	105	194	402	387	215	Steering by the land.			29·80	1	1	2
Total	149,310	11·0	20½	1,297	515,570	37·4	16¾	1,607	2,904	3,883	3,832	3,242							

The engineer appends the following general remarks in addition:—"May 31. At 10.25 a.m., started engines ahead slow, at 10.50, a.m., stopped engines; at 11.30, a.m., dropped anchor off Quarantine ground. June 1. At 8.30, a.m., started engines, at 10.35 discharged pilot, at 10.45 full speed. June 2. Light beam wind and sea smooth, fore and aft sails set. June 3. Dense fog, sea smooth, fore and aft sails set. June 4. Dense fog standing by engines. June 5. Beam winds, fore and aft sails set, coals running very small and bad quality. June 6. Strong N.W. winds, fore and aft sails set. June 7. Fresh N.W. breeze, fore and aft sails set, coals running very small and bad quality. June 8. Light beam wind, fore and aft sails set. June 9. Light beam wind, coals running very small and bad quality. June 10. Beam wind, coals running very small and bad quality. June 11. At 2.30 a.m., stopped engines to take pilot on board. Actual time steaming, 227 hours 45 minutes—9 days 11 hours. Indicated horse-power of paddle-engines, 3,600; ditto of screw engines, 4,656 horse-power; total horse-power, 8,256. Density of water in boilers, 1⅝; vacuum in paddle engines, 25; ditto in screw-engines, 25·5. Extreme diameter of paddle-wheel, 50ft.; effective diameter, 48ft.; 150·79ft. each revolution; pitch of screw, 44ft. Immersion leaving New York, 25ft. forward; aft, 25ft. 6in. Immersion on arrival at Liverpool, 21ft. forward; aft, 23ft. Average daily consumption of coals per paddle-engines, 137 tons; ditto screw-engines, 170 tons; total daily consumption, 307 tons. Slip of paddle-wheels, 19¾ per cent.; ditto screw, 19¼ per cent. Average distance run, 14½ knots per hour."

COQUIMBO RAILWAY.

This railway, which bids fair to eventually become one of the most profitable and useful in the Republic of Chile, South America, was formally inaugurated upon the 21st of April, 1862, with all the ceremonies usually observed in Catholic countries. Its length, including two branches, is about forty and a half English miles, and the object of its construction is not only to connect the city of Serena, the capital of the province, with its spacious and well sheltered Port Coquimbo, eight miles distance, but to facilitate the conveyance of the mineral riches from the districts lying to the south of the latter.

The line forms a letter V, and commencing upon the coast of the Pacific at the port of Coquimbo, it thence runs for eight miles in a north-easterly direction to the city of Serena, beyond which place it is continued for two and a quarter miles, as far as the large copper smelting works of the Compañia Lambert, where it terminates for the present, on this side of Coquimbo, the intention, however, being to extend it ultimately up the rich and fertile valley of Elgin to the town of Vieuña, about forty miles further.

From Coquimbo, southwards, the railway runs for twenty-eight and a half miles, passing first in its course the extensive smelting works of Don José Tomas Urmeneta, at Guayacan, where twenty-four reverberating furnaces are constantly at work, and to these works a branch has been formed nearly two miles in length. Beyond this, after traversing a distance of eighteen miles from Coquimbo, the great mineral districts of Andacollo and Tambillos are reached, and thence to the present termination of the railway at the foot of the Cardas range of mountains. The entire country is rich in copper and other minerals.

This line is intended to be continued hereafter thirty miles further to Ovalle, the chief town of a department containing immense resources, both mineral and agricultural. Within this province is situated the wonderful copper mines of Tamaya, which probably are the most productive in the world, the chief of which belongs to the proprietor of the large smelting works at Guayacan, already mentioned. To the foot of the mountain of Tamaya the railway has already been surveyed, and although the line will be somewhat difficult, yet there exists no serious obstacle to its execution, and arrangemements are being already made to raise the additional capital required.

The Coquimbo Railway is the first line in Chile yet made exclusively with capital raised in the country; it has cost, including rolling stock, stations, land, and every other expense, £5,680 per mile, or £230,000 for the entire length of forty and a half miles, and the estimated expense of continuing it to Ovalle is £250,000.

The works upon the line are of a simple though durable character; a kind of calcareous limestone found in the district has been employed in the construction of the various bridge abutments and in the culverts; and cast iron piles, with wrought iron girders, have been generally adopted for the principal bridges, one of which, over the Coquimbo river, is 500ft. in length.

The gauge adopted is that of the remainder of the lines of Central Chile, viz., 5ft. 6in., the rails being 64 lb. per lineal yard. The locomotives are by Slaughter, Gruning, and Co., of Bristol. They are very handsome specimens of English manufacture, and are quite equal to the duty which will be required of them.

The curves of the main lines in no case exceed 1,000ft. radius, and the steepest gradient is 1 in 70.

The Coquimbo Railway is the cheapest yet made in Chile. It has been carried out for an amount considerably below the estimate, and the execution of the works has occupied only sixteen months.

The chief engineer of the line is Mr. Lloyd, M. Inst. C.E., who is also the chief engineer of the Valparaiso and Santiago Railway; the resident engineer is Mr. William Stirling.

In Chile there are now 289½ miles of railway open or ready for use, viz.:—

Caldera and Copiapo	50½	miles
Copiapo and Pabellon	23½	"
Pabellon and Chañarcillo	26	"
Valparaiso and Santiago	77	"
Santiago and Rengo	72	"
Coquimbo Railway	40½	"
	289½	"

Upon these railways exist features such as are rarely to be met with upon any lines in the world; as, for instance, upon the Valparaiso and Santiago Railway is an incline of 1 in 45 for twelve miles in length, combined with curves of 600ft. radius; the summit level of this line will be 2,650ft. above the sea; and upon the Chañarcillo line is an incline of 1 in 25, nine miles in length, with curves of 500ft. radius, up which English engines ascend daily to an altitude of 4,400ft. above the sea, an altitude not previously attained by the locomotive.

Between the existing lines of Central Chile and the railway of Coquimbo there is a distance of about 190 miles; and although the nature of the country between the two railways is of a very rugged and formidable nature, it is contemplated hereafter to connect them, arrangements having been already made for making the requisite surveys. Should this be accomplished, and the southern line from Santiago be continued to its proposed terminus Talca, upon the river Maule, Chile will then possess a direct north and south communication of about 470 miles in length.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

508. Charles William Heckethorn, St. Ann's-road, Brixton, Surrey, "Improvements in obtaining and applying motive power by means of a wheel containing mercury."—*Petition recorded 25th February, 1862.*

611. John Carpendale and Thomas Middleton, Sheffield, Yorkshire, "Improvements in means of producing raised chasing on copper, silver, and Britannia metal, by the application of pressure."—*Petition recorded 7th March, 1862.*

1013. Josiah Jones, jun., Sefton-street, Liverpool, "Improvements in constructing and arming ships and vessels."—*Petition recorded 9th April, 1862.*

1084. Alfred Vincent Newton, Chancery-lane, London, "Improvements in the manufacture of blasting powder."—A communication from Frederick Wynans and Prosper Esseiens, Ixelles, Belgium.—*Petition recorded 15th April, 1862.*

1223. Enrico Angelo Ludovico Negretti and Joseph Warren Zambra, Hatton-garden, London, "Improvements in the construction of mercurial minimum thermometers."—*Petition recorded 25th April, 1862.*

1238. Alfred Vincent Newton, Chancery-lane, London, "Improvements in the manufacture of hollow glass ware."—A communication from James Seaman Atterbury, Thomas Bakewell Atterbury, and James Reddick, Pittsburg, Alleghany, U.S.—*Petition recorded 26th April, 1862.*

1251. EDWIN CLARK, Great George street, Westminster, "Improvements in arches."—A communication from Johann Fillanger, Landstrasse, Vienna.
1257. DAVID MONROE CHILDS, New Oxford-street, London, "Improvements in steam engines."—A communication from James Mills Ray, John Hooper Renstone, and Albert Ellis Redstone, Indianapolis, Indiana, U.S.
1258. DAVID MONROE CHILDS, New Oxford-street, London, "Improvements in reaping and mowing machines."—A communication from James Mills Ray, John Hooper Redstone, and Albert Ellis Redstone, Indianapolis, Indiana, U.S.
1259. DAVID MONROE CHILDS, New Oxford-street, London, "Improvements in the means of changing a rotary into a reciprocating and a reciprocating into a rotary movement in machinery."—A communication from James Mills Ray, John Hooper Redstone, and Albert Ellis Redstone, Indianapolis, Indiana, U.S.—*Petitions recorded 29th April*, 1862.
1361. THOMAS MARKLAND, Hyde, Cheshire, "Certain improvements in wearing apparel."—*Petition recorded 7th May*, 1862.
1376. WILLIAM RIDDLE, Gerrard-street, Islington, London, "Improvements in hydraulic and other presses, and apparatus used therewith, adapted to packing cotton and other fibrous substances."—*Petition recorded 8th May*, 1862.
1412. JEAN BAPTISTE CRISTOFINI, Paris, "Improvements in tents."—*Petition recorded 16th May*, 1862.
1463. THOMAS HENRY LE MESURIER, St. Peter's Port, Guernsey, "Improvements in raising sunken vessels and other heavy bodies."
1465. ROBERT WALSHAM and JOSIAH WALSHAM, Birmingham, "A new or improved sleeve tie or fastener."
1467. JOHN DICKER, Hendon, Middlesex, "Improvements in apparatus for the delivery of bags or parcels from railway trains in motion."
1469. GEORGE HENRY BIRKBECK, Southampton-buildings, Chancery-lane, London, "Improvements in apparatus for consuming smoke."—A communication from M. Etienne Deshurand and Madame Anais Lemercier, Paris.
1478. CHARLES ATTWOOD, Taw Lan Ironworks, Durham, "Improvements in the production or manufacture of steel and iron of a steely quality."
1475. ISHAM BAGGS, Cambridge-terrace, Middlesex, and WILLIAM SIMPSON, Tovil Upper Mills, Maidstone, Kent, "Improvements in treating straw, Spanish grass, and other vegetable fibres, in preparing a bleaching agent for vegetable fibres, and in recovering and treating an alkali resulting from the treatment of the said fibres, and in apparatuses employed therein."
1477. ALFRED WATNEY, Upper Berkeley-street, Portman-square, London, "Improvements in constructing ships, vessels, and other structures intended to resist shot."—*Petitions recorded 15th May*, 1862.
1479. JOHN RAILTON and THOMAS RAILTON, St. Paul's Foundry, Blackburn, Lancashire, "Improvements in warping machines."
1481. REST FENNER, Red Lion-court, Fleet-street, London, "Improved machinery for folding envelopes."
1482. RICHARD LAMING, Priory-road, Kilburn, West Hampstead, Middlesex, "Improvements in constructing and using electric telegraphs."
1483. CHRISTOPHER BIKES, Parliament-street, Westminster, "Improved methods of and apparatus for treating linseed and other oils and fats."
1485. ALBERT LOUIS THIRION, South-street, Finsbury, London, "Improvements in the construction of railway and other carriages."
1487. DUDLEY CHARLES LE SOUEF, Twickenham, Middlesex, "Improvements in embossing metal plates."—A communication from Wenzel Seidan, Vienna.
1489. SAMUEL PEERDY, Philadelphia, Pennsylvania, U.S., "Improvements in apparatus for knitting ribbed fabrics."
1491. NATHAN THOMPSON, Abbey-gardens, St. John's Wood, London, "Improvements in stoppers or covers suitable for closing bottles, jars, and other similar vessels."
1493. BENJAMIN SHARPE, Hanwell Park, Middlesex, "Improvements in the construction of ships and vessels, and in masts and spars for the same."
1495. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improved machinery applicable to the cutting out of boot and shoe soles and kindred operations."—A communication from Caleb Griffin, Boston, U.S.—*Petitions recorded 16th May*, 1862.
1499. EDOUARD TAILBOUIS, South-street, Finsbury, London, "Improvements in rectilineal knitting frames."
1501. JAMES BROADLEY, Saltaire, Yorkshire, "Improvements in means or apparatus employed in weaving."
1503. JOSEPH NEEDHAM, Piccadilly, London, "Improvements in sheathing or coating iron ships."
1507. JOHN CHRISTOPHER GORE, Jamaica Plain, Norfolk, Massachusetts, U.S., "Improvements in belt shippers."—*Petitions recorded 17th May*, 1862.
1509. JAMES EASTWOOD, Blackburn, Lancashire, "Improvements in machinery or apparatus for removing and wringing hanks of thread or yarns and all kinds of fabrics when saturated with liquid."
1511. GEORGE MACDONALD, Puttorghatta, Colgany, Bengal, East Indies, "Improved apparatus for ginning cotton, and for cleaning and preparing fibrous substances, also applicable for cleaning or polishing metal or other substances."
1513. WILLIAM PICKSTONE, Radcliffe, and THOMAS MELLODEW, Oldham, Lancashire, "An improved fabric in the nature of a cord or corduroy."
1518. TIMOTHY MORRIS, ROBERT WEARE, and EDWARD HENRY CRADOCK MONCKTON, Trafalgar-square, London, "Improvements in the means and apparatus for the protection of life and property by the agency of electricity."—*Petitions recorded 19th May*, 1862.
1519. MARC ANTOINE FRANCOIS MENNONS, Rue de Mont Thabor, Paris, "Improvements in the method of and apparatus for applying screw power to the locomotion of railway trains on steep inclines."—A communication from Giusseppe Velini, Cours Porta Vittoria, Milan.
1521. WILLIAM NAYLOR, Queen's-road, Dalston, London, "Improvements in forging metals and in power hammers employed therein."
1522. REBECCA TALLERMAN and LEWIS ABRAHAM TALLERMAN, Bishopsgate-street Without, London, "An improved method of protecting ladies' and children's boots and shoes."
1523. JAMES TAYLOR, Fenchurch buildings, Fenchurch-street, London, "Improvements in abstracting heat from liquids and aeriform fluids, and in apparatus employed therein, and for other purposes."
1525. EDWARD FEWTRELL, Birmingham, "Improvements in the manufacture of metal tubes, and in machinery to be employed for that purpose."
1527. JOHN KENNEDY, Whitehaven, Cumberland, "Improvements in ship propellers."—*Petitions recorded 20th May*, 1862.
1529. HENRY BULLIONER BARLOW, Manchester, "Improvements in presses for cotton and other substances."—A communication from Isaac Mason, Bombay, East Indies.
1531. JOHN KENNEDY, Whitehaven, Cumberland, "Improvements in plates for plating and for forming the outside skin of ships and vessels, and in protecting the same from fouling and oxidation."
1533. MACEDO ALEXANDRE LE BRUN VIEILOY, Paris, "Improvements in drying and carbonising wood, peat, and other fuel."
1535. ALFRED GILES, Adelphi-terrace, Strand, London, "Improvements in constructing floating breakwaters."
1537. HERMANN CHRISTIAN MEYER, Ashford-street, Hoxton, London, "Improvements in the means of stopping or retarding railway and other carriages."—*Petitions recorded 21st May*, 1862.
1539. JOHN OXLEY, King's-cross Wheelworks, Old St. Pancras-road, London, "Improvements in making wheels, and in the machinery to be employed therein."—*Petition recorded 22nd May*, 1862.
1556. CHARLES DE BERGUE, Strangeway's Works, Manchester, "Improvements in machinery or apparatus for the manufacture of metal reeds for weaving."
1558. JAMES WEBSTER, Birmingham, "Improvements in coating and indurating metals."
1560. EUGENE MOCLINE, Vals, Ardèche, France, "Improvements in apparatus used in weaving."—*Petitions recorded 23rd May*, 1862.
1561. GEORGE THOMAS LUVESEY, South Metropolitan Gasworks, Old Kent-road, Surrey, "Improvements in purifying illuminating gas, and in treating the products obtained in the various processes of purification."
1566. WILLIAM HARRISON, JOHN HARRISON, JOHN ODIE, and WILLIAM PARKINSON, Blackburn, Lancashire, "Certain improvements in machinery for winding, sizing, and weaving."
1570. JACOB TAYLOR, Oldham, Lancashire, "Improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun."
1576. GEORGE AUGUSTUS HUDDART, Brynkir, Carnarvonshire, "Improved means for superheating steam."
1578. JOSEPH ELLICOTT HOLMES, South Parade, Chelsea, Middlesex, "Improvements in machinery for digging or cultivating land."—A communication from George Ramsey, New York, U.S.
1580. THOMAS DUTTON TEMPLE SPARROW, Piccadilly, London, "An arrangement or arrangements for shading street lights, in order to protect or shade the eyes of riders and foot passengers from the dazzling effect of the flames of such lights."—*Petitions recorded 26th May*, 1862.
1584. JOHN HALLIDAY, Manchester, "Improvements in the manufacture of ornamental trimmings."
1586. HENRY DUNCAN PRESTON CUNNINGHAM, Bury House, Alverstoke, Hampshire, "Improvements in anchors."
1592. WILLIAM PALMER, New York, U.S., "Improvements in revolving fire-arms."
1594. GEORGE HENRY DAW, Threadneedle-street, London, "Improvements in fire-arms."—*Petitions recorded 27th May*, 1862.
1595. HENRY EATON, Manchester, "Improvements applicable to presses for baling purposes."
1598. JAMES SIMPSON, Hulme, Lancashire, "Improvements in machinery or apparatus for cutting or producing 'mouldings' upon surfaces of wood or other suitable material."
1600. CHARLES COHEN, Bury-street, London, "Improvements in walking, umbrella, and other like sticks."
1602. RALPH MARTINDALE, Birmingham, "Improvements in the manufacture of globes and glasses, more particularly applicable to hydrocarbon and spirit lamps, and also in fastenings for securing the globes or glasses in those and other descriptions of lamps."
1604. HENRY SAUNDERS and JOHN HENRY MILLS, Birmingham, "Improvements in the manufacture of Venetian blinds and other window blinds, and in apparatus for raising and lowering the same."
1606. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in circular looms or machinery for the manufacture of looped or knitted fabrics."—A communication from Charles Armédée de Laire de la Broose, Boulevart de Strasbourg, Paris, and Emile Adrien le Cœur, Rue Ecureuil, Rouen, France.—*Petitions recorded 28th May*, 1862.
1610. JOHN CRITCHLEY, Manchester, "An improved rib fastener for umbrellas and parasols."
1614. GEORGE ASHTON, Heywood, Lancashire, "Improvements in dyeing fibrous substances, and in the means or apparatus employed for that purpose."
1616. WILLIAM PERKS, jun., Birmingham, "An improvement or improvements in metallic sash bars for windows, skylights, hothouses, and other like purposes."
1618. ROBERT GRIFFITHS, Mornington-road, Regent's Park, London, "Improvements in marine propellers for ships and boats, and for the sheathing of iron ships with metal sheathing to keep them from fouling."
1622. SAMUEL MINTON, Woodlands-grove, Isleworth, Middlesex, "An improved construction of revolving battery."—*Petitions recorded 29th May*, 1862.
1624. FLORIMOND DATICHY and EUGENE SABATIER, Mortimer-street, Cavendish-square, London, "Improved machinery and process for making pulp for the manufacture of paper and other purposes."
1630. CHARLES OCTAVIUS STAUNTON, Paulton-square, Chelsea, Middlesex, "Improvements in apparatus for signalling and indicating the position of shots on targets in rifle practice, and for preventing accidents to the markers."
1632. ROBERT CHURCHYARD STEED, Aylesford-street, St. George's square, Pimlico, London, "Improved apparatus for signalling on railways."
1634. WILLIAM EDDINGTON, jun., Chelmsford, Essex, "Improvements in apparatus for draining and tilling land."
1636. JULIUS IVES, Bow, Middlesex, "Improved machinery for washing and wringing clothes or fabrics."—*Petitions recorded 30th May*, 1862.
1638. JOHN HENRY HOLLAND, Lorrimore-road, Surrey, "An improvement in traction engines."
1644. DAVID ALEXANDER LAMB, Berwick-upon-Tweed, "Improvements in railway buffers or apparatus to relieve concussions on railways."
1652. WILLIAM KIRBY SULLIVAN, Upper Leeson-street, Rathmines, Dublin, "Improvements in the preservation of stone, plaster, cement, and other like matters, the invention being likewise applicable to the manufacture of artificial stone, and to the fixation and production of colours on and in the body of stone, plaster, or cement."—*Petitions recorded 31st May*, 1862.
1654. BENJAMIN TEMPLAR, Manchester, "Improvements in apparatus for regis-tering and indicating billiards and other games."
1656. JOHN ELCE and WILLIAM JAMES CRADWELL, Manchester, "Certain improvements in machinery for spinning, doubling, and winding cotton and other fibrous substances."—*Petitions recorded 2nd June*, 1862.

Inventions Protected for Six Months by the Deposit of a Complete Specification.

1700. WILLIAM HARDING, Aldersgate-street, London, "Improvements in the manufacture of bonnet fronts, and in apparatus to be employed therein."—*Deposited and recorded 7th June*, 1862.
1712. GEORGE HASELTINE, International Patent-office, Fleet-street, London, "A new and improved photographic camera."—A communication from Allen Benjamin Wilson, Waterbury, Connecticut, U.S.—*Deposited and recorded 7th June*, 1862.

Notices to Proceed.

313. ROBERT RUSSELL, Derby, "Improvements in stove grates and kitchen ranges."
315. PETER HYDE ASTLEY, Matthew's-place, and CROSBY LEIGHTON, Manby-grove, Manby Park, Stratford, Essex, "Improvements in the construction of lifeboats, applicable also to ship's boats, gunboats, and other vessels."—*Petitions recorded 6th February*, 1862.
324. PETER SHAW, Edinburgh, "Improvements in lamps."
325. HUGH ADAMS SALVER, Silver town, Essex, "Improvements in the manufacture of trays, vases, and other similar articles, and bottles in ebonite, vulcanite, or other hard india-rubber."—*Petitions recorded 7th February*, 1862.
335. FREDERICK TOLHAUSEN, Boulevart Bonne Nouvelle, Paris, "Improvements in the manufacture of the tyres of railway wheels, and in apparatus for such purposes."—a communication from Antoine Duplay, Rue du Faubourg Montmartre, Paris.
337. JAMES CARRINGTON, Queen's-gate-mews, Kensington, Middlesex, "Improvements in the construction and fitting up of stalls and horse-boxes."—*Petitions recorded 8th February*, 1862.
347. WILLIAM CLARK, Chancery-lane, London, "Improvements in reflectors."—A communication from Mr. Louis Jacques Chateau, Boulevart St. Martin, Paris.—*Petition recorded 10th February*, 1862.
351. THOMAS FYFE, Leicester square, London, "Improvements in knapsacks, and in apparatus for supporting them or other similar burdens upon the shoulders."
355. WILLIAM WOOD, Monkhill, Pontefract, Yorkshire, "Improvements in the process of manufacturing pomfret or liquorice cakes."
358. JOHN BRINSMEAD, Charlotte-street, Fitzroy-square, London, "Improvements in pianofortes."
359. RICHARD JOHNSON, Manchester, "Improvements in welded wires used for telegraphic and other purposes."
360. GUSTAV LINDEMANN, Manchester, "Improvements in applying gas for the purpose of singeing or dressing yarns or threads and woven fabrics, and for obtaining heat for other purposes."
363. JOHN HETHERINGTON, Manchester, "Improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning."—*Petitions recorded 14th February*, 1862.
365. FREDERICK TOLHAUSEN, Rue du Faubourg Montmartre, Paris, "Improvements in the construction of vertical steam boilers."—A communication from Jean Larmanjat, Rue du Mail, Paris.
369. ANDREW HINSHAW, Aldermanbury Postern, London, "Improvements in hooped skirts."—A communication from John Coulthard Kelley, New York, U.S.
370. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in preparing and ornamenting cast iron and other metals in order to fit them for articles of furniture and decoration and other similar uses."—A communication from Jean Baptiste Godin, Guise, France.
371. JOHN STEPHEN JOSEPH, Rhostyllan, near Wrexham, Denbighshire, "Improvements in coke ovens, and in utilising the waste heat from the same."
374. THOMAS HORSLEY, jun., Coney-street, York, "Improvements in breech-loading fire-arms."—*Petitions recorded 13th February*, 1862.
376. JOHN STEPHEN JOSEPH, Rhostyllan, near Wrexham, Denbighshire, "An improved retort oven, and the utilisation of the spare heat from the same."
383. CHARLES DENTON ABEL, Southampton-buildings, Chancery-lane, London, "Improvements in towing boats or other vessels on rivers, and in apparatus employed for that purpose."—A communication from Jean François Cail, Paris.
384. THOMAS DAVISON, Belfast, Antrim, Ireland, "Improved means for preventing the corroding of steam boilers."
390. EDWARD ELLIS ALLEN, Parliament-street, and JOHN STEWART, Blackwall, Middlesex, "Improvements in the construction of steam engines."—*Petition recorded 13th February*, 1862.
400. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in machinery or apparatus for propelling ships and boats."—A communication from Charles Arnaud and Joseph Labrion, Paris.—*Petition recorded 14th February*, 1862.
410. JOHN COOKE, Willington, Durham, "Improvements in the method of propelling ships and other vessels."—*Petition recorded 15th February*, 1862.
419. HUGH CRAWFORD, JAMES CRAWFORD, ROBERT CRAWFORD, and ROBERT TEMPLETON, Belth, Ayrshire, N.B., "Improvements in looms for weaving."
420. JOHN HODGKINSON and DANIEL GREENHALGH, Bolton, Lancashire, "Improvements in machinery or apparatus for preparing or combing cotton, wool, and other fibrous materials."—*Petitions recorded 17th February*, 1862.
436. JOHN TOMLINSON PENDLEBURY, Elton, near Bury, and GEORGE PENDLEBURY, Tottington Lower End, Lancashire, "Improvements in machinery for doubling, folding, or plaiting cloth."
439. FREDERIC BARNETT, Oxford-street, London, "An improved lamp or lantern for street lighting and other purposes."—*Petitions recorded 19th February*, 1862.
463. WILLIAM HAMER, Little Lever, near Bolton, Lancashire, "Improvements in apparatus employed in the preparation of cotton and other fibrous materials."—*Petition recorded 21st February*, 1862.
470. WILLIAM ASHTON, Manchester, "Certain improvements in machinery or apparatus employed in the manufacture of braids and similar articles."—*Petition recorded 22nd February*, 1862.
492. THOMAS NESHAM KIRKHAM, West Brompton, and VERNON FRANCIS ENSOM, Highgate, Middlesex, "Improvements in bleaching and dyeing yarn and thread when in the form of cops or otherwise wound."
498. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in the joints or chairs of the permanent way of railways."—A communication from Raymond French, Seymour, Connecticut, and William Goddard, Boston, Massachusetts, U.S.—*Petitions recorded 24th February*, 1862.
519. GEORGE REES, Goswell-road, Clerkenwell, London, "Improvements in the construction of marine subways."—*Petition recorded 26th February*, 1862.
545. WILLIAM HENRY MUNTZ, Millbrook-lodge, Hampshire, "Improvements in paddle-wheels."—*Petition recorded 28th February*, 1862.
717. WILLIAM MCADAM, Glasgow, Lanarkshire, N.B., "Improvements in the manufacture of blocks, pulleys, and weights for window sashes and other purposes, and in the mode of applying the same."—*Petition recorded 15th March*, 1862.
771. JOHN CUMMING, Edinburgh, "Improvements in the method of and apparatus for distributing and setting up type."—*Petition recorded 19th March*, 1862.
775. BERNHARD SAMUELSON, Banbury, Oxfordshire, "Improvements in chain-harrows."—*Petition recorded 20th March*, 1862.
872. JOHN BOUCHER, Surrey-villas, Camberwell, New-road, Surrey, "Improvements in rifled ordnance and fire-arms, and in the projectiles to be used therewith."
873. YOUNGS PARFREY, Upper Belgrave-place, Pimlico, London, "Improvements in breech-loading fire-arms."—*Petitions recorded 24th March*, 1862.
826. RICHARD BURLEY, Lower Thames-street, London, "An improved material for forming or lining the bearings of axles and shafts, and other rubbing parts of machinery."—*Petition recorded 31st March*, 1862.
922. WILLIAM CURRIE HARRISON, Sutherland-place, Pimlico, London, and HENRY JOHN STANDLY, Cockspur-street, Westminster, "An improved instrument or tool for boring or drilling holes in slate or other rock."—*Petitions recorded 2nd April*, 1862.
957. LEONARD LINDLEY and FREDERICK TAYLOR, Comyn-street, Nottingham, "Improvements in sewing and embroidering machines."—*Petition recorded 4th April*, 1862.
1182. ALEXANDER ROBERTSON, Bachelor's-walk, and RICHARD BARTER, St. Anne's, Barrack, Cork, "Improvements in apparatus for distributing and projecting fluids either for surgical, sanatory, or domestic purposes."—*Petition recorded 22nd April*, 1862.
1238. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improvements in the manufacture of hollow glass ware."—A communication from James Seaman Atterbury, Thomas Bakewell Atterbury, and James Patterson, Alleghany, U.S.—*Petition recorded 29th April*, 1862.
1247. JOHN WILLIAM CALEY and FREDERICK GOODMAN CALEY, New Windsor, Berkshire, "An improved textile fabric."
1260. EDWARD BROWN WILSON, Parliament-street, Westminster, "An improvement in the machinery or apparatus used in the manufacture of malleable iron and steel."—*Petitions recorded 29th April*, 1862.
1328. HERBERT ALLMAN, Bedford-row, London, "Certain improvements in the construction of locks."
1334. JOSEPH VICTOR, Wadebridge, JAMES POLGLASE, Bodmin, and WILLIAM ROUNSEVELL ST. BREOK, Wadebridge, Cornwall, "Improvements in the manufacture of safety fuses for mining and other purposes."
1339. EDWARD BROWN WILSON, Parliament-street, Westminster, "An improvement in the machinery or apparatus used in the manufacture of malleable iron and steel."—*Petitions recorded 5th May*, 1862.
1486. FREDERICK BONAPARTE ANDERSON, Birmingham, "Improvements in watches and other time-keepers."
1491. NATHAN THOMPSON, Abbey-gardens, St. John's Wood, London, "Improvements in stoppers or covers suitable for closing bottles, jars, and other similar vessels."—*Petitions recorded 16th May*, 1862.
1592. WILLIAM PALMER, New York, U.S., "Improvements in revolving fire-arms."—*Petition recorded 28th May*, 1862.
1602. RALPH MARTINDALE, Birmingham, "Improvements in the manufacture of globes and glasses, more particularly applicable to hydrocarbon and spirit lamps, and also in fastenings for securing the globes or glasses in those and other descriptions of lamps."—*Petition recorded 29th May*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

1417. THOMAS FREDERICK HENLEY, Denbigh-street, Pimlico, London.—Dated 11th June, 1859.
1493. ALEXANDER PARKES, Birmingham.—Dated 21st June, 1859.
1509. GEORGE TOMLINSON ROUSFIELD, Loughborough Park, Brixton, Surrey.—A communication.—Dated 22nd June, 1859.
1436. EDME JULES MAURENE and VICTOR ROGELET, Rheims, France.—Dated 15th June, 1859.
1448. CHARLES WILKINSON, Shaithwaite, Yorkshire.—Dated 16th June, 1859.
1507. MARC ANTOINE FRANCOIS MENNONS, Rue de l'Echiquier, Paris.—A communication.—Dated 23rd June, 1859.
1456. THOMAS CATTELL, Euston-square, London.—Dated 16th June, 1859.
1517. GEORGE CHARLES GRIMES, Wandsworth, Surrey.—Dated 23rd June, 1859.
1517. JAMES MILLS, Heaton Norris, Lancashire.—Dated 24th June, 1859.

Patents on which the Stamp Duty of £100 has been paid.

1355. GEORGE ARTHUR BIDDELL, Ipswich, Suffolk.—Dated 13th June, 1857.
1369. HIPPOLYTE MATHIS, Rue Notre Dame des Victoires, Paris.—Dated 15th June, 1857.
1355. JOSEPH BETTELEY, Liverpool.—Dated 13th June, 1857.
1425. RICHARD KEEVIL, Lacock, Chippenham.—Dated 21st June, 1855.

And notice is hereby further given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days next after the date of the Gazette (and of the Journal, in which this notice is issued.

List of Specifications published during the Week ending 14th June, 1862.

2717, 3d.; 2718, 3d.; 2719, 5d.; 2720, 1s. 4d.; 2721, 3d.; 2722, 3d.; 2723, 3d.; 2724, 6d.; 2725, 3d. 2726, 4d.; 2727, 2s. 7d.; 2728, 1s. 1d.; 2729, 5d.; 2730, 3d.; 2731, 3d.; 2732, 1s. 1d.; 2733, 9d.; 2734, 3d.; 2735, 6d.; 2736, 9d.; 2737, 3d.; 2738, 7d.; 2739, 5d.; 2740, 3d.; 2741, 3d.; 2742, 7d.; 2743, 10d.; 2744, 6d.; 2745, 7d.; 2746, 3d.; 2747, 3d.; 2748, 3d.; 2749, 10d.; 2750, 3d.; 2751 3d.; 2752, 6d.; 2753, 10d.; 2754, 1s. 5d.; 2755, 3d.; 2756, 6d.; 2757, 9d.; 2758, 10d.; 2759, 10d.; 2760, 6d.; 2761, 3d.; 2762, 1s. 3d; 2763, 1s.; 2764, 5d.; 2765, 6d.; 2766, 10d.; 2767, 3d.; 2768, 6d.; 2769, 3d.; 2770, 6d.; 2771, 9d.; 2772, 1s. 4d.; 2773, 3d.; 2774, 10d.; 2775, 7d.; 2776, 9d.; 2777, 10d.; 2778, 10d.; 2779. 3d.; 2780, 6d.; 2781. 3d.; 2782, 3d.; 2783, 3d.; 2784, 6d.; 2785, 3d.; 2786, 1s. 2d.; 2787, 6d.; 2788, 2s. 2d.; 2789, 9d.; 2790, 3d.; 2791, 3d.; 2792, 10d.; 2793, 3d.; 2794, 10d.; 2795, 10d.; 2796, 3d.; 2797, 1s. 3d.; 2798, 7d.; 2799, 1s. 4d.; 2800, 4d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

3065. H. G. SCHRAMM, *Hamburgh*, "*Rotary engines and pumps.*"—*Partly a communication.—Dated 6th December*, 1861.

For the purposes of this invention an outer cylinder is employed with two end covers suitably constructed to receive a shaft or axis through their centres, the passage of the shaft or axis through the covers being made fluid tight, as is well understood. On the shaft or axis is fixed a cylinder, suitably formed for receiving hinged pistons or valves at its periphery, and on the inner surfaces of one or both covers of the main or outer cylinder grooves or guides are formed to draw or move the hinged pistons or valves in towards the cylinder to which they are hinged, and to move them outwards against the inner surface of the main or outer cylinder as required, the valves or pistons being arranged to move into and from recesses in the inner or rotating cylinder. Each valve or piston is hinged or attached to the inner rotating cylinder at a distance from the recess into and from which it is moved, a curved plate perforated with holes being employed for this purpose, one end of the curved plate being hinged to the rotating cylinder, whilst the other end of the plate projects beyond, is fixed to, and forms part of, the valve or piston; and it is this end of the curved plate which presses against the inner surface of the main cylinder, in order to keep the valve or piston fluid-tight. The ends of the pistons or valves work against the end covers of the main cylinder. The curved plate, when its piston or valve is within the recess of the rotating or inner cylinder, fits in a recess formed in the surface of that cylinder, so that, when that part of the cylinder passes in contact with the stop or inner projection which is interposed between the inlet and outlet passages, it acts as part of the surface of the inner or rotating cylinder. When used for a rotatory pump, motion is communicated to the shaft or axis, and the pump is furnished with an outlet and an inlet pipe, the inlet being in connection with a suction pipe, and having a valve in it opening inward. It is between the inlet and outlet passages that the stop or projection before mentioned is applied with in the outer cylinder. When the engine is to be worked by steam or other fluid, so as to give motion to the shaft or axis, then the steam or other fluid will enter the outlet passage and pass away at the inlet passage.

3083. R. A. BROOMAN, *Fleet-street, London*, "*Improvements in treating atmospheric air and other elastic fluids for motive power purposes, and in engines and apparatuses to be employed therewith.*"—*A communication.—Dated 9th December*, 1861.

This invention consists, First, in the hydration or moistening of common

air, or other elastic fluids, to the extent of their capacity to retain and transport the watery particles in the condition of vapour, when the same are to be employed for purposes of motive power, in combination with heated surfaces. Secondly, in the circulation of the fluids thus treated through heated chambers or passages under conditions that will allow of the dilatation or expansion of the whole volume at each stroke of the engine. Thirdly, in the construction of an engine to be worked by such fluids in which the cylinder and air pump are combined in one common vessel. Fourthly, in the construction and use of a movable furnace or fire-grate capable of being raised or lowered or withdrawn at pleasure, and simultaneously starting or stopping the engine. Fifthly, in the employment of a reciprocating rotary valve with movable port lips, adjustable by screws, to compensate for friction and wear.

Class 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

2088. S. Newton, *Edgeware-road, London*, "*Apparatus for steering and stopping vessels.*"—*Dated 9th December*, 1861.

This invention consists in the application of plates or surfaces inlaid in the sides of ships below the water line, such plates presenting a flush surface with the side of the ship when in the recesses made for their reception. They are made by preference of considerable length, and somewhat wider at one end than at the other. At the base or wider end they are hinged to the ship's side, and from this point they are laid forward in the recesses prepared for their reception, and have chains attached at the free end which are rove through eyes or other gear and laid on deck or otherwise, whereby the surfaces can be extended at right angles, or at any other angles to the ship's side, or hauled close into their respective recesses.—*Not proceeded with.*

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

2026. J. Hemmingway, *Robert Town, York*, "*Manufacture and ornamentation of textile fabrics.*"—*Dated 4th December*, 1861.

The patentee claims, First, the combination or admixture of the feathers or parts of feathers, or (down) or both, of birds with or in textile fabrics, as described, such feathers or down being raised on the surface so as to form a pile or nap. Secondly, the combination or admixture of the short hair or fur of animals with or in textile fabrics, such short hair or fur being raised on the surface thereof, so as to form a pile or nap, as described. Thirdly, the ornamentation of textile fabrics by the combination or the admixture therewith in figures or ornamental designs (on a plain ground) of such feathers or parts of feathers, down, hair, or fur, either separately or combined, as described. Fourthly, the ornamentation of textile fabrics by the application thereto or insertion therein of the whole or parts of the skins of animals, birds, insects, reptiles, or fishes, as described. Fifthly, the ornamentation of such fabrics by the insertion or introduction therein or application thereto of artificial imitations of birds, beasts, fishes, insects, reptiles, or other living animals, or of shells, trees, plants, and flowers, or other similar devices, as described.

3037. T. Stead *and* W. Higham, *Ashton-under-Lyne*, "*Apparatus for spinning cotton, &c.*"—*Dated 4th December*, 1861.

This invention relates to the hand and self-acting mule, and consists in placing an additional roller covered with cloth or flannel a short distance below the under clearer roller, and causing it to revolve in an opposite direction to the clearer roller, for the purpose of preventing hard threads from being mixed with the waste during the process of spinning. When a thread breaks, instead of the hard waste end falling on and being taken up by the under clearer roller, as at present, it will fall on the additional roller, which will retain the hard threads, and prevent them from being mixed up with the soft waste. The patentees cause the additional roller to revolve by means of straps or gearing from any revolving part of the machine, so that it may either turn continuously during the drawing out or taking in of the mule carriage, or only during the revolution of the drawing rollers.

3040. H. G. Hacker, *Woodford Bridge, Essex*, "*Manufacture of chenille, &c.*" *Dated 4th December*, 1861.

This invention consists in winding or lapping, by means of a suitable flyer, the material for forming the pile of the chenille, or other circular pile, round a frame of metal or other suitable material, of a width corresponding with the number of pieces of chenille or other circular pile fabrics required to be made at one time. The side or sides of this frame is or are inclined to such an extent as to allow the pile material, already wound on, to slip freely along it when a slight impulse is imparted to it. When this material arrives at the narrowest part of the frame it is nipped between a pair of revolving rollers, which draw the material off the frame as it is wound on. These rollers have circular grooves at distances corresponding with the width of the chenille, or other circular pile fabric required to be made; these grooves serve as guides to conduct the material for forming the body of the chenille, or other circular pile fabric, in the centre above and below the pile material. The rollers have also deeper circular grooves in which the cutting edges for severing the pile material are placed, which cutting edges may have a reciprocating or other suitable motion. Bobbins containing the material for forming the body of the chenille, or other circular pile fabric, are placed in any convenient position, the material being conducted by suitable guides to its proper position above and below the pile material. These materials pass through the grooved rollers, and when the pile material arrives at the centre between the same, where it is held by means of the pressure upon the rollers, it comes in contact with the cutting edges, which severs it into strips, and, as the rollers revolve, these strips, together with the bodies which lie down the centre above and below each strip, pass out, and the ends of each are connected to suitable spinning apparatus, which is caused to travel away from the rollers as fast as the material is delivered from them, and which twists the same respectively into separate pieces of chenille, or other circular pile fabric. At the place where the pile material is bent round the side of the tapering frame it is cut open by means of a circular, or other suitable cutting edges, so that no waste occurs in the process.

3046. C. S. H. Habtoo, *Norfolk-street, Strand, London*, "*Preparation and treatment of vegetable fibres the better to adapt them for combining, working up, and dyeing with different fibres.*"—*Dated 4th December*, 1861.

This invention consists, First, in producing and preparing vegetable fibres of a silky and woolly nature, suitable for admixing, spinning, and working up with animal wool and hair, shoddy and mungo wools, silk, cotton, or other different fibres, which the patentee obtains from the plants commonly known as rheea, rance, bon, sunn, jute, Indian flax and hemp, aloes, plantain, pine apple, Indian and other nettles, leaves of grasses and trees, and other vegetable products. Secondly, in the employment of these products in spinning and manufacturing all kinds of yarns and woven fabrics, or any other applications in which animal wool, hair, shoddy, and mungo wools, silk or cotton, are employed, either by using it alone, or in any other combinations. Thirdly, in the use of such chemical agents and such mechanical apparatus as will entirely remove all resinous, ligneous, and other matters from such vegetable fibres, so as to cleanse and bleach them and prepare them to take perfectly dyes of all colours, and with any admixture of wool, silk, cotton, or other material.

3055. M. Henry, *Fleet-street, London*, "*Printing and ornamenting textile fabrics, paper hangings, &c.*"—*A communication.*—*Dated 5th December*, 1861.

This invention relates to the production of figures, devices, or designs upon textile fabrics, paper hangings, artificial leather, and other materials, by printing or applying pressure, that is to say, by the use of printing, figuring, or pattern surfaces bearing the required device or design, which they transmit to the fabric or material to be printed or ornamented by means of pressure. Among other results figured effects may be produced imitating the embossed or raised effects obtained by jacquard machinery and by tapestry or needle work.

Class 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

3039. J. E. Boyd, *Lewisham*, "*Scythe, scythe handles, and apparatus for connecting the same.*"—*Dated 4th December*, 1861.

This invention consists in making the scythe handles (commonly called snaeds or snaiths) of iron or other metal pipes or tubing or rods, which are to be suitably shaped or bent, either during the progress of tubing or afterwards. The aperture on the end of the said metal tube or scythe handle will be so constructed as to form a case or socket or receiver, and made capable of fitting, regulating, and holding therein the tang or heel of the scythe, which is to be previously made suitable thereto, either by altering the present continuous heel or tang, or by the substitution and introduction of a separate heel piece or loose tang, to be constructed and formed to certain angles or shapes, and being rivetted or fastened on the back of the scythe, made to take the place of the present continuous fixed tang. The handle will also be made capable of receiving any form, die, plug, wedge, ratchet, plate, impression, or other contrivance or apparatus.—*Not proceeded with.*

3053. W. Bushby, *Newton-le-Willows, Yorkshire*, "*Ploughs.*"—*Dated 5th December*, 1861.

This invention is designed to obviate the necessity for shifting the mould board of ploughs from one side to the other in ploughing right and left, as commonly practiced with Kentish ploughs, and in which only one mould board has heretofore been used. The inventor proposes to effect this improvement in ploughs by employing two plough boards or plates of metal of the shape of a plough board fixed together, and projecting each side of the slive of the plough to which they are hinged in front; the opposite ends of said plough boards or metal plates are connected together by a cross piece of metal, into which one end of a lever rod takes, the fulcrum of the said lever rod being upon a pin connected to a cross piece of metal fixed to the handles of the plough. He also connects another lever to the first mentioned lever for the purpose of moving the coulter from side to side, according to which of the mould boards are brought into action, and which may be effected by moving the before-mentioned lever handle from left to right, or right to left, as required.—*Not proceeded with.*

3063. W. Smith, *Kettering, Northampton*, "*Horse hoes.*"—*Dated 6th December*, 1861.

This invention relates to certain details of construction in the horse hoe, whereby the efficiency of that implement will be greatly increased, particularly as respects the maintenance of the hoe stems in position (without a tendency to work loose), and the adjustment of the position of the hoes on the hoe bars. These bars the inventor proposes to make with double flanges (thus—I), and the lever stems he notches to fit on to the double flanges. The hoe stems are to be secured to their bars by clips formed with two eyes to receive the stem, and a binding screw tapped into the stem bears against the side of the bar, thus holding the notched stem close up to the flanges. The notches being on the stems, instead of, as is usual, on the transverse bars, allows of the adjustment of the former at any required distance apart, and permits also of their being fitted to either side of the bars. The transverse bars—of which he proposes to use two, as usual—are connected together near their extremities by bracing cross pieces, the ends of which are rivetted to the bars. To remove all interference to the nice adjustment of the hoes on their bars he makes the handles adjustable, attaching the handle irons to the back bar by means of clips, and he is then enabled to shift the position of the handles laterally to suit the varying positions of the hoes on the bars. To give increased strength to the double handle irons he inserts therein a solid stay piece, rivetting the same to the iron.—*Not proceeded with.*

3064. J. Howard, *Bedford*, "*Hay making machines.*"—*Dated 6th December*, 1861.

Hitherto in the working of hay making machines the accumulation of the grass upon the cross bar of the framing in front of the tine barrels has been so great as to occasion considerable inconvenience, the implement having from time to time to be stopped to allow of the attendant removing the grass from the framing. To prevent this accumulation, which is caused by the tine barrels tossing the grass forwards and causing it to lodge on the frame, the inventor obtains a self-acting discharge of such lodgments before they add materially, as they do at present, to the weight of the implement. In carrying out this object he mounts loosely in bearings upon the front cross bar of the drawing shafts or framing a transverse roller, on to which the grass to sed over by the tine barrels will fall. This roller, being free to turn in its bearings, will, as the grass accumulates, receive a slight axial motion from the preponderating weight on one or other side of the roller, and it will thus cause the grass to be dislodged. He may also find it desirable to apply to the sides of the machine loose rollers, which, acting in a similar manner, will throw off any grass that might otherwise accumulate on the side framing.—*Not proceeded with.*

Class 5.—BUILDING.—None.

Class 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

3056. E. D. S. T. F. Wells *and* G. A. Phillips, *Norfolk, Massachusetts, U.S.*, "*Apparatus for holding and placing percussion caps on fire-arms.*"—*Dated 6th December*, 1861.

The inventors make use of an outer casing containing a trough in which the caps are placed; a spring acting on a piston or plunger forces the caps to the mouth of the trough, which is preferably rectangular, and has at its extremity a pair of tweezers or nippers which prevent the escape of the caps, and keep the first cap of the series within the trough just over a hole in the bottom of it corresponding in size with the nipple of the gun. The cap is then firmly pressed on to the nipple of the gun, and, on the instrument or implement being removed, the springs give way, allowing the cap on the nipple to pass between them; the spring piston or plunger in the rear forces the row of the caps towards them, and the same action is repeated —*Not proceeded with.*

Class 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

3061. E. Collier, *Aldershot*, "*Coverings for the feet and legs.*"—*Dated 6th December*, 1861.

This invention consists in forming externally the gaiter or legging without the inconvenience of any fastening, the leg of the boot being made without any opening at the side or front, but is provided with buttons, imitation button holes, and buckle and strap, so that when the boot is worn with the leg thereof outside the trousers it presents the appearance of a gaiter and boot, without incurring the trouble of securing any fastenings whatever, as it is simply drawn on precisely like the ordinary Wellington boot. The legs of these boots may be made of any desired length, according to the purpose for which they are worn, and of different kinds of leather, according to the taste of the wearer. For military purposes the leg should be cut the same length as the military gaiter at present in use, so that it may not be discerned from the regulation gaiter required on parade.—*Not proceeded with.*

3087. W. Clark, *Chancery lane, London*, "*Gloves.*"—*A communication.*—*Dated 9th December*, 1861.

This invention consists in placing a piece of elastic in the palm of the glove, somewhat in the form of a triangle, the base of which is widened and extends some short distance up on each side.

Class 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

3043. W. H. Balmain, *St. Helens, Lancashire*, "*Manufacture of potash and salts of potash.*"—*Dated 4th December*, 1861.

This invention consists in the employment of the spent bark, or other woody fibre from which tanning or colouring matter has been extracted, as a source of potash and its salts. The method of carrying out this invention consists in incinerating the spent bark, or other woody fibre, or the charcoal obtained therefrom, and then lixiviating the residuum, after which the salts may be obtained from the solution in any of the well known manners. Or the residuum may be applied without lixiviation direct to the formation of salts of potash, by the addition of suitable acids, according to the particular salts required. Or the residuum containing the impure potash may be applied to the uses for which salts of potash may be required.

3076. B. W. Gerland, *Newton-le-Willows, Lancashire*, "*Manufacture of sulphate of copper and other salts of the same metal.*"—*Dated 7th December*, 1861.

The patentee claims, First, the manufacture of sulphate and other salts of copper from that description of ore known as malachite; Secondly, the use of malachite or other carbonate of copper, and also of oxide of copper for precipitating iron and other metals from cupreous solutions.

Class 9.—ELECTRICITY.—None.

Class 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

2827. D. Y. Stewart, *Glasgow*, "*Manufacture of cast iron pipes.*"—*Dated 11th November*, 1861.

This invention consists, in the First place, in ramming up the outer mould for a pipe or similar article upon a pattern constructed so that the whole or a part thereof may be contracted or collapsed to permit of its removal from the mould longitudinally, without rubbing injuriously upon the mould surface, and without its being required to open or divide the mould. The collapsible pattern may be constructed according to any suitable plan, such as is at present in use in making collapsible core bars. The invention relates, Secondly, to the removing of the cores from the castings. According to one modification a rotating tool, such as a cylindrical saw, or a hole furnished with cutting or abrading instruments, is made to enter at one end between the pipe and the core bar, and by its rotation to cut or break away the sand or a part of it between the inside surface of the pipe and the central box of the core. As the action proceeds, the clearing out tool is made to move along, and on completing its traverse will have made the core bar quite loose and free from the casting, so that it can be removed with the greatest facility.

2828. G. Leslie, *Mall, Hammersmith*, "*Pens and writing instruments.*"—*Dated 11th November*, 1861.

This invention consists in the manufacture of pens of hardened caoutchouc gutta percha, or gum known by the names of vulcanite or ebonite. The inventor proposes either to mould them into the proper shape while the gum is in a plastic state, and then harden them by the process well known, to the manufacturers of vulcanite or ebonite; or to shape them with files and other tools into forms most desirable for writing after the material has been hardened and become vulcanite or ebonite.—*Not proceeded with.*

2839. A. V. Newton, *Chancery-lane, London*, "*Dinner plates.*"—*A communication.*—*Dated 12th November*, 1861.

This invention relates to forming around the main body of plates used for table purposes depressions or receptacles for articles of food, such as sauces, vegetables, or condiments, whereby they may be kept separate from each other, and all within convenient reach, in one and the same vessel, whereby the use of many small plates in connection with a large one may be dispensed with.—*Not proceeded with.*

2840. W. E. Newton, *Chancery-lane, London*, "*Self-feeding inkstands.*"—*A communication.*—*Dated 12th November*, 1861.

This invention cannot be described without reference to the drawings.

2841. W. E. Newton, *Chancery-lane, London*, "*Skates.*"—*A communication.*—*Dated 12th November*, 1861.

This invention consists in a new mode of fastening a skate to the boot or shoe, whereby the skate is rigidly held in its place by means of a longitudinal binding force (that is in the direction of its length) exerted upon the boot or shoe, and in such a manner as to avoid any wrenching of the sole. This result is effected by means of a movable clamp, either at the toe or at the heel, or both, which can be moved forward and backward, and can be held at any desired point, so as to be engaged with, or be disengaged from, the boot or shoe, the toe piece being so constructed and so attached to the skate as to slightly lap over the toe of the boot or shoe, and form a bearing for the foot to press against, and prevent the skate from dropping at the toe.

2845. M. Henry, *Fleet-street, London*, "*Treating iron and steel.*"—*A communication.*—*Dated 12th November*, 1861.

The patentee claims, First, the employment, in the manner described, of garlic, oil, and fat, when used together or conjointly, in the manufacture of compositions for treating iron and steel and articles manufactured thereof. Secondly, the combination of garlic with oil and fat (whether with or without other ingredient or ingredients, for the manufacture of a composition for treating iron and steel, and articles manufactured thereof. Thirdly, the treatment of iron and steel, and articles manufactured thereof, by immersing the same, when in a red-hot state (once or oftener), in a composition consisting of garlic, fat, and oil, with or without other ingredient and ingredients.

2843. J. H. Johnson, *Lincoln's-inn-fields, London*, "*Construction of steam or other vapour and water or other liquid tight joints.*"—*A communication.*—*Dated 12th November*, 1861.

This invention relates to a peculiar construction of joint suitable for steam, gas, and water pipes, or for other purposes where a perfectly tight joint is required, and consists in the combination of an open or split packing ring of copper, or other suitable metal, with a V or angular circular groove formed on one or both junction surfaces, or with angular or bevelled surfaces on one or both faces of the joint, in such a manner that the ring, which is open or in a slightly expanded state, when placed in or upon one of the angular surfaces or grooves, shall be closed, and forced into its proper place by the act of compressing the two parts of the joint together. In making the ring above mentioned, care should be taken that the two abutting ends of the piece of wire or round metal, after it has been bent into an annular form, be made perfectly square and even, so that, when forced against each other, a perfectly tight joint in the ring itself will be formed. In all cases the ring should be slightly larger in diameter than is required for the actual joint before it is compressed by the tightening up of the two halves of such joint, so that the compression of the two parts of the joint will at the same time effect the tight closing of the split in the ring, and so complete the efficiency of the entire joint. Any section of ring may be used with any form of groove or angular surface, provided such ring and surface be so constructed as to effect the closing of the ring by the compressing together of the two junction surfaces.

2850. W. Clark, *Chancery-lane, London*, "*The application of electricity in refining cast iron, for the purpose of converting it into wrought iron or steel.*"—*A communication.*—*Dated 13th November*, 1861.

In some cases, as in chemistry, when certain bodies are brought in presence of each other, and their temperature is but slightly elevated, no change will result from the juxtaposition; but if, on the contrary, the temperature be raised to any extent, the bodies will become decomposed, or combine with more or less rapidity; while, by the intervention of electricity, in the majority of instances, these results will be produced instantaneously. Thence arises the question why has not electricity been employed in metallurgical operations for producing certain reactions? Take, for example, cast iron in a fusible state, and in it will be found all the conditions suitable for the employment of electricity; thus there is the principal element iron, which possesses great power of conduction; next the charcoal raised to white heat, and, consequently, having very considerable conducting power; lastly, there is the raw metal in a fluid state, in which its molecular mobility is as great as possible. It is only necessary to subject this bath to the action of a pile, when the refining process may be quickly effected, especially if, at the same time, a reactive agent be employed capable of removing the carbon, silicum, and other substances which injure the quality of the iron.

2859. F. Coney, *Waterloo-road, Southwark*, "*An improved stock for brooms.*" *Dated 13th November*, 1861.

The object of this invention is to obtain the equivalent of two separate brooms upon one stock or handle; and the invention consists in forming the stock with a head and two sides, as hereafter explained. A hole is made in the stock for the reception of the stock or handle; the two sides are continued down at angles, approach or meet at the bottom of the broom, and carry bass, hair, or other fibre; one side may be filled with bass and the other with hair, or they may both be filled with similar or different materials suitable for brooms.

2860. R. A. Brooman, *Fleet-street, London*, "*Albums for containing photographic and other pictures.*"—*A communication.*—*Dated 13th November*, 1861.

This invention cannot be described without reference to the drawings.

2861. H. Bird, *Liverpool*, "*Improvements in the construction of bottles and other vessels, and in stoppers for the same, to indicate that they contain poison.*"—*Dated 13th November*, 1861.

The object of this invention is to prevent the accidental use, or inadvertent withdrawal, of poison contained in bottles or other vessels to which the invention is applied, and the invention consists in forming on or applying to the tops of corks or other stoppers a number of horizontal short points, radiating from, and beyond the upper edge of, the cork or other stopper, so that the cork or other stopper cannot be casually withdrawn from the bottle or other vessel in which it is fixed by hand, without the operator feeling one or more of the sharp points. The top of the cork or other stopper may consist of a device resembling a star, or other radiating pointed figure (the points of which project beyond the body of the stopper), and may be marked poison. And in constructing bottles and other vessels for containing poison, having on their external surface a number of sharp angular points so placed that the bottle or other vessel to which they are applied cannot be casually grasped by the hand without the hand being brought into contact with one or more of the points, and, in some cases, as an additional security, the patentee prefers to surround the outer edge of the mouth of the vessel with a row or rows of angular pointed projections.

2862. A. E. Carter, *Kensington, and* T. Hack, *Hammersmith*, "*Screw-cocks.*" —*Dated 13th November*, 1861.

In screw cocks where the valve is actuated by a screw, the stem of which passes through a stuffing box, it becomes necessary from time to time to renew the packing of the stuffing box, and this at present can only be done when the pressure of the water or other fluid is removed from the cock, as otherwise the water or fluid would escape around the stem of the screw, and in practice it is frequently very inconvenient to relieve the valve of the pressure of the water or fluid for this purpose. To avoid this inconvenience the patentees form a water-tight joint between the upper surface of the thrust collar on the stem of the screw and the under side of the cover of the valve box, so that, when the valve is shut down, and the upper surface of the thrust collar pressed strongly against the under surface of the cover, the escape of water or fluid around the stem of the screw is prevented, even when the packing is removed; and as the water-tight joint, in order to be of any service, must be so constructed as to shut closely, not only when first made, but even after the parts have been long exposed to the corrosive action of the water or fluid, they let a ring of brass or other suitable metal into the cover of the valve box, around the hole, for the passage of the stem of the screw, and turn the same, by preference, concave. The thrust collar on the screw (which is preferred to be of brass) is turned convex on its upper surface, and it is ground into the ring let into the cover, as is ordinarily the practice in making valve joints. By this arrangement it is obvious that the packing may be removed whilst the valve is still exposed to the pressure of the water or fluid, it being necessary only to shut the valve closely.

2865. H. R. Fricker, *Whitechapel, and* J. Manley, *Truro*, "*Apparatus for facilitating the cleansing of sewers and other watercourses or traps.*"—*Dated 13th November*, 1861.

This apparatus consists of a bar or axis of wood or iron, having thereon numerous tines or blades or stirrers, which are fixed round the circumference of the bar or axis in such a position as to stand in the plane of the thread of a screw, the bar forming the centre or shaft of such screw; thus placed the tines or blades or stirrers are actually detached portions of the thread of the screw. The two ends of the shaft or axis are furnished with swivels, and by the act of drawing or moving the shaft or axis longitudinally through water or mud such shaft or axis will revolve or rotate, together with the tines or blades or stirrers thereon, so as to agitate the mud and matters which are below the water, and beat up and intimately mix such mud and matters as are in the sewers, rivers, or other waterways or courses with the water.

2866. A. O. LIPSETT, *Manchester*, "*Heating or boiling fluids.*"—*Dated 14th November*, 1861.

This invention is carried into effect as follows:—The inventor employs a vessel of any desired dimensions, and formed of a conical shape, tapering smaller towards the bottom, at which part it is provided with a water-tight aperture employed for fitting the vessel upon a tube fixed to a circular concave saucer or plate, in such a manner that the bottom of the vessel does not touch the saucer, but allows it, as well as the conical surface of the vessel, to be exposed to the flame arising from the ignition of methylated spirit of wine or other suitable spirit placed in the saucer.—*Not proceeded with.*

2868. W. HEAP, *Ashton-under-Lyne*, "*Instrument for cutting pipes and bars of metal.*"—*Dated 14th November*, 1861.

This instrument consists of a frame with an opening in it through which the pipe or bar to be cut passes; the pipe or bar is held in the frame between rollers, and at one side of the frame is a screwed boss for the bush of the handle, which is made with a spindle acting on a sliding stud, to which one pair of the rollers is connected; and at the other side of the frame is the cutting tool, which is acted upon by the spindle of the other handle, the bush of which is also screwed on a boss. The instrument is turned round by the handles above referred to, in order to cause the cutter to act on the pipe or bar.—*Not proceeded with.*

2869. M. WIGZELL, *Strand, Topsham, Devonshire*, "*Machinery or apparatus to be used in moulding and casting twisted nails, spiral fluted nails, bolts, and screws.*"—*Dated 14th November*, 1861.

This invention relates to improvements in machinery or apparatus to be used in moulding and casting twisted nails, spiral fluted nails, sheathing nails of a spiral fluted form, and other similar driving articles, with or without a slot, hole, or projection on the head, and of a plane, fluted, grooved, ribbed, or indented section throughout or in part, and either parallel or tapered throughout or in part; also bolts, screws, and other articles to which it may be made applicable. The invention consists of a plate or plates fitted with any number of nuts, through which screws of the required pitch work; on the ends of the said screws are attached the screws or twisted form of nails forming the patterns of the articles to be made, which patterns, by being made to descend, screw themselves into the sand, or other material used instead of sand, and produce the required form or mould. The plate or frame containing the screws is made to rise or fall by a screw or lever, by hand or any known motive power, and this plate or frame, when raised, carries with it the screws and patterns of the nails or other articles to be made, and causes them to twist or unscrew themselves out of the mould, the nuts through which the screws work being fixed and arranged on a suitable framework or stand. The patentee sometimes uses a series of tooth wheels, worked by a rack or racks, for the purpose of twisting the patterns or twisted form of articles to be made in and out of the sand, or other material used instead of sand; and he attaches the said patterns to spindles which work through the said wheels, and are made to rise and fall by being attached to a plate which is worked up and down by a screw or lever. The flask or flasks containing the sand, or other material used, when placed under the machine, is or are made to rise or press against the lower plate of the machine, so as to be ready to receive the descending patterns of the nails, or other articles to be made, by means of a screw lever or comb, and to travel to and from the machine upon a movable truck or bed running on smooth or toothed wheels worked by a rack or other suitable means.

2870. R. HEATH, [*St. George's-place, Hyde Park Corner*, "*Umbrellas and parasols.*"—*Dated 14th November*, 1861.

For the purpose of this invention, in order to connect the ribs and stretchers of umbrellas and parasols together, an eye is attached to each of the ribs by brazing, soldering, or otherwise; this eye is made of bent wire or other suitable material, which, being bent or shaped into the proper form, is passed through the hole or holes at the end of a stretcher, and then fixed to a rib of an umbrella or parasol; or the material of which the eye is formed may be first passed through the hole or holes at the end of the stretcher before shaping it into an eye.

2872. R. WILSON, *Patricroft, near Manchester*, "*Steam hammers.*"—*Dated 5th November*, 1861.

This invention consists in an improved arrangement of valves and gearing for working steam hammers, by which the steam may be admitted both below and above the piston to which the hammer block or ram is connected, or only to the former when required. The improvements in valves for steam hammers and other steam engines consist in so constructing them that their area, and, consequently, the weight and power required for working them, are greatly reduced. In constructing slide valves according to these improvements the valve piece works between two faces, as is described in the specification of letters patent, granted to the present patentee on the 5th of September, 1856, No. 2,070, and the balance plate is provided with steam and exhaust ports of the same area as those in the opposite face, by which means the valve-piece can be reduced to half the usual size, the steam being admitted to the cylinder and exhausted from both sides of the valve simultaneously. In constructing cylindrical valves for steam hammers the case in which the valve works is provided with ports of an equal area on both sides, and the valve has segmental projections at one end, which projections, when the valve is turned partly round, cover the ports, and partially or entirely shut off the steam from one end of the cylinder. In applying the improved flat slide valves to steam hammers with self-acting motion the patentee uses two valves in separate steam chests, one valve to supply steam to the top and the other to the bottom of the piston, and the gearing is so arranged as to shut off the steam from the top valve when not required, and the steam is admitted to the top of the piston by increasing the length of the stroke. The velocity of steam hammers can thus be greatly accelerated and the force of the blow increased.

2872. G. HAWKSLEY, *Bromley-by-Bow*, "*Apparatus for sounding alarums and actuating ventilators.*"—*Dated 14th November*, 1861.

This invention has for its object improvements in apparatus for sounding alarums and actuating ventilators. For these purposes apparatus is combined, as hereafter described, in order that an alarum may be sounded or a ventilator opened when the temperature of a room or an apartment or other locality is increased beyond that at which the apparatus is set to go off. A strip of metal, which expands freely with heat (by preference of zinc), is attached at one end to a screw or other instrument which is capable of being moved or adjusted; the other end of this rod is attached to the shorter end of a lever mounted to a fixed centre, and to the longer end of which is attached one end of another expansive strip, and the other end of this second strip is attached to the shorter end of a second lever, which in turn has a third expansion strip attached to it, and so on, the number of strips employed depending on the degree of delicacy required in the instrument. The levers may be made of any suitable material, and their axes may be carried by wood or other material not largely acted on by heat. The last of the series of levers is connected with a spring or other suitable instrument which keeps the expansion strips at all times in a state of tension. The last of the series of levers carries the instrument which acts on the detent or stop of the sounding appparatus, or of the power apparatus for working the ventilator, and such last lever is made with a point which moves over or opposite a graduated scale, commencing at zero, and so divided that, if the lever by the screw or adjusting apparatus is moved to a particular degree or division on the index, the apparatus will go off when the heat rises to that extent above the temperature at which the thermometer stood at the time of setting the apparatus.—*Not proceeded with.*

2875. J. NIXON, *Cardiff*, "*Ventilating coal or other mines.*"—*Dated 15th November*, 1861.

This invention consists in the arrangement of rectilinear ventilating pistons in such a way that they can work in correspondingly formed air chambers in a horizontal manner. These pistons are supported on rollers or wheels which travel on a railway, tram road, or other metallic surface. The pistons are attached to the motive power by piston and connecting rods in the usual mode. The air chambers can be constructed of wood, iron, or masonry, or of each or all of them combined or conjointly. The pistons can be made air tight by leather or other packing, or by being sufficiently accurately fitted to the size of the air chambers as to render such packing unnecessary. These air chambers are fitted with intake and out stroke valves.

2876. J. SPRATT, *Camden Town*, "*Preparation of food for hogs, dogs, cats, &c.*"—*Dated 15th November*, 1861.

The apparatus the patentee uses for reducing the greaves or the baked food consists of circular saws placed on an axis in close proximity to each other, and all set at an angle to the axis, so as to present somewhat the form of a cylinder, but which is somewhat oval in its cross section by reason of the inclination of the saws; this cylinder is driven at a high velocity, and against the breast of the table on which the greaves or biscuit is pressed up against the cylinder, by which they are rapidly reduced. The patentee claims mixing and combining animal matters, such as greaves, dregs, or scraps, being the residue from boiling down animals or portions thereof, or of rough fat from tallow chandlers or fat melters, or of butchers' and other trimmings, with farinaceous matters, as described, for the purpose of feeding hogs, dogs, cats, and poultry.

2880. W. STAUFEN, *London-road, Southwark*, "*Brushes.*"—*Dated 15th November*, 1861.

This invention consists in the application to such manufacture of the vegetable fibres of the arenga saccherifera, which grows extensively in different parts of India. It is from the leaves that these fibres are obtained, and they are collected after the other portions of the leaves have become dry, and have more or less shelled off from the fibres, leaving the fibres for the most part separated from each other.—*Not proceeded with.*

2881. J. GRINT, *Gray's-inn-road, London*, "*Pegs, nails, or like fastenings for uniting the soles of boots, shoes, &c.*"—*Dated 16th November*, 1861.

This invention consists in making pegs or nails of wood, bone, or metal, or other suitable material, so that they will enter readily, having a sharp point, and, at the same time, will hold securely, being barbed near the point for that purpose. The head or after end is enlarged from the body of the peg in regular, tapered, or curved lines. By these means the peg or fastening cannot be readily withdrawn from the material in which it is inserted as the foundation, nor can the substance it attaches thereto be withdrawn over its head; a secure connection between the substances is thereby established.—*Not proceeded with.*

2883. J. C. GOODALL, *Great College-street, Camden Town, and* J. BEALE, *East Greenwich*, "*Machinery for folding envelopes.*"—*Dated 16th November*, 1861.

For the purposes of this invention a revolving disc or table is used, in which four recesses are formed, each of the size of an envelope, and each recess has four guides or pins at the four angles, to facilitate the reception and correct placing of the pieces of paper cut to the proper size and form for an envelope. This table or disc is caused to make one-fourth of a rotation at each action of the machine, and provision is made for correctly holding the table or disc after each partial revolution. The machinery is so arranged and combined that the apparatus for embossing the seal flap, for applying gum or cement to the other flaps, for creasing the paper, and for pressing down the flaps, are all carried, and are simultaneously caused to act by a lever, so that, at each action of that lever (when the machine is at work), there will be three pieces of paper simultaneously acted on, and a fourth will be fed into the machine; a completed envelope will also be delivered at each action of the machine, supposing properly cut pieces of paper be fed regularly into the machine. The apparatus for embossing, for gumming or cementing the flaps, for creasing the paper, and for folding down the flaps, are not separately new, but are similar to what have been before employed in envelope folding machines.

2885. E. D'ESTANQUE, *France*, "*Instrument for drawing teeth.*"—*Dated 16th November*, 1861.

This invention cannot be described without reference to the drawings.

2886. D. STEWART, *Newcastle-upon-Tyne*, "*Hydraulic cotton presses.*"—*Dated 16th November*, 1861.

This invention consists, First, in the combination and arrangement of a small steam engine and set of pumps in one with the press, which steam engine and pumps are adapted alone for the individual press with which they are combined, each press being so furnished and fitted, in contradistinction to the ordinary mode of working all the pumps for several presses, by one large separated and independent steam engine. For this purpose the patentee extends the sole or ground plate of the press—which is usually near the upper part of the hydraulic cylinder—and on such extension of the sole plate he erects a steam engine and set of pumps, the same framing answering for both. He uses a separate shaft to actuate the pumps, which is driven from the crank shaft of the engine by suitable spur gear; the pump rods are driven from such intermediate shaft by eccentrics thereon, or cranks all at work at the same time. The part of the press in which the cotton is pressed is arranged in the usual manner, and of which no description will be necessary. The pumps are of course placed in suitable connection with the hydraulic cylinder, and are all kept continuously in motion at one and the same time; but, in order to throw one or more of the pumps out of action, a lever is applied below the ball of the suction valve of each pump, which is simply lifted and held up, and thus suspends the operation of pumping. He further places these levers of all the pumps in communication with another lever, whereby they may be all actuated at once by one operation, and so throwing all the pumps out of action at the same time if desired. This additional lever, although acting on all the others, leaves them all at the same time free to be acted on separately by their individual levers, as may be required. Thus, the pumps, and therefore the press, are all perfectly under command while the engine continues in motion. A further improvement consists in the application of a receiver or accumulating vessel, into which the pumps throw the water and retain it under a pressure, while the ball of the cotton is being lashed or secured and removed from the press. The water so accumulated is allowed to pass into the hydraulic cylinder so soon as another quantity of cotton is ready to be pressed; the water so accumulated rapidly compresses the cotton in its loose state, and saves much time that would otherwise be occupied by the pumps in effecting a similar lift and compression. He applies an air vessel and suitable safety valve to the water accumulator or receiver, in order to keep it under an elastic pressure. He prefers to drive the several engines by steam from one boiler, but a separate boiler may be used for each engine and press if desired.

2888. J. ELSE *and* T. GODFREY, *Mansfield, near Nottingham*, "*Washing apparatus.*"—*Dated 16th November*, 1861.

This improved apparatus consists of an oblong frame (of wood, or other suitable material), the bottom whereof is open, and the lower ends of the sides of the frame are either straight or inclined inwards, the inclination being such that the frame will be firmly on the bottom and sides of a puncheon or washing tub or vessel. On the sides of the frame, inside thereof, are two grooves, which receive the edges of a sheet of zinc, or other suitable metal, which is corrugated in the direction of its width, having corrugations either of an uniform character, or varying in their width or depth. The corrugated sheet is somewhat raised in the centre, and lies on a strip of wood or other material which is placed centrally between the sides of the frame, and stands a little higher than the slots in the sides of the frame; the ends of the strip rest upon two pieces of wood or other material stretching from side to side of the frame. From a little below the top piece, and at a short distance from the back thereof, is a piece of wood or other material which extends to the top of the frame, and connects the top end and sides together, and also forms a surface for the water to run down when the apparatus is in use. The apparatus may be used as follows:—It may be placed in a tub or other suitable vessel with the corrugated plate upwards; the clothes or other articles to be washed are lifted out of the water, a portion at once, in the usual way, and are pressed and rubbed up and down the corrugations until they are sufficiently cleansed; the water which is forced out during the operation flows above the plate or sheet of metal, and runs into the tub or other vessel again.

2898. G. P. BONNETON *and* M. G. PRODON, *Thiers, France*, "*Apparatus for rolling metals.*"—*Dated 18th November*, 1861.

This invention relates to a combination of means by which facility is obtained for the production of various forms in relief. For this purpose the patentees form the extended figures or forms on the surface of rings which are applied to an axle, so as to be held thereon by screw nuts, aided by grooves and keys or ribs. For change of pattern or figure it will only be necessary to remove one pair of rings, or one of each, and replace them by others. The metal to have form or figure given to it is conducted correctly to its position on the surface of the rollers by guides which are capable of adjustment. The bearings of the upper rolls are supported or operated by screws geared so as to be operated together, and thereby to insure uniformity of pressure, with capability of variation of pressure, if desired, during the progress of the work. These means are particularly applicable to various articles of cutlery.

2901. L. *and* M. SMITH, *Haywood*, "*Raising liquids.*"—*Dated 19th November*, 1861.

This invention consists in forcing air into the cask or other vessel containing the liquid to be raised, which air displaces the liquid and occupies the space. In beer or other fermented or distilled liquids this mode of raising them will be found very advantageous, as the compressed air forced into the cask prevents the evaporation of the liquid. The patentees prefer to employ an air chamber into which the air is forced by an ordinary air pump, or by a pump provided with one of these improved pistons, consisting of a thin metal dished block and a lining of vulcanised india-rubber or other suitable material. The end of the pipe communicating from the air vessel to the cask is covered with a piece of vulcanised india-rubber, or other suitable elastic material, which covers the hole in the pipe, thus forming a stop valve, to prevent any escape from the vessel containing the liquid to the air vessel, or to the air pump, but which allows the air to enter the vessel containing the liquid. This valve may also be used as a vent plug for beer and other barrels, to admit air when the beer or other liquid is being drawn off. In pumping water from mines a continuous flow is obtained by the use of two pipes communicating from the air vessel to the chambers in which the water is collected; these pipes and chambers are provided with taps and valves, which are opened or open themselves alternately. That part of the invention which relates to improving the quality of fermented liquors consists in collecting the gases evolved by the fermented liquors, and in forcing these gases again into the vessel containing the liquors, from which they had escaped. These gases may either be forced into the vessel in combination with the compressed air employed for raising the liquids, or alone.

2902. J. HEMINGWAY, *York*, "*Apparatus to be used in the working, 'winning,' or mining of coal, clay, shale, &c.*"—*Dated 19th November*, 1861.

This invention consists, First, of a frame in which is or are mounted a revolving circular saw or saws, or cutters, or a revolving wheel or wheels, or disc or discs, to which are attached saws or other cutters, either toothed or edged, and either separately or combined, as may be found most useful, which wheel or wheels, disc or discs, saws or cutters, are caused to revolve simultaneously, either by manual labour or by steam or other power. This machine may be arranged so as to make horizontal, perpendicular, or oblique cuttings, and is to be used for the purpose of cutting any square or other formed block of coal or other matter which it is desired to "win," or get so as to partially detach the same from the general mass, and thus render its complete separation therefrom by the ordinary means much easier than heretofore.

2906. S. DEDE, *Paris*, "*Discolouring, purifying, and improving varnish, oil, resin, gum, ether, wines, spirits, &c.*"—*Dated 19th November*, 1861.

The inventor proposes to discolour, or take away colour from, and to purify or improve oils, gums, resins, ethers, wines, brandy, vinegar, alcohol, essences, and other matters, by the application of compressed air, such application being modified according to the nature of the matter or liquid under treatment, and the result desired.—*Not proceeded with.*

2907. B. D. GODFREY, *Melford, Massachusetts, U.S.*, "*An improved boot or shoe with a wooden shank part and a flexible fore part to the sole.*"—*Dated 19th November*, 1861.

This invention consists in making the shank or rear part of the sole, which does not require to bend, of wood, and the front part of the sole of a more flexible material, as vulcanised india-rubber or leather.

2909. J. SCHLOSS, *Cannon-street, London*, "*Pouches.*"—*Dated 19th November*, 1861.

This invention consists in cementing, or otherwise securing, inside of ordinary flap pouches, one or more division pieces, with or without a flap or flaps. If only one division piece with a flap is used the patentee cements the bottom and side edges to the inside of the pouch, and leaves the flap free. The tobacco, or other material to be contained in the pouch, is inserted between the back of the pouch and the division piece; the flap of the division piece is turned over the tobacco towards the back of the pouch, and the flap of the pouch is brought over the flap of the division piece and tucked in between the division piece and the front of the pouch.

2910. F. L. STOTT *and* M. TOMLINSON, *Rochdale*, "*Vessels or apparatus for supplying lubricating matter to machinery.*"—*Dated 19th November*, 1861.

This invention consists in combining a glass vessel or cistern for containing the oil or other lubricating matter with a tube of metal, or other suitable material, or a tube partly of metal and partly of glass, this tube ascending from the bottom of the interior of the vessel or cistern to nearly the top of it, and being also continued below the bottom for a short length, so as to conduct the lubricating matter delivered by the wick (which descends the tube) to the orifice or communication leading to the journal or other mechanism to be lubricated.—*Not proceeded with.*

2912. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Apparatus for cutting irregular and other curvilinear forms in wood, &c.*"—*A communication.*—*Dated 20th November*, 1861.

According to the First part of this invention it is proposed to combine with a table or other equivalent means for rotating the frame to be cut, a pattern of the general form of the frame to be produced, and two rotating shafts, each carrying a suitable tracer and cutters. One of these shafts is made self-adapting to the other by a lateral sliding motion, while the other shaft is, by a similar contrivance, made self-adapting to the inner periphery of the pattern, so that the cutters which, by their form and rotation, produce the required mouldings, shall be guided in the required track to cut the general form of the frame to be produced. The Second part of this invention consists in the combination with a pattern and tracer, or equivalent mechanism for determining the oval or other curvilinear form to be given to a frame, of two sets of cutters, carried by parallel shafts, and so mounted that the distance between the two shafts shall be self-adapting by a lateral sliding motion of the shafts, the cutters being forced up to the work by a weight or equivalent yielding pressure, whether one or both of the said shafts be so mounted. The Third part of this invention consists in arranging two parallel cutter shafts relatively to the table which carries the rough frame or plank in a plane at right angles to the axis of the cutter shafts, so that the cutter shafts shall be on the opposite sides of the axis of such frame, one of the shafts being outside, and the other inside, the frame, so that, by a lateral movement in one direction, both sets of cutters shall be made to act, and by a movement in the reverse direction they shall be relieved from action, whereby the entire surface of a frame can be cut at one operation without any liability to the cutters interfering with each other.

2914. F. JOHNSON, *North-street, Westminster*, "*Ground or earth screws.*"—*Dated 20th November*, 1861.

This invention consists in making the periphery of the flange of the screw with a number of teeth, similar to a circular saw, and arranged so as to assist the pitch of the screw, thereby enabling it to cut its way into the ground with greater facility than those at present used with a plain unbroken flange; or the screw may be made by having only a portion of its periphery with teeth; and in this case a projection would be made at its cutting edge, so that the remainder of the screw, which is of a lesser diameter, would follow in the opening made by the said projection.

2915. J. C. CROXFORD, *Chapel-row, Exmouth-street, Clerkenwell, London*, "*Fastening doors.*"—*Dated 20th November*, 1861.

This invention consists in constructing a fastening for doors, drawers, windows, and other like purposes, in the following manner:—A segmental or straight bolt is worked by, or, if preferred, fixed to, the handle, on turning which the bolt is made to protrude and enter a groove or other similar provision made in the door jamb; one or more catches or tumblers fall by this movement, and prevent the return of the bolt; therefore, to unlock, it is necessary not only to lift the tumblers or catches, but at the same time to turn the handle. The patentee also makes a key way in the lock which, turns with the key, so that, on any attempt being made to introduce a pick, the key way closes itself, and leaves but a very small passage to introduce anything further.

2917. F. PULS, *Hackney Wick*, "*Treating fatty or oily matters.*"—*Dated 20th November*, 1861.

This invention consists in subjecting fatty or oily matters to the action of an oxidising agent. The oxidising agent which the inventor employs consists of oxygen gas rendered more active as an oxidising agent by the means described in the specification of a patent, No. 1207, bearing date the 13th day of May, 1861.—*Not proceeded with.*

2919. E. PEYTON *and* F. BATHO, *Birmingham*, "*Improvements in the moulds or chills employed in casting corner blocks, dovetailed grooves, and other parts of metal bedsteads and other like articles, frames for carrying such moulds, and in tubes for the pillars of bedsteads and other like articles.*"—*Dated 20th November*, 1861.

This invention consists in constructing the moulds or chills in manner hereafter explained. The moulds are composed, by preference, of two principal parts or boxes, each of which will lift away from each other after the casting is completed. In the following description one part or box is first described and then the other, supposing only two parts to be used. The First part consists of two cheeks of iron, between which is inserted, what the patentees term a bed, equal to the length or thickness of the intended dovetail grooves; the cheeks and bed are bolted together. Upon the bed a chill or metal mould, containing the counterparts of the two dovetail grooves and of the inner side of the pillar block is inserted, and this chill or mould is also equal in length or thickness to that of the intended block and dovetail grooves; an aperture is made in the cheeks of the box for the pillar, on which the casting is to be effected to pass through. The Second main part or box consists also of two cheeks, between which a metal chill or mould is fixed, which chill or mould, when the two boxes are placed together, completes the pattern or shape of the corner block to be cast. Apertures are formed in the checks of the second part, which correspond with those in the cheeks of the first, for the reception of the pillar on which the casting is to be effected. When any raised pattern or device is to be cast on the outer part of the blocks which will not allow of the casting leaving the moulds, then the chills must be formed in pieces, and loose pieces may be added which will come away with the casting, and drop off or be readily removed. The grate for pouring in the metal is formed in the thickness of one of the cheeks in each of the boxes or main parts. Although the two boxes have been described as being formed of three pieces, yet they may be formed in one piece. The moulds or chills for casting on other parts to the pillars are formed similarly to those described, only the internal chill or mould must be varied according to the form required to be produced. Again, instead of the internal mould or chill for the dovetails and inner side of the pillar block being only equal in length or depth to that of the intended dovetails and blocks, the chill may be made to pass through the checks of the box, and may be composed of one, two, or more pieces. In casting large corner blocks, in order to obtain lightness and ornament, the patentees sometimes use sand or loam cores in connection with the chills, and run the sand out or not after the casting is completed through the centre of the pillar or otherwise. The frame for carrying the chills is constructed of a cast iron planed bed, into which the chills are bolted, supported horizontally by two standards held together by stretchers; there are journals at the end of the planed bed working into suitable bearings in the standards, so that the bed is free to revolve and carry the chills into the most convenient position for pouring. The bed may be made double to carry two sets of chills. The above frame, with the addition of suitable slides to carry the necessary chills in the case of French ends, is applicable for casting stump and French ends complete. In casting dovetails on to the sides and ends of bedsteads, they use chills or boxes open at top and bottom, which are placed on the frame before described, and by means of it can be turned into such a position as will bring the grate on the under side, and thereby do away with grinding. The invention further consists in forming the pillars for bedsteads and other like articles at those parts where the corner blocks and dovetails or other projections are to be applied, of increased diameter to that of the other parts of the pillar.

2920. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Treatment of zinc ores.*"—*A communication.*—*Dated 20th November*, 1861.

This invention relates more particularly to the treatment of ores of zinc, in order to obtain metallic zinc or the oxide of zinc therefrom, and is also applicable to the treatment of phosphates or phosphatic minerals, in order to obtain phosphorus therefrom. According to this invention it is proposed, with a view to the attainment of metallic zinc or oxide of zinc, to subject the ores to be treated, in combination with the proper fluxes, to an elevated temperature in a suitable oven or reverberatory furnace, before introducing such ores and fluxes into the blast furnace, which it is proposed to employ for the reduction and distillation of the ore of zinc, in lieu of introducing the charges in a cold state. The oven or reverberatory furnaces employed in the preparatory heating of the ores and fluxes are also intended to be used for heating the coke to be supplied to the blast furnace, special ovens or furnaces being used for that purpose. They are made with two tiers or sets of floors one above another, and the materials to be heated are first laid upon the upper floor and gradually raked down through a vertical opening on to the lower and more highly heated floor, whence they are finally introduced into the blast furnace.

2921. T. COWBURN, *Manchester*, "*Apparatus for elevating boiling soap, and for dividing the same into bars when congealed.*"—*Dated 21st November*, 1861.

This invention consists in elevating boiling soap from the vessel in which it has been boiled to the required level by means of an endless chain of buckets passing over two pulleys, one of which is placed in the vessel containing the boiling soap, and the other being supported at the proper level

in a frame by two or more pipes which are screwed together in the ordinary manner of connecting gas pipes. The endless chain is made of links of hoop iron, bent in a mould of the shape of the link required. The pulleys over which the chain passes have projecting studs set to the pitch of the chain and resting on the links. The frame is mounted on wheels with uprights to which the cutting wires are attached at intervals, according to the thickness of the bars required; by moving the frame to and fro, the wires are made to cut the mass of slabs of soap to the thickness of the bars.—*Not proceeded with.*

2924. G. H. Polvelank, *Gracechurch-street, London.* "*Protecting and preserving photographic and other prints, water colour drawings, &c.*"—*Dated 21st November*, 1861.

This invention consists in coating the work of art to be protected and preserved with paraffin made fluid by heat.—*Not proceeded with.*

2926. J. Stubbs, *Winsford, Chester.* "*Apparatus for heating and evaporating brine.*"—*Dated 21st November*, 1861.

This invention consists in arrangements of apparatus whereby the brine to be evaporated is supplied to the pan at an elevated temperature, and consists in the employment for that purpose of a large shallow wrought iron evaporating pan, as ordinarily used, heated by a suitable fire-place or fire-places, situate at one end of the pan, and within these fire-places and flues is placed a number of iron tubes in connection with the evaporating pan, so that the brine liquor may be heated as it passes through them on its way to the pan, in lieu of being supplied at the ordinary temperature.—*Not proceeded with.*

2930. W. Hirst, *Halifax*, "*Paste.*"—*Dated 22nd November*, 1861.

This invention consists in dispensing with the use of wheat flour, and employing in lieu thereof a combination of rice flour and barytes, or pea meal and barytes, or bean meal and barytes will answer for the purposes of pasting.—*Not proceeded with.*

2934. G. J. Farmer, *Birmingham*, "*Apparatus for polishing shoe heels, toe plates, &c.*"—*Dated 22nd November*, 1861.

The inventor constructs a suitable frame of wood or iron, at the upper part of which a polishing bob or wheel is mounted in suitable bearings (capable of adjustment), the surface of the bob being dressed or prepared with glue and emery, or other materials of cutting quality, as is well understood. Motion is communicated to the polishing bob in any convenient manner so as to cause it to rotate at a high velocity. Below the polishing bob a strong endless leather or other band is caused to travel slowly around pulleys supported in suitable bearings (also capable of adjustment) carried by part of the main framing. The shoe heels, toe plates, or other articles to be polished, are held upon the surfaces of the endless band while passing under the bob to be polished by small pieces of metal rivetted or otherwise fastened to the surface of the band; or the articles may be attached to the band whilst being polished in any other convenient manner.—*Not proceeded with.*

2935. T. W. Davenport *and* S. Cole, *Balsall Heath, Worcester*, "*Compositions to be used in making buttons, beads, miniature and picture frames, and other articles susceptible of being moulded in a plastic material.*"—*Dated 22nd November*, 1861.

In carrying out this invention the patentees take paper or papier mache, or dried paper pulp, and reduce it to fine powder. This powder is then to be mixed with some or all of the following ingredients:—glue, paste, gas tar, black tar, varnish, copal varnishes, resin, and gold size, and a small quantity of oil. The powder with glue and paste alone answers for some uses; for others, such for instance as bead making, it requires strengthening, consequently they introduce gas tar or varnish, and other vegetable fibre, such as paper reduced to pulp, india rubber or gutta-percha in small quantities. These would be applicable when a dark coloured composition is required, but when they want a light colour, they employ copal varnishes, gold size, or some vehicle more nearly colourless than the tar varnish, using with them any suitable colouring agent they may find best. They prefer to make the powder from waste papier mache, such as broken trays; for these having already undergone a process of manufacture by which they become to a certain extent impregnated with oil and tar spirit, the powder is much stronger. Where great strength is not requisite, or where the bulky nature of the article may admit of more substance being employed, they use a quantity of common sawdust, mixed with some or all of the above-named ingredients. Gold size and whitening forms another excellent composition for some works.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

Preliminary Meeting Next Week—Present Demand for Iron: *Growing Inquiry*—The Iron for the Achilles again Rejected: *None going from South Staffordshire*—Pig Iron: *Higher Rates Demanded*—Iron Stone Trade: *Stiffening Prices*—Coal Trade—General Manufacturing Trades: *Unaltered as a rule: The Russian Trade: Letter from St. Petersburg*—The Proposed Exhibition in Paris: *Will Birmingham and Wolverhampton show?*—Growing Trade with France.

The Preliminary Meeting of the iron trade will be held at the Stewpony next Thursday. Some little surprise was occasioned to the trade, early in the week, when they received the usual circular from the chairman of the association announcing that the meeting would be held yesterday (Thursday). This being a week earlier than usual, much speculation was being indulged in as to the cause of the alteration. On Wednesday morning, however, a second circular came to hand stating that it was by mistake that the meeting was called for the 19th, and that it would be held, as we have indicated, on the 26th. It is not expected that it will be resolved to recommend any alteration in prices, inasmuch as masters continue to report favourably of the state of the iron trade of the district, as well in its finished as in its pig department. Orders continue to flow in from America in a steady though quiet stream, and these, added to the demand for India, for the Continent, for Canada, and the large home demand, have had the effect of producing the greatest activity in the plate and sheet mills of most works where such iron is manufactured. So great is the demand for these descriptions at some of the works, and so brief is the period allowed for the execution of the orders, that the difficulty which was last week experienced by some firms is now felt by a larger number of such concerns. They have to apply to neighbouring makers to assist them in rolling the stuff demanded. Seldom, however, have the applications proved successful; and in some cases, where the request has been complied with, the duty has not been carried out. Most of the firms are now working their plate and sheet mills full time. One-sixth more iron is probably now being produced in this district than a month ago; and the impression prevails that at the close of the month the demand will be larger. Already a disposition is being evinced by certain large buyers at home to "place" orders for delivery early next month, after midsummer stock-taking is completed. Prices for really good iron keep up: makers rarely find that they lose a valuable order by not reducing their rates. Masters on 'Change in Wolverhampton on Wednesday, and in Birmingham yesterday, were talkative upon the statement in "Military and Naval Intelligence" of the *Times* of the former date, that nearly 100 tons, chiefly of five-eight's plate iron, had been rejected at the Chatham Dockyard that had been delivered by the various contractors to be used in the construction of the Achilles. The frequent occasions upon which this vessel, in connection with the iron supplied to build her, has been before the public, makes the present announcement the more noteworthy. It has been before said on, at least, two or three occasions, that she was being delayed in consequence of the inability of the Government to procure iron for her of the required strength. But the last announcement before the one of Wednesday was to the effect that the Admiralty had made arrangements for a continued supply of excellent iron. That in consequence a large number of hands had been set on, and she would be got out of hand in the stipulated time. Now, however, we learn that the iron was delivered of a good quality only for a short time, and that it soon fell off. The report says:—"For some time the iron received at Chatham was of very superior quality, but lately it has proved rather inferior. In consequence considerable quantities have been rejected, by which the works have been greatly retarded. This will cause a serious delay in the construction of the ship, as only a very small number of platers are now employed, owing to the scarcity of good iron. There are rather less than 560 hands now employed on the Achilles, but at least double that number of workmen will be required to be placed on her, if she is to be completed by the time originally fixed by the Admiralty." Masters here are amused at the "difficulty" of the Admiralty. They can afford to be so, because no portion of the iron rejected, either now or at any former period, has been manufactured here. Whenever these reports appear, certain substantial firms in this district invariably advert to the commendation which their iron has received from Government officials when it has been examined in the yards of respectable contractors, who are always prepared to give a reasonable price for the commodity supplied to them.

Pig makers continue to demand an advance of half-a-crown a ton for iron, the produce of this district, and orders of considerable value, with cash terms offered on Wednesday in Wolverhampton, were refused.

Ironstone—both flats and balls—keep up in price; and very large sales could be effected if holders were not firm in demanding at least 9d. a ton more than buyers are willing to give. Thin lean descriptions are offered in large quantities and at tolerably low rates.

Coal is unaltered.

In the general hardware trades there is a total absence of animation. The foreign trade, however, keeps up; but in almost every part of the home market there is comparative deadness. Disappointment is being experienced in the demand from Russia and other northern ports, that was expected just at this period to prove of considerable value. This state of things cannot be surprising, however, to most persons who have watched the course of events in that part of Europe. On Tuesday afternoon, a merchant in Birmingham received a letter from an agent in St. Petersburg, dated 12th June, countermanding all goods about to be sent out because of the revolutionary spirit which is being displayed there. He says:—"At present all commerce is at a standstill." The fancy trades of Birmingham are all of them much depressed. In Wolverhampton the tin-plate workers in the commoner description of goods continue to make about five days a week; but for the better class and for japanned wares the demand has not improved. Locks continue in improved demand, both in that town and in Willenhall; but there is still much partially employed labour in the latter township. Around Dudley and the other parts of East Worcestershire there is much distress amongst the chain, nail, hinge, and vice makers. The edge tool makers are unimproved: but the railway spike and bolt makers are doing slightly more. The general hardware makers and japanners, with the factors, are divided in opinion as to the probable benefit to be derived by them in the event of the Exhibition proposed by the Emperor of the French becoming an accomplished fact. There is but little doubt, however, that in the event of such being the case, most of the leading manufacturers in Birmingham and Wolverhampton will exhibit permanently. For our own part we are convinced that nearly all that is wanted to secure a much larger demand for British hardwares in France is a knowledge on the part of the French people of the precise character of the goods that we are prepared to supply. We are the more convinced of this from the information contained in the following paragraph.

The returns moved for by Mr. Peel, on Thursday, and which have since been printed, are further corroborative of the particulars which we have from time to time gathered from the monthly returns of the Board of Trade relative to the rapid growth of the trade between this country and France. It seems that the value of the exports from our shores to France from this country in the eight months from September, 1861, to April this year inclusive, increased from £6,017,018 to £13,796,269, as compared with the corresponding period of 1859-60. British produce and manufactures made £7,615,423 of the total, against £2,928,398 in the earlier period, and foreign and colonial merchandise £6,182,846, against £3,088,620. The increase was very gradual in the two former of the three periods selected for comparison, especially as regards British manufactures, the increase in which during the eight months of 1860-61, as compared with the corresponding period of the preceding year, was less than a third, while the exports of foreign and colonial goods doubled in value. During the eight months, ended April 30th, 1862, however, there was little increase under the latter head, while the exports of British manufactures doubled in value. The increase extends to nearly every article. Amongst the articles which stand out most prominently in this increase we note hardwares and cutlery, machinery, and iron, and zinc. The extent of the increase will be seen by the following estimated value of the specific manufactures mentioned. Hardwares and cutlery, £54,594 to £172,734; iron (wrought and unwrought), £239,015 to £739,515, and zinc (wrought and unwrought), £5,848 to £20,484.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

Northern Matters: *Strike of Puddlers at Messrs. Hawks, Crawshay, and Co.'s: Eden Valley Railway: River Tyne Commission*—San Paulo Railway: *Trial of a Manchester Locomotive*—State of Trade at Sheffield—Liverpool: *Mersey Docks and Harbour Board: Launch of an Iron Clipper*—Manchester, Sheffield, and Lincolnshire Railway.

We commence with the north. It appears that the puddlers of Messrs. Hawks, Crawshay, and Co. have lately been out on strike, but that they have agreed to accept the same rate of wages as that paid by other employers throughout the country. Before passing Shygarth Bridge, Temple Sowerby, on the Eden Valley Railway, which has just been opened for traffic, Captain Tyler, the Government Inspector, recommended that additional braces should be added to the structure for its security. The bridge is composed of four spans 105ft. from centre to centre, constructed of iron or lattice girders, 11ft. deep, and was contracted for by Messrs. Kennard and Co., of London, the masonry being erected by Messrs. Lawton. On examining the bridges and the whole of the works in general Captain Tyler expressed his entire satisfaction. At the monthly meeting of the River Tyne Commission, yesterday week, the Piers Committee reported that Mr. Lawton had attended before them, and promised to use every exertion to complete his contract within the shortest possible time. It was stated that the depth of water on the bar was much greater now than formerly. Mr. Ure, the engineer, said in little more than a month, about 60,000 tons of dredge had been raised from the bar. The depth of water was now 10ft., and he hoped in the course of two or three weeks to increase it to 12ft. Tenders are about to be accepted for the construction of two large dredgers instead of one, as first determined on.

Advices recently to hand from Brazil describe the first trial on the St. Paulo Railway of a locomotive recently manufactured by Messrs. Sharp, Stewart, and Co., of Manchester. A local journalist narrates the interesting event in the following happy terms:—"At two o'clock in the afternoon (to use the English phrase) 'steam was up,' and all was ready for a start, of which sufficient signs were given by the puffing and blowing of the monster inside his shed, like some wild beast about to make his exit from his den. The signal to move out having been given there immediately echoed over sea and mountain the well-known scream—all children begin life with screaming—and the little gentleman made his appearance. He was greeted by Mr. Sharp and his son, Mr. Paul Sharp, Messrs. Auberstin and Fox, and others, and immediately the christening took place. And what a christening it was! In the place of sympathising smiles, not unmixed with tears of joy, in the place of tender words and a few drops of consecrated water the unfeeling priest advanced—in the person of the superintendent, Mr. Auberstin—and swinging in the air a bottle of champagne which he was holding in his hand, he dashed it with violence against the 'innocent,' crying out at the same time with a loud voice 'Imperador!' The child survived the shock, and thus was christened, all around consenting to the proceeding with waving of hats and loud 'vivas.' The engine being then stopped Mr. Auberstin, the engineers, Messrs. Bolland, Swindells, Henderson, and Faloon, and Mr. Toobrey, immediately mounted on the front and sides, Mr. Fox, chief resident engineer, and Mr. P. W. Sharp, stood with the driver; and Mr. Sharp himself led the way with the wagons, followed by Dr. Cochrane and as many more as could find places. All was then put in movement, and the engine, whistling, puffing, and casting out water on all around, accomplished with complete success a run out of about a mile, and returned. It is to be observed that the laying of the rails was perfect, not the slightest jerk occurring in even this first essay."

There is not the slightest amelioration in the general trade of Sheffield, although hopes are entertained of an improvement in home business if the harvest turns out satisfactorily. In the meantime, with the exception of the demand for steel, and to some extent also for files and saws, there is not an average business doing in the country markets.

At the last weekly meeting of the Mersey Docks and Harbour Board the engineer was instructed to report as to what further accommodation he considered necessary to give every reasonable facility to the coal trade. A report was read from Mr. Gisborne to the effect that the Dee and Mersey telegraph cables had been repaired, and that the whole line was working satisfactorily. Messrs. Vernon and Son have just launched from their building yard, Brunswick Dock, the Cornwallis, a fine iron passenger-ship, intended to trade between London and Sydney. Subjoined are the dimensions of the vessel:—Length between perpendiculars, 205ft; breadth of beam, 34ft. 6in.; depth of hold, 23ft.; tonnage by old measurement, 1,166 77/94 tons; calculated register tonnage, 1,194. When launched she had about 60 tons of her cargo on board, consisting of iron work for the construction of bridges in Australia. The alacrity with which the Cornwallis has been built will be seen when we state that the Lord Lyndhurst was launched from the same ways so recently as the 30th of last November. Immediately after the launch the Cornwallis was towed into one of the graving-docks connected with the Queen's Dock to receive her topmasts, &c., she having been launched with her lower masts standing. She will be rigged with the patent galvanised charcoal wire rope of Mr. G. B. Richardson, manufactured at his steam-power works at Kirkdale.

The construction of the branch of the Manchester, Sheffield, and Lincolnshire Railway from Grimsby to Cleethorpes is progressing. The line is expected to be opened in August. In consequence of the advanced period of the session and the opposition encountered the bill for the amalgamation of the South Yorkshire and Manchester, Sheffield, and Lincolnshire companies has been withdrawn for the present. It will, however, be re-introduced at the earliest possible period.

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

	£ s. d.	Dis. p. ct.
IRON, English Bar and Bolt:—		
in London ..... prin	5 15 0	3
in Wales ..... "	5 0 0	"
in Liverpool ..... "	5 10 0	"
Staffordshire Bars .. "	7 0 0	1
Sheet, single "	8 10 0	"
Dbl. "	10 0 0	"
Hoop ..... "	8 0 0	"
Rod, round "	7 0 0	"
Nail Rod, sq. "	7 5 0	"
SHIPPING IRON { Staffordsh. Bars "	7 0 0	"
Sheet, Single "	8 15 0	"
Double "	10 5 0	"
Hoop ..... "	8 5 0	"
Rod, Round ..... "	7 10 0	"
Nail Rod, Square.. "	7 5 0	"
IRON, Rails, in Wales, cash "	5 10 0	nett
" " 6 months "	5 7 6	"
Old, to cut up "	0 0 0	"
Railway Chairs, in Wales "	4 0 0	"
" in Clyde "	3 15 0	"
Pig No. 1, in Clyde ... "	2 11 0	"
3-4ths No. 1 & 2-5ths } No. 3. ..... }	2 12 3	"
No. 1, in Wales..... "	3 10 0	"
No. 1, in Tyne and Tees "	2 12 0	"
Ditto, Forge ..... "	2 9 0	"
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom. }	3 10 0	"
Welsh Forge Pig (all Mine), at the Port .. }	3 5 0	"
Acadian Pig, Charcoal.. "	7 10 0	"
Scotch Pig, No. 1, in London ..... }	0 0 0	"

	£ s. d.	Dis. p. ct.
IRON, Swedish, Indian assortment..... } prin	11 5 0	2
Russian C C N D to arrive "	16 0 0	"
STEEL, Swedish Keg, bam. "	15 10 0	2½
Ditto, rolled..... "	15 0 0	"
Faggot..... "	17 0 0	"
SPELTER, on the spot .. "	17 10 0	nett
To arrive ..... "	18 0 0	"
Hard, remelted ..... "	17 0 0	"
ZINC, in sheets ..... "	24 0 0	"
COPPER, Tile, 14 to 23 lb. "	93 0 0	"
Tough Cake. ..... "	93 0 0	"
Sheathing and Bolts ..per lb.	0 0 10½	"
Sheet..... "	0 0 10½	"
Bottoms..... "	0 0 11	"
Old ..... "	0 0 9	"
Yellow Metal ..... "	0 0 9	"
Barra..... "	86 0 0	"
Russian..... do. .. "	0 0 0	"
LEAD, British Pig ..... "	21 5 0	"
Spanish ..... "	20 0 0	"
W. B. .. .. "	21 10 0	"
Sheet..... "	21 10 0	"
TIN, English Block, nom.. "	114 0 0	"
Bar "	115 0 0	"
Refined "	119 0 0	"
Foreign Banca ..... "	121 0 0	"
Straits . . . . . "	114 0 0	"
TIN PLATES, Char coal, IC..... } prbx	1 9 0	"
Ditto IX .... "	1 15 0	"
Coke, IC .... "	1 2 6	"
Ditto IX .... "	1 8 6	"
Do. at Newport, 1s per bx less	—	"
Do. at Liverpool, 6d. "	—	
CANADA, Plates.... per ton	12 0	
QUICKSILVER ..... prbt		

Rails.—The market is very much firmer this week, and most of the makers, being tolerably well off for orders, are asking higher rates.

Scotch Pig Iron has been very flat during the past week, and prices have declined from 53s. to 52s. 3d., at which the market closed in Glasgow for warrants.

Spelter continues dull.

Copper is also dull of sale.

Lead is firm at £21 5s. for best English pig, and £21 10s. for W.B. and sheet.

Tin.—Moderate demand for English, but purchasers of foreign are waiting the result of the Dutch sale on the 25th inst., consequently nothing has been done this week in Banca and Straits.

Tin Plates in fair request.

June 19th, 1862. Moate and Co., 65, Old Broad-street, E.C.

PRICES CURRENT OF TIMBER.

Per load—	1861. £ s.	1862. £ s.	1862. £ s.
Teak.....	15 10	17 0	15 0 16 0
Quebec, red pine ..	3 10	4 10	3 5 4 0
yellow pine..	3 0	4 0	3 0 3 15
St. John, N. B., yel.	5 0	5 10	5 0 5 10
Quebec, oak, white	5 0	5 10	5 0 5 10
birch	3 10	4 0	4 0 0 0
Memel..	0 0	0 0	0 0 0 0
elm	3 10	4 15	3 10 4 15
Dantzic, oak	3 10	6 0	3 10 6 0
fir.....	2 15	3 10	3 0 4 0
Memel, fir	3 10	4 0	3 10 4 0
Riga	2 5	3 10	3 10 3 15
Swedish	2 15	3 0	2 15 3 0
Masts, Queb. red pine	5 0	6 0	5 0 6 0
yl. pine	5 0	6 0	5 0 6 0
rd pine	0 0	0 0	0 0 0 0
Lathwood, Dantz. fm	6 0	6 10	6 0 7 0
St. Petersb.	5 0	8 10	9 0 9 10
Deals, per C., 12 ft. by 3 by 9 in.			
Quebec, wht spruce	12 0	18 0	15 0 19 0
St. John, wht spruce	13 0	16 0	16 0 17 10

Per load—	1861. £ s. £ s.	1862. £ s. £ s.
Yel. pine, per reduced C.		
Canada, 1st quality	17 0 18 10	17 10 19 0
2nd do ..	12 0 12 10	12 0 13 0
Archangel, yellow	13 0 13 10	14 0 15 0
St. Petersbg, yel.	13 0 13 10	13 10 13 10
Finland.....	9 0 10 0	9 10 10 10
Memel	10 0 15 0	10 0 15 0
Gothenburg, yel...	10 0 11 10	10 0 12 10
white	9 10 10 0	9 10 11 0
Gefle, yellow	10 0 11 0	11 0 12 10
Soderhamn	10 0 10 10	11 0 12 10
Christiania, per C		
12 ft by 3 by 9 in.....yellow	22 0 25 0	22 0 24 0
Deck plank, Dutch per 40 ft. 3 in.	0 14 1 4	0 14 1
Staves, per standard M		
Quebec, pipe	70 0 75 0	80 0 85 0
puncheon	16 0 18 0	16 0 18
Baltic, crown pine ...	160 0 170 0	170 0 180

SCOTCH PIG IRON REPORT.

		s.	d.	
No. 1	Gartsherrie	56	3	f.o.b Glasgow.
" 1	Coltness	55	6	do.
" 1	Calder	54	6	do
" 1	G.M.B.	52	0	do.
" 3	Do.	50	9	do.
M. Nos.	Do.	51	3	do.

WARRANTS.

			s.	d.	
3-5ths No. 1 and 2-5ths " 3 .. G.M.B.	Cash prompt	.. ..	52	3	per ton.
	1 mo. open	.. ..	52	6	do.
	2 mos. "	.. ..	52	9	do.
	3 " "	.. ..	53	0	do.

MANUFACTURED IRON.

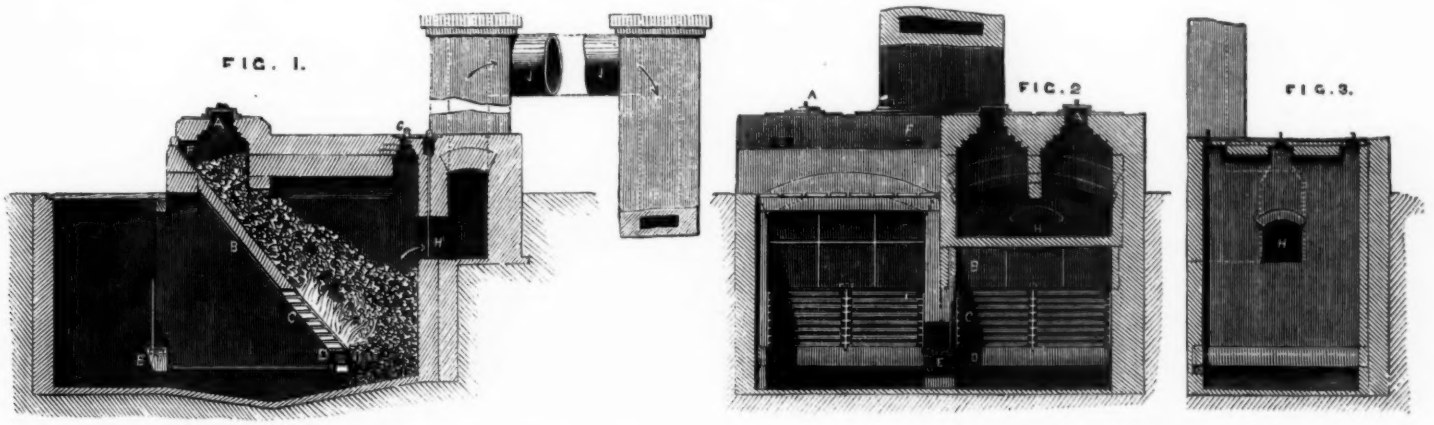
	£	s.	d.	
Bars, Govan	7	0	0	
" Common	6	10	0	
Drumpeller, Common	6	10	0	
Do. Best	7	10	0	
Cramond Scrap Bars Delivered in London	10	5	0	less 5 per cent.
Plates and Sheets	9	0	0	to £9 10s.
Rails	6	5	0	
Pipes	4	17	6	
Chairs	3	15	0	

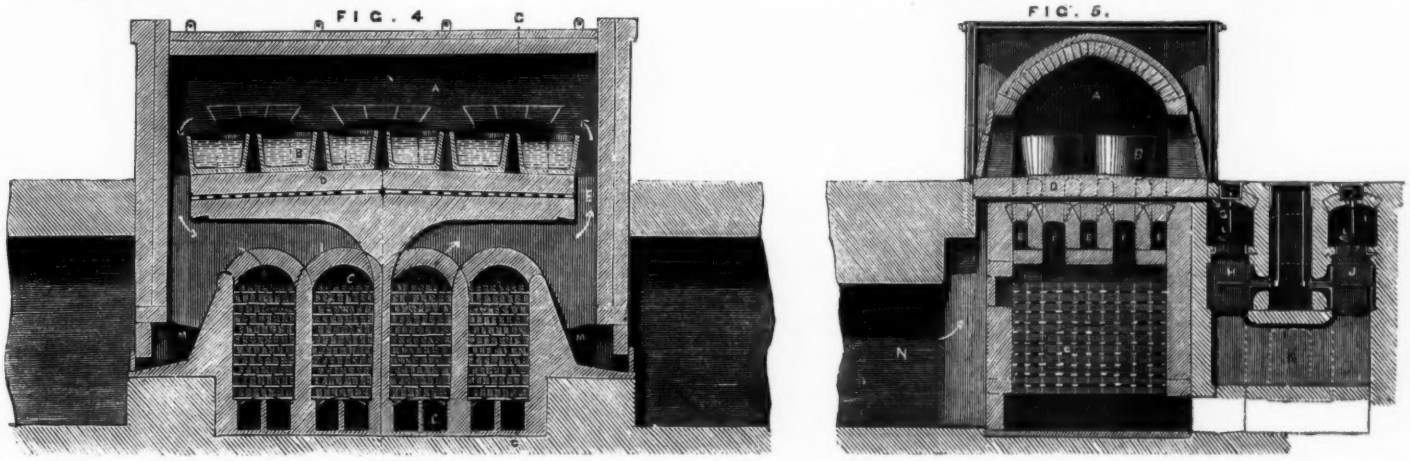
Glasgow, 18th June, 1862.

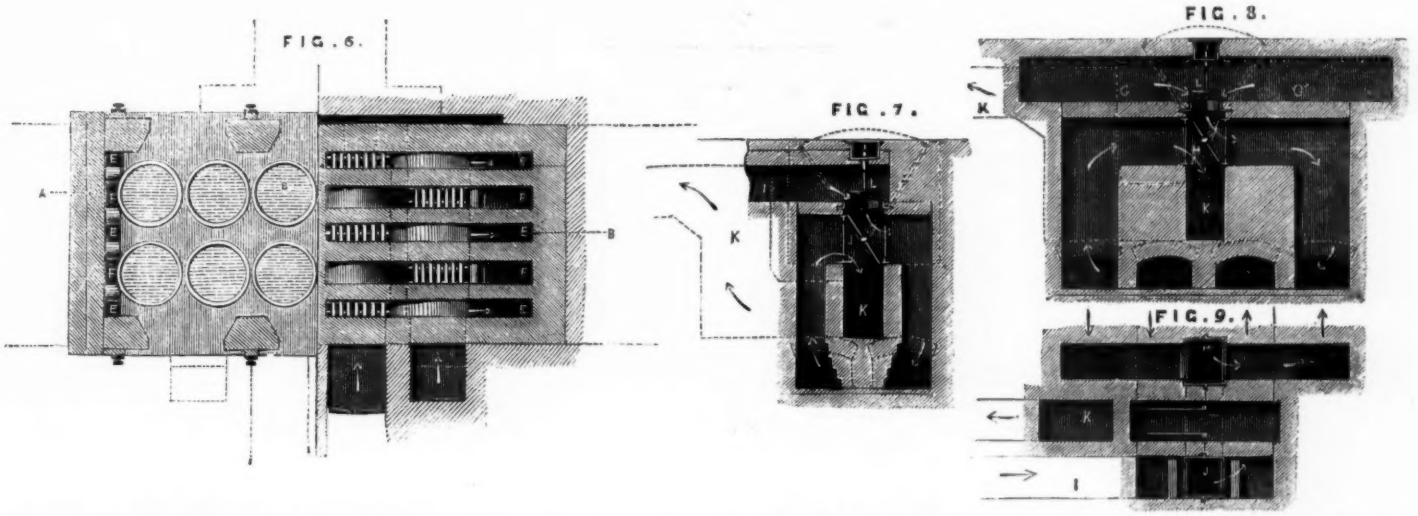
The market for Scotch pig iron has been declining these few days past. The demand has been exceedingly limited, and to induce buyers the makers have been reducing their prices. The aspect of the trade is still disquieting, and lower prices will yet be taken.

Exports last week were only 8,695 tons, against 14,709 tons in the same week last year. Shaw, Thomas, and Moore, Metal Brokers.

SIEMENS' REGENERATIVE FURNACES.







INSTITUTION OF MECHANICAL ENGINEERS.

Birmingham, January 30th, 1862.

ON A REGENERATIVE GAS FURNACE, AS APPLIED TO GLASS-HOUSES, PUDDLING, HEATING, &c.

By Mr. C. WILLIAM SIEMENS, of London.

THE arrangement of furnaces about to be described is applicable with the greatest advantage in cases where great heat has to be maintained: as in melting and refining glass, steel, and metallic ores, in puddling and welding iron, and in heating gas and zinc retorts, &c. The fuel employed, which may be of very inferior description, is separately converted into a crude gas, which in being conducted to the furnace has its naturally low heating power greatly increased by being heated to nearly the high temperature of the furnace itself, ranging to above 3,000 deg. Fah.; undergoing at the same time certain chemical changes whereby the heat developed in its subsequent combustion is increased. The heating effect produced is still further augmented by the air necessary for combustion being also heated separately to the same high degree of temperature, before mixing with the heated gas in the combustion chamber or furnace; and the latter is thus filled with a pure and gentle flame of equal intensity throughout the whole chamber. The heat imparted to the gas and air before mixing is obtained from the products of combustion, which after leaving the furnace are reduced to a temperature frequently not exceeding 250 deg. Fah. on reaching the chimney, whereby great economy in fuel is produced, with other advantages.

The transfer of heat from the products of combustion to the air and gas entering the furnace is effected by means of regenerators, the principle of which has been recognised to some extent since the early part of the present century, but has not hitherto been carried out in any useful application in the arts, unless the respirator invented by Dr. Jeffreys be so considered. The discovery of this principle is ascribed to Rev. Mr. Stirling of Dundee, who in conjunction with his brother James Stirling attempted as early as the year 1817 to apply it to the construction of a hot air engine: their engine did not, however, succeed, nor did Captain Ericsson's later attempts in the same direction lead to more satisfactory results. The economical principle of the regenerator having attracted the writer's attention in 1846, he constructed in the following year an engine in which superheated steam was used in conjunction with the regenerator: many practical difficulties, however, prevented a realisation of the success which theory and experiments appeared to promise; but it is gratifying to find that one principle then adopted, that of superheating the steam, has since received the sanction of an extended application.

The employment of regenerators for getting up a high degree of heat in furnaces was suggested in 1857 by the writer's brother, Mr. Frederick Siemens, and has since been worked out by them conjointly through the several stages of progressive improvement. The results obtained by the earlier applications of the principle were communicated by the writer in a paper read at a former meeting of this Institution (see Proceedings Inst. M.E., 1857, page 103): and two or three of the furnaces then described, employed for heating bars of steel, remain still in operation. In attempting, however, to apply the principle to puddling and other larger furnaces, serious practical difficulties arose, which for a considerable time frustrated all efforts: until by adopting the plan of volatilising the solid fuel in the first instance, and employing it entirely in a gaseous form for heating purposes, practical results were at length attained surpassing even the sanguine expectations previously formed.

In the early form of the regenerative heating furnace, which has been in continuous work during the last three years for heating bars of steel at Messrs. Marriott and Atkinson's Steel Works, Sheffield, and also at the Broughton Copper Works, Manchester, there is a single fire-place containing a ridge of fuel fed from the top; and two heating chambers, in which the bars of metal to be heated are laid, with a regenerator at the end of each chamber, by which the waste heat passing off from the furnace is intercepted on its way to the chimney, and transferred to the air entering the furnace. Each regenerator is composed of a mass of open fire-bricks, exposing a large surface for the absorption of heat, through which the products of combustion are made to pass from the furnace, and are thus gradually deprived of nearly all their heat previous to escaping into the chimney: the end of the regenerator nearest the furnace becomes gradually heated to nearly the temperature of the furnace itself, while the other end next the chimney remains comparatively cool. The direction of the draught being now reversed by means of a valve, the air entering the furnace is made to pass through the heated regenerator in the contrary direction, encountering first the cooler portions of the brickwork, and acquiring successive additions of heat in passing through the regenerator, until it issues into the first chamber of the furnace at a very high temperature, and traversing the ridge of fuel produces a flame which fills the second heating chamber; whence the products of combustion passing through the second cold regenerator deposit their heat successively in the inverse manner, reaching the chimney comparatively cool. By thus alternating the current through the two regenerators, a high degree of temperature is maintained constantly in the furnace. This arrangement of furnace is evidently applicable only in exceptional cases where two chambers are to be heated alternately, nor does it admit of being carried out upon a large scale.

In heating a single chamber the expedient was resorted to of providing two fire-places to be traversed in succession by the heated air, with the heating chamber placed between, as in the furnace shown in the drawings accompanying the previous paper (Proceedings Inst. M. E. 1857, Plate 118). Here the difficulty arose that the air, the oxygen of which was already combined with carbon (forming carbonic acid) in traversing the first fire-place, took up a second equivalent of carbon (forming carbonic oxide) in traversing the second, so that the fuel of the second fire was consumed to no purpose. In order to diminish this loss, and also avoid impairing the draught by a double resistance, the ridges of fuel were discontinued and the coal was fed into the furnace from the sides, resting on a solid hearth, to be there volatilised by the heated air passing over it. By frequently stirring the first fire its combustion was favoured until the current was reversed, when it was left undisturbed until the next change, and so on alternately. It was found very difficult, however, to maintain an active and uniform combustion and to burn the purely carbonaceous substance that was left in the fire-place after the gaseous portion of the fuel had been volatilised; and it had frequently to be raked out in order to make room for fresh gaseous fuel. This circumstance led to the first step towards the employment of fuel in the form of gas, by providing a small grate below the heap of fuel, through which a gentle current of air was allowed to enter, forming carbonic oxide, which afterwards further combined with oxygen on meeting with the hot current of air entering the furnace from the regenerator. The two fire-places of alternating activity were, however, attended with considerable practical inconvenience: the furnacemen in particular disliked the idea of attending two fire-places instead of one, and being little interested in the saving of fuel, took no pains to work the furnace in a satisfactory manner.

It therefore became necessary to devise a plan of heating a single chamber continuously by one fire-place, in combination with the alternate reversal of currents through the regenerators, but without reversing the direction of the flame. This was accomplished by means of double reversing valves, and was practically carried out in a puddling furnace that worked for a considerable length of time a the ironworks of Messrs. H. and W. Johnson near Manchester

The two regenerators were placed longitudinally side by side, with a flue between, underneath the puddling chamber, and the fire-place was put at one end of the puddling chamber, as in an ordinary puddling furnace, and fed with fuel from above. The heated air from the first regenerator was brought up at the back of the fire-place, and meeting there with the fuel produced the required flame in the puddling chamber; whence the products of combustion passed down at the end of the chamber, and were carried back along the flue below to the hot end of the second regenerator, through which they made their way to the chimney. For reversing the currents through the regenerators two valves were needed, connected by a lever, one at the hot end of the regenerators near the fire, and the other at the cool end next the chimney; whereby the heated air was made to enter the fire-place by the same passage as previously, and the direction of the flame through the puddling chamber was not changed. By this arrangement the regenerative furnace was assimilated as nearly as could be to an ordinary puddling furnace in form and mode of working. The few furnaces constructed in this manner produced a great heat with little more than one-half the consumption of fuel of ordinary furnaces in doing the same amount of work. A considerable saving of iron was also effected in puddling, owing to the absence of strong cutting draughts, a mild draught being found sufficient to produce the necessary heat. There still remained drawbacks, however, which prevented an extensive application of this form of furnace: the fire required frequent attention, and it was difficult to maintain a uniform volume of flame in the furnace; the reversing valve at the hot end of the regenerators was moreover liable to get out of order, and the furnace was costly in construction.

The most important step in the development of the regenerative furnace has been the complete separation of the fire-place or gas producer from the heating chamber or furnace itself. When a uniform and sufficient supply of combustible gas is insured, it can evidently be heated just like the air, by being passed through a separate regenerator before reaching the furnace, whereby its heating power is greatly increased. The difficulty of maintaining a uniform flame in the furnace is thereby certainly removed, and there is no longer any necessity for keeping the flame always in the same direction through the furnace, since the gas can be introduced with equal facility at each end of the heating chamber in turn, and the periodical change of direction of the flame through the furnace tends only to make the heat more uniform throughout, whereas in the previous plan of employing solid fuel for heating in the furnace, the relative position of the fire-place and heating chamber being fixed and unchangeable required the direction of the flame to be kept always the same, unaltered by the reversal of currents through the regenerators. The new plan of a separate gas producer has now been successfully carried out in practice, and there are already a considerable number of the regenerative gas furnaces in satisfactory operation in this country and on the Continent, applied to glass-houses, iron furnaces, &c. In the neighbourhood of Birmingham, at Messrs. Lloyd and Summerfield's Glassworks, a flint glass furnace constructed upon this plan has now been in continuous operation for nearly twelve months, and affords a good opportunity for ascertaining the consumption of fuel of the regenerative furnace as compared with the previous furnace performing the same work. At the glassworks of Messrs. Chance Brothers and Co., near Birmingham, the regenerative gas furnace has been under trial for the same length of time, and has latterly been adopted for the various purposes in crown and sheet glass making upon a very large scale. Messrs. James Russell and Sons, Crown Tube Works, Wednesbury, are also applying the furnace to the delicate operation of welding iron tubes, and, in a short time, will probably employ no solid fuel for any furnaces at their works. Another flint glass furnace erected by Messrs. Osler in Birmingham, and several puddling furnaces erected by Messrs. Gibbs Brothers at Deepfields, and by Mr. Richard Smith at the Round Oak Ironworks, are amongst the latest applications of the regenerative gas furnace, the designs having in all cases been furnished by the writer and carried out under his brother's immediate superintendence.

The gas producer is shown in Figs. 1, 2, and 3; Fig. 1 is a longitudinal section, Fig. 2 a front elevation and transverse section at the front, and Fig. 3 a transverse section at the back. The producers are entirely separate from the furnace where the heat is required, and are made sufficient in number and capacity to supply several furnaces. The fuel, which may be of the poorest description, such as slack, coke dust, lignite, or peat, is supplied at intervals of from six to eight hours through the covered holes A, Figs. 1 and 2, and descends gradually on the inclined plane B, which is set at an inclination of from 45 deg. to 60 deg. according to the nature of the fuel used. The upper portion of the incline B is made solid, being formed of iron plates covered with fire-brick; but the lower portion C is an open grate formed of horizontal flat steps. At the foot of the grate C is a covered water trough D, filled with water up to a constant level from the small feeding cistern E, supplied by a water pipe with a ball tap. The large opening under the water trough is convenient for drawing out clinkers, which generally collect at that point. The small stoppered holes F F at the front and G G at the top of the producer are provided to allow of putting in an iron bar occasionally to break up the mass of fuel and detach clinkers from the side walls. Each producer is made large enough to hold about ten tons of fuel in a low incandescent state, and is capable of converting about two tons of it daily into a combustible gas, which passes off through the opening H into the main gas flue leading to the furnaces.

The action of the gas producer in working is as follows:—The fuel descending slowly on the solid portion B of the inclined plane, Fig. 1, becomes heated and parts with its volatile constituents, the hydro-carbon gases, water, ammonia, and some carbonic acid, which are the same as would be evolved from it in a gas retort. There now remains from 60 to 70 per cent. of purely carbonaceous matter to be disposed of, which is accomplished by the slow current of air entering through the grate C, producing regular combustion immediately upon the grate; but the carbonic acid thereby produced, having to pass slowly on through a layer of incandescent fuel from three to four feet thick, takes up another equivalent of carbon, and the carbonic oxide thus formed passes off with the other combustible gases to the furnace. For every cubic foot of combustible carbonic oxide thus produced, taking the atmosphere to consist of one-fifth part by volume of oxygen and four-fifths of nitrogen, two cubic feet of incombustible nitrogen pass also through the grate, tending greatly to diminish the richness or heating power of the gas. Not all the carbonaceous portion of the fuel is, however, volatilised on such disadvantageous terms: for the water trough D at the foot of the grate, absorbing the spare heat from the fire, emits steam through the small holes I under the lid; and each cubic foot of steam in traversing the layer of from three to four feet of incandescent fuel is decomposed into a mixture consisting of one cubic foot of hydrogen and nearly an equal volume of carbonic oxide, with a variable small proportion of carbonic acid. Thus one cubic foot of steam yields as much inflammable gas as five cubic feet of atmospheric air; but the one operation is dependent upon the other, inasmuch as the passage of air through the fire is attended with the generation of heat, whereas the production of the water gases, as well as the evolution of the hydro-carbons, is carried on at the expense of heat. The generation of steam in the water trough being dependent on the amount of heat in the fire, regulates itself naturally to the requirements; and the total production of combustible gases varies with the admission of air. And since the admission of air into the grate depends in its turn upon the withdrawal of the gases evolved in the producer, the production of the gases is entirely regulated by the demand for them. The production of gas may even be arrested entirely for twelve hours without deranging the producer, which will begin work again as soon as the gas valve of the furnace is reopened; since the mass of fuel and brickwork retain sufficient heat to keep up a dull red heat in the producer during that interval. The gas is, however, of a more uniform quality when there is a continuous demand for it, and for this reason it is best to supply several furnaces from one set of producers, so as to keep the producers constantly at work. The opening H leading from each producer into the main gas flue can be closed by inserting a damper from above, as shown in Fig. 1, in case any one of the producers is required to be stopped for repairs or because part of the furnaces supplied are out of work.

It is important that the main gas flue leading to the furnaces should contain an excess of pressure, however slight above the atmosphere, in order to prevent any inward draughts of air through crevices, which would produce a partial combustion of the gas and diminish its heating power in the furnace, besides causing a deposit of soot in the flues. It is, therefore, necessary to deliver the gas into the furnace without depending upon a chimney draught for that purpose. This could easily be accomplished if the gas producers were placed at a lower level than the furnaces, but as that is generally impossible, the following plan has been adopted. The mixture of gases on leaving the producers has a temperature ranging between 300 deg. and 400 deg. Fah., which must, under all circumstances, be sacrificed, since it makes no difference to the result at what temperature the gas to be heated enters the regenerators, the final temperature being in all cases very nearly that of the heated chamber of the furnace, or say 2,500 deg. Fah. The initial heat of the gas is, therefore, made available for producing a plenum of pressure by making the gas rise about twenty feet above the producers, then carrying it horizontally twenty or thirty feet through the wrought iron tube J, Plate 1, and letting it again descend to the furnace, as shown by the arrows in Fig. 1. The horizontal tube J being exposed to the atmosphere causes the gas to lose from 100 deg. to 150 deg. of temperature, which increases its density from 15 to 20 per cent. and gives a preponderating weight to that extent to the descending column, urging it forwards into the furnace.

The application of the regenerative gas furnace as a plate glass melting furnace is shown in Figs. 4 to 7, which represent a melting furnace now in course of erection at the British Plate Glass Works near St. Helen's. This furnace does not differ materially from the regenerative gas furnaces previously erected and at work at Messrs. Chance's and Messrs. Lloyd and Summerfield's, but is selected in preference because it is the most improved in details of construction. Fig. 4 shows a longitudinal section of the furnace, Fig. 5 a transverse section, and Fig. 6 a sectional plan above and below the bed or "siege" as it is termed of the furnace. Figs. 7, 8, and 9 show the detail of the gas and air valves.

The heating chamber A of the furnace, Figs. 4 and 5, contains twelve glass pots B, which are got out through the side doors when the glass is ready for casting upon the moulding table. Underneath are placed transversely the four regenerators C C, composed of open fire-bricks built up on a grating, which are arched over at the top and support the bed or siege D of the furnace. The regenerators work in pairs, the two under the right hand end of the siege communicating with that end of the heating chamber, while the other two communicate with the opposite end, as shown in Fig. 4. The gas enters the chamber through the three passages E, Figs. 5 and 6, and the air through the two intermediate passages F, whereby they are kept entirely separate up to the moment of entering the furnace, but are then able immediately to mingle intimately, producing at once an intense and uniform flame in the heating chamber. The siege D is built of fire-brick, with a number of transverse channels, shown black in Figs. 4 and 8, through which the cold entering air is made to pass on its way into the air flue G, as shown by the arrows in Fig. 5; by this means the siege is kept comparatively cool, so that no fluid glass can pass through crevices into the regenerators. Any melted glass that may fall from the heating chamber through the apertures at the ends of the siege does not get into the regenerators, but falls into the pockets M, Fig. 4, whence it can be removed through the opening at the bottom. The passage N, Fig. 5, by which the air enters, affords the means of getting at the regenerators through an opening at the end of each.

From the air flue G, Fig. 8, the entering air is directed by the reversing valve H into the air regenerator, as shown by the arrows, and there becomes heated ready for entering the furnace; at the same time the gas entering from the gas flue I, Fig. 7, is directed by the reversing valve J into the gas regenerator, where it becomes heated to the same temperature as the air. Similarly the products of combustion on leaving the opposite end of the furnace pass down through the second pair of regenerators, as shown by the arrows in Fig. 4, and after being here deprived of their heat are directed by the reversing valves H and J into the chimney flue K. When the second pair of regenerators have become considerably heated by the passage of the hot products of combustion, and the first pair correspondingly cooled by the entering air and gas, the valves H and J are reversed by the hand levers, as shown dotted in Figs. 7 and 8, causing the currents to pass through the regenerators and the heating chamber in the contrary direction, whereby the hot pair of regenerators are now made use of for heating the gas and air entering the furnace, while the cool pair abstract the heat from the products of combustion escaping from the furnace. The supply of air and gas to the furnace is regulated by the adjustable stop valves L, whereby the nature and volume of the flame in the furnace may be varied at pleasure, whilst the chimney damper is used to regulate the amount of pressure in the furnace in relation to the atmosphere, so as to allow the opening of working holes.

The construction of furnace above described may be varied in many ways to suit local circumstances. The regenerators are in some instances not placed immediately under but at the side of the furnace; but it is important that they should always be placed at a lower level than the furnace, in order that the air and gas may rise naturally into the heating chamber, forming there a plenum of pressure.

Figs. 10, 11, and 12 show the application of the regenerative gas furnace as a round flint glass furnace. Figs. 10 and 11 show vertical sections of the furnace taken at right angles to each other, and Fig. 12 a sectional plan above and below the siege. The round form of furnace is found convenient in flint glass houses, affording the greatest amount of accommodation to the glass blowers. The four regenerators C are here arranged below the siege as before, and the air and gas from the hot regenerators enter the annular heating chamber A at one side of the furnace, as shown by the arrows in Fig. 10, and pass all round it, the products of combustion escaping at the opposite side into the cold regenerators. The direction of the current is reversed at intervals exactly as in the plate glass furnace already described, by means of the reversing valves H and J in the air and gas passages, Figs. 11 and 12. Furnaces of this construction have lately been got to work at Namur in Belgium and at Montluçon in France, and several others of the same description are in course of erection at the present time. The furnace just started by Messrs. Osler in Birmingham also partakes of this form, being made semi-circular.

In setting out each individual furnace, the heating effect required, the quality of the fuel employed, and the particular nature of the process to be performed, have to be considered. The amount of heat required determines the capacity of the regenerators; and the gas regenerators require fully as large a capacity as the air regenerators, and sometimes even a greater. This would perhaps hardly be expected, but will be seen to be the case from the following considerations. The gases proceeding from the gas producers are a mixture of olefiant gas, marsh gas, vapour of tar, water and ammoniacal compounds, hydrogen gas, and carbonic oxide; besides nitrogen, carbonic acid, some sulphuretted hydrogen, and some bisulphuret of carbon. The specific gravity of this mixture averages 0·78, that of air being 1·00; and a ton of fuel, not including the earthy remnants produces according to calculation nearly 64,000 cubic feet of gas. By heating these gases to 3,000 deg. Fah. their volume would be fully six times increased, but in reality a much larger increase of volume ensues, in consequence of some important chemical changes effected at the same time. The olefiant gas and tar vapour are well known to deposit carbon on being heated to redness, which is immediately taken up by the carbonic acid and vapour of water, the former being converted into carbonic oxide and the latter into carbonic oxide and pure hydrogen. The ammoniacal vapours and sulphuretted hydrogen are also decomposed, and permanently elastic gases with a preponderance of hydrogen are formed. The specific gravity of the mixture is reduced in consequence of these transformations to 0·70, showing an increase of volume from 64,000 to nearly 72,000 cubic feet per ton of fuel, taken at the same temperature. This chemical change represents a large absorption of heat from the regenerator, but the heat is given out again by combustion in the furnace, enhancing the heating power of the fuel beyond the increase due to elevation of temperature alone.

The chemical transformation is also of importance in preventing "sulphuring;" for it is believed that the sulphur in separating from its hydrogen takes up oxygen supplied by the carbonic acid and water, forming sulphurous acid, a firm compound, which is not decomposed on meeting with metallic oxides in the furnace. This view is so far borne out by experience that glass containing a moderate proportion of lead in its composition may be melted in open crucibles without injury, instead of requiring covered pots for the purpose as in ordinary furnaces. In dealing with the highest quality of flint glass, however, it is found necessary to retain covered pots; but every other description of glass is melted in open pots. In all branches of glass manufacture, saving of fuel is of relatively small moment as compared with the improvement effected in the colour and general quality of the glass by the use of the regenerative gas furnace, owing to the absence of dust and cinders and the higher degree of temperature which may with safety be maintained throughout the heating chamber.

These advantages of the regenerative gas furnace are of equal value in the case of puddling and welding iron. Figs. 13 to 18 represent a puddling furnace constructed on this plan. Fig. 13 is a longitudinal section of the furnace, Fig. 14 a sectional plan of the puddling chamber, and Fig. 15 a sectional plan of the regenerators; Fig. 16 is a transverse section at the end of the furnace, and Figs. 17 and 18 are vertical sections through the gas and air passages.

The four regenerators C are in this case arranged longitudinally underneath the puddling chamber A, which may be of the usual form. In order to complete the combustion of the gas and air in passing through the comparatively short length of the puddling chamber, it is necessary to mix them more intimately than is requisite in the large glass furnaces previously described. For this purpose a mixing chamber O, Fig. 13, is provided at each end of the puddling chamber, and the gas and air from the regenerators are made to enter the mixing chamber from opposite sides, as shown in Fig. 16; the gas aperture E is moreover placed several inches lower than the air aperture F, so that the lighter stream of gas rises through the stream of air while both are urged forward into the puddling chamber, and an intense and perfect combustion is produced. The mixing chambers O are sloped towards the furnace, as shown in Fig. 13, in order to drain them of any cinders which may get over the bridge. The reversal of the current through the furnace is effected about every hour by the reversing valves H and J in the air and gas flues, the arrangement of which is exactly similar to that already described in the glass furnace: the supply of gas and air is regulated by the throttle valves L, and the draught through the furnace by the ordinary chimney damper.

This same arrangement, with obvious modifications, may be applied also to blooming and heating furnaces, the advantages in both cases being a decided saving of iron, besides an important saving in the quantity and quality of the fuel employed. The space saved near the hammer and rolls by doing away with fire-places, separate chimney stacks, and stores of fuel, is also a considerable advantage in favour of the regenerative gas furnace in ironworks. The facility which it affords for either concentrating the heating effect or diffusing it equally over a long chamber, by effecting a more or less rapid mixture of the air and gas, renders the furnace particularly applicable for heating large and irregular forgings or long strips or tubes which have to be brought to a welding heat throughout. It has already been applied to a considerable extent in Germany for heating iron, having been worked out there under the direction of the writer's eldest brother, Dr. Werner Siemens, who has also contributed essentially to the development of the system. The furnaces at the extensive iron and engine works of M. Borsig, of Berlin, are being remodelled for the adoption of this system of heating, as have also been those at the imperial factories at Warsaw.

Another important application of the regenerative gas furnace is as a steel melting furnace, in which the highest degree of heat known in the arts is required, presenting consequently the greatest margin for saving of fuel. Figs. 19 to 21 represent a regenerative steel furnace which has been in satisfactory operation in Germany for a considerable length of time, being worked with lignite, a fuel little superior to peat in heating power. This application of the regenerative gas furnace is indeed rapidly extending in Germany, but has not yet practically succeeded in Sheffield where it was also tried; it is, however, in course of application at the Brades Steel Works, near Birmingham. Fig. 19 is a longitudinal section of the furnace, Fig. 20 a transverse section, and Fig. 21 a sectional plan.

The two pairs of regenerators C C, Figs. 19 and 21, are situated at the ends of the long melting chamber A, in which the steel melting pots B B, are arranged in a double row. The chamber is covered with iron cramped arch pieces P, any of which can be readily removed for getting at the pots. The arrangement of the reversing valves and the air and gas flues is similar to that in the glass furnace previously described.

Other applications of the regenerative gas furnace are being carried out at the present time; among which may be mentioned one to brick and pottery kilns for Mr. Humphrey Chamberlin near Southampton, for Messrs. Cliff, of Wortley, near Leeds, and for Mr. Cliff of the Imperial Potteries, Lambeth; also to the heating of gas retorts at the Paris General Gas Works, and at the Chartered Gas Co.'s Works, London. The description already given, however, is sufficient to show the facility with which this mode of heating may be adapted to the various circumstances under which furnaces are employed. The important application of the regenerative system to hot blast stoves for blast furnaces by Mr. E. A. Cowper has already been separately communicated to this Institution (see Proceedings Inst. M.E., 1860, page 54).

The experience hitherto obtained with the regenerative mode of heating shows that it is attended with the greatest proportionate advantage in localities where good coal is scarce but where an inferior fuel abounds. This applies most forcibly to the South Staffordshire district, where the best coal in lumps is worth 12s. 6d. per ton, whereas good slack can be had at 3s. or 4s. per ton. The question gains, moreover, in importance when it is considered that, according to the best authorities, the thick coal of the district is coming to an end, while million of tons of coal dust have accumulated, of no present commercial value, which on being converted into gas in the manner described by means of the gas producers would acquire a heating value equal at any rate to the same weight of the best coal in the manner in which it is at present used. Considering also the proximity of the pits to the ironworks in this district, it may be suggested whether the gas producers being of very simple construction might not with advantage be placed near the banks of fuel above or even under ground, the gas being conveyed to the works by a culvert so as to supersede carting of the fuel. Such an arrangement might notably contribute to perpetuate the high position which South Staffordshire has so long maintained as an iron producing district.

(To be continued next week.)

MESSRS. MERRYWEATHER AND SON'S new steam fire-engine, the Deluge, was again tried on Tuesday at the canal wharf, King's-cross. A 1⅝in. jet was thrown 190ft. horizontally.

COAL FOR THE FRENCH NAVY.—An elaborate report, which we have received on this subject, enables us to state that the French Imperial marine is now entirely supplied with French coal instead of English, which was almost, if not completely, exclusively used up to 1859. The consumption averages 170,000 tons per annum at present, and the determination to adopt French coals was only arrived at by the Ministry of Marine after long and careful experiments. It is asserted that it has been proved satisfactorily that some of the French basins yield quite as efficient steam coals as those previously obtained from Newcastle and Wales.

ROYAL INSTITUTION OF GREAT BRITAIN.

Friday, May 16, 1862.

Sir HENRY HOLLAND, Bart., Vice-President, in the Chair.

ON THE IRON WALLS OF OLD ENGLAND.

By JOHN SCOTT RUSSELL, Esq., F.R.S.

It was not the first time the speaker had been allowed the honour of expounding such truths as had been the object of his special study, but he had never treated on one of so great national importance. He was somewhat rash, perhaps, in accepting from the managers the title of this adress—rash because the subject was then in a state of transition. It was even worse now, for it had come to what geologists had called a "slip;" he might almost say he found himself at "fault." What he had to say now was as different as possible from what he should have said when he made the promise. Six or eight months ago he should have met here a formidable phalanx of adverseries—amongst them nearly all the naval officers—arrayed against him as the advocate of iron ships of war, and he should have had to argue every point as he proceeded. But unfortunately now we were all on one side; the pugilistic encounter which might then have entertained his audience could not come off. Twelve months ago he had written a pamphlet showing that the end of wooden men-of-war was at hand, and that it was a sin and a shame to send our sailors to sea in them; but the authorities of that day brought their guns to bear upon him and completely demolished him. Since then, however, he had got up again; and his heterodoxy had become orthodoxy, and he thought there would be no opponent of "iron walls" for the future. About the beginning of the year we were on the eve of war with a people who, whatever their faults, have never hesitated to adopt for war the fittest weapons—who, long before rifles were introduced into our army, were celebrated for their use of them and for their manufacture—to whom we are indebted for the revolvers we found so useful in India, and which, whether they invented them or not, they brought to perfection. That people excelled also in ships; for while the English people, priding themselves on the beautiful "wave lines" on which their fast steamers were built, were slow to perceive the advantage of the same lines for sailing ships; the Americans adopted them for their sailing vessels, and came over and beat our fleetest yachts in our own waters. It was the Americans, too, who first built ships of large size, and carried off our best freights in their large wave line clippers. When going to war with such a powerful nation it became necessary to take stock of our fighting material. The Government did take stock of your fleet; and the extent of your navy, fit for a naval battle, at the beginning of the present year—as announced in a powerful leader in the *Times*—was one ship of the line. At the present moment we have two ships of the line fit for service, the Warrior and the Black Prince, and no more. This serious point is no longer a matter of speculation. It is now universally accepted as a fact—and accepted by us on a very small naval engagement in American waters, the contest of the Merrimac and Monitor—that an iron vessel of war is better than a wooden one; while the battle of the Merrimac with the Congress and Cumberland has settled the point in dispute eight or nine months ago, viz., that a wooden vessel could not sustain the attack of a ship of war in iron armour. Sir John Hay, the chairman of the naval commission, is quoted in an excellent article in the *Quarterly Review*, as using this expression,—"The man who goes into action in a wooden vessel is a fool, and the man who sends him there is a villain."

Let us now inquire how this revolution has come about. How is it that our brave sailors ought no longer to face our enemies from behind our wooden walls? This revolution has been chiefly brought about by the introduction in artillery of horizontal shell-firing. A certain General Paixhans, a Frenchman, contributed more than any one else to this result. He made cannon of eight or ten inches bore, by which explosive shells—which previously had been fired up in the air and had to come down again upon their object—could then be fired straight at the mark, especially at a wooden ship, which was as good a target as an enemy could possibly desire. This horizontal firing was for a long time a favourite idea with artillerists; but they had very little opportunity of trying it in practical war. Sir Howard Douglas, speaking of its effects, says, "a shell exploding between decks acts in every direction; under the deck it would blow up all above it; on deck it would make a prodigious breach below it, at the same time that it would act laterally." The shell which accidentally exploded in the Medea, on the lower deck, killed the bombardier and several of the crew, knocked down all the bulkheads, and threw the whole squadron into consternation; and the like effect was to be expected from an enemy's shell lodged before its explosion had taken place. The first experiment on a large scale in actual war was at the commencement of the Russian war. The Russian fleet, sneaking about the Black Sea, put into Sinope, and in a very short space of one morning sank and burnt the Turkish squadron. This battle was the entire effect of horizontal shell firing. The true nature of this horizontal fire has had another illustration. You were all astonished, and wanted to know why Sir Charles Napier did not take Cronstadt, and that our other fleet did not take Sebastopol? It was well known to professional men then why we did not, and there is now no reason why the secret should be kept. Our enemies know it, so why not our friends? Our sailors were not fools enough to stand to their guns in wooden ships exposed to horizontal shell-firing. The speaker had read a letter from Lord Dundonald, one of the bravest sailors that ever trod the deck, written by him to Napier off Cronstadt, in which he expresses the greatest apprehension that Sir Charles would be goaded on to try the attack with what he called combustible ships. We tried Sebastopol—or rather we tried to "make-believe." We drew up our fleet a great way off, and one or two brave sailors did go in closer. But the Russian gunners were trained to horizontal shell-firing, and they soon found out it was best to be farther off. The admiral was to be considered the wisest man on board the fleet, for he anchored his ship the farthest off. Those ships that ventured in were rendered by these shells incapable of continuing the action, and it is not now considered a disgrace to those sailors to say that after three shells had exploded in one ship it was not possible to find men "fools" enough to stand to the guns. "Now, you know why we did not take Cronstadt; and why you did not know it sooner, was because the Government did not wish you should fail to believe in the wooden walls. At last, however, the Monitor and Merrimac have let out the secret, and I am here to tell you the whole truth." It need not be said that those shells at Sinope and Sebastopol were not the perfect weapons we have now—the Armstrong shells are much more precise, and will scatter greater destruction around them. How much more I may not tell.

Attention has, therefore, since 1854 till now, been strongly directed to inventions for protecting ships from the effects of shells—and shot also, but chiefly shells. Men will stand against shot, but not against shells; they will run the risk of being hit, but will not face the certainty of being blown up. The invention of iron armour took place fifty or sixty years ago. He was not prepared to name the first inventor; but, long before we thought of using it in our navy, Mr. R. L. Stevens, a celebrated engineer, of New York, the builder of some of the fastest steam-vessels on the Hudson, was, he thought, the inventor. Certainly Mr. Stevens, between 1845 and 1850, gave him a full account of experiments made in America, partly at his own and partly at the State's expense, and found that six inches thickness of iron-plate armour was sufficient to resist every shot and shell of that day. In 1845 he (Mr. Stevens) proposed to the American Government to construct an iron-plated ship, and in 1854 the ship was begun. This ship is in progress, but not yet finished. Mr. Stevens is therefore the inventor of iron armour; but no doubt the first man who applied it practically for warfare was the Emperor of the French. In 1854 he engaged in the Russian war, and being a great artillerest, he felt deeply what his fleet could not do in the Black Sea, and we could not do in the Baltic, and so he put his wise head to work to find out what could be done. In 1854 the Emperor built some floating batteries—four or five; we simply took his design and made five or six.

He had called the introduction of iron-armour ships, Stevens' and the Emperor's; but something he laid claim too for ourselves. Stevens used thin flat plates one over the other; but Mr. Lloyd, of the Admiralty, being consulted at that time, did express his opinion that solid 4½-in. plates would be more effectual than the six inches of thickness in a congeries of plates. Mr. Lloyd has some of the merit as well as the Emperor for the adoption of this kind of armour. The speaker exhibited a model of the first iron batteries. The form, he said, was not very handsome; in short, they were not only not good sea-boats, but in a sea good for nothing. They did, however, in smooth water some good work; at least three of the French Emperor's did. We never got so far. They went to the Black Sea—to Kinburn; and when they came back they were covered with the marks of shot, but not one of them was seriously damaged. This proved the value of these coated vessels, and so convinced the Emperor that he wisely determined the fleet of France in future should be an iron fleet. We all know with what decision, what success, what economy he has carried that idea out. "I have here," said the speaker, "the means of showing you what this armour is. Now to tell the secret of the efficacy of an armour plate. First, as a matter of fact, it stops the shot, as an anvil stops a hammer, and stops it outside the ship; and so, therefore, the armour acts practically as an anvil. When these plates were made they were made to resist 8-pounders, and 4½in. thickness was ample; but now they were firing shot very much larger. When a round ball, or a round shell, strikes the iron plate, the first thing done is, that it stops the bit of the ball that first touches the armour; next, the bits round it rush on until they too get stopped by the armour; and so this little (!) ball makes a dent for itself; the remainder of the crushed ball seems, as Mr. Faraday says, to be 'squermed'* out of shape. I stole the word, it is so capitally expressive. The shape is not like the original ball,—it is an entirely new form altogether. I call it 'Faraday's squerm.' But we have not the full weight of metal here. We have only a part of the shot left, the remainder is dispersed in numerous fragments. This is all that remains—a beautiful, smooth, polished cone; the rest has gone everywhere. What, meanwhile, has happened to the armour? The plate first gets a dent; if Sir William Armstrong hits it twice in the same place the dent gets deeper; and if he hits it again in the same hollow, as he so maliciously does, the dent parts company with the plate and starts on a voyage of exploration for itself. But if this ball (150-pounder) were used I am sure that at the first hit it would take a piece of its own size away with it. Now, if this occurs with a solid shot, what would happen with a hollow ball made to explode, and fired at the ship? Fortunately we know what would happen. We have seen it fired, and it not only got smashed to pieces, but it forgot to explode; and the only excuse that can be made for this is that it had not time to do so. I do not know if you know what takes place inside of a gun; but artillerists know it takes some 4 or 5-1000ths of a second for the explosion to go from one end of the charge to the other. Explosion in a shell also takes time, and what happens with the shell striking the armour is that it gets shattered to pieces and the powder scattered about before it has time to explode; and this not only with 4-in. iron, but with plates a great deal thinner." This power of annihilating shell is one of the advantages which iron bestows on a ship, and for which wood is powerless; and upon this very fortunate fact the new principle of naval construction is based, for whatever armour will do against shot, it will infallibly keep out the shell. What kind of armour is best against shell and what against shot is still a subject of discussion. The most important results were being worked out by the Committee on Iron Plates as to the best adaptation of armour for the purposes we want.

To the speaker's mind the best kind of armour, and the best kind of ship was that combined in the Warrior. There was one gun-deck, in which a battery of guns of the heaviest calibre was placed, and that battery was entirely covered with iron plates, backed with eighteen inches of wood lying between them and the iron skin of the ship. A great effort was now being made to get rid of this wooden backing, which was liable to rot, and contributed no strength to the vessel. When an effective iron backing was constructed, the last improvement would be got that was looked for in the construction of an armour plated ship. He then explained what were the great difficulties to contend with in the construction of the new fleet. There was no difficulty in the armour; we know we can keep out the shell and the shot; for if Sir William Armstrong pushes us too hard we know how much more iron will keep him out. What we have to do that is difficult is to build a ship that will not merely keep out shell and resist shot, but also possess speed with good sea-going qualities—a monstrous difficulty. The problem was purely one of naval architecture. The difficulty arose in this way: the iron armour placed a very great weight in a very bad place; it tended to make the ship top heavy, and "crank." Now such a vessel rolls, and a very heavy roll might roll her upside under—an event to be avoided as long as possible. The puzzle was, therefore, to make a stable ship that should stand under this great top-weight of armour and be a good sea-going vessel. The first iron batteries were totally devoid of this quality. They were not "ship-shape," but "sea-chest" shape. Those we sent out to the Black Sea—and one was under a very good captain—never got there, or, if they did, they never did anything but come back again. He referred to them because they were a class of ships that were now being agitated for. The question was now being entertained, in the highest quarters, as to whether our new fleet of vessels should be fit for long voyages and able to encounter heavy seas, such as were necessary for the protection of our colonies and commerce; or whether they should be made unseaworthy slow vessels, incapable of following the enemy if he ran away, still less of catching him. They were only adapted for staying at home; and, in order to hurt the enemy, the enemy must come to them to be hurt.

Mr. Scott Russell then went into the details of what he advocated as the best class of shot-proof vessel—the improved Warrior class.

This class was 58ft. wide, 400ft. long, and more than 7,000 tons in size; and cost, fully armed and fitted for sea, not much short of half-a-million. The distinguishing quality of the Warrior was, that she had proved a very excellent sea-going vessel. He was happy to say that four more of this class were building, and two already built. Her armour consisted of 4½-in. iron plates, and extended over the whole length to be protected, and came down about 5ft. below water. This arrangement of armour was such that its centre of gravity was brought to 6ft. above the water. Now, for a comfortable ship it was held that the centre of gravity should be near the water line, and this was therefore a problem of some difficulty; but the ship had turned out, nevertheless, a faster man-of-war than any other, and also an easy, good sea-boat.

This difficulty of top weight was got over, in Stevens' early armour vessel, by a different method from the Warrior. Giving up the problem of a sea-going ship, he took to smooth water, and built his vessel much on the mid-ship section of a London barge; the sides sloped outwards under water, and sloped inwards above water so as to form a narrow upper deck, carrying seven guns, the angles of the sides being usually a little above water, but capable of being sunk to the level of it during action. So little, however, was she adapted for a sea-going ship, that a false side was obliged to be put up to make her at all sea-worthy; and he would only ask our naval officers if such vessels were fit to protect our trade and our possessions on the wide ocean? The Stevens' battery is as long as the Warrior, is to have as high a speed, and carry a central, shot-proof platform, with seven large guns mounted on turn-tables, and worked below decks by machinery. The guns were pointed downwards for loading, and were returned to their positions, and worked thus by men and machinery below the iron deck, and wholly under cover. There were points of this battery so like some recently proposed to be constructed in this country, that it was difficult to conceive the secret had not transpired. This battery was begun in 1854, and is now about to be finished. The Stevens' battery is a favourable specimen of a ship built for action in the smooth waters of America. But it is our duty to construct quite a different class of ships, and the Warrior is the type of that class. No one can help seeing the superiority, for our uses, of having such vessels only as can go anywhere and do anything, and are faster, more powerful, more enduring, and more seaworthy than any other steam ships of any other navy.

The Merrimac, one of the most beautiful of the American frigates that first set the pattern which has been followed in so many of our own noble vessels, was cut down by the Southerners, and said to have been covered with rails; but, in reality, covered with one coating of plates, 6in. broad and 1½in. thick, laid diagonally, and a second coating 2½in. thick in an opposite direction, over a backing of wood. By this simple means she was converted into the formidable vessel that attacked so victoriously the Congress and Cumberland, and disabling them by the shells poured in, as much as by her power as a ram, destroyed them in a short encounter. The Monitor, improvised by Ericsson in three months, is 160ft. long, 40ft. wide, and 6ft. deep, and below this upper body is another propelled by steam. She carries a revolving iron tower of 6in. thick, containing two heavy guns. Now the upshot of the contest of these two vessels has decided two points for us. 1. That wooden men-of-war are worthless in presence of iron coated ships; for the Merrimac sank two of them without the slightest difficulty. 2. That wooden ships, even coated with iron, are ineffective against iron ships coated with iron armour; for after a long contest the Merrimac failed to injure the Monitor, and had to retire.

Capt. Coles' shield vessel was next described. His plans were submitted to the Admiralty in 1859, long prior to the construction of Ericsson's battery. These shields and the Monitor's are much alike in principle, but Capt. Coles' vessel is a far better sea-boat than the Monitor, and carries twelve guns instead of one, as in that vessel. Coles' shield has a conical roof, and carries one or two Armstrong 100-pounders fixed in slides, which are parts of the interior of the shield, that moves round on the central pivot, and the men working the guns are turned round in it entirely under cover. The construction of the shield ship designed by the Admiralty is altogether better than the Monitor's. The speaker does not wish, however, to see our war-ships replaced by vessels of this class, but by those worthy of ourselves—a fleet of Warriors.

Mr. Scott Russell hoped he had now shown how it had come to pass that we had got a useless navy of wooden ships, and only two iron ones ready for service. There were two more nearly ready, not of the Warrior class, about which the less he said the more he should praise them. The Government had, however, laid down the lines for four more enlarged Warriors, and this was an atonement for the two he would not say anything about. We must then look to a long time before we shall have more than two ships of the Warrior class. He considered this delay deplorable. When the Duke of Somerset was asked in the House why he had not sooner built more iron ships, he said, "the House of Commons had been in no particular hurry." And when he was asked about his tardy adoption of Capt. Coles' plan, he replied, "he delayed until he had consulted the House of Commons about it." Now the serious difficulty was this, while the French Emperor had been making rapid use of his experience of iron batteries we had not. In 1854 his were at Kinburn and up to their work. In 1856 Capt. Halsted made application to have one of our batteries made the subject of experiment, in order to see if she would resist shot and shell, with a view then to make an iron navy. The Admiralty did have the Trusty made ready; and had her out. Then they took fright and sent her back again; and so we lost two years' start. He would now mention a fact of which there was no longer any grounds for concealment. In 1855 he submitted to the Surveyor of the Navy a drawing and model of the Warrior class of ships. That model was now on the table, and exhibited all the important features of construction of the Warrior class. But the Admiralty delayed the construction of the first ship of the class till 1859; and so we lost our just claim to the original design of iron ships in armour, with sea-going qualities and speed united. It was Sir John Pakington who, in 1858, first ordered an iron fleet to be commenced, on a joint design of himself, (Mr. Scott Russell), and the Survey or of the Navy. But the French Emperor had already commenced the Gloire; so that instead of being, as we might have been, three years ahead of the French Emperor, our delay had given him the lead, and deprived us of our true priority. He concluded by expressing a hope that the delays and doubts of the Admiralty might now end; that a fleet of enlarged Warriors would speedily be constructed, fit to carry English sailors on every sea where our colonies and commerce required their protection; and that no more of our time or money would be wasted in the consideration or construction of inferior classes of vessel, unfit for ocean navigation, and good only to stay at home until the enemy should choose to come and be hurt. We had now proved our Warrior class to be sound, wholesome sea-going ships, and to be unparalleled in speed. Of course, improvements would in future be made, and changes introduced. But when our constructions truly embodied the best knowledge and experience of their time our responsibility was fulfilled, and at present we know of no match for the enlarged Warrior class of 7,000 tons, and, therefore there can no longer remain any excuse for continuing in our present inefficient condition.

* "Squirm" is an Americanism, older, even, than Mr. Faraday.—ED. E.

THE MANCHESTER BOILER ASSOCIATION.

At the last ordinary monthly meeting of the executive committee of this association, held at the offices, 41, Corporation-street, Manchester, on Tuesday, June 24th, 1862, Hugh Mason, Esq., Vice-President in the chair, Mr. L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

During the last month there have been examined 224 engines—5 specially; 400 boilers—9 specially, 8 internally, 68 thoroughly, and 315 externally; in addition to which 7 of these boilers have been tested by hydraulic pressure. The following defects have been found in the boilers examined:—Fracture, 5 (2 dangerous); corrosion, 43 (7 dangerous); safety-valves out of order, 7; water-gauges ditto, 11; pressure-gauges ditto, 6; blow-off cocks ditto, 36; fusible plugs ditto, 3; furnaces out of shape, 6 (1 dangerous); over pressure, 4; blistered plates, 4; total, 125 (10 dangerous). Boilers without glass water gauges, 8; without pressure gauges, 5; without blow-off cocks, 7; without back pressures valves, 26.

No explosion has happened during the past month to any boiler under the inspection of this association, neither have I heard of the occurrence of any in other parts of the country.

Advantage has been taken of the very general stoppage of the works during Whit-week to make as many "internal and thorough" boiler examinations as possible, the ordinary routine of visits being entirely laid aside in order that the inspectors might exclusively devote themselves to this special branch. Applications for these examinations have this year been so numerous that the inspectors were incessantly occupied upon them during the whole week, notwithstanding which, however, a few late applications could not be complied with. Members might avail themselves of any holidays peculiar to their own district for securing these "internal and thorough" examinations. Early applications should in all cases be made for the visit of inspection.

Several cases of extensive corrosion were revealed by these examinations, and which attested to what a dangerous extent they are too frequently postponed. In one instance, the plates at the bottom of a boiler were found so reduced in thickness, that the engine attendant feared lest the removal of the cake of incrustation should rob them of so much assistance as to prove fatal to the integrity of the shell.

I find it necessary again to repeat that it is absolutely imperative, if these examinations are to be satisfactory, that the flues should be thoroughly swept, and the boilers suitably prepared, otherwise the condition of the plates cannot be ascertained. While on the score of economy, I would remark, in passing, that our members can scarcely be aware of the amount of fuel wasted by allowing the plates of their boilers, while in work, to be coated with so non-conducting a substance as soot. Feed-water, passed through heaters, loses 30 deg. of its temperature within a week after sweeping, while the utility of the heater is almost lost if allowed to go unswept for a longer period. This will give some idea of the loss occasioned to boilers by neglect, and I have found the soot to hang from the surface of the

WORSSAM'S SAWING MACHINERY.

FIG. 1.

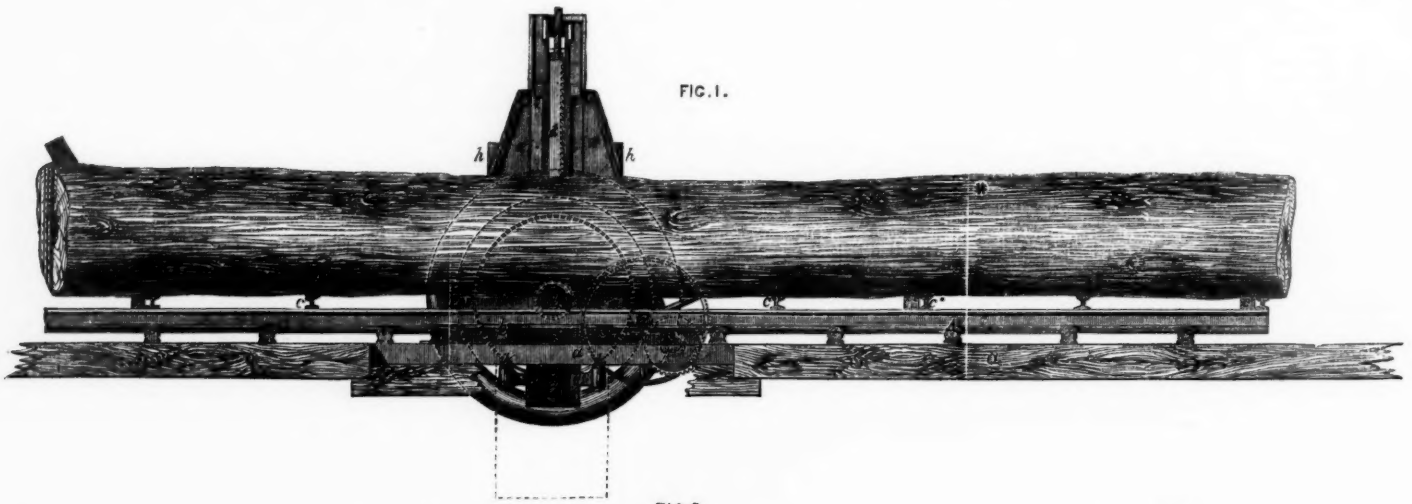


FIG. 3.

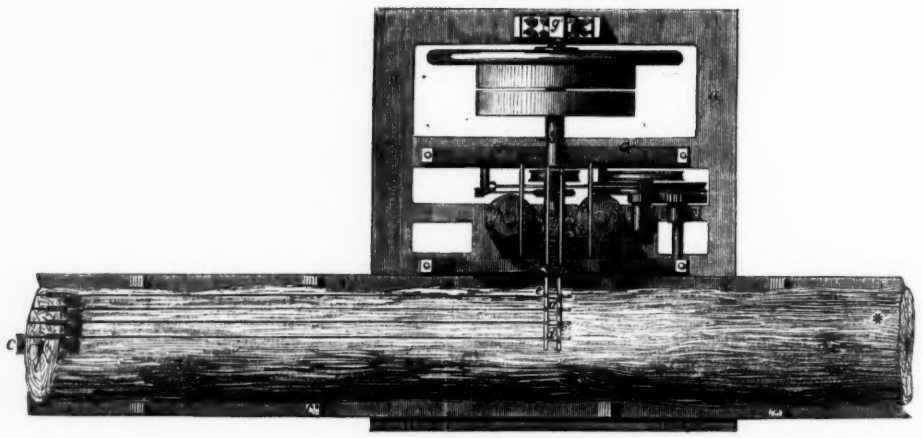
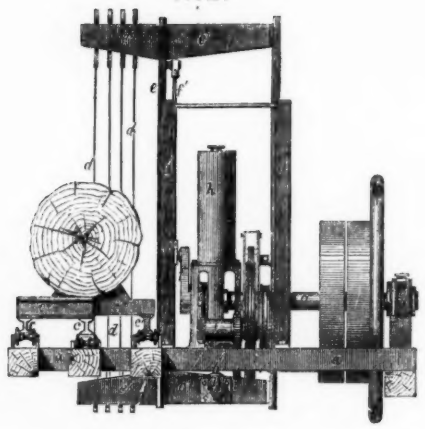


FIG. 2.



plates in complete festoons immediately after the flues themselves had been passed as swept.

Safe Working Pressure of Boilers and Hooping of Flues.

For some time since I have been desirous of touching upon the point of safe working pressures for boilers, since it not unfrequently happens that it is necessary to warn our members on account of excess.

The scale adopted by the association as a general standard is as follows:—For shells of boilers 7ft. in diameter, made of $\frac{3}{8}$th plate, the safe working pressure is 50 lb; if of $\frac{7}{16}$th plate, 60 lb.; and other dimensions in proportion. This allowance corresponds with the general practice of the manufacturing engineers of the district, is quite as high as the standard in other parts of the country, and considerably in excess of that permitted either in France, Holland, or Belgium, by their respective Governments. It must, however, be distinctly understood that this standard should not be applied arbitrarily in every case, without any allowance being made for the attendant circumstances. It is only applicable in cases where the boiler is well made, both as regards materials and workmanship, and where the condition of the plates is good. It would be highly dangerous to apply it to boilers weakened by the wear and tear of years; while, on the other hand, a new and thoroughly well made boiler might, for a time, be allowed to work at a pressure slightly in excess of that given. But this could only be safe where everything is in first-rate condition.

It is a very common idea that the bursting pressure of a boiler is six times as high as that given above as its safe working pressure. This, however, I am persuaded is a great mistake, and leads in many cases to undue confidence. I am confirmed in this conclusion by the constant examination of the rent plates in boilers that have exploded, where I find that, even where explosion results from thinning of the plates, rupture ensues long before they are reduced to one-sixth of their original thickness, and in one case I knew a well-made and nearly new boiler, in first-rate condition, to explode, on account of only a comparatively slight increase of pressure, which had accidentally been allowed through an error in the steam gauge. In this case, that at which the boiler actually burst did not exceed its ordinary working pressure by more than 50 per cent., the one being about 90 lb., the other 60 lb. I believe that an application of anything like six times the pressure given in the scale above would burst most of the boilers in Lancashire, and where it has been actually attempted by hydraulic pressure the steam domes have been found to tear off long before the strain referred to has been attained. I cannot, therefore, think that shells of cylindrical boilers can be worked without risk at a higher pressure than that given in the preceding scale, unless under very exceptional circumstances.

With regard to the furnace tubes which are exposed to external pressure I am glad to find that the practice is becoming increasingly general of strengthening them either with flanged seams or hoops, the hoops being made either of angle iron, T-iron, or other approved form; and since it too frequently happens that flues are not made, in the first instance, truly cylindrical, on which their strength so much depends, and that other sources of weakness creep into the manufacture unawares, it is extremely desirable that no new boiler should be constructed with flues unstrengthened in the way just described, however slight the working pressure may be.

These hoops are frequently added to boilers after their first construction, and since some of our members have suffered inconvenience from the imperfect manner in which they have been fixed, I may state the method found by experience to be the best, which is as follows:—The hoops, if made in two halves, may be passed in through the man-hole, and can then be secured to the furnace tubes when in position. They should not, however, be brought in direct contact with the plates of the tube, but should have ferrules of about an inch thick placed between the two, so as to leave a clear space all round through which the water can circulate. Where this space has been omitted, the plates have been found in some places to crack at the rivet holes, and in others to blister and buckle, in consequence of which many plates have had to be cut out and the hoops removed, from which the system of hooping has been in some cases unfairly condemned. Where, however, the ferrules have been introduced, and the water space allowed, no injury has been found to arise to the plates even over the hottest part of the fire. The rivets uniting the hoops to the furnace tube should pass through these ferrules, and be spaced about 6in. apart, while the two halves of the hoops should be connected together by butt strips rivetted to their ends at the back. When hoops are applied as an after-clap in this way, angle-iron is preferable to T-iron, as the flange, being narrower, is less liable to cause over-heating of the plate. It may be necessary to vary the size of the angle iron in some cases, but, generally speaking, one 3in. in the flange and half an inch in thickness will be found to answer every purpose. It is sometimes the practice to put two angle irons back to back. This is quite unnecessary, and a single one is all that is required. A drawing, to show the arrangement recommended, has been made for the assistance of the members, and can be seen on application at the offices of the association.

Since writing the above I have met with some additional cases, where considerable expense has been incurred by having to remove angle iron hoops from furnace tubes, in consequence of the injudicious mode in which they have been fixed, and would therefore impress upon our members the importance of attention to the above, if they wish to prevent the recurrence of disappointment in their own case.

WORSSAM'S MACHINERY FOR CUTTING WOOD.

This invention, by Samuel W. Worssam, of the King's-road, Chelsea, relates to sawing machinery for cutting logs or large baulks of timber both longitudinally and transversely. The first part of the invention relates to the machine for cutting up the timber longitudinally, and the second part of the invention relates to the machine for cutting up logs or timber transversely.

In the sawing maching for cutting up the log longitudinally the log is placed on a travelling platform, which is actuated by gearing, so as to bring the timber up to the saws, or the log may be fed forward by means of feed rollers, without the use of the travelling platform. The saws are attached to the cross-heads of a vibrating framing, to which an up-and-down motion is given by means of a connecting rod and crank, driven by any prime mover, but the saws (of which there may be one, two, or more, as may be required) are arranged to work outside of the main standards of the machine, so that the log may be moved up laterally to the saws when the cuts have been finished.

Fig. 1 is a side elevation of the machine for sawing logs longitudinally, constructed according to the improvements; Fig. 2 is an end elevation of the same; and Fig. 3 is a plan view.

The horizontal part of the stationary framing is seen at a, a, a, a, and on this stationary part there are placed at convenient distances apart several rollers b, b, b, for supporting the travelling bed c, c, c^1, on which the log to be operated upon is placed. It will be seen on referring to Fig. 2 that this travelling bed is divided into two parts, of which the longitudinal bars c, c, are connected together by metal transomes or crosspieces c^*. The other longitudinal bar c^1 travels with the other bars c, c, but is not connected therewith, and serves to support the wooden crosspieces c^2, which assist in supporting the log. As the log advances against the saws d, d, the wooden transomes or crosspieces c^2 are removed to allow the saws to pass.

a^1, a^1, a^1, a^1, are upright standards firmly bolted to the horizontal framing a, a, and serving as guides to the vertical side pieces e, e, of the saw frame. The saws d, d, are mounted in the ordinary manner in the top and bottom cross-heads e^1, e^1, which complete the saw frame, and to which an up and down motion is communicated by the crank f, at one end of the main driving shaft g, through the intervention of the connecting rod f^1. The end bearings g^1 of the shaft g are placed within the standards of the working frame, and by placing the saws d, d, outside of the stationary framing, as shown in Fig. 2, a large log may be cut or sliced up in a frame or machine of moderate dimensions, whereas if the log were placed within the frame or between the side standards a^1, a^1, a machine of considerable width would be required to take a large log.

In order to render the machine portable and to dispense with the heavy counterbalance weights on the fly wheel, two air or vacuum cylinders h, h, provided with suitable valves at top are employed, and placed within the working frame a^1, a^1. It will be seen on referring to Fig. 3, that an air or vacuum cylinder is placed on each side of the crank shaft, and the pistons of these cylinders are connected by means of their piston rods h^1, h^1, to the bottom crosshead d^1 of the working frame, so that when the pistons in the air cylinders are drawn down they will be working against a vacuum.

The feed motion of the log up to the saws is effected by racks and pinions, or in any other convenient manner; but, as this forms no part of the present invention, it will not be necessary to give any detailed explanation thereof.

In order to keep the saws steady the patentee proposes, in addition to the usual longitudinal packed guides o, o, to employ other guides p, p, which will also support the saws before they enter the wood. The additional guides p, p, are mounted on hinges, so that they may yield or fold down in a vertical direction when they come against the timber. The two saws are driven by one wide band q, q, which passes over a large driving rigger r on the main shaft, and also round suitable tightening and guide pulleys s, s^1, all of which are mounted in bearings in the movable frame. The bearings of the tightening pulleys s are adjustable and are provided with a regulating screw t, for screwing up the bearings when the driving band gets slack. The machine is driven by a band u, which is actuated by a pulley v, mounted in bearings in the lever arm w below.

The travelling frame n is actuated by racks and pinions, as shown, and as the driving pulley v is mounted in swing bearings in the lever arm w, which is weighted, the driving band will always be kept at the proper tension, whatever may be the position of the travelling saw frame.

Coal Mines.—The following is the principal clause in the new Act, brought in by Sir George Grey, for providing against such accidents as that of the Hartley colliery:—"After the passing of this Act it shall not be lawful for the owner of a new mine, and after the first day of January, 1865, it shall not be lawful for the owner of an existing mine, to employ any person in working within such mine, or to permit any person to be in such mine for the purpose of working therein, unless there are in communication with every seam of such mine, for the time being at work, at least two shafts or outlets, separated by natural strata of not less than 10ft. in breadth, and affording distinct means of ingress and egress to the persons employed in the mine; but it shall not be necessary for the two shafts or outlets to belong to the same mine, if the persons therein employed have a free right of ingress and egress by not less than two shafts or outlets, one or more of which may belong to another mine. This section shall not apply to opening a new mine for the purpose of searching for minerals, or to any working for the purpose of making a communication between two or more shafts, so long as not more than twenty persons are employed at any one time in the said new mine or working." Provision is made for exceptional cases, in which mine-owners are to be allowed an extension of time in sinking the second shaft of new mines.

The Morpeth Steamer.—The *Sydney Morning Herald* reports the arrival at that growing centre of wealth and enterprise of the Morpeth, built for the Hunter River Steam Navigation Company, by Messrs. C. Mitchell and Co., of Newcastle. She is 222ft. over all; 25ft. 3in. beam; 13ft. depth of hold; and, when loaded with her coals and 150 tons of cargo, draws 7ft. 6in. She is a paddle steamer, propelled by a pair of splendidly-finished engines of 184-horse power. The cylinders are oscillating, and are from the manufactory of Messrs. R. Morrison, of Newcastle. The Morpeth occupied 151 days in her outward voyage, having been detained at the Cape of Good Hope. She left Newcastle on the 17th November, under steam, which she carried to the Bay of Biscay; here she encountered very heavy, adverse weather, when she was put under canvas; passed St. Vincent on 23rd December, and crossed the Equator on the 4th of January. On her passage from thence she sprang her foremast, and put into the Cape of Good Hope on the 16th February to repair damages. These having been effected, she left again on the 1st March, and made a fine run to Van Dieman's Land. She made her easting in the parallel of 46 deg. S., and for eight consecutive days averaged 200 knots, under canvas, the wind varying from N.W. to S.W., proving her to be a very smart vessel. She passed the S.W. Cape on the 9th instant, and got up steam when off Cape Howe, having only been under steam for thirty-six hours from the Cape.

TO CORRESPONDENTS.

**** *Covers for binding the volume can be had from the publisher, price 2s. 6d. each.*

E. H.—*Your question is incompletely stated.*

P. AND D.—*Address Mr. J. F. Spencer, Bank-buildings, Newcastle-on-Tyne.*

H. D.—*We are not aware that the photographs to which you allude are for sale.*

E. D.—*If Mr. Valentine's patent was taken out in March it will not be published until October.*

J. P.—*Steam engines have been made with two pistons in the same cylinder working in opposite directions.*

F. C. S., P. B., OLD SUBSCRIBER.—*There is no examining board, the Secretary of the Board of Trade informs us, for marine engineers.*

C. T. P.—*We cannot publish testimonials of machinery in our correspondence columns. The tone of your own letter, too, is little calculated to benefit you.*

J. O.—*The Appold pump is employed to force water out at the stern of the floating fire engine in the Thames, the reaction being the propelling power of the boat.*

ONWARD.—*We cannot say. Some of the naval engineers published a pamphlet, a few years ago, containing some of the information you require, but we do not know if the pamphlet is now in print.*

J. F. (Frome).—*The colonies afford little employment for draughtsmen, but if, as you say, you are a practical engineer and have some capital, you ought to do well in British Columbia or in New South Wales.*

W. B.—*There is no rule for the proper speed of pistons. The cylinder has less time to cool internally at each stroke, at a high than a low speed and if there be steam enough and the engine is adapted to it and fitted to stand it, the speed may be 1,000ft. per minute.*

SUBSCRIBER.—*The force of impact, strictly speaking, is infinite and incalculable. The power discharged by a falling weight is equal to that, measured in foot-pounds, expended in raising it to the height from which it fell, and, generally, that discharged by any striking body is due to the height corresponding to the velocity of motion. But this cannot be compared, except by experiment in each case, with the pressure of a load at rest.*

CONCUSSION SHELLS AND NAVAL WARFARE.

(To the Editor of The Engineer.)

SIR,—On looking over some old newspapers I found the *Standard* of June 5th, 1843, in which is the following short paragraph:—"In the course of practice with Captain Norton's concussion shells at Woolwich, at the respective ranges of 1,250, 800, 600, and 400 yards, it was found that the shells exploded between the two bulkheads, placed 12ft. asunder, thus proving what formidable engines they are for naval warfare." I am glad to have found the *Standard* of the 5th June, 1843, because it fixes the date when the late General Chalmers, R.A., who was at that time a captain, and Secretary to the Select Committee, informed me that they were so well pleased with the results of the practice with my concussion shells that they resolved to recommend me to Government for the ordnance pension of five hundred a year. J. NORTON.

Howard's Hotel, Kingstown, June 21st, 1862.

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Letters relating to the advertisement and publishing department of this paper are to be addressed to the publisher, MR. BERNARD LUXTON; *all other letters and communications to be addressed to the Editor of* THE ENGINEER, *163, Strand, London, W.C.*

THE ENGINEER.

FRIDAY, JUNE 27, 1862.

THE ROYAL AGRICULTURAL SOCIETY'S SHOW.

THE first show which the Royal Agricultural Society has ever held in London opened in Battersea Park on Monday. The attendance of visitors both on that and the following day was exceedingly thin, indeed but for a small number of foreigners who are just now making the collection of information here a matter of business, the receipts could not have exceeded £10 for each of the two days. The great attractions were reserved for Wednesday, when the judges gave their awards in the presence of as many visitors as chose to pay twenty shillings each for admission.

But whatever may be the success of the show, it is the most complete of its kind ever made. The display of machinery and implements is particularly full, the objects under these heads numbering 5,064 in a catalogue of nearly 450 pages. The Society make no trials and offer no prizes this year — their show-yard has been opened, with hardly any restriction, to all comers—and thus Messrs. Ransomes and Sims', Messrs. Garrett's and others' "reasons for not exhibiting" have been removed, and the two firms named—obstinate secessionists for the last two or three years—are now in the yard with about 130 machines and implements, a goodly show in themselves. The number of traction, portable, and fixed steam engines exhibited is about 125, of which we counted 15 or 16 by Messrs. Clayton, Shuttleworth, and Co., 13 by Messrs. Tuxford and Sons, 8 by Messrs. Garrett and Son, &c. At least forty makers of agricultural steam engines are represented, and we are continually hearing of new firms engaging in the trade. Four out of the five engine makers in Lincoln have sent up examples of their work, and one of these firms, Messrs. Clayton, Shuttleworth, and Co., are understood to be turning out seventy engines a month, or not far from one thousand a year. Their latest engines are numbered 4,900 and upwards, a wonderful result, indeed, for a business of only thirteen years' standing. There are, of course, those who repeat these numbers suspiciously, and who more than hint that they are fictitious. This we do not believe, and we mention the matter only for the opportunity of saying so. But if we take even the numbers of portable engines which the most sceptical admit to have been turned out from the five factories in Lincoln, we may well wonder where they have all gone to. The trade in this class of engines is, indeed, enormous, and one of the leading builders assures us that he could now sell fifty at once were they but ready for delivery. The adoption of self-propelling gear for these engines appears likely to become general. Two years ago, at Canterbury, there were but two self-propelling engines in the yard, one by Mr. Aveling, of Rochester, and one by Mr. Chaplin, of Glasgow. The officers of the Society appeared to look upon them with indifference, and they were catalogued only among the "miscellaneous articles." Now there are nine self-propelling engines at Battersea, and nearly all the builders are preparing to greatly increase the number in use. Mr. Aveling's agricultural traction engine is the best, we think, that has been yet produced; indeed several of those turned out by other makers are anything but what they should be to bring this class of engines into general favour. Mr. Aveling's engine, which has already run nearly 500 miles over common roads—having, among other journeys, lately gone down to Wells and back on its own steam — is nearly identical with the one in the International Exhibition. It weighs 8 tons empty, and about 10 tons in working trim; it has a single 10-in. cylinder and 12-in. stroke; the boiler is 3ft. 3in. in diameter, and contains 37 tubes 2¾ in. in diameter and 5ft. long; the firebox is 34in. long, 31in. wide, and 29in. deep inside, and the whole boiler, with smoke-box, is made flush from end to end without angle iron. The barrel and outer firebox are of ⅜in. Butterley plates, the inner firebox being of Bowling plates of the same thickness, with the exception of the tube plate and door plate, which are ½in. thick. The front or smoke-box tube plate is a circular ⅝in. plate, flanged all round, and rivetted within the smoke-box. The barrel of the boiler is rivetted with butt joints and butt straps, and the firebox stay-bolts are but 5in. from centre to centre, the barrel of the boiler being furthermore stayed with longitudinal stay rods. Altogether this is the very best example of agricultural boiler making of which we have any knowledge, and we have referred to it thus fully in the hope that other builders will conform to it. As every one knows, higher and higher pressures of steam are being employed, even on farms. The Royal Agricultural Society, whose limit of pressure at the Leeds show, last year, was 30 lb. per square inch, have this year made it 45 lb., an increase of 50 per cent. at a jump. All this points to the necessity of having very strong boilers, and simplicity and strength in boiler-making are almost the same. The fireboxes with raised crowns, and angle iron or flanged necks, are less strong and considerably more expensive than those made flush with the boiler. In the best locomotive practice, which ought to regulate that in portable engine making, flush boilers are now generally adopted, as any one may see in the western annexe of the International Exhibition. As for the raised smoke box, 5in. or 6in. larger in diameter than the barrel of the boiler, and with a double ring of angle irons, and three circumferential seams of rivets, it is simply an ingenious contrivance for increasing work, weight, and cost, without a particle of corresponding advantage, and at the expense, moreover, of disfiguring the engine. These matters, however, are perhaps of even less consequence than the staying of portable engine boilers. In Messrs. Garrett and Son's engine, the firebox stay bolts measured 8in. from centre to centre in one direction, and 10in. in the other, while one firebox had only three stay-bolts on each side. In Messrs. Turner's, the average pitch was 7½in.; and Mr. Burrell's, Messrs. Kirby and Barrows', and Messrs. Maggs and Hindley's engines would have been all the better for a few extra stays. Messrs. Richardson and Darley, of Kirton in Lindsey, Lincolnshire, have a traction engine in the yard, with a steel boiler of ¼in. plates, abundantly stayed, and intended to work at a pressure of 120 lb. per square inch. Whatever may be thought of the engine as a whole, this boiler deserves the attention of other makers. Another important matter in connection with portable engine boilers, is the lagging of the firebox, which is, of all parts of the boiler, that from which the greatest loss by radiation is usually allowed to take place. Among the makers who now lag the sides of the firebox—most of them also making the flush boiler, are Messrs. Ransomes, Turner, Tuxford, Aveling, Barrett, Exall, and Andrewes, Allchin, Riches and Watt, and Maggs and Hindley. Most of the others, including several of the principal makers, still send out naked fireboxes. Messrs. Ransomes and Sims and Garrett and Son place the exhaust pipe outside of the boiler to avoid its condensing effect upon the live steam when placed within. In Mr. Aveling's engine the exhaust pipe is outside and is very short, the cylinder being placed near the chimney. The cylinder is cast with a steam jacket 1in. wide all round, and the boiler is perforated with a number of holes to admit steam directly to this jacket, through which all the steam has to pass on its way to the slide valve box on top. When the engine is ascending steep hills, and when, therefore, there would, with the usual pattern of portable engine having the cylinder over the firebox, be the greatest tendency to prime, Mr. Aveling's engine supplies itself with dry steam. His self-propelling gear is very simple and effective. A pinion is keyed to the end of the crank axle and gears into a larger wheel on a stud below. This stud is adjustable in a curved slot struck from the centre of the crank axle. On the wheel thus supported is cast a pinion with chilled teeth to take into a pitch chain, made with best iron links and steel pins. This chain, the tension upon which, as it gradually slackens by wear, may be adjusted by means of the curved slot already referred to, works upon a large chain gear fastened to the driving axle and close to the driving wheel. The ratio of the whole gearing is about 1 to 9, and either wheel may be connected or disconnected at pleasure by removing a pin. The axle is of hammered iron, 5in. in diameter and 7ft. long. The driving wheels have cast iron rim and nave, and sixteen wrought iron arms, 2½in. by ¾in. with their ends, where cast in, previously cut with coarse notches and dipped in tar. The cast iron rim is 16in. wide, or 4in. wider than the wheels of the engine by the same maker in the Exhibition. The rim, with the spokes properly set, is cast one day and the nave the day afterwards, so that the contraction of the rim and nave shall not affect the strength of the wheel. The surfaces of the wheel rims are roughened, and, upon yielding ground, clips or spikes are employed to gain adhesion. The weight is chiefly on the driving wheels—on steep hills almost entirely so—and thus the engine has actually taken itself, with a load of 10 tons, up an incline of 1 in 6, which is probably the greatest result ever attained with a traction engine of the same weight. The steering is effected by a light guide wheel carried by a pair of angle iron "shafts" in front of the engine, and moved with the utmost ease, by means of a long radial handle, by the steersman sitting in front of the smoke box. The engine has four wheels besides the steering wheel, and, as the intended speed is only three miles an hour, no springs are employed. All the bearings are inside the wheels. The chimney is of cast iron, in a single casting ¼in. thick, increased in thickness at the base. A powerful friction brake, a steam jet or blower in the chimney, a lock-up safety valve, a steam gauge with the syphon neatly cast in the safety valve chimney, and other necessary appendages are provided. The manhole, which is not visible from the outside, is in the smoke box tube plate, which is ⅝in. thick, and is easily approached by removing the smoke box door, which is taken off on turning two handles.

Among the other self-propelling engines is one, the Bee, by Mr. Smith, of Coven, combining some good points. In several respects it is an incomplete copy of Mr. Aveling's engine. The weight is kept well upon the driving wheels, and the cylinder is placed on the top of the boiler towards the smoke box, just at the back, however, of a large steam dome. The cylinder is 8½in. in diameter, and 10in. stroke, the whole weight of the engine, empty, being about 6 tons. The steering gear is in front, and occupies but little room. The driving wheels are 6ft. in diameter, and only 8in. wide. A friction strap is placed on the back of each, and through this strap all the power is applied. The gearing is for slow and quick speeds, the geared wheels being too light for much service. The driving axle is 4½in. in diameter. This engine is employed to drive a thrashing machine, and in this are two fans drawing hot air, through a series of large and readily connected pipes, from the firebox of the engine, the object being to dry the grain in the process of thrashing. There are but two belts on the whole machine. Some practical farmers prefer this arrangement to Bruckshaw and Underhill's fan blast, now extensively adopted by implement makers.

Another self-propelling engine in the yard was one of Messrs. Clayton, Shuttleworth, and Co.'s make, exhibited by Messrs. J. and F. Howard, of Bedford. This engine, however, was kept under a tarpauling until it was hauled away by horses to Farningham, to be ready for the steam plough trials there. It has a two-wheel tender, and, as the engine could not readily back this appendage, it is drawn by a horse. Messrs. Robey and Co., of Lincoln, send a self-propell ng engine, with double cylinders, 7½in. in diameter, and having a very small steel pitch chain already very slack and without any adjustment for tightening it. This engine has too much weight forward for heavy work. The steerage is simple and good, the boiler is strongly stayed, and a reversing link motion is employed. The brackets for supporting the boxes of the crank shaft are of wrought iron, and are rivetted to the boiler. The firebox is of the kind generally employed by these makers, a water bottom extending beneath the ash-pan. The wheels have cast-iron naves, the spokes being made of stout gas pipe cast in, but already "working" at their connection with the cast iron. The price of this engine is only £360.

Messrs. Richardson and Darley's engine, the Bacchus, is a somewhat oddly-constructed affair, with double 7in. cylinders and 10in. stroke, a long cast-iron bed plate for the engine being fastened to the top of the boiler. A pitch chain is employed to carry the power back to a pinion near the cylinders (and which would have been saved by placing the cylinders next the smoke box), and the gearing is somewhat complicated, while the teeth show signs of distress. There is no steam dome, and we should suppose the cylinders would take in water when going up hill. The steerage is Robey's, and very good. The boiler is of steel, strongly stayed, and is fed by a No. 4 Giffard Injector, with a pump in reserve. The driving wheels are 7ft. in diameter, and are of a pattern which does not appear to be over-strong, notwithstanding that the exhibitors state that the engine has done some stiffish work in Scotland.

We ought here to notice Mr. John Fowler, jun.'s, engine, although it is not, as are the others described, in the yard for machinery in motion. It is a double cylinder of 14-horse power, and weighs 11 tons in working order. The workmanship, as might be expected from Messrs. Kitson and Hewitson's workmen, is good, but there is nothing particularly commendable in the design. The firebox is not lagged, neither is the large steam dome near the chimney. The engine has Mr. Fowler's clip drum beneath, and arranged for driving the steam plough. Formerly this drum was secured, in part, by a heavy frame below, this frame being fastened at its ends to the boiler. The drum and the whole draught of the plough are now taken upon a stout stud, secured to a broad wrought iron flange rivetted to the under side of the boiler. The self-propelling gear might be simplified we think. The driving wheels are 20in. wide, and some are now made 2ft. wide. The engine is 7ft. 8in. wide over all, which is 8in. more than the parliamentary allowance. We understand that there are now nearly 250 sets of Fowler's steam ploughing tackle in use, the present engine being the 140th made for the purpose in Leeds.

We may here note that Mr. Fowler has made a disc anchor windlass, including the clip drum, and arranged to be worked by a belt from a V-pulley on the crank shaft of a common portable engine. The belt is made of alternate links of iron and leather, and is of the same class as that employed in the Belgian flax spinning machinery in the Exhibition. The disc anchor windlass and ploughing tackle (3 furrow balance plough) for a 10-horse engine now costs £320, while the cost of the engine alone is, say, £300, making the whole £620, or £165 less than the cost of the Fowler combined engine and tackle of the same power as now made at Leeds. The 8-horse power engine and tackle has, it appears, ploughed one acre an hour in light land, with a four-furrow plough going 8in. deep. We may add that, in adapting the common portable engine to the disc anchor windlass, Mr. Fowler connects the former to the latter, when in the field, so that, as the windlass winds forward, it takes the engine with it.

Messrs. Lee and Co., of Leicester, exhibit a three wheeled self propelling engine, with 6ft. driving wheels, and a 2½in. axle, 4½in. cylinders, 9in. stroke, with direct gearing in the

ratio of 1 to 8¼ from the crank shaft to the driving axle. The whole looks very flimsy.

Messrs. Smith Brothers, of Thrapstone, send a small self propelling engine, with a pitch chain from the crank shaft to a shaft below, on which is a pinion at each end taking into an internal rack around the rim of the driving wheel. The pinions project many inches beyond any visible bearing, the link of the link motion is so hung that the block slips 2in. or more at every stroke, and the work generally is capable of improvement.

Messrs. Coleman and Son's cultivating apparatus, with Yarrow and Hilditch's engine gear, is exhibited. By this system two ploughs and two ploughmen are employed, the engine standing between them, alternately pulling each plough towards it, the other at the same time being idle.

Mr. Smith, of Woolston, exhibits his cultivator, and with it an engine bearing no maker's name that we could find, but which, the catalogue informs us, was made by Mr. Butlin, of Northampton. It has a superheater, and the crank shaft has three bearings. Some of Messrs Ruston, Proctor, and Co.'s engines, as that also by Richardson and Darley, have Injectors, Messrs. Allchin and Sons' has a feed water heater in the smoke box, Messrs. Marshall's (of Gainsborough) portable engines have a steam jet or blower in the chimney, and Mr. Rowland, of Salisbury, sends one with piston valves and a parallel motion. Messrs. Allchin's engine has plate springs to the hind wheels, and one by Kirby and Barrows, of Banbury, has volute springs. There is, indeed, no want of variety.

We must reserve for a future notice some of the novelties among the implements exhibited. We may note here, however, that Messrs. Warner and Sons, of Cripplegate, and Messrs. B. Fowler and Co., of Whitefriars, have put in a good appearance in the way of pumps, the first-named firm sending one which, at its ordinary speed, would lift 3 tons of water per minute to a height of nearly 6ft. Messrs. Smith Brothers, of Nottingham, exhibit a great variety of steam gauges and boiler fittings, including a 10-inch steam whistle, two of which were made by the firm for the Cunard steamer Scotia. Messrs. H. Clayton and Co. and Messrs. E. Page and Co. exhibit brick machinery in motion, and Mr. Whitehead, of Preston, sends a lot of tile making machinery.

Before our next issue the steam ploughing trials at Farningham will have been concluded, and with a notice of these we shall complete our account of the show at Battersea.

LETTERS TO THE EDITOR.

(We do not hold ourselves responsible for the opinions of our Correspondents.)

THE NAVAL ENGINEERS.

Sir,—The very long and ably written letter which has appeared in the last three numbers of your journal on the "Royal Naval Engineers," has, you will readily conceive, given rise to considerable comment among "the class," and, were it not for the sweeping accusation which the writer has made in charging the great bulk of the present chief engineers of the navy with mechanical inefficiency, would have given entire satisfaction. The clear insight into the evils of the present system, which the writer of that letter evinces, must have been obtained by personal contact with that system, and it appears evident that his individual experience during, possibly, a very short stay in the navy, has tinged his estimate of the entire body, every one of whom, he imagines, is prepared either to inflict or endure the indignities which he speedily found too much for himself.*

My present object in writing is principally to offer my thanks to the writer "C." for so ably calling attention to what I, in common with himself, fear may sooner or later lead to a national disaster unless a searching remedy be speedily applied. But, while offering my thanks, I cannot but express my regret that so well-intentioned a writer should have disfigured his letter by an assertion which the Admiralty themselves could so readily disprove. Deficiency of mechanical ability has never been considered the principal failing of our chief engineers, nor is it just or true to charge them with being "ignorant bullies."

The melancholy failure of the "naval engineer apprentice" scheme certainly produced a number of chief engineers whose skill as mechanics, either to work or to direct, was lamentably deficient, but had "C.'s" experience of the service been more extended he would have known that these few chiefs are not by any means the most amenable to the charge of being ignorant bullies; while, on the contrary, if in the list of about two hundred chiefs there are a few who may be rightly considered as entitled to that unenviable character, I think it would be found that they are men whose services have been retained especially, if not solely, on account of their undoubted mechanical ability.

The remedy of a more searching examination, which is urged by "C.," has been advocated by several engineers for many years past, but, unfortunately for us, we may justly exclaim, "save us from our friends." Some of the engineers of our dockyards—men who, of all others, ought to have been the first and most urgent in endeavouring to elevate our class—have been its most better enemies. It is generally believed that the Admiralty, with all their prejudice against the engineers as a body, have had, more than once, to reprimand one or two of these officers for the very absurd and insufficient tests they have applied to candidates for entry.

One of these gentlemen, who is generally considered to have signalised himself in this very respect, has fortunately retired from his position. With such enemies at the gates, and with indifference or repugnance at head quarters, no wonder naval engineers "go to the wall." However, as "C." very justly points out, the increasing requirements for mechanical science and skill in the "navy of the future" will before long compel attention to this disagreeable subject, and the patching and tinkering schemes of the past will have to give place to a thorough "reconstruction." R. N.

CENTRIFUGAL PUMPS AND STEAM HAMMERS.

Sir,—May not the number of the revolutions of a centrifugal pump, when working at such a speed as only to support its head of water to the top of the column — as contrasted with its revolutions when producing its maximum duty — be found to be in the exact ratio that the total power consumed is to the actual duty performed?

That is, if 50 revolutions support a certain height of head without running over, and 400 revolutions deliver the maximum quantity for the power applied, then is not the effective duty 75 per cent.?

If the centrifugal pump works indefinitely thus at 50 revolutions no trace of the transposed power will be found but in the increased temperature of the water; but when the maximum speed is applied does the water then come over the delivery orifice in the ratio of 350 or of 400?

The figures, of course, are only assumed. If the "centrifugal" were a rotative or other water tight medium for raising water, then all revolutions would produce a corresponding duty, and, if the head were too high for the power, then the revolutions would be reduced to *nil*, and no heat would be evolved. The subject is, I think, one of fitting consideration, and, if in favour of centrifugal pumps, then their simplicity of parts would soon effect a general adoption.

Concerning the steam hammer controversy, may there not practically be a corresponding different kind of effect produced by one ton falling one foot in one unit of time, and one quarter of a ton falling four feet in the same time as there is found to be between the joiner and mason's iron hammer and his wooden mallet: the latter allows time for the inertia of the object struck to be overcome, and produces a certain class of work which the iron cannot do. So likewise in pile driving, a light tup and great height may sink the pile as soon as a heavy one a less height; but the latter produces a different effect on the pile itself. If self-acting apparatus to hammers is objectionable, why not effect this without any machinery, and be able to admit the steam either above the hammer or not, and to work the valve by hand or otherwise, according to the practical experience of each operator and the material he has to work upon, and the speed he ought to work at? W. E. C.

23rd June, 1862.

* We believe "C." is still in the service.—Ed. E.

THE STRENGTH OF SHAFTS.

Sir,—In order to explain myself more fully, allow me to put the question again.

Required, the diameter of a wrought iron shaft 100ft. long, having a pulley of 3ft. diameter, and making 100 revolutions per minute, with 15-horse power acting at the circumference of the pulley, the value of a horse power to be 33,000 lb., raised 1ft. high per minute. The answers given in this week's number do not take into account the length of the shaft; the rules given are perhaps intended for fly-wheel shafts, where a 20-horse shaft would differ little in length from one for 50-horse power. In "Templeton's Workshop Companion," at page 148, the following appears:—

"Elasticity of Torsion.—The angle of flexure by torsion is as the length and extensibility of the body directly, and inversely as the diameter, hence the length of a bar or shaft being given, the power and the leverage the power acts with being known, and also the number of degrees or torsion that will not affect the action of the machine, to determine the diameter in cast iron with a given angle of flexure."

"Rule.—Multiply the power in pounds by the length in feet, and by the leverage in feet, divide the product by 55 times the number of degrees in the angle of torsion, and 4th root of the quotient equals the shaft's diameter in inches." In an example given for a 35ft. length, 1 degree in the angle of torsion is used. To apply this rule in my case 1-horse power acting at the circumference of this pulley would raise 55 lb. 600ft. high per minute (I find I have made an error in my former letter, 110 lb. at 300ft. per minute ought to have been 55 lb. at 600ft. per minute), $55 \times 15 = 825$ lb., which 15-horse power would raise at 600ft. per minute.

$$\frac{825 \times 1{,}5 \times 48}{55 \times 1} = 1080 \quad \sqrt[4]{1080} = 5{,}7 \quad \frac{5{,}7}{1{,}12} = 5\text{in. nearly for wrought iron.}$$

The question appears to be how many degrees in the angle of torsion a shaft will bear without its permanent elasticity being destroyed in terms of its diameter and length. W. C.

Sir,—Having seen in The Engineer of the 20th inst. that "W.C." remarks, How many degrees in the angle of torsion ought to be allowed per foot in length for wrought iron?

I beg to refer him to the following rules, which, I hope, will enable him to make the proper allowance for torsion:—

Let θ = the angle of torsion in degrees of a circle.

Then for cast iron $\theta = \frac{2284 \text{ L.}}{1000\ d.}$

Then for wrought iron $\theta = \frac{1965 \text{ L.}}{1000\ d.}$

in which L is the length of the shaft in feet, and d the diameter in inches. As an example, suppose a vertical shaft of cast iron, 6in. in diameter and 40ft. in length, be strained to the extent of its elastic force, the angle of torsion will be

$$\frac{2284 \times 40}{1000 \times 6} = 15{\cdot}22 \text{ deg.}$$

This amount of twisting could not, in ordinary cases, be permitted in practice; but it shows the range within which the calculation must be confined, and the limit of absolute safety as respects strength to resist torsion. The rule, moreover, indicates the condition that the angle of torsion is as the length directly, and the diameter inversely; and may, therefore, be adjusted with precision to the degree of accuracy with which the motion of the first mover must be transmitted.

Again, perhaps, the following rule may be useful for finding the diameter of shafts.

Multiply the power in pounds by the leverage at which it acts, and by the length of the shaft, both in feet; divide the product obtained by 53·5 or 71·3 times the number of degrees in the angle of torsion allowed, according as the shaft is of cast or wrought iron, and extracting the biquadrate root, equal the diameter of the shaft in inches.

Thus, by a line of shafting 48ft. in length, the power transmitted is 500 lb. acting at the circumference of pulleys of 1½ft. radius, required the diameter, so that the angle of torsion shall not exceed 3 deg. at the extremity, the shaft being wrought iron.

$$\left.\begin{array}{rl} \text{Here } 500 \times 48 \times 1{\cdot}5 &= 36{,}000 \\ \text{and } 71{\cdot}3 \times 3 &= 213{\cdot}9 \end{array}\right\} \text{ then}$$

$$\frac{36000}{213{\cdot}9} = \sqrt[4]{168{\cdot}3} = 3{\cdot}60\text{in. the diameter of the shaft.}$$

Wearmouth Colliery, June 25th, 1862. T. B.

A GROAN FROM THE CYLINDER.

My dear Mr. Editor,—I live near Manchester, and singular to say in these bad times, I work night and day: now I am very much overworked, and troubled, and so pray do advise my master what doctor he must have to me: as doctors do so much differ, he is quite perplexed what to do. My body is 35in. diameter, and I stride twenty times every minute, and take 6ft. each stride, and to accomplish this, and with it, pull a weight equal to 216 horses, the valves of my body have to open full, and keep open as long as I stride, or nearly so; my vacuum or condensing powers are consequently bad, being positively choked; now this being the case, they find it necessary to bang into my body, through my very large (24in. across) D valves 26lb. of steam, and continue the same on nearly all the stride; this is too bad they say; I can stand it tho', and so they go on. I therefore sometimes lose my temper, and kick my great big driving spur off me. I then get a short rest. My last speed of the sort was rather a serious one, so my master sent for three steam doctors, and consulted upon my state: when the first said, O, smash her up, and put in a pair of high pressure horizontals in her place, and you will save 30 to 40 per cent. in fuel. Now this is unkind, and fairly cut me to the quick, sir; I hate those horizontal fellows. Young upstarts, they do not know their own place; I declare they are quite taking ours; but, sir, I am glad to say, my master won't take No. 1 doctor's advice. Then comes doctor No. 2: he says, "you must give her valves more lap, so as to cut off at about half stroke." Now, how is this possible? They cannot give me more steam at the beginning of stroke, and if my steam gets down 2lb. the engineer comes at me and says I am running under speed, when all the time I am doing all I can; then he says, Put her in first-rate order. I beg to say I am in good order, considering the work I do. Now doctor No. 3 says, Change her spur-gearing, and run her 30 strokes a minute; you can then cut off at earlier than half stroke, if you keep the same steam on at the commencement of stroke you will have power gained, vacuum made good, and a saving of 20 per cent. in fuel. Now the other doctors are bad, but this man surely must be raving mad; why, I shall be done up in half a day. Pray advise my master what to do with me, as I know he reads your most valuable paper, and if you say a word for me he is sure to see it.—Yours sincerely,

A 40-Horse Engine.

Manchester, June 23, 1862.

MARINE GOVERNORS.

Sir,—In the second portion of Mr. Olrick's paper on marine governors, reported in your impression of June 20th, we note a description of our governor so full of errors that we shall feel obliged if you will, in justice to us, find space for the following few lines.

In the first place, great stress is laid by Mr. Olrick on the error of using a weight to bring back the sleeve. It so happens that we now never use a weight for that purpose, having in our patent claimed the use of either a weight or spring. The former we have entirely abandoned, not for the reasons given by Mr. Olrick, but simply because, by the use of a spring, we can make a more compact arrangement, and we also find it better adapted to bring the valve back.

The statement that our governor only acts when a sudden start occurs is simply untrue (we trust for Mr. Olrick's credit not wilfully so), the slightest increase beyond a certain speed of the engine causing a corresponding action of the throttle valve. This we can assert from our own experience, and confirm by the testimony of many practical engineers who have used our governor.

We do not find in practice that the fly-wheel of our governor requires any counterbalance to its *vis viva* (or, we should add, vanes), but as we have not yet heard of a case where the fly-wheel has "run away any how," as described by Mr. Olrick, we do not (as our aim is to introduce as simple a governor as possible) see the necessity of adding any such encumbrances.

In addition to the above misstatements Mr. Olrick, during the reading of the paper, exhibited a model, as he said, of our governor; but in this model one of the most essential parts of our governor, viz., the stops on the shaft, upon which much of its sensitiveness consists, was omitted; and even after this was pointed out to Mr. Olrick he insisted on exhibiting this model, and pointing out its defects as belonging to our governor.

It surely does not look well for Mr. Silver, nor do we consider that it is calculated to do him much benefit, that his agent is forced to use arguments so utterly false and contrary to facts and practice in order to draw comparison between two governors favourable to his own. Miller and Knill.

June 25th, 1862.

The Danish Government have sent a steamer, the Hekla, to London with 200 young Danish engineers, artists, and mechanics on board, who come to see the Exhibition and the great manufactories of London. The arrangements are under the care of Mr. Hummel, Professor of Mechanics in the University at Copenhagen, and Mr. Rimestad, a popular member of the liberal party in the Danish parliament. The Government assumes the whole expense of the undertaking, the visitors sleeping on board their steamer.

Oil Wells.—The number of oil wells now flourishing near Oil Creek (Penn.), the great centre of the trade in that State, is 75; the number of wells that formerly flowed and pumped is 62; the number of wells sunk and commenced is 358; total, 495. The amount of oil shipped is set down at 1,000,000 barrels; amount on hand to date, 92,450 barrels; present amount of daily flow, 5,717 barrels. The average value of the oil, at 1 dol. per barrel, is 1,092,000 dols.; average cost of wells, at 1,000 dols. each, is 495,000 dols.; machinery, building, &c., from 500 dols. to 700 dols. each, 500,000 dols. The total number of refineries is 25. The oil sells at 58c. per barrel at the wells.—*New York Sun.*

The Railway Bridge at Pimlico.—A correspondent of the *Daily Telegraph* writes as follows with regard to the wrought iron arch railway bridge at Pimlico:—"Allow me to draw the attention of the proper authorities, through the columns of your journal, to the extraordinary vibration of the Victoria Railway Bridge. Being a frequent passenger and a practical engineer experience convinces me that the matter ought to be attended to. Many dreadful catastrophes have occurred through want of timely notice; I therefore humbly submit this to you, hoping at the same time that my fears on this important subject may be groundless.—I am, Sir, yours, &c.,

"June 17." "Viator."

Progress in the Plate Country.—The advices brought by the recently-established French mail service to the Brazils, state that Mr. James Bell, of Monte Video, has made propositions to the Government for the establishment of steam navigation on the two rivers Santa Lucia and San José. He will also carry out several important and necessary works to the same end. His enterprise is no easy undertaking, as the Santa Lucia river, during several months of the year, is almost a torrent. Yet, if Mr. Bell is successful, there is no doubt that he will render Banda Oriental an immense service. The Monte Video papers state that the Uruquay river is at present unusually low, and that the Villa del Salto steamer found great difficulty in passing the difficult Corralito paso. A project has been started by the Monte Video Government to carry out, in conjunction with that of Entre Rios, works for the improvement of the navigation. The San Jeruando Railway is far advanced, and a trial trip will be made upon it in the course of the ensuing month.

Naval Gossip.—Several shipwrights from the Sheerness dockyard are employed at Shoeburyness in preparing the Warrior target for further experiments.—The new wet and dry docks and floating basins in course of formation at Chatham will be sufficiently capacious to receive vessels at least 100ft. longer than any of those now attached to the navy.—The construction of the various defences for the protection of Pembroke Dockyard and the haven at Milford have been vigorously carried on during the spring. Batteries are now in course of erection on four commanding sites, viz., Popton Point, Hubberstone Point, and South Hook Point, while new fortified barracks are in progress at Scoveston.—On Friday, or rather early on Saturday, for it was long after midnight, Mr. Monsell moved for, and, to the surprise of most people, obtained a select committee to inquire into the expenditure incurred since the beginning of 1858 on various descriptions of improved ordnance, whether obtained by contract or manufactured at Woolwich, and into the result obtained by such expenditure.

Foreign and Colonial Jottings.—A company is proposed, with a capital of £500,000, for the further development of river navigation in India and China.—"Prince Alfred of England," says the *Phare de la Manche*, "visited, at Cherbourg, the iron-plated frigates Normandie and Couronne, and the steam vessel Napoleon, which are in the roadstead. He also went over the breakwater, arsenal, and other maritime establishments in the town.—The Peninsular and Oriental Company's steamers will cease running from Lisbon on the 7th of July. The commercial community at Lisbon have expressed much regret at this step, and trust that the directors will allow the India steamers to call off the port for passengers and mails. We wonder whether French competition has anything to do with this change? There can be no doubt that the development of railways and improved inland communication through Spain and Portugal will have an important influence on previously existing arrangements.—The length of the proposed Varna Railway is 116 miles. It will run from Rutschuk, on the Danube, to Varna, on the Black Sea, and thus, by connecting with the existing steam lines on those waters, will complete the route from London to Constantinople, and reduce the distance between the two places to four and a half days.—We read in a contemporary:—"There is an item in the news from America which may not be understood without a word of explanation. The first is the vote of Congress to enlarge the locks of the Erie and Oswego canals. These canals are State works, with which the general Government has nothing to do; but they are now seized, like the railways, for military purposes. When these locks are enlarged every gunboat in the Federal navy can pass into the great lakes, including Lake Ontario and the river St. Lawrence. The enlargement of these locks means the invasion of Canada and war with Great Britain."

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants of Provisional Protection for Six Months.

807. MICHAEL HENRY, Fleet-street, London, "Improvements in kilns, ovens, and furnaces."—A communication from the Société Coignet, pere et fils, et Compagnie, Boulevart St. Martin, Paris.—*Petition recorded 22nd March*, 1862.

1051. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in fire-arms."—A communication from the Society Cordier and Company, Paris.—*Petition recorded 11th April*, 1862

1151. ALFRED PIERRE TRONCHON, South-street, Finsbury, London, "Improvements in the construction of houses, palisades, and other similar constructions."—*Petition recorded 21st April*, 1862.

1205. THOMAS WOODHOUSE ASHBY, Stamford, "Improved apparatus for obtaining motive power from the wind."—A communication from Ludwig Hauswald, Friederich Hauswald, and Carl Gustav Dittmar, Riga, Russia.—*Petition recorded 24th April*, 1862.

1232. ALFRED HENRY FIELDEN, Castle-street, Holborn, London, "Improvements in show jars, lamps, signals, and lighthouses, and other methods of illumination."—*Petition recorded 30th April*, 1862.

1389. LEOPOLD D'AUBREVILLE, Boulevart de Strasbourg, Paris, "Improvements in metallic cross sleepers for railways."—A communication from Pierre Quantin, Bordeaux, France.—*Petition recorded 9th May*, 1862.

1434. JEAN DANIEL GAVILLET and JEAN PIERRE FELIX GANTON, Rue Leonie, Montmartre, Paris, "Improvements in paddle-wheels applied either for propelling steamboats or as prime movers."

1449. MICHAEL HENRY, Fleet-street, London, "An improvement in, or addition to, gloves."—A communication from Hugues Michel Cheilley, Philippine Antoinette Cheilley, and Philippe Cheilley, Rue de Grammont, Paris.—*Petitions recorded 13th May*, 1862.

1497. ROBERT WILLIAM SIEVIER, Guilford-street, Russell square, London, "An improvement in rams for naval warfare."—*Petition recorded 17th May*, 1862.

1543. GEORGE CRAWFORD, Beaumont-street, Portland-place, London, "Improvements in musical instruments."

1545. SAMUEL TURNBULL and FREDERICK TURNBULL, Holywell Mount, Shoreditch, London, "Improvements in the manufacture of floorcloths and like coverings."

1549. GEORGE BARLOW, Birmingham, "A new or improved method of laying submarine telegraphic cables."—A communication from Thomas Shaw, Philadelphia, U.S.

1551. WILLIAM ROBERTS and THOMAS GREENACRE, Millwall, Middlesex, "Improvements in cocks or valves for steam or other fluids."—*Petitions recorded 22nd May*, 1862.

1554. PETER MCGREGOR, Manchester, "Certain improvements in machinery for spinning and doubling cotton and other fibrous substances."

1555. ROBERT BLACKLIDGE Accrington, Lancashire, "Improvements in the preparation of materials for sizeing, dressing, or finishing warps, yarns, textile fabrics, or paper, and also for thickening colours."

1557. WILLIAM EDWARD WILEY, Graham-street, Birmingham, "Improvements in the manufacture of certain kinds of penholders; which improvements may also be applied to pencil-cases and holders for crayons and other solid writing or marking materials."

1561. EDWIN MAW, Leamington, Warwickshire, "Improvements in constructing ships, vessels, forts, and batteries."

1563. WILLIAM CLARK, Chancery-lane, London, "A new manufacture of socks and stockings."—A communication from Jean Jacques Maurer, Boulevart St. Martin, Paris.—*Petitions recorded 23rd May*, 1862.

1565. JOHN HARRISON and ROBERT PARKINSON, Blackburn, Lancashire, "Improvements in the manufacture of rollers for preparing, spinning, doubling, sizeing, winding, warping, and weaving."

1567. CHARLES DE BERGUE, Strangeways Works, Manchester, "Improvements in iron framing applicable to supporting coverings or surfaces intended to resist blows or pressure."

1568. CHRISTOPHER BRAKELL, WILLIAM HOEHL, and WILLIAM GUNTHER, North Moor Foundry Company, Oldham, Lancashire, "Improvements in steam and other motive engines."

1569. MARK WALLS and JOHN CROMPTON, Bolton, Lancashire, "Improvements in railway signals."

1571. WALTER BRIERLEY and GEORGE FREDERICK SMEETON, Halifax, Yorkshire, "Improvements in apparatus connected with targets."

1573. WILLIAM WORBY, Ipswich, Suffolk, "Improvements in reaping machines."

1574. JEAN ANDRE CECILE NESTOR DELPECH, Castres, France, "Improvements in pumps."

1575. ROBERT MICHAEL LETCHFORD, Three Colts-lane, Bethnal Green, London, "An improvement in the manufacture of matches."

1577. JOSEPH ELLICOTT HOLMES, South Parade, Chelsea, Middlesex, "Improvements in machinery for digging or cultivating land."

1579. JOSEPH ELLICOTT HOLMES, South Parade, Chelsea, Middlesex, "Improvements in printing machinery."—A communication from Frederic Otto Degener, New York, U.S.—*Petitions recorded 26th May*, 1862.

1581. EDMUND TUCK, Leadenhall-street, London, "Certain improvements in electrical manipulation, applicable to submarine telegraphs."

1583. WILLIAM EDWARD GEDGE, Wellington-street, Strand, London, "Improvements in the manufacture of wire ropes or cables."—A communication from Louis Chauvet, Passage des Petites Ecuries, Paris.

1585. JONATHAN IRELAND, Manchester, "Improvements in forming moulds for card cylinders."

1587. WILLIAM CLARK, Chancery-lane, London, "Improvements in brakes for railroad carriages."—A communication from Augustine Irel Ambler, Roseline Nancy Ambler, and Warrick Martin, Milwaukee, Wisconsin, U.S.

1588. FREDERICK TOLHAUSEN, Faubourg Montmartre, Paris, "A new or improved method of applying various mineral and organic substances to wire gauze, metallic and asbestos tissues, for rendering said tissues available for ornamental and useful purposes."—A communication from Edouard Heinhold, Faubourg Montmartre, Paris.

1589. GEORGE HENRY SANBORN, Fleet-street, London, "Improvements in revolving breech-loading fire-arms."—A communication from George Gates, Worcester, Massachusetts, U.S.

1590. JOHN HAY, Troon, Ayrshire, N.B., "Improvements in war ships, also applicable in part to floating and land batteries or forts, and in part to mercantile and other vessels."

1591. JOHN DUFFUS, Cullen, Banffshire, N.B., "Improved apparatus for measuring piece goods or webs."

1593. DENNIS TOPHAM MOSS, Camden-terrace, Leeds, Yorkshire, "Improvements in fastening horse shoes."—*Petitions recorded 27th May*, 1862.

1597. JOHN HOWARD KIDD, Manchester, "An improved manufacture of compositions applicable for waterproofing fabrics, for coating and protecting various articles, and for various other purposes."

1599. JOHN ROGERSON, Newcastle-upon-Tyne, Northumberland, "An iron floating dock to be used for the purpose of building and repairing ships, steamers, barges, and floating vessels of all descriptions."

1601. JAMES FORTESCUE HARRISON, Cambridge-quare, Hyde Park, London, "Improvements in preserving the bottoms of ships from the attacks of barnacles and other incrustations."

1603. THOMAS TURNER, Redditch, Worcestershire, "Improvements in machinery for scouring and polishing knitting and other pins and needles."

1605. JOHN HIRST, jun., Dobcross, and ENOCH OPENSHAW TAYLOR, Marsden, near Huddersfield, Yorkshire, "Improvements in means or apparatus for evaporating water and other fluids, and in economising the use of steam."

1607. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in the manufacture of tinned lead pipes, and in the apparatus employed therein."—A communication from Charles Felix Sebille, Paris.

1608. WILLIAM BLACKMORE Foynes, Limerick, and HENRY LAMB, Ennis, Clare, Ireland, "Improvements in burning limestone, and generating steam."

1609. JAMES ALLEN RANSOME, Ipswich, Suffolk, "Improvements in the manufacture of and in fastening railway chairs with wood trenails."—*Petitions recorded 28th May*, 1862.

1628. ISOPY LEON, South street, Finsbury, London, "An improved curb or rein for enabling riders or drivers to stop restive or runaway horses."—*Petition recorded 30th May*, 1862.

1640. WILLIAM THOMAS SMALLWOOD, Narrow-street, Limehouse, and WILLIAM WRIGHT, Dean's-buildings, West India Dock-road, Middlesex, "Improvements in water-closets."

1642. THEODORE VICOMTE DE VEYE, Passage des Petites Ecuries, Paris, "A coating intended to protect iron from rust, and to preserve wood, cloth, paper, and pasteboard used for packing or roofing."

1650. LEOPOLD CHAUBART, Great Tower-street, London, "An improved mode of and apparatus for raising the level of water in rivers, canals, and other watercourses."—*Petitions recorded 31st May*, 1862.

1660. JOSEPH BAKER, Coatbridge, Lanarkshire, N.B., "Improvements in pumps."

1662. CARROLL EUGENE GRAY, Great Suffolk-street, Southwark, Surrey, "Improvements in apparatus for extracting, rendering, receiving, purifying, cooling down, and delivering oleaginous and fatty matters or other material treated by steam pressure for extraction."

1664. WILLIAM EDWARD NEWTON, Chancery-lane, London, "An improved mode of making the handles of shovels, spades, dung forks, and other analogous articles."—A communication from Alonzo Virgil Blanchard, John Dickinson Blanchard, and Franklin Blanchard, Palmer, Massachusetts, U.S.

1666. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improved machinery for breaking and cleaning flax and other like fibre-yielding plants."—A communication from Gelston Sanford and James Edward Mallory, New York, U.S.

1668. JOHN JAMES HENRY GERHARDT, Lawrence-lane, London, "An improved fastening for bags, purses, and other similar articles."—A communication from Anton Berg, Frankfort-on-the-Maine, Germany.—*Petitions recorded 2nd June*, 1862.

1670. GOLDSWORTHY GURNEY, Bude, Cornwall, "Improvements in apparatus for production and application of artificial light."

1674. STRINGER WESTON, Tenterden, Kent, "Improvements in trusses."—*Petitions recorded 3rd June*, 1862.

1678. GEORGE PEEL, jun., and JOSEPH SIMPSON, Soho Foundry, Manchester, "Improvements in the construction, arrangement, and mode of working hydraulic presses, and in the arrangement of force-pumps."

1680. WILLIAM JAMES, Red Hill House, Dudley, Worcestershire, "Improvements in bolts, spikes, and nails, and in apparatus for their manufacture."

1682. RICHARD ROE, Friargate, Yorkshire, "Improvements in planes for tonguing, working sash fillisters, or other similar purposes."

1684. GIOVANNI BATTISTA TOSELLI, Threadneedle-street, London, "Improvements in apparatus for freezing and cooling liquids and mixing syrups."

1686. GEORGE HENRY SANBORN, Fulham-road, Brompton, Middlesex, "Improvements in refrigerators."—A communication from Thomas Gates, Worcester, Massachusetts, U.S.

1688. EDWARD SCHEUTZ, Brompton, Middlesex, "Improvements in rotatory engines."

1690. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improvements in the construction of grain and grass harvesters."—A communication from David Osborne, Auburn, New York, U.S.—*Petitions recorded 4th June*, 1862.

1692. GEORGE RYDILL, Wardrobe-place, London, "An improved hydraulic pump or engine for raising liquids and obtaining motive power, also applicable for the ventilation of mines and other useful purposes."

1694. JAMES BELL, Portobello, Midlothian, N.B., "Improvements in fastenings for railway chairs."

1696. JOHN MARTIN STANLEY and JABEZ STANLEY, Sheffield, Yorkshire, "Improvements in stoves or apparatus for diffusing heat."

1700. WILLIAM ROWE, East India-road, Poplar, Middlesex, "An improved forge and bellows."

1702. GEORGE HADFIELD, Bootle Village, near Liverpool, "Improvements in the manufacture of casks or barrels, and in the machinery and apparatus to be used in the construction of the same."—*Petitions recorded 5th June*, 1862.

1704. JAMES VERITY, Carlton-road, Kentish-town, London, "An improved composition for coating and preserving walls or other exposed surfaces."

1706. GEORGE DARLINSON, Much Park street, Coventry, Warwickshire, "Improvements in the manufacture of ribbons."

1708. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improvements in knitting machinery."—A communication from James Green Wilson, New York, U.S.—*Petitions recorded 6th June*, 1862.

1714. JAMES LOVEGROVE, Dalston-lane, Hackney, London, "Improvements in apparatus for inspecting small sewers and drains, and for facilitating the removal of obstructions therein."

1716. ALFRED FORD, Priory, Battersea, Surrey, "An improved method of protecting beer and other fluids from the direct action of atmospheric air."

1718. JOHN KEELING, Reading, Berkshire, "Improvements in apparatus for the manufacture of gas."

1720. CHARLES WILLIAM HECKETHORN, St. Ann's-road, Brixton, Surrey, "Improved apparatus for obtaining and applying motive power."—*Petition recorded 9th June*, 1862.

1724. WILLIAM SMITH, Salisbury-street, Adelphi, London, "Improvements in photography"—A communication from M. Henri Lissagaray, Rue Ollivier, St. George's, Paris.

1726. JOHN KINLOCK and THOMAS EDMESTON, Preston, Lancashire, "Improvements in looms for weaving."

1730. HENRY CONSTANTINE JENNINGS, Great Tower-street, London, "Improvements in the preparation of skins for driving bands and harness traces."—*Petitions recorded 10th June*, 1862.

1736. JOHN DAVIS WAKE, Cornhill, London, "Improvements in the construction of ships and vessels."

1740. DAVID CRICHTON, WILLIAM DONBAVAND, and DUNCAN CRICHTON, Manchester, "Improvements in looms for weaving."

1742. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in cradles or swing cots."—A communication from Hans Nannestad, Stockholm, Sweden.

1744. JOSEPH ELLICOTT HOLMES, South Parade, Trafalgar-square, Chelsea, Middlesex, "Improved machinery for cultivating or harrowing land"—A communication from Orman Coe, Port Washington, Wisconsin, U.S.—*Petitions recorded 11th June*, 1862.

1746. JOHN INGHAM and WILLIAM PICKARD WOOD, Valley Dye Works, Bradford, Yorkshire, "Improvements in preparing colouring matters for dyeing and printing."

1748. FREDERICK TOLHAUSEN, Rue du Faubourg, Montmartre, Paris, "A new or improved surgical injecting apparatus."—A communication from Claude André Jozansl. St. Romain-de-Benet, Charente Intérieure.

1750. HENRY STOCKTON FIKMAN and WILLIAM JAMES WILLIAMS, Great Suffolk-street, Southwark, Surrey, "Improvements in apparatus for cutting up and preparing as food or chaff for animals or for any other purpose straw, hay, corn-stalks, roots, and all other similar substances."—A communication from Joseph Eystra, Muscatine, Iowa, U.S.

1752. ANTOINE SALVIATA, Great Portland-street, London, "An improved mode of producing indestructible inscriptions and ornamental surfaces in gold and other precious metals."—A communication from Laurent Radi, Venice.

1754. MICHAEL JACKSON, Curtain-road, Shoreditch, London, "An improved shield for the gums, to protect them from injury when cleaning the teeth."—*Petitions recorded 12th June*, 1862.

Invention Protected for Six Months by the Deposit of a Complete Specification.

1795. GEORGE HASELTINE, International Patent-office, Fleet-street, London, "Improvements in roofs for railroad cars and hurricane decks of vessels."—A communication.—*Deposited and recorded 17th June*, 1862.

Notices to Proceed.

345. GEORGE SMITH, Holland-grove, North Brixton, Surrey, "Improvements in shawls."—*Petition recorded 10th February*, 1862.

502. FRANCIS JOHN BOLTON, Bolton-row, Mayfair, London, "Improvements in rifle and gun stoppers and oil bottles."—*Petition recorded 11th February*, 1862.

366. JOHN ROBB, Aberdeen, N.B., "Improvements in ventilation, and in apparatus employed for that purpose."

372. THOMAS SPENCER, Liverpool, "Improvements in propellers for navigable vessels and engines for actuating the same, parts of which are applicable to other purposes."

373. ALEXANDER SAMUELSON, Cornhill, London, "Improvements in building ships and vessels."—*Petitions recorded 12th February*, 1862.

379. WILLIAM WILLIAMS, Bath, Somersetshire, "Improvements in pianofortes."

382. WILLIAM HENRY BROWN, Camberwell, Surrey, "An improvement in yards, fore, and aft booms and gaffs."—*Petitions recorded 13th February*, 1862.

397. ARTHUR JOHN DODSON, Clapham, Surrey, "An improved composition for coating, covering, or protecting ships' bottoms, applicable also for coating or covering railway sleepers, telegraphic wires, and other surfaces, and likewise as a cement and as a substitute for metal for certain constructive purposes."

399. THOMAS DUNCAN MCFARLANE, Glasgow, Lanarkshire, N.B., "Improvements in sewing machines."—*Petitions recorded 14th February*, 1862.

408. CORNELIUS TURNER and JACK SHAW, Airedale Woollen Felt Mills, Leeds, Yorkshire, "Improvements in felted fabrics."

415. ARTHUR HENRY HARRISON, Park-place, Highbury, London, "An improved under garment for gentlemen and ladies' wear."

417. JONATHAN RUSSELL, Westbury-villas, Camberwell, Surrey, "Improvements in the method of raising sunken, submerged, or stranded vessels."—*Petitions recorded 15th February*, 1862.

423. EDWARD THOMAS HUGHES, Chancery-lane, London, "An improved method of and apparatus for collecting the gases given off from furnaces."—A communication from Emil Langen, Siegburg, Prussia.—*Petition recorded 17th February*, 1862.

434. WILLIAM FIRTH, Burley, Leeds, Yorkshire, "Improvements in machinery for digging or turning up soil."—*Petition recorded 18th February*, 1862.

441. NATHANIEL SYMONS, Cambridge-street, St. Pancras, London, "Improvements in steam engines for increasing the powers thereof by a different form of piston, internal top and bottom of cylinder."—*Petition recorded 19th February*, 1862.

457. CHARLES WOOD, Bramford, Suffolk, "Improvements in horse rakes."—*Petition recorded 20th February*, 1862.

464. EDWARD SMITH CREASE, Gracechurch street, London, "Improved machinery for drilling, boring, or excavating rock or other earthy substances."

467. WILLIAM MCADAM and WILLIAM CHRYSTAL, Glasgow, Lanarkshire, N.B., "Improvements in sheaves or pulleys, journals, bushes, and other similar bearing or rubbing surfaces."—*Petitions recorded 21st February*, 1862

471. WILLIAM HENRY ROSS, Liverpool, "Improvements in the manufacture of sugar."—A communication from Edward Beanes, Havana, Island of Cuba.

479. DAVID BLAIR WHITE, Newcastle-upon-Tyne, "Improvements in apparatus for protecting liquids from the atmosphere while remaining in and during their discharge from the vessels containing the same."—*Petitions recorded 22nd February*, 1862.

495. LEWIS DAVIS, Gloucester-garden, Hyde Park, and FREDERICK MAJOR PARKES, Marylebone, London, "An improvement in the production or manufacture of gas for lighting and heating."

496. RICHARD ARCHIBALD BROOMAN, Fleet-street, London, "Improvements in reaping and mowing machines."—A communication from Marie Pierre Amaranthe Ferdinand Manier, Laigle, France.—*Petitions recorded 24th February*, 1862.

499. JOHN CARNABY, Skinner-street, London, "Improvements in turning, managing, and regulating the taps and valves of gas pipes."

505. WILLIAM CLARK, Chancery lane, London, "Improvements in tobacco pipes."—A communication from Mr. Paul Ambroise Doury, Boulevart St. Martin, Paris.

503. THOMAS WATSON and ROBERT DRACUP, Thornton, near Bradford, Yorkshire, "Improvements in means or apparatus for preparing and combing wool and other fibres."

512. COURTENAY KINGSFORD, Fenchurch-street, London, "A new composition for the manufacture of bread."—*Petitions recorded 25th February*, 1862.

527. WILLIAM CLARK, Chancery-lane, London, "Improvements in the clasps or fastenings of bracelets, neck chains, and other articles of jewellery."—A communication from Messrs. Eugene Fauche and Charles Auguste Ravaut, Boulevart St. Martin, Paris.

531. JOHN SMITH, sen., Coven, near Wolverhampton, Staffordshire, "Improvements in drying wheat and other grain."—*Petitions recorded 26th February*, 1862.

578. THOMAS TILLAM, Church-street, Deptford-green, Kent, "An improved method of purifying gas."—*Petition recorded 3rd March*, 1862.

1045. FRANCOIS RIGOLLOT, Passage des Petites, Ecuries, Paris, "Improvements in machinery or apparatus for manufacturing rivetting pegs for boots and shoes and other pins or pegs."—*Petition recorded 11th April*, 1862.

1232. ALFRED HENRY FIELDEN, Castle street, Holborn, London, "Improvements in show jars, lamps, signals, and lighthouses, and other methods of illumination."

1288. HENRY FOWLER BROADWOOD, Great Pulteney-street, London, "Improvements in the construction of pianofortes."—*Petitions recorded 30th April*, 1862.

1591. JOHN DUFFUS, Cullen, Banffshire, N.B., "Improved apparatus for measuring piece goods or webs."—*Petition recorded 27th May*, 1862.

1655. JOHN HIRST, jun., Dobcross, Saddleworth, and ENOCH OPENSHAW TAYLOR, Marsden, near Huddersfield, Yorkshire, "Improvements in means or apparatus for evaporating water and other fluids, and in economising the use of steam."—*Petition recorded 28th May*, 1862.

1610. JOHN CRITCHLEY, Manchester, "An improved rib fastener for umbrellas and parasols."—*Petition recorded 29th May*, 1862.

1664. WILLIAM EDWARD NEWTON, Chancery lane, London, "An improved mode of making the handles of shovels, spades, dung-forks, and other analogous articles."—A communication from Alonzo Virgil Blanchard, John Dickinson Blanchard, and Franklin Blanchard, Palmer, Massachusetts, U.S.

1666. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improved machinery for breaking and cleaning flax and other like fibre yielding plants."—A communication from Gelston Sanford and James Edward Mallory, New York, U.S.—*Petitions recorded 2nd June*, 1862.

1690. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improvements in the construction of grain and grass harvesters."—A communication from David Osborne, Auburn, New York, U.S.—*Petition recorded 4th June*, 1862.

1692. GEORGE RYDILL, Wardrobe-place, London, "An improved hydraulic pump or engine for raising liquids and obtaining motive power, also applicable for the ventilation of mines and other useful purposes."—*Petition recorded 5th June*, 1862.

Patents on which the Stamp Duty of £50 has been Paid.

1494. LEMUEL DOW OWEN, Tottenham-court-road, London.—A communication.—Dated 21st June, 1859.

1492. JAMES MEIKLE, Rumford-street, Glasgow, Lanarkshire, N.B.—Dated 21st June, 1859.

1567. BRIDGE STANDEN, Salford, Manchester.—Dated 1st July, 1859.

Patents on which the Stamp Duty of £100 has been paid.

1442. FREDERICK WILLIAM MOWBRAY, Shipley, near Leeds, Yorkshire.—Dated 23rd June, 1855.

1431. WILLIAM TEALL, Wakefield, Yorkshire.—Dated 22nd June, 1855.

1418. JOHN LOUIS JULLION, Combe House, Tovil, Kent.—Dated 21st June, 1855.

And notice is hereby further given, that all persons having an interest in opposing any one of such applications are at liberty to leave particulars in writing of their objections to such application, at the said Office of the Commissioners, within twenty-one days next after the date of the Gazette (and of the Journal, in which this notice is issued.

List of Specifications published during the Week ending 21st June, 1862.

2801, 4d.; 2802, 9d.; 2803, 7d.; 2804, 7d.; 2805, 4d.; 2806, 3d.; 2807, 3d.; 2808, 3d.; 2809, 9d.; 2810, 1s. 10d.; 2811, 10d.; 2812, 3d.; 2813, 10d.; 2814, 6d.; 2815, 3d.; 2816, 1s. 7d.; 2817, 7d.; 2818, 3d.; 2819, 4d.; 2820, 3d.; 2821, 6d.; 2822, 7d.; 2823, 10d.; 2824, 10d.; 2825, 5d.; 2826, 1s. 6d.; 2827, 10d.; 2828, 3d.; 2829, 3d.; 2830, 9d.; 2831, 3d.; 2832, 3d.; 2833, 7s. 6d.; 2834, 3d.; 2835, 6d.; 2836, 10d.; 2837, 7d.; 2838, 3d.; 2839, 3d.; 2840, 7d.; 2841, 7d.; 2842, 6d.; 2843, 7d.; 2844, 7d.; 2845, 4d.; 2846, 3d.; 2847, 6d.; 2848, 1s.; 2849, 3d.; 2850 6d.; 2851, 10d.; 2852, 3d.; 2853, 3d.; 2854, 6d.; 2855, 3d.; 2856, 3d.; 2857, 6d.; 2858, 3d.; 2859, 6d.; 2860, 9d.; 2861, 7d.; 2862, 5d.; 2863, 4d.; 2864, 3d.

*** Specifications will be forwarded by Mr. Bennet Woodcroft, Great Seal Patent Office, Southampton-buildings, London, on receipt by him of the amount of price and postage. Sums exceeding 5s. must be remitted by post-office order, made payable to him at the Post-office, High Holborn, to Mr. Bennet Woodcroft, Great seal Patent Office.

ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

CLASS 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

2979. J. STANDFIELD, *Stratford*, "*Apparatus for regulating and indicating the speed of steam engines, &c.*"—*Dated 27th November*, 1861.

The First part of this invention consists in apparatus for indicating the number of revolutions or speed of the machinery to which it is attached, and at the same time giving motion to or regulating the valve or apparatus, which constitutes the second part of the invention, the said valve or apparatus being that through which the steam or other fluid is supplied to the cylinder or machine to be regulated. The apparatus for indicating the speed of the machinery consists of a cylindrical or otherwise conveniently shaped vessel, wholly or partially filled with water or other fluid, and in which fluid a fan or series of fans is caused to revolve with more or less rapidity, and thus to raise a column of the said fluid to a greater or less height in a tube connected to the said vessel; or the pressure of water may be exerted against any ordinary pressure gauge, the dial or tube being marked with figures corresponding to the speeds of the machinery. The tube may be fitted with a float, or have air enclosed at its upper end in the ordinary manner of such instruments. To compensate for evaporation when necessary the said tube may itself be supported on the surface of the water by means of a float, thus keeping its position in reference to the level of the fluid. Motion is given to the fan or fans by means of toothed wheels, a strap or cat-gut or other band, the wheels or pulley for the strap or band not being fixed to the spindle upon which the fan or fans are fixed, but to a collar which surrounds it, the said collar carrying the spindle round with it, but allowing of its free motion in a vertical direction. The spindle may be square, or have a fixed key in it upon which the collar slides; or the collar may have a set screw working in a key bed cut in the spindle. Instead of the fan or fans being set in the form of a screw, which they require to be in order to give the spindle upon which they are fixed a vertical motion, as above stated, and in which case the spindle may be immediately attached to the regulating valve of the engine or machine, the said fan or fans may be plain discs or arms, which are made to rotate in the fluid, the resistance to such rotation increasing with the speed of revolution. In order that this speed should not be excessive when the resistance desired must be sufficient to open a large valve or close the same, the patentee fixes intermediate arms in the cylindrical vessel in which the fluid is placed, which also prevent the water or fluid from receiving centifugal motion.

3045. A. PULLAN *and* W. LAKE, *New Cross*, "*Improvements in traction and other engines, and in wheels for traction engines and other carriages, and in giving motion to ploughs and other agricultural machines.*"—*Dated 4th December*, 1861.

These improvements in traction engines relate, First, to means for preventing the communication of the driving wheels to the parts of the engine generally. Also the improvements relate to the means for keeping the pinion on the driving shaft in connection with the teeth on or giving motion to the driving wheel. The improvements also relate to a former

patent granted to one of the present inventors (A. Pullan) and Richard Longstaff, and bearing date the 14th day of July, 1859 (No. 1670), and consists in obtaining increased width of bearing surface to the bearing wheels by an additional wheel, which is brought into position when required, and which, when not in use, will remain stationary, and in coming into and going out of action will move in a vertical direction. The improvements also relate to preventing the slipping of wheels of traction engines. Also the improvements relate to applying teeth or grippers to the metal surface or tyre of wheels upon wood felloes, such tyres projecting on each side beyond the felloes to facilitate the affixing of fresh teeth or grippers when they are required. The teeth or pins before referred to may be caused to act intermediate of these fixed teeth or grippers. Also the improvements relate to, when supplemental rails or shoes are employed in connection therewith, the bearing wheels of traction engines and other carriages. Also the improvements relate to the application of teeth on axes, and moving on the side surfaces of driving wheels, such teeth being connected together by links, and worked by a rod or rods from an eccentric on the driving shaft. Also the improvements relate to communicating motion to the driving wheels of traction engines by an endless band or endless bands of wire rope aided by clip sheaves or drums. Also the improvements relate to the use of wire ropes with projections formed thereon to run upon wheels whose surfaces are provided with holes or recesses for the projections to work in. Also the improvements relate to means of giving motion to the main wheels of traction engines.—*Not proceeded with.*

3120. H. J. OLDING, *Clapham-road, Surrey*, "*Locomotive engines.*"—*Dated* 12*th December*, 1861.

This invention relates, First, to a novel mode of transmitting motion from the pistons or piston rods of the steam cylinders to the driving wheels. The object of this improvement is to connect the piston rod to the driving wheel, or to attach the latter to its axle in such a manner that the driving wheel may be allowed to run loose on the axle when desired, as, for instance, when the steam is cut off from the working cylinders. This object is effected by means of a self-acting lever clutch, which is adapted to the nave of the wheel; and, when it is desired to transmit motion from the piston of the working cylinder to the driving wheel, this lever clutch is made to bind on the axle and nave, and thereby attach them for the time being firmly together; but upon cutting off the steam from the working cylinders, and thereby stopping the action of the pistons, the lever clutch will be drawn back, and the driving wheel left free to move on the axle without the latter rotating and keeping in motion the whole of the driving gear of the engine, as is now the case. The next improvement relates to an improved mode of constructing the pistons of the working cylinders. The piston consists of a top and bottom disc or plate, the former of which may be permanently attached to the piston rod, and the other secured in its place by screw bolts or otherwise. Recesses are made in the inner surfaces of these plates or discs to receive coiled or convolute springs, like clock or watch springs, which are made to act on the back of wedge shaped pieces or blocks. Segmental packing pieces form the packing of the piston, and are kept thrust outwards by means of the wedge shaped pieces, which, by bearing against the clock springs behind, will give a considerable amount of elasticity to the packing. The top and bottom plates or discs of the piston are secured together with the springs and segmental packing pieces between them by means of screw bolts, which may pass through the springs. The next improvement relates to the slide valves of steam engines, and consists in adapting to the backs of these valves segmental or other suitably formed packing pieces, which are kept up to the working face of the top plate of the valve by means of coiled, convolute, or clock or watch springs, as in the piston above referred to under the second head of the invention. The last improvement consists in adapting to the lever of the safety valve a convolute spring of the same construction as that employed under the second and third heads of the invention.

3123. S. B. HEWETT, *Bow*, "*Boilers or generators for steam engines and other uses.*"—*Dated* 13*th December*, 1861.

This invention, of improvements in the construction of boilers or generators for steam engines and other uses, applicable also to evaporators, and in pumps used therewith, or otherwise used, some of which improvements in pumps are applicable to pistons and piston rods generally, consists, with reference to boilers, in the construction of boilers or steam generators for steam engines and other uses, and evaporators, with a number of cells, tubes, or boxes, so as mutually to afford strength to stay each other, and to give strength to the whole structure of the boiler, generator, or evaporator; also to increase the amount of heating surface by causing the heat to pass through the cells, tubes, or boxes in the manner described. The invention, with reference to pumps, consists, in the First place, in the use of a piston constructed in two parts, to the upper of which is connected a tube enclosing the ordinary piston rod, and to the lower the piston rod is connected, both tube and rod being connected with a crosshead at the top, so as to admit of the tube or rod being turned, and the parts of the piston respectively connected thereto being also turned, thereby moving the intermediate packing outwards and tightening the packing of the piston, the under side of the upper plate of the piston being formed with bevelled teeth or cogs, gearing into bevelled pinions or pawls and ratchet wheels connected to screws and nuts, which act so as to expand the metallic or other packing. Another improvement in the pistons of pumps consists in a mode of tightening the packing, in which the lower plate of the piston is connected with a piston rod, and the upper plate with a tube concentric with and surrounding the said piston rod, as before described, but instead of the tube taking a circular motion, for the purpose of tightening the packing, it has a longitudinal motion (either with or without a circular motion, as preferred), by means of suitable tightening screws and nuts at the outer ends of such rod and tube, the outer edges of the plates of the piston being bevelled, so that, when the plates are forced towards each other by the said screws, they force the wedge formed packing rings outwards against the inner surface of the cylinder. The improvements in pumps consist, in the second place, in using a suction pipe with a worm rose inserted in it to prevent choking, such plug being capable of being withdrawn in order to clean out the pipe and remove sediment therefrom when required. And, in the Third place, the improvements in pumps consist in the adaptation and application of a two-throw crank with its connections, as described.

3126. H. J. OLDING, *Smith-square, Westminster*, "*Improvements in the mode of, and apparatus for, feeding steam boilers, also in apparatus for supplying fluids for other purposes, and in apparatus for raising fluids.*"—*Dated* 13*th December*, 1861.

The patentee claims, First, the mode described of arranging, combining, and applying apparatus for feeding steam boilers, according to which a chamber and pipes or passages are so arranged and combined with each other and with the boiler that the feed or supply of fluid to the boiler is self-acting or self-regulating, and is effected by the tendency of the fluid to act on the law of equilibrium of fluids, or to find its level, substantially in manner described. Secondly, the improved flat valve described, in so far as regards the arranging and combining of an annular float with stem and valve plate, substantially as described. Thirdly, the impinging plate valve described, in so far as regards the combining of a valve plate with a plate of broader surface, substantially as described. Fourthly, the arranging and combining of the impinging plate valve described with the spring with angular bend or projection, as described. Fifthly, the arrangement and combination of apparatus, substantially in manner described, for the purpose of feeding or supplying fluids to vessels other than steam boilers. Sixthly, arranging and combining apparatus for raising fluids, substantially in manner described.

3132. S. PADLEY, *Sawston*, "*Paddle wheels.*"—*Dated* 13*th December*, 1861.

This invention is carried into effect as follows:—The floats are disposed in any suitable manner independently around and between the concentric rims of the paddle wheels, which are keyed fast on the paddle shaft in the usual manner. Each float has an axis or shaft which passes through, and is free to vibrate in the rims of the wheels; the axis of each of the floats is, on the exterior face of the inner rim of the wheels, formed as a crank, or has a half crank fixed thereon, the pin of which is received by, and rotates in a corresponding hole or bush formed in, the rim or periphery of a disc placed parallel with the wheels, but eccentric to the axis thereof, and capable of adjustment thereon, which eccentric movement is employed in causing the floats to enter and leave the water, without the complication of mechanism involved in the various contrivances at present in use for producing the reefing or feathering motion in floats which have not a vibratory action, such as is due to their being mounted upon a horizontal shaft or axis according to the present invention.—*Not proceeded with.*

3133. P. QUANTIN, *Bouscat, near Bordeaux*, "*Moulded earthen or stoneware cross-sleepers for superseding wooden ones in the construction of railways*"—*Dated* 13*th December*, 1861.

In carrying out this invention, instead of using or employing wood sleepers or sleepers of iron cast or moulded for the purpose of supporting rails, the patentee manufactures moulded earthen or stoneware cross sleepers, of any required shape or size, and moulded hollow or solid, and to suit the various descriptions of rails which may be employed. He supports the rails upon such cross sleepers either by the interposition of wooden or other bed pieces, or without their intervention, and they may be keyed or fastened in any of the ordinary ways. Instead of employing clay alone he mixes it and tempers it with any other suitable material, the better to adapt it to the purpose for which it is intended to be employed. The cross sleepers of this invention can be made of various sizes and shapes to suit the rails of different descriptions; they are composed of two blocks of earthen or stoneware moulded to an uniform shape, which two blocks are united together by an iron rod of suitable strength. Thicknesses of felt, or any other similar compressible material, are inserted betwixt the blocks of earthenware and connecting iron rod or bar, the chains are placed over the rod or bar, and the whole is bolted fast together to form cross sleepers ready to receive the rails.

3140. R. A. BROOMAN, *Fleet-street, London*, "*Improvements in, and apparatus for the production and application of motive power in locomotive and other steam engines.*"—*A communication.*—*Dated* 13*th December*, 1861.

This invention is based upon what the inventor terms the spontaneous transformation of a liquid into an elastic fluid, or, in other words, into dry steam at the moment of generation, which he terms spheroidal steam. The invention consists, First, in the employment of a steam chamber floating in or on a metallic bath, serving in case of need for regulating the supply by the quantity of non-vaporised liquid it is capable of containing. Secondly, in the employment of a metallic bath of tin, lead, or other fusible metals, at the bottom of a generator for causing the spheroidal vaporisation in the floating chamber. The bath renders the bottom of the generator inoxidisable, and prevents it becoming perforated or pierced, a result often produced by the sudden and incessant effects of expansion and contraction. Thirdly, in the general arrangement of the feeding apparatus. Fourthly, in the construction and arrangement of a pyrometic vessel. Fifthly, in the construction of heat indicators for showing the temperature in the generators and condenser, and for registering and indicating the draught in the chimney. Sixthly, in the construction of a tubular supply generator. Seventhly, in the construction of a tubular condenser. The invention cannot be fully described without reference to the drawings.

3157. A. W. R. *and* W. WOODWARD, *Manchester*, "*Compound steam engines.*"—*Dated* 6*th December*, 1861.

This invention consists, First, in the arrangement and combination of a vibratory or fixed cylinder placed between the pillars of a beam engine, or between the pillars and the wall of the engine house, thereby requiring no additional foundation or engine house. The said vibrating or fixed cylinder is employed as an auxiliary or pusher to the beam engine, or it may act as a separate engine. In some cases the patentees take away the pillars of the beam engine, and substitute in their place a framework of iron so constructed as to support the vibrating or fixed cylinder; or they take away only one of the pillars, or substitute in its place a framework of iron so constructed as to support one side of the said vibrating or fixed cylinder, and cause the other side to be supported by a fixing, firmly secured to the wall of the engine house. They connect the said vibrating or fixed cylinder to the beam engine by means of a separate crank, crank shaft, and spur wheels, one end of the crank shaft being carried by the framework, and the other end working in a bearing fixed in the wall, through which it is carried, if required, so as to drive a separate part of the mill. The wheels are made of any desired size or proportion, and the vibrating or fixed cylinder is worked by high pressure steam direct from the boiler, and the steam, after passing through the said cylinder, passes to the cylinder of the beam engine, thereby forming a compact and efficient compound engine. Or the vibrating or fixed cylinder may be connected direct with the condenser of the beam engine, and thus form another arrangement of compound engine. The invention consists, Secondly, in the arrangement and application of a vibrating or fixed cylinder to a horizontal engine to act as an auxiliary or pusher to the said engine. They fix or place at the end of the engine a framing of cast iron, similar to the one they apply to beam engines, constructed so as to carry the vibrating or fixed cylinder, as the case may be; the said cylinder is connected to the horizontal engine by means of a separate crank, crank shaft, and spur wheels, one end of the crank shaft being carried by the said framework, and the other end working in a bearing secured to the wall through which it passes, if required, so as to drive a separate part of the mill, or for any other purpose. The invention consists, Thirdly, in the improved arrangement and construction of the framework for carrying the vibrating or fixed cylinder, so that the power will be contained within the said framework.

CLASS 2.—TRANSPORT.

Including Railways and Plant, Road-making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

3047. A. T. CARR, *Carlisle-street, Soho, London*, "*The addition to horses' shoes of certain materials to prevent slipping.*"—*Dated* 5*th December*, 1861.

The inventor takes a fibrous material—such as cocoanut fibre, or any other fibre sufficiently strong to bear the pressure of a horse's foot—and makes a layer of it of the shape of a horse's shoe, and in preparing such layer it may be made of threads of the material employed, plaited or laid side by side together, or the fibres may be in any other manner formed into a layer of the shape above mentioned. He then applies the layer of material thus made to the ground or wearing surface of a shoe on a horse's foot, and secures the layer in that position by the means of wires passing round both the shoe and the whole or a portion of the layer of material in several places. In order to facilitate the application of a layer of material to a shoe in this way he prefers to form the shoe with transverse recesses across that surface of it which is placed in contact with the horse's foot, through which the wires for securing a layer of material to the shoe may be passed. *Not proceeded with.*

3055. S. W. SILVER, *Bishopsgate-street, and* H. PRINGLE, *King's-road, Chelsea*, "*Shoes for horses, &c.*"—*Dated* 9*th December*, 1861.

This invention consists, First, in manufacturing shoes entirely of hardened india-rubber, known as ebonite or vulcanite, alone or mixed with metal filings or particles of metal, or with gritty material, in order to give hardness and durability to the shoe. Secondly, in lining shoes as at present made with vulcanite or ebonite, in order to prevent the jar to the feet of the animals. Thirdly, in forming shoes, whether made of iron and lined or not, with one or more joints to allow of the natural lateral expansion of the hoof.—*Not proceeded with.*

3094. V. L. DAGZAN, *Paris*, "*Paving roads, &c.*"—*Dated* 10*th December*, 1861.

This invention consists in the superposition of two roads or ways, one underneath composed of trenches or gutters made of beton and covered with bitumen or other water-resisting composition, serving to conduct the water and detritus into the drains, and sufficiently strong to support the upper way, which is intended for the circulation of horses, carriages, and foot passengers. The upper road or way is composed of slabs or flags placed horizontally side by side, with spaces left at certain distances between them for the passage through them of water, detritus, and other matters into the drains. These slabs or flags may be of granite, or other stone or substance sufficiently strong and suitable for the purpose. The patentee prefers, however, using slabs made of cast iron frames, having cellular openings or spaces in which are applied and fixed, by bitumen or other suitable substance, blocks of sandstone, porphyry, granite, or wood impregnated or not with preservative substances. The distance between the two ways may vary; thus the upper road or way may be close to and be supported on parts of the lower road or way, provided with canals or conduits for running off the waters, detritus, and other matters driven into the drains by flushing or by cleaning tools; or the distance between the two roads or ways may be several yards, in which case the slabs or flags forming the upper way are supported by walls, posts, columns, arcades, vaults, or other suitable supports, so that the cleaning may be easily effected, and at convenient times, underneath the upper way. With this latter construction drains may be placed in the centre of the lower road or way, which will render the cleaning easy, and permit of placing under the upper way water and gas pipes and telegraphic wires, which may be placed between the two ways, so that their keeping in order and repairing may be performed without stopping the circulation, or very rarely.

3113. W. LIGHTFOOT, *Harwell, Berks*, "*An improved bridle.*"—*Dated* 12*th December*, 1861.

The bit, the subject of this invention, acts or causes action not in the mouth of the horse, but on the nose and under jaw, except in so far as regards the snaffle, and acts with any required degree of severity at the option of, and with perfect ease to, the rider or driver, as the compression on the nose is consequent on an easy pull on the curb rein, which, putting in action the lever force obtained by the manner in which the parts of the bit are put together, prevents any horse, however fidgety or vicious, from bolting. The invention cannot be described without reference to the drawings.

3117. W. S. LONGRIDGE, *Derby*, "*Railway wheels and tyres.*"—*Dated* 12*th December*, 1861.

This invention cannot be described without reference to the drawings.

3130. T. WALKER, *Birmingham*, "*Apparatus for indicating the speed of vessels, and for taking soundings.*"—*Dated* 13*th December*, 1861.

For indicating the speed of vessels the patentee applies inclined or oblique vanes upon a tube which is capable of freely rotating upon a central spindle or axis, when acted upon by passing through the water. The fore end of the axis is provided with a protector, which he prefers to be of a conical form, adapted to prevent the water pressing upon the end of the tube carrying the vanes, and thereby causing friction, which would impede the proper working of that tube by the action of the water on its oblique or inclined vanes. The wheelwork for registering the rotation of the vanes is carried by a frame, which, like the protector, does not revolve, and is enclosed within the tube, or within the protector, or it is carried by some other part of the apparatus which does not revolve. Motion is given to the registering wheelwork by a wheel attached to the tube of the rotators acting on a pinion, or by a stud on the tube of the rotators acting on the arms of a wheel affixed to a worm or pinion giving motion to the first of the series of wheels, or by other suitable means. A slide or other cover encloses the dials, which slide is capable of easy removal to see the distance run without removing the wheelwork. For taking soundings the apparatus is similarly arranged, but with a weight to assist its descent, and the dials are formed to indicate fathoms and parts of fathoms in place of miles and parts of miles.

3149. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Railway rolling stock.*"—*A communication.*

This invention relates to certain improvements in railway rolling stock, whereby the passage over sharp curves is greatly facilitated, and the wear and tear of the rails and wheel tyres thereby considerably reduced. According to this invention it is proposed to fit one of the wheels of the axles of railway rolling stock in a peculiar manner upon the axle, so as to admit of it rotating freely thereon, the opposite wheel being secured fast on the axle in the ordinary manner. The boss of the loose wheel is prolonged and extended considerably towards the longitudinal centre of the axle, and this long boss is bored out conically or tapering at each extremity, in which parts are fitted correspondingly tapered or conical metal bushes made in two or more segments, which are connected together by having a projection or tongue formed on one segment fitting into a corresponding slot or opening in the other, so that one segment cannot be moved longitudinally along the axle without drawing the others with it. These conical bushes are tightened up by means of bolts, one end of which bears upon the inner ends of the bushes, whilst the other passes out through the boss at the outer side of the wheel, where a nut is applied; the turning of this nut draws either of the conical bushes along the axle, and further into the tapered bore of the boss, thereby tightening the bushes, and insuring the perfect coincidence of the centre or axis of the axle and the centre of the wheel. The wheel is maintained upon the axle by means of a ring bolted on to the inner end of the long boss, and bearing against a shoulder or collar forged or fitted on to the body of the axle. A chamber or cavity is left between the two bushes inside the boss for the reception of lubricating material.—*Not proceeded with.*

3157. W. G LAWS, *Tynemouth*, "*Railway point signals.*"—*Dated* 16*th December*, 1861.

This invention cannot be described without reference to the drawings.

CLASS 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

3075. T. MELLODEW, *Oldham*, C. W. KESSELMEYER, *Manchester, and* J. M. WORRALL, *Salford*, "*Dyeing and printing certain descriptions of woven fabrics.*"—*Dated* 7*th December*, 1861.

This invention relates to an extended application of a method of dyeing and printing, for which letters patent were granted to the present patentees, dated 17th June, 1861 (No. 1547), and refers to certain descriptions of woven fabrics with a silk face and cotton or linen back, or substantially so, which are manufactured in such a manner that the silk surface thereof may be raised so as to form a plush or nap. According to the specification filed in accordance with the above letters patent, the said method was stated to be applicable only to velvets, velveteens, cords, and other such fabrics with floated threads as are woven with a silk face and cotton back, or substantially so, and it was also stated that these fabrics usually consisted, First, of a close and form back of grey or undyed cotton warp threads, interwoven at intervals for the purpose of forming this back with weft threads either of cotton or silk; and, Secondly, of a floating surface of silk weft threads which are interwoven with the warp threads of the back, in such a manner as to cover one side of such back, and to produce races between the floating weft threads of the surface and the back of the fabric, into which races a cutter's knife and guide can be introduced, in order to cut open and divide the floating weft threads of the surface, thus producing the plush or pile of the fabric. The patentees now find that the said method of printing and dyeing may be applied also to such fabrics with a silk face and cotton or linen back, or substantially so, as are not intended to be cut as aforesaid, but in which a plush or nap may be produced by raising the silk surface instead of cutting open the silk threads of such surface, although they do not confine themselves to such process of raising, as all goods with back and face as aforesaid, which are manufactured so as to be capable thereof, will be benefitted by these improvements. The patentees claim, First, the application of the solution of iron or other mordaunt by the process of padding to the back only of such fabrics as aforesaid. Secondly, the use for the above described fabrics of yarn of cotton, or other such material as aforesaid, which is prepared only for dyeing by the application of a mordaunt.

3089. C. TEAR, *Liverpool*, "*Facilitating the drying of wet or damaged cotton or wool, &c.*"—*Dated* 10*th December*, 1861.

This invention consists in placing a layer of wet cotton between suitable open net work formed of waterproofed or prepared cord or twine (to prevent rotting), and which is caused to hold the cotton in the required position by means of suitable strips of wood inserted through the meshes across the net work. After the nets are filled it is proposed to suspend them from the ceiling of a room, or upon suitable supports, where a free current of air can circulate around them, or, when convenient, in the open air.—*Not proceeded with.*

3091. H. SPENCER, *Rochdale*, "*Apparatus for spinning and doubling cotton, &c.*"—*Dated* 10*th December*, 1861.

This invention relates, First, to throstle or doubling frames, and consists in placing hooks screwed or otherwise fixed in the front of the thread or guide board, such hooks to be bent in an angular form, so that, if the thread or yarn should expand or throw out, it will then come in contact with such hooks, which will prevent making hard waste, and will also prevent breaking the adjoining threads or yarns. The invention relates, Secondly, to an improvement in the drag in throstle frames, and consists in fixing a slide or slides so as to rise and fall with the lifting or lowering rails or plates. Another improvement is intended to give a more equal drag upon the cloth. Thirdly, the improvements relate to the guide wires of the throstle and doubling frame, and consist in bending and forming such guide wires so that the thread or yarn can be placed in front of the same without having to thread from the back.—*Not proceeded with.*

3091. J. LEEMING, *Bradford, Yorkshire*, "*Looms.*"—*Dated* 11*th December*, 1861.

This invention relates to an improved method or means of actuating movable shuttle boxes, the object being to obtain much greater simplicity in detail, and to reduce the cost of construction. For these purposes the patentee affixes on the crank shaft, by preference (although a stud or other fixing would answer), a casting fitting loosely thereon, and allowing the said shaft to revolve without impediment; the said casting is formed with a provision at one of its ends for the insertion and securing by a bolt or screw of a wrought iron (or other suitable material) continuation extending through the frame of the going pivot, and having a hook near its extremity, and immediately over the star or pin wheel, which is a wheel made fast to the axis of the series of shuttle chambers; the said hook is raised out of contact with the star or pin wheel by reason of the casting upon the crank shaft being so weighted as to be the heavier end. On the same shaft he places another similar casting and wrought iron continuation with hook immediately under the said star or pin wheel; the weight in the case of this second casting and continuation is so arranged as to give the preponderance to the hooked end, so that when not operated upon the slay board carrying the series of shuttle chambers and the star or pin wheel is free to vibrate, without the said star or pin wheel coming in contact with the hooks on either of the continuations of the two castings upon the crank shaft. He applies springs or other equivalents to the two castings upon the crank shaft, and passes them partly round bowls or pulleys, and from thence to the usual or other operating motion. The change from one shuttle to the next, in either direction, is effected by the operating of either of the before-mentioned strings or connections, which will lower or raise one of the hooks into position to be operated upon by the star or pin wheel coming in contact therewith when the slay board is in the act of beating up, which will have the effect of causing the series of shuttle chambers to turn in one direction or the other, as desired, according as the different strings are operated. It will be obvious that, by applying these means to both ends of a loom, together with a series of shuttle chambers at each end of the slay board, the patentee is enabled to weave what is termed pick and pick or single pick. This motion, when applied in connection with a Jacquard or index machine, requires to have another motion, which he applies to the top rail of the loom, and consists of a bracket bolted thereto, and containing two bell-cranked levers mounted upon a stud; to one end of each lever the string for operating the hook and casting is made fast, and to the other a string passing partly round a bowl or pulley to the needles of the machine; the two bell cranked levers are so arranged and adapted that, when operated by the needle of the Jacquard or other machine, they will remain raised in such position until the slay board has been beat up, and the hooked end of the continuation of the casting upon the crank shaft has come in contact with the star or pin wheel, and so turned the series of shuttle chambers, after which a horizontal bar, sliding in a bracket attached to the top rail, comes in contact with the bell crank lever, which has remained raised, and pushes it back to its normal position, ready to be again operated upon in like manner. The slide bar he operates by means of a tappet or cam and lever worked from the tappet shaft, or other suitable place, which enables him to adopt the time of its operating to the requirements of any pattern machine. The invention also consists in means for imparting a variable motion to the cloth roller in looms, according as such roller is increased in diameter by the addition of the cloth. To attain this object he applies to the crank shaft or elsewhere a wheel made fast thereon, and geared into another wheel mounted upon a stud made fast to the frame of the loom, and on which it may revolve freely, carrying upon its axis two double elliptical cams or tappets and frame in which the said cams or tappets work, and similar to the cams or tappets for which letters patent were granted to the present patentee on the 5th February, 1861 (No. 301), and which he then employed for actuating the lay of the loom, but which he now uses for actuating a lever mounted upon a stud made fast to the frame of the loom, and carrying pawls or catches mounted upon a stud made fast thereon, and operating upon a catch or ratchet wheel; the upper end of this lever he forms with a slot, to allow of a horizontal bar or connection between it and the frame in which the two double elliptical cams or tappets rotate being raised as the diameter of the cloth roller increases, in order to impart to the said roller, through the ordinary train of gearing, the desired variable motion. The connection between the lever and frame, in which the cams or tappets rotate, he causes to be operated by means of a screwl or wedge-like incline being operated upon by the increased diameter of the cloth roller, and coming in contact therewith.

3122. R. ASHWORTH, G. SHEPHERD, J. CORMACK, *and* J. DEARDEN, *Stacksteads, Lancashire*, "*Looms.*"—*Dated 13th December*, 1861.

These improvements consist in dispensing with the roller known as the emery roller in front of the loom, and in bringing the cloth from the loom at any constant velocity agreeing with the number of picks, thereby making the cloth even and uniform in texture.—*Not proceeded with.*

3131. T. B. GIBSON, *Glasgow*, "*Ornamenting certain fabrics.*"—*Dated 13th December*, 1861.

This invention relates to the production of a new ornamental fabric, and consists in applying coloured designs, either by the aid of block or cylinder printing, to harness curtains and other figured fabrics of that class. The designs—which may be printed in various colours upon the fabric—may either differ from the pattern woven into the fabric, and be applied both to the ground and patterns alike, or they may be of precisely the same design as the woven patterns, and applied only to the patterns, so as to leave the ground uncoloured.

3136. J. HETHERINGTON, *Manchester*, T. WEBB, *Uttoxeter, Stafford, and* J. CRAIG, *Tutbury*, "*Apparatus for spinning and doubling cotton, &c.*"—*Dated 13th December*, 1861.

This invention relates, First, to the spindles of spinning and doubling machines which have no top bearings, and consists in forming the top of the spindle as a screw for the purpose of holding and conducting the thread to the flyer. As a matter of construction the patentees form the screw of a separate piece, and adapt it to the spindle. Secondly, the invention consists in the application of a flexible band to the copping rail. The elasticity may be gained by metal or other substances, but the method they prefer is to apply a strip or bush of leather to the copping rail, which, while it is sufficiently small to afford steadiness to the spindle, is elastic enough to admit of a little play, and so prevent a building action. Thirdly, the invention consists in the employment of a tube fixed to the bolster rail for the purpose of supporting the spindle, and which tube is traversed by the copping rail. Fourthly, the invention relates to a method of throwing the wheels of spinning and doubling spindles out of gear. For this purpose they so adapt the wheels that they may be lifted or depressed the one from the other, the former method being preferred.

3153. G. DAVIES, *Serle-street, Lincoln's-inn-fields, London*, "*The manufacture of textile materials.*"—*A communication.—Dated 16th December*, 1861.

This invention consists, First, in the employment or use for the manufacture of textile fibres of certain parts of the leaves and stalks of the plant known as Indian corn or maize, in lieu of the materials hitherto employed for such purposes. Secondly, in a novel and peculiar process whereby the fibrous portions of such plant are separated from the other parts of the same, and reduced to a state in which they are capable of, and suitable for, being prepared, spun, and woven by the machines and processes originally employed in the preparing, spinning, and weaving of flax, hemp, and other similar textile materials. The leaves which surround the grain as well as the stalks are placed separately in a steam boiler, where they are exposed during several hours to the boiling or steaming process. Ordinarily steam alone is sufficient to separate the filamentous matter from the other portions of the plant; sometimes, however, according to the quality of the fibrous material, it is necessary to add to the water a little lime or solution of soda. During the boiling process the textile matter separates itself from the other constituent parts of the plant, and precipitates itself by reason of its greater specific gravity to the bottom of the boiler, whilst the lighter parts continue to remain in suspension in the liquid, so that, when the latter is drawn off, the textile matter alone remains at the bottom of the boiler. The boiling being terminated, the textile material is removed from the boiler to be washed and dried. After drying the filaments are heckled in a similar manner to flax or hemp, and they may then be spun and woven in the ordinary manner.

3155. D. CHALMERS, *Glasgow*, "*Improvements in looms for weaving, and in the manufacture of cloth therefrom.*"—*Dated 16th December*, 1861.

This invention cannot be described without reference to the drawings.

3162. R. SHAW, *Marple, Chester*, "*Carding engines.*"—*Dated 17th December*, 1861.

This invention consists in the employment of an endless band or web of open wire work, lattice, or woven fabric continuously traversing beneath the carding cylinders, and used as a creeper for the purpose of conveying any loose cotton or other fibrous material falling from the cylinders whilst being carded back again to the "licker in." The endless web or creeper passes around rollers at each end of the carding engine, and extends the entire length thereof, and the fly and loose filaments are taken from its surface by an extra card roller, and delivered thereby to the "licker in," the dirt and extraneous matter falling through the meshes of the wire web.

3165. J. PLATT *and* W. RICHARDSON, *Oldham*, "*Gins for cleaning cotton from seeds.*"—*Dated 17th December*, 1861.

This invention relates, First, to apparatus which acts as a transferring comb for conveying the material to the rollers in a prepared condition, after the manner described in the specification of a patent granted to the present patentees 5th June, 1861 (No. 1439), and also to other apparatus used for agitating the material, or pushing it forward towards the rollers, and consists in so forming such apparatus that it shall yield to any undue resistance. Thus if a connecting rod be employed they cause it to act through the agency of springs, which may be caused to collapse by such resistance as aforesaid. Secondly, the invention consists in the adaptation of weights to the rollers of roller gins, for the purpose of causing the one to bear against the other.

CLASS 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

3102. H. TANNER *and* W. PROCTOR, *Bristol*, "*Applying manure to growing crops, &c.*"—*Dated 11th December*, 1861.

This invention relates to the method of applying manure (by preference in the state of powder) to the land during the growth of various crops, and consists in applying the same by means of an implement which, at the same time that it supplies the desired quantity of manure, mingles or intermixes the same with the soil. The machinery or apparatus which the inventors propose to employ for effecting this object consists of a combination in one machine or implement of any suitable drill or apparatus for distributing the manure with a horse hoe, or with any other cultivator of the like description, which stirs up or scarifies the land without inverting or turning it over.—*Not proceeded with.*

CLASS 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

3124. W. BELL, *Leamington*, "*Kitcheners or cooking ranges.*"—*Dated 13th December*, 1861.

The patentee claims, First, making the bottom grate in two parts, namely, of a frame to be built into the brick work, and a perforated plate or set of grate bars to be dropped or placed in the said fixed frame. Secondly, making the false or contracting grate-bottom with a projection at its back, so as to make it fit against the back of the fire-place, and prevent the fire falling at the back of the said false or contracting grate-bottom into the ash pit or pan of the grate. Thirdly, a ventilator consisting of an iron box situated at the back and on the top of the oven, the said box extending the whole or nearly the whole width of the oven, and communicating therewith by means of a series of openings or one large opening. Lastly, the new or improved latch for the oven doors of kitcheners or cooking ranges constructed essentially in the manner described.

CLASS 6.—FIRE-ARMS.

Including Guns, Swords, Cannons, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

3062. F. VETTERLIN, *Scarborough-street, Goodman's Fields, London*, "*Breech loading arms, and the projectiles to be used therewith.*"—*Dated 10th December*, 1861.

This invention relates, First, to the novel mode or method on which the inventor constructs breech loading ordnance, and in the novel application and mode of working the same as fitted to such ordnance. The Second part or portion of the present invention has reference to the novel form and description of projectile intended to be discharged either from breech loading ordnance or small arms. In constructing breech loading ordnance according to the present invention the inventor forms the breech end of the gun, or that portion of the metal surrounding the breech or chamber, of an increased thickness, sufficient to resist without injury the strain which it is possible could be produced by the explosive force of a maximum charge. At right angles to the longitudinal axis of the piece he forms a horizontal opening through the chamber at a suitable distance from the rear end, such horizontal opening or crossway being of greater depth or vertical height than the diameter of the chamber, and of such a width in the direction of the axis as will enable two pieces of metal to be inserted therein, and of a sufficient thickness to resist the effects of the explosions. For the purposes of stopping or closing the breech, as well as for guiding the cartridge into its proper place in the chamber, and preventing the abrasion which would otherwise take place against the sharp edges of the horizontal opening or crossway, he forms two blocking pieces, of such a length as will enable a circular hole or opening to be bored at one end of each, of the same diameter as the chamber, and when the charge has been entered and driven home, these blocking pieces being slid back or across into such a position as they shall present a portion of their surface at about the middle of their length to the end of the chamber or space devoted to the reception of the projectile and its explosive charge, so that the breech is for the time effectually closed and the escape of gas prevented. For smooth bores he forms a projectile, whether conical, pointed, rounded, or flat headed with the body recessed, or of a reel like form, and he winds thereon a layer or layers of rope or twisted strands to such a diameter as will fill the chamber or bore, and by means of a groove or recess around the edge of the after flange of the projectile, he secures the cartridge or case containing the explosive charge. The projectiles may be of cast or wrought iron, or of steel, for ordnance purposes, and for small arms they may be of lead or any other suitable metal. For rifled arms having three grooves he forms the projectile with longitudinal dovetail grooves, therein at such an angle as shall correspond with the spiral or twisted grooving of the bore, and he fits into the dovetail grooves wooden wings of any suitable wood, the direction of the fibre being transversely with the axis of the projectile, instead of being parallel therewith. The point or fore end of the projectile may be conical, convex, flat, or concave.—*Not proceeded with.*

CLASS 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

3099. D. VOGL, *Sambrook court, Basinghall-street, London*, "*Garments for gentlemen and ladies wear.*"—*Dated 10th December*, 1861.

This invention consists in manufacturing garments for gentlemen and ladies' wear in imitation of waistcoats or vests and fronts of jackets for ladies in such a manner that they shall be fastened behind instead of in front by means of rigid or elastic straps or bands, buckles or other suitable fastenings, the waistcoat or vest or jacket front being furnished in front with buttons or studs, and with or without button holes, so as to appear similar to an ordinary waistcoat or other front, dispensing entirely with the back thereof; but in cold weather a flap forming the back may be attached by means of buttons or otherwise, and the straps or bands may be so arranged as to combine a belt with the waistcoat or vest for the use of riflemen and others.

CLASS 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting, Glass, Pottery, Cements, Paint, Paper, Manures, &c.

3116. R. MUSHET, *Coleford*, "*Manufacture of iron and puddled steel.*"—*Dated 12th December*, 1861.

This invention consists in adding to and puddling with ordinary pig iron, cast iron, or refined iron in the puddling furnace, a quantity of titanic pig metal, in order by the said addition of titanic pig metal to improve the quality of the bar iron, or malleable iron, or puddled steel which it is intended to produce by puddling the said ordinary pig iron, cast iron, or refined iron in the puddling furnace.—*Not proceeded with.*

3139. J. KELLY, jun., *Roscommon*, "*Treatment of milk for the manufacture of butter.*"—*Dated 13th December*, 1861.

This invention relates to an improved mode of manufacturing butter by means of a dairy range. By this invention the milk is preserved in milk vessels of glass from the time it is taken from the cows until the butter is made, that is, from three to four days, which it takes to ripen, and it is kept entirely free from a tainted atmosphere, vermin, and all other impurities. The process of churning (in the lever churn, which is to be in connection with the dairy range) will occupy only a few minutes, as there is nearly a spontaneous separation of the butter from the whey and milk.—*Not proceeded with.*

3150. E. CAJOT, *St. Servais Belgium*, "*Treatment of pyrites for the manufacture of iron.*"—*Dated 14th December*, 1861.

According to these improvements the patentee mixes the residues of pyrites with other matters adapted to their proper fusion. The matters he employs are argillaceous earths, pulverised limestone or chalk, and he employs them conjointly or separately, according as their ascertained qualities are found favourable to the proper fusion of the pyritous residuum.

3151. J. WILLIS, jun., *Newcastle-on-Tyne*, "*The preparation of materials applicable to the manufacture of paper.*"—*Dated 16th December*, 1861.

This invention consists in the preparation of oatmeal, seeds, and saw-dust, so as to adapt them for use as ingredients in the manufacture of paper, either separately or in combination. The mode of preparing the oatmeal seeds is, for some kinds of papers, to split or divide them in a mill by means of fluted grinding stones, and for other kinds to grind them into a fine powder by bringing the grinding stones closer together, and if necessary to sift the powder. The mode of preparing the saw-dust is first to dry it in a kiln or otherwise, then to sift it and grind it into a fine powder, and sift it again if required. In case it should be found necessary, a small quantity of salt may be mixed with the sawdust for the purpose of preventing it from becoming inflamed by the heat caused by the friction of the stones. Also for finally sifting the ground sawdust it may be found advisable to employ a set of brushes, fixed on a travelling endless belt, kept to the surface of the sieve by springs on a revolving barrel covered with wire, and fixed brushes may be combined with the sieve.

CLASS 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-Magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

3100. J. W. AGNEW, *West Canada*, "*Electro-voltaic pocket battery.*"—*A communication.—Dated 10th December*, 1861.

The object of this invention is to produce an electro-voltaic battery simple in its construction, easy in its use, and capable of producing a great quantity of electro-voltaic fluid combined with weak tension and greatly increased chemical action, having a mild continuous polar current, sufficient to overcome the resistance of the human body, without inordinately shaking or convulsing the nervous system, and highly applicable for surgical and therapeutical purposes. It is constructed as follows:—A series of any number of hollow spiral tubes is formed composed of zinc and platinised silver ribbons or flattened wires, or any other of the heterogeneous metals, insulated from each other by crotchet cord, or other absorbent material calculated to retain moisture, so as to prevent contact between the two metals, and these ribbons or flattened wires and the crotchet cord are regularly and methodically twisted to the right and to the left in alternate tubes, and the tubes are placed horizontally parallel to one another at a sufficient distance to prevent contact, except at their extreme ends, where the metallic ribbons separate and diverge at right and left angles by the heterogeneous metal of the one crossing that of the other, and are efficiently soldered thereon. This series of tubes is held together on both sides by a framework composed of narrow slats of glass or other suitable material, coated with dissolved sealing wax, and adhering to narrow strips of gutta-percha, or other non-conducting material, cemented to the sides of tubes. The great advantage of this construction of battery is that, the tubes being hollow and open from end to end, an immense quantity of electricity is evolved by means of the atmospheric action and the action of the acids or other exciting fluids upon their interior as well as exterior surfaces.—*Not proceeded with.*

3109 J. POTTER, *Leeds*, "*Jointing or connecting telegraph wires, &c.*"—*Dated 11th December*, 1861.

According to this invention the wires to be jointed or connected are passed through separate conical shaped ferules or blocks, and a rivet head is then formed at the end of each of the wires. This will prevent the wires from being drawn back out of the ferules or blocks. Both the ferules or blocks are hollowed to admit of the wire passing through, and one of them is provided with a male screw and the other with a female screw, into which the male screw enters. Behind the thread of the female screw, and within the ferule, is a chamber or socket to admit the rivet heads of both the wires. When the two ferules or blocks are screwed together the rivet heads of the wires within the socket are pressed or drawn into contact, thereby forming a continuous length of wire or strand, while the ferules or blocks themselves form a close fitting joint.

CLASS 10.—MISCELLANEOUS.

Including all Patents not found under the preceding heads.

2936. T. W. DAVENPORT *and* S. COLE, *Balsall Heath*, "*Machinery to be employed in the manufacture of ornamental and useful articles in papier mache.*"—*Dated 22nd November*, 1861.

This invention is carried into effect as follows:—The inventors place a cutting tool similar to a brace bit, or of any kind suitable to produce the form of article they are about to make, in a chock upon the end of a spindle of a lathe, and the papier mache of which the article is to be formed they place in front of the back slide rest of the lathe. The material on the slide rest is then advanced to the cutting tool upon the spindle, which operates upon one-half of the thickness of the papier mache panel; the panel is then reversed, and the cutting tool operates upon the other side of it, cutting through the other half, and thus forming the article complete, with the exception of sand papering off the slight fur or edge that is left upon the periphery of the article.—*Not proceeded with.*

2938. B. PEYTON *and* W. F. BATHO, *Birmingham*, "*Laths for supporting bedding and cushions in bedsteads, couches, &c.*"—*Dated 22nd November*, 1861.

This invention consists in constructing elliptical laths, each separate lath being composed of two strips of metal united or brought together at their two ends, and bowed towards the centre; then between the two strips the patentees fix hoops of steel, volute or other metal spring or springs, to constitute spring laths for supporting bedding cushions and seats.

2941. S. SANSUM, *Birmingham*, "*Penholders.*"—*Dated 23rd November*, 1861.

This invention consists in making penholders wholly of metal, each of the said penholders being made of one piece of sheet metal. The piece of sheet metal of which the holder is made is of a length equal to that which it is intended the holder to be made shall have, and of such a width that, when bent into a tubular form, it will make a hollow cylinder or tube of the diameter required for a penholder. The said piece of sheet metal is bent into a tubular form, so as to make an open jointed tube. One end of the said tube is suitably formed for the reception of a pen, and the other part of the tube is a substitute for the stick of ordinary penholders. The penholder may have an ornamented top on it, and may be otherwise ornamented.—*Not proceeded with.*

2944. J. WEEMS, *Johnstone, Renfrew*, "*Improvements in the manufacture of metallic tubes, and in coating or plating metals.*"—*Dated 23rd November*, 1861.

This invention relates, First, to the manufacturing of metal tubes with the view of producing a cheap substitute for brass or other similar tubing. Under one modification zinc tubes are formed by passing the metal strips through dies or rollers, and the overlapping or contiguous edges of the metal are brazed or soldered with the aid of the blow pipe, or other equivalent means. The tube may then be passed through a die or other suitable aperture, in order to impart a smooth finish thereto. The tube is then to be coated with copper, either by means of a galvanic battery, or by immersion in cold or heated solutions of the salts of copper, suitable for precipitating the metallic base upon the surface of the tube. These tubes may also be coated or plated with compound solutions of metals, so as to deposit a metallic alloy upon the surface of the tube, or its surface may, if preferred, be coated with tin and its alloys, or bronzed or lacquered.

2945. J. H. JOHNSON, *Lincoln's-inn-fields, London*, "*Toothed wheels.*"—*A communication.—Dated 23rd November*, 1861.

This invention relates to a peculiar manufacture of toothed wheels and pinions, and consists in moulding such gearing from sheet india-rubber in suitable moulds, the india-rubber moulded wheel or pinion being afterwards hardened in the manner usually adopted in making hard india-rubber articles, namely, by submitting the article whilst in the mould to the action of heat.

2943. B. A. BROOMAN, *Fleet-street, London*, "*An improved cup or vessel for administering liquids.*"—*A communication.—Dated 23rd November*, 1861.

The difficulty of drinking out of a glass or cup when in a recumbent position, and in giving drinks to children on the knees or in bed, has given rise to the present invention. This improved vessel is formed with a curved spout made to project from the lower part thereof, the outflow from which is regulated by a stopper carried on the end of a lever, and kept in contact with the mouth of the spout by a spring, and which is released to the extent required by depressing the tail of the lever; or a stopcock is fixed in the spout, or the spout is opened and closed by a plug fitting into or over the passage where it springs from the vessel, the plug being worked by a stud outside the vessel, connected to a rod to one end of which the plug is fixed.—*Not proceeded with.*

2947. J. PITKIN, *Clerkenwell, London*, "*Aneroid barometers.*"—*Dated 23rd November*, 1861.

This invention consists in "jewelling" the axes of the working parts of the mechanism of aneroid barometers and in inserting jewelling in the hole through which the spindle which carries the needle passes, so that the spindle shall be entirely surrounded by the ruby or other stone of which the jewelling is composed. And for the protection of the glass of portable aneroid barometers, the inventor applies a spring cover similar to the cover of a watch.—*Not proceeded with.*

2949. E. A. ROUVIERE, *Paris*, "*An improved pump.*"—*Dated 23rd November*, 1861.

The principle of this improved pump consists in the employment of two pistons of different diameters, which are firmly secured to each other, and work together in a pump barrel composed of two barrels or portions of different diameters, so that, as the pistons move or travel in their respective barrels, the capacity of the space comprised between them, that is to say, the space or portion of the pump bounded by the pistons, and the sides of the pump barrels, shall be continually undergoing variation, being either increased or reduced according to the direction in which the pistons travel, that is to say, when the direction of the piston's motion is such that the larger piston is moving towards the smaller barrel, and the smaller piston is receding from the larger barrel, the capacity of the said space is contracted or reduced, and when the pistons move in the reverse direction the capacity of the said space is increased or enlarged, by which means the forcing and suction of the water or liquid, that is to say, the pumping action, is effected.

2958. J. WILCOX, *Ludgate-hill, London*, "*Sewing machines.*"—*A communication.—Dated 25th November*, 1861.

The patentee claims, First, the general construction and arrangement of sewing machines, and apparatus used in connection therewith substantially as described. Secondly, the application and use to, and in, sewing machines of a revolving loop retainer or tension "let off," in combination with a rotatory hook or looper, and an eye-pointed needle, in the manner and for the purpose described. Thirdly, the application and use of leather or other sound deadening material interposed between those parts of the feed mechanism of sewing machines which strike against or come in contact with each other when at work, with a view to the prevention of noise as described. Fourthly, the system or mode of producing a self-acting intermittent action of the needle thread in sewing machines by holding such thread rigidly between suitable nipping surfaces until the stitch or loop is nearly or quite drawn up to the surface of the material being sewed, and then releasing the thread suddenly, so as to allow sufficient thread to be drawn through the apparatus with little or no tension or friction for the forming of the next stitch. Fifthly, the making of the hole through which the needle works in sewing machines in a separate piece or metal secured to the cloth plate, and carrying the feed surface to operate on all four sides of such needle hole, as described. Sixthly, the peculiar combination of mechanism for driving sewing machines, as described. Seventhly, the application and use of a double or forked connecting rod in combination with a suitable clamping apparatus arrangement for driving sewing machines, as described. Eighthly, the application and use in combination with a hammer of any suitable construction, of a check or adjusting plate substantially, as described.

2959. J. H. JOHNSON, *Lincoln's-inn fields, London*, "*Apparatus for preparing oval picture frames.*"—*A communication.—Dated 25th November*, 1861.

This invention relates to certain peculiar combinations of machinery or apparatus for coating oval picture frames with the enamel usually employed to gilding, and consists, essentially, in the use of a scraper or working down tool, in combination with the force plate of an eccentric lathe, or with an elliptograph or other suitable apparatus capable of describing or generating ovals, the scraping tool being made self-adapting to the inequalities or variations on the surface of the frame, and its scraping edge being the reverse of the intended moulding. When an eccentric lathe is used, the oval frame is mounted upon the face plate of the lathe, and describes an oval or ellipsis when rotated, while the scraper remains stationary, but is held against the frame by a yielding pressure. In the second case, where an elliptograph, or other similar contrivance is used, the oval frame is laid upon a stationary bed, and the scraper is caused to travel over its surface, by the action of the elliptograph, it being at the same time free to rise and fall, so as to allow for any inequalities on the surface under treatment.

2962. J. HALFORD, *Birmingham*, "*Improvements in collecting and utilising smoke, gases, and such like products of combustion, rendering the same available for heating steam boilers and other purposes where heat is required, which improvements are also applicable to the desulphurisation of coal in making coke.*"—*Dated 25th November*, 1861.

In applying this invention to coke ovens or open coke fires or heaps, instead of the chimney or chimneys now ordinarily used, the inventor constructs a close built or solid chimney which is closed at the top. Through the sides of this, near the top, he leaves holes which encircle it placed at such distances apart as may be required. This said chimney is enclosed in another of the same kind, as is now ordinarily made use of, or one constructed in any manner so as to draw off the smoke and other combustible products of the coal. He either connects this outer chimney with the inner one at the top or not, according to circumstances. The outer chimney has the effect of drawing off the smoke, gases, and such like products from the burning coal, and conveying the same to the holes near the top of the solid chimney, through which they ascend into a pipe or flue, which he constructs at the bottom of the fire, either on or under the surface of the ground, and which is either extended to the place where the heat is to be applied, or discharges itself into a main flue or pipe. Where a main flue is made use of (which, like the former or subsidiary flues, is carried either along or under the surface of the ground) he extends the same to the boiler, or to any other place where the heat is to be applied; as soon as the smoke arrives underneath the boiler, it is ignited, and the heat given therefrom serves either partially or totally instead of ordinary fuel. From the increased draught caused by this means of burning coal into coke, the sulphur is more effectually extracted from the coke than by the ordinary method.—*Not proceeded with.*

2961. P. COWAN, *Barnes*, "*A mode of utilising the waste heat of furnaces used in reburning animal charcoal.*"—*Dated 25th November*, 1861.

In the reburning of animal charcoal in revolving or moving cylinders, vessels, or retorts, the heat required for the purpose of reburning has to be raised to a very elevated point. Hitherto a large portion of this heat has been wholly wasted. Now the object of this invention is to utilise this waste or hitherto lost heat, and for this purpose the patentee applies to, or combines with, the furnace in which the cylinders, vessels, or retorts, are fitted and heated, or to or with the flues communicating with such furnace, a boiler or generator in such position as to be exposed to the action of the waste heat of the furnace, so that, if desired, steam shall be generated in such boiler or generator simultaneously with the carrying on of the process

of reburning the charcoal. The steam so produced may be carried off for use as required. The word "revolving," wherever it is used in this specification, is intended to include partially as well as completely revolving.

2965. A. W. Willis, *Great Russell-street, Bloomsbury, London*, "*Pencil cases or holders.*"—*Dated 26th November*, 1861.

For the construction of cases or holders for using short pieces of pencil in accordance with this invention, tubes of metal, wood, or any suitable substance may be employed. A tube is formed of the desired length and calibre or bore, the same being open at both ends, and having a slot down one side thereof, such slot commencing at one extremity of the tube, and extending nearly to the other end thereof. A small solid barrel or cylinder of brass or other suitable metal or substance is arranged so as to work within the tube, one end of such barrel or cylinder being furnished with two or more steel pins or points fixed vertically therein, and the side of the barrel or cylinder being provided with a knob or stud, such knob or stud working in the said slot, so as to cause the barrel or cylinder to traverse backward and forwards in the tube. The pencil employed is the ordinary cedar black lead pencil, and is fixed for use by gently pressing it upon the pins or points at the end of the said barrel or cylinder, which will hold the pencil perfectly firm. The pencil is introduced into the tube at the end at which the slot commences, and which may then be covered by a movable cap, thus closing or securing the end of the tube, and preventing the barrel or cylinder upon which the pencil is fixed from falling out.

2967. J. Brown, *Ribchester-terrace, Bridge-road, Stratford*, "*Fire bars and furnaces.*"—*Dated 26th November*, 1861.

This invention consists, First, in manufacturing fire bars in several parts, which the inventor calls clumps; these clumps can be made either of prepared clay, such as fire clay or iron as the case may require, so that one bar would consist of several clumps, according to the length of the bar required; these parts are kept together and prevented from falling through by means of troughs made of sheet iron, or by two flat sides kept apart by stretchers or bolts, the clumps lying therein. Secondly, in a novel shape for the ash hole or fire-place. This is done by making it bell mouthed and with a door to fit the mouth of the fire-place or ash hole working on a bar that extends across the mouth of the ash hole, and forms a damper, and regulates the generating of steam.—*Not proceeded with.*

2969. R. Harcourt, *Birmingham*, "*Fastening knobs to doors, drawers, &c.*"—*Dated 26th November*, 1861.

This invention consists in fastening knobs to doors, drawers, and other articles, and in connecting knobs to locks or other spindles, by means of a divided collar or plate, which is made to engage with the flange or shoulder which terminates the neck of the knob, or to engage with the neck of the knob. The invention cannot be described in detail without reference to the drawings.

2970. W. Sellers, *Keighley*, "*Apparatus for sewing.*"—*Dated 26th November*, 1861.

These improvements relate to that class of sewing machines in which two threads are employed, one operated by a needle and the other by a shuttle, and in which the various movements are obtained from one cam or tappet. The improvements consist in operating the needle by its cam or tappet, so that, when the shuttle enters the thread on the needle, the needle may have a slight back motion given to it sufficient to admit of the shuttle passing through without drawing off more thread than required for the passage of the shuttle, by which facility is given for using a much greater range in sizes of needles and thread in the machine, and of sewing greater varieties of work.—*Not proceeded with.*

2971. C. Stevens, *Charing-cross, London*, "*Penholders.*"—*A communication.*—*Dated 26th November*, 1861.

This invention cannot be described without reference to the drawings.—*Not proceeded with.*

2973. G. Bottomley, *Leeds*, "*Machinery for cutting up linen, cotton, woollen, and other rags*"—*Dated 26th November*, 1861.

In carrying this invention into effect one of the rollers employed is provided longitudinally with a series of blades having angular cutting edges, which, as the roller rotates, are brought in succession against the surface of a corresponding series of flat metal bars which are fixed in the periphery of the other roller. The cutting blades of the first roller are secured in their places by wedge-shaped pieces, which are firmly held by screw bolts, or in any other convenient manner. The two rollers are geared together by toothed wheels on their respective axles, so that they may revolve in unison, in order that the cutting edges of the upper roller or cylinder may always come against the flat bars of the other cylinder. It will, therefore, be understood that, by this arrangement of parts, the rags or other substances will be nipped between the cutting edges of one roller and the flat bars of the other, and will thus be cut or divided; and, after having passed between the two rollers, the rags or other substances will be delivered on to a pair of conical rollers, which are placed beneath and are made to rotate in opposite directions, so as to turn the cut rags or other substances over or round, and deposit them on another travelling cloth or apron in a longitudinal direction. The rags will be carried forward by this second travelling cloth or apron to a second pair of cutting rollers constructed like the first, and whereby they are still further cut up or divided, and in this state they are ultimately delivered from the machine into any convenient receptacle.

2974. D. Ker, *Plymouth*, "*Soap.*"—*Dated 26th November*, 1861.

The object of this invention is to improve the quality of that class of soap in which sulphate of soda is used as an ingredient. Hitherto soap made by the admixture of sulphate of soda with the saponified compounds while in a melted state has been very apt to become incrusted with an effervescence of soda, which detracts from its marketable value. The patentee has, however, found that, by the introduction of gluten into the soap containing sulphate of soda, the tendency to this effervescence will be removed, and a firm, clear soap will result.

2975. W. Firth *and* R. Ridley, *Leeds*, "*Machinery for working coal and other mines.*"—*Dated 26th November*, 1861.

This invention consists in applying, as hereafter explained, hammers actuated by compressed air, in order to drive suitable cutting tools into the face of the mineral in coal or other mines which are being worked, and so as to form longitudinal grooves or narrow cuttings to the extent required into the coal or other matter forming the upright face of the work. For these purposes a carriage is used mounted on wheels, suitable for moving on a tram or railway and being thereby guided parallel to the upright face of the work. On the carriage is applied a compressed air engine, arranged to work as a compressed air hammer by having a suitable hammer or head applied thereto, in such manner as to admit of such head or hammer receiving a quick to and fro motion from the compressed air continually supplied thereto from a suitable machine at a distance, properly arranged to keep up a constant supply of compressed air, a flexible pipe being used where necessary to admit of the carriage moving a distance along the face of the work, and yet retain its connection with the air supply pipe. Apparatus is applied to the carriage to support and guide a cutting tool to the work, in such a manner as to admit of the cutting tool being driven more and more into the coal, stone, or mineral, by repeated blows of the hammer, actuated by compressed air, and when the cutting tool has been driven by repeated blows a sufficient distance into the coal, stone, or mineral, the tool is withdrawn to admit of the carriage being moved a short distance, in order that the cutting tool may commence at a fresh point and be again driven in by the repeated blows of the compressed air hammer. The moving back of the cutting tool and the moving of the carriage or either of these operations may be performed by the person attending the carriage. By these means longitudinal grooves or narrow cuttings may be made horizontally in the upright face of the work, and in order to make the requisite upright grooves or narrow cuttings apparatus is employed in which provision is made for raising and lowering the cutting tool, and parts working therewith, so as to produce any desired length of groove or narrow cutting in an upright or vertical direction.

2976. J. H. Johnson, *Lincoln's-inn fields, London*, "*Apparatus for supporting the womb.*"—*A communication.*—*Dated 26th November*, 1861.

This invention relates to a peculiar construction of apparatus, which the inventor terms the hysterophore, for supporting the womb in cases of prolapsus uteri or bearing down of the womb. This apparatus, which may be made of hardened india-rubber or other suitable material, consists of a ring which is connected by swivel joints to two link-pieces, situate diametrically opposite the sides of the ring, the opposite ends of the link-pieces being respectively jointed to the outer ends of two expanding wings. These wings are jointed or hinged together in the centre of the apparatus, similar joints or hinges being formed across the ring for the purpose of enabling the apparatus to be closed or contracted when being inserted into the vagina, and expanded or opened out when properly adjusted in its place.

2977. G. E. Donisthorpe, W. Firth, *and* R. Ridley, *Leeds*, "*Machinery and apparatus for working coal and other mines.*"—*Dated 26th November*, 1861.

This invention consists in combining, as hereafter described, compressed air engines with picks and cutting tools, such as are hereafter explained, which are mounted on carriages moved on and guided by rail or tramways, such picks or cutting tools being arranged to cut longitudinal, horizontal, and also upright grooves to the desired depth or extent into the upright face of the work, and thus to divide the work into rectangular sections, each section being bounded by grooves on three or four sides. For these purposes a carriage mounted on wheels suitable for being moved on a rail or tramway (which is laid down parallel with the upright surface of the work) is employed, on which is placed a compressed air engine, which is constantly in connection, by a suitable pipe, with machinery at a distance, arranged in a suitable manner to keep up a constant supply of compressed air to the compressed air engine (on the carriage before mentioned), and a flexible length of pipe is used between the compressed air engine and the fixed air pipe, in order to allow of the carriage moving a distance along the work. On the carriage are applied any desired number of picks on lever handles moving on axes, the lever handles being by preference cranked levers, so that at one end the pick is applied, and at the other end the lever is acted on directly, or is attached, by a connecting-rod or rods, to the piston-rod or rods of the compressed air engine; hence, as the carriage is moved at intervals along the face of the work, horizontal longitudinal grooves are made in the upright face of the work by repeated blows of one or more picks moving on an upright axis or axes; and in order to make the necessary upright grooves one or more picks is or are applied to the carriage, and it or they receive motion in a similar manner from the compressed air engine.

2981. F. F. Dumarchey, *Paris*, "*Machines for crushing and pounding stones, ore, &c.*"—*Dated 27th November*, 1861.

This invention cannot be described without reference to the drawings.

2987. A. Barclay, *Kilmarnock*, "*Apparatus for boring and winding purposes.*"—*Dated 27th November*, 1861.

This invention relates to the arrangement and construction of machinery adapted for facilitating the operation of boring for minerals or water, and also for winding the boring rods and the pump used for clearing the bore. Under one modification a portable or locomotive engine is used for the purpose; on the upper part of the boiler shell are arranged two horizontal cylinders, the piston-rods of which work in the direction of the front of the engine, and give motion to a horizontal shaft, on which is fitted a winding barrel. On this shaft is keyed a pinion which drives a spur wheel carried on a second shaft, and also fitted with a winding barrel. On the barrel of the first shaft is wound the wire rope for lowering and raising the pump or cleaner, and on the second barrel the chain for lifting the boring rods is wound. In front of the horizontal steam cylinders, or in any other convenient position, is fitted a vertical cylinder, with an ordinary slide-valve chest at the back part. The spindle of the slide-valve extends upwards some distance above the stuffing-box, and this portion of the spindle is screwed. Two nuts, with internal screws corresponding to the spindle, are fitted thereon; these nuts form the bosses of a pair of hand wheels, by means of which they are readily shifted up or down the spindle. Between the nuts a loose collar traverses up and down the valve spindle, the extent of its traverse being regulated by the position of the nuts above and below it. This collar forms the central part of a crosshead, the extremities of which are connected by links to another crosshead above. The upper crosshead is connected to the end of the rocking lever, which actuates the boring rods, and this lever is also connected to the piston-rod of the vertical cylinder from whence it derives its motion. In lieu of this arrangement other modifications of valve gearing, as used in steam hammers, may be used for the purpose. The steam is admitted to the upper side of the piston, only the lower part of the cylinder having an aperture communicating with the atmosphere. The steam upon being admitted to the cylinder depresses the piston, and so raises the front end of the rocking lever and the boring rods. The descent of the rods and boring tool is regulated by controlling the escape of the steam from the cylinder; this is done by means of a cock fitted in the exhaust pipe.—*Not proceeded with.*

2988. H. Mearing, *Great Randolph-street, Camden Town*, "*Lucifer match, and prepared paper for igniting the same.*"—*Dated 27th November*, 1861

In carrying out this invention the patentee takes splints made either of wood, wax, or other substance, and dips the ends in melted sulphur; when dry he again dips them in a composition made in the following manner:—He takes of powdered potash ten parts, oxide of antimony four parts, smalts five parts, gum two parts, and reduces them, adding a sufficient quantity of water to form a paste. After being dipped in the above-mentioned paste the match is dried in the ordinary manner. For the manufacture of the prepared paper he first makes the following composition:—He takes flour or glue and renders it into a paste. To two parts of this paste he adds—amorphe phosphorus six parts, graphite in powder one part, and silicate of soda one part; these substances must be intimately mixed together, and the paper is to be coated with this preparation by a brush or other means and dried.

2990. W. Clark, *Chancery-lane, London*, "*Clasps or fastenings of purses, bags, portfolios, tobacco pouches, &c.*"—*A communication.*—*Dated 27th November*, 1861.

Portemonnaies manufactured according to this invention can be of any form and the same number of parts as others, but with two catches instead of one for fastening it, and, instead of being placed at the upper part of the frame of the bag, are placed one at each side of the said mouth, giving greater facility for opening the same, and preventing its self-fastening again after unlocking. Again, to effect the opening of these fastenings when closed, the patentee places a spring round the axis of rotation of the two closing frames, which tends constantly to open it in such way that, when once unlocked or fastened, the springs act so as to open it automatically.

2993. M. Ohren, *Sydenham*, "*Manufacture of gas.*"—*Dated 27th November*, 1861.

It is a known fact, the inventor states, that, although a gas exhauster working at level gauge draws off a considerable portion of the gas produced in a retort still a pressure is maintained in the retort equal to the seat of the dip pipe, from two to four inches, and that, consequently, a large portion of gas is thereby destroyed in the retort. He claims to remove this pressure from the retorts, and for the most efficient means of doing so he claims the use of a movable disc, whereby the water in the hydraulic main is kept at one uniform level, just sufficient to seal the pipe when the retort is at work. The disc can be raised or lowered most effectually by the use of a screw and wheel with a pointer attached to show the lineal opening. On the movable disc being lowered, the water from the hydraulic main will flow away, and the pressure will be removed from the retort to such an extent that the whole of the gas evolved can be drawn off by the exhauster at level gauge. It will be necessary when the exhauster is stopped to raise the disc, so as to give the full seal in the hydraulic main, otherwise the back pressure will unseal the dips, and allow the gas to pass down the ascension pipes when the retorts are being drawn.—*Not proceeded with.*

2996. S. Amphlett, *Birmingham*, "*Ornamenting surfaces.*"—*Dated 27th November*, 1861.

This invention consists in ornamenting surfaces by means of photographs of objects, from which photographs the back ground produced in taking the said photographs has been cut away, the said photographs being mounted upon tartan or Scotch plaid patterns, or imitation tortoiseshell, the said tartan or Scotch plaid patterns or imitation tortoiseshell constructing the back ground to the said photographic pictures of the object or objects, whether the tartan or Scotch plaid patterns or imitation tortoiseshell on which the photograph is mounted be produced directly upon the surface of the article to be ornamented, or produced on paper, and the said paper secured to the surface of the article to be ornamented.

2999. C. Stevens, *Charing-cross, London*, "*Furnaces for working iron ore.*"—*A communication.*—*Dated 28th November*, 1861.

This invention cannot be described without reference to the drawings.—*Not proceeded with.*

3001. S. A. Carpenter, *Birmingham*, "*Attaching name plates or labels to umbrellas, parasols, &c.*"—*Dated 28th November*, 1861.

This invention consists in attaching name plates or labels to umbrellas, parasols, walking sticks, and whips by means of a spring tubular clip, to which the name plate or label is affixed, the said clip being secured to the umbrella, parasol, walking stick, or whip by springing it thereon as described.

3003. F. F. Weiss, *Strand, London*, "*Fastening for boxes and cases.*"—*Dated 28th November*, 1861.

This improved fastening applies to all cases and boxes having lids or covers. It consists of one or more undercut studs fixed to the lids, with button slots fixed to the case; or the studs may be fixed to the case and the slots to the lid. There is or are one or more sliding hinges applied to the case or lid; the hinges may be made without stops, so that the lid may be entirely removed from the case; or they may be made with stops, when the lid will turn down upon them, as upon ordinary hinges. Among other applications this fastening will be particularly applicable to the razor cases the inventor has devised, and in which four razors answer instead of the seven generally sold one for each day in the week. He makes three with two different days, and one with one day only.—*Not proceeded with.*

3005. J. D. A. de Ladaume, *Dorset-terrace, Clapham-road, London*, "*Machinery for cooling and freezing water, &c.*"—*A communication.*—*Dated 28th November*, 1861.

This invention cannot be described without reference to the drawings.

3006. B. Pitt, *Great Carter-lane, and* J. J. Sheldock, *Earl's-court, Kensington*, "*Cocks or valves.*"—*Dated 28th November*, 1861.

For the purposes of this invention a box or case is employed having inlet and outlet passages at its ends. The valve works within this box or case; and it is preferred that the box or case in which the valve works should be of a square or rectangular section, and that the inlet and outlet passages at the two ends thereof should be of a circular section, but of less diameter than the ends of the box or case. Through one side of the box or case a spindle or axis passes into the interior of the box or case, a stuffing box being employed to prevent the escape of the fluid around the axis. The inner end of the spindle or axis turns in a suitable bearing, and has fixed upon it an eccentric, or it may be simply a projection. The valve is fixed to the end of a frame, which is supported by and slides on two ledges or guides on the interior of the box or case. The spindle or axis abovementioned passes through the frame, so that the cam or projection upon it will, when the axis is turned in one direction, press the valve against its seat, and when the axis is turned in the opposite direction will move the valve away from its seat. By thus arranging a circular valve in a rectangular box or case, the fluid will be able, when the valve is open, to pass between the periphery of the valve and the interior of the box or case.

3008. L. H. C. J. Carle, *Holborn, London*, "*Indicating and registering the score for billiards and other games.*"—*Dated 29th November*, 1861.

This invention cannot be described without reference to the drawings.

3010. A. B. Childs, *New Oxford-street, London*, "*Wringing machines.*"—*A communication.*—*Dated 29th November*, 1861.

This invention consists of a pair of india-rubber rollers hung in a framework of galvanised malleable iron, or some other suitable metal, of a peculiar form. The pieces composing the frame are held together by a single rod or tie passing through them nearly in the centre, and forming a joint in the frame, by means of which the rolls are held in their proper place, and the machine clamps itself firmly to the tube or box. The rolls are held together by forcing the opposite ends of the frame in which they are placed apart by pressing them down on the edge of the tub or box, so that they are separated. On the ends of the frame opposite to the rolls are small buffers made of india-rubber or a spring equivalent. These buffers are held in their place by a small rivet, and allow the rolls to adjust themselves to the different thicknesses of clothes which are passed between them, and they also fasten the machine to the tub.—*Not proceeded with.*

3012. R. C. Perry, *Manchester*, "*Infants' feeding bottle.*"—*Dated 29th November*, 1861.

This invention consists in the application to the ordinary "feeding bottle" of a novel form of valve, for the purpose of admitting air to the interior of the bottle, which valve is of a more simple construction than those which have hitherto been employed for the same purpose. The improved valve is made of caoutchouc or other similar elastic material, and is in the form of a short tube, one end of it being attached to the cork or stopper of the feeding bottle, the other end projecting a short distance into the bottle, and terminating in an orifice of about the same size as the outer diameter of the suction tube which passes through it; a perforation in the cork or stopper admits air to the interior of the valve, where the pressure caused by the withdrawal of the liquid contents of the bottle expands the opening at the extremity of the valve, and admits air to the interior of the bottle; but in the case of the bottle being reversed or overturned, the contents of the bottle will not pass through the valve, as the pressure of the fluid, acting on the exterior surface of the valve, tends to close it more effectually.

3016. R. Cook *and* G. H. Spencer, *Hathersage, Derby*, "*Umbrellas and parasols.*"—*Dated 29th November*, 1861.

According to one part of these improvements the "middle bit," as a separate piece of metal, is done away with, and the hole for a pin as a connection for the stretchers is obtained by operating upon the rib at that part, so as to produce a slit or opening; and the inventors make a similar hole at the end of each rib. The improvements also relate to applying a shield extending over the circular groove or notch around the runners, and adapted to receive and enclose the ends of the ribs, the stretchers of which are formed longer for the purpose. By this means the covering of the umbrella or parasol will be protected from wear at such part. And they apply a spring catch to hold the runner and shield in position. The improvements also relate to the application of india-rubber as a shield over the circular notch of the runner, and extending over parts of the stretchers, as also on the barrel of the runner, in order that, when the umbrella or parasol is shut, the ribs may lie on the india-rubber, and thereby prevent the ribs from entering between the stretchers.—*Not proceeded with.*

3023. W. P. Bain, *Blackwall*, "*Protecting ships' bottoms from fouling.*"—*Dated 2nd December*, 1861.

This invention consists in cementing canvas or other textile fabric to the bottoms of ships, using asphalte, by preference, for the cement. After a ship has been sufficiently long at sea for her bottom to become foul the inventor strips off the canvas, which will carry with it all the animalculæ and other matters which usually foul the bottoms of ships. The invention further consists in paying over ships' bottoms with asphalte, or other bituminous or adhesive composition in which zinc or copper fillings, or both, have been mixed or incorporated.—*Not proceeded with.*

3024. G. Ralston, *Tokenhouse-yard, London*, "*Preparing and applying a certain material on the hulls of iron or wooden ships, &c.*"—*A communication.*—*Dated 2nd December*, 1861.

This invention is carried into effect in the following manner:—The patentee first takes armorphose graphite, and reduces it to fine powder, and frees it as much as possible from impurities. The powdered graphite is then mixed with oil in a "mixer" in the following manner:—The "mixer" is slightly warmed by a coil of pipe heated by steam, so that the powdered graphite shall not be allowed to cool and take up atmospheric moisture. Then pure crude or raw linseed oil is put therein, in the proportion of one pound of oil to three pounds of the dry powdered graphite, and when these have been gradually mixed or combined in the "mixer," there must be added hot pure yellow beeswax, in the proportion of about one pound of beeswax to every ten pounds of the powdered graphite; the whole must then be well and thoroughly incorporated together therein previous to being ground cold, or at a suitable temperature in a paint mill, wherein it must be ground to a consistence equal to white lead ground in oil to preserve it for readily combining with additional oil when needed for use.

3025. T. W. G. Treely, *Westbourne-terrace Villas, Paddington*, "*Machines for boring holes in rocks, &c.*"—*Dated 3rd December*, 1861.

This invention consists of a drill or boring tool which is fastened to a striking rod, which rod moves in iron or wood framing. On this striking rod there is fastened a serrated disc or face ratchet; and on this striking rod there is also attached a spring that gives the blow to the boring tool. The boring tool is withdrawn by a cam or lug working on a spindle; the cam or lug on the spindle rotating strikes against the serrated disc or face ratchet on the striking rod, pressing the spring back; as soon as the cam or lug passes the centre the striking rod is instantly released, and the blow is given by means of the spring before named. The cam or lug, on pressing the serrated disc back, slightly turns it, so that the tool does not strike the rock in the same place. The spindle or spindles that have the cam or lug on them are set in motion by gear work driven by any of the known powers, such as steam, water, air, or any other engine or machine. Any number of the striking rods can be worked at one time from one engine or machine. Any of the striking rods can be held back by a catch at the pleasure of the workman. When a jumping blow is not required, the whole of the striking rods are held back, and a rotary motion given to the striking rods that hold the boring tool. On each striking rod there is a cog wheel, which is loose where a striking motion is required, but when a rotary motion is required the wheel is made fast to the rod that the patentee calls the striking rod. The cog wheels are so geared that any number of drills may rotate in boring through slate or soft rock: or part of the drills may rotate, and others have the jumping motion. The iron framing before named is fixed on a carriage, which carriage is so constructed that the drills may be moved in any direction with facility.

3027. A. M. A. Pichery *and* P. L. Danais, *Nantes, France*, "*Hermetically stoppering or covering jars, pots, &c.*"—*Dated 3rd December*, 1861.

The inventors propose, First, to polish with emery the rim of the pot or vase, and also the edge of its cover, to form a circular throat or groove surrounding exteriorly the mouth of the pot or vase, and a similar groove on the cover which two grooves will materially assist the soldering with mastic, by which the pot or vase is to be hermetically closed. Or, instead of grinding flat with emery the rim of the vase and of its cover, so as to place them in juxtaposition the one above the other, the circular edge of the cover may be bevelled and ground with emery, and this bevel, together with the inner protuberance of the rim of the pot or vase, will assist the hermetical stopping. The circular cover or lid, as well as its upper median, will present a square button, larger at top than at bottom, which, with the arrangements of the inner throat of the pot or vase, will assist in the perfect retention of the mastic.—*Not proceeded with.*

3028. J. H. Glen, *Howland-street, Fitzroy-square, London*, "*Apparatus for sewing or stitching.*"—*Dated 3rd December*, 1861.

This invention consists in the employment of two shuttles, in machinery or apparatus for sewing or stitching, instead of one, as heretofore, by which the inventor is enabled to use two needles, and, consequently, produce an increased amount of work at the one operation.—*Not proceeded with.*

3029. J. Burrows, *Wigan, and* J. Dougan, *Haigh, Lancashire*, "*Winding or driving drums or pulleys.*"—*Dated 3rd December*, 1861.

The First part of this invention consists in the application of power or pressure to some part or parts of the rope, band, or chain, during the time in which such parts or portions of the rope remain in contact with the drum or pulley, by which means the patentees obtain an increased amount of adhesion, and a correspondingly greater power for driving machinery, drawing or lifting weights, and similar purposes. At a number of points in the circumference of the winding drum, or driving drum or pulley, they attach slips or holding pieces, which are caused to press upon the rope, band, or chain while it is in contact with the pulley, and to force it against the sides or bottom of the groove in the pulley. The clips turn upon centres, so as to be withdrawn from the rope or chain at or near the point at which it leaves the drum or pulley, and are attached to or acted upon by rods radiating from the centre of the pulley, and having antifriction rollers at their inner extremities which are in contact with the circumference of a cam placed on the drum shaft, a portion of which cam, corresponding to the portion of the pulley which is in contact with the rope, is formed to a greater radius than the rest, so that the cam being held from revolving with the pulley, as each antifriction roller arrives at the raised portion of the cam, the rod to which it is attached is forced outwards, and, acting upon the clip, causes it to press upon the rope as long as the roller continues to run on the raised portion of the cam, and released by a small spring or other suitable apparatus when the roller is clear of the raised part of the cam; or the clips may be attached to the outer extremities of levers radiating from the centre of the pulley, and having antifriction rollers at their inner ends, acted upon by a suitable cam for the purpose of closing the holding pieces on to the rope at the proper time, and a corresponding cam reversed for the purpose of releasing the clips. The Second part of the invention applies to winding drums or planes for round ropes, in particular employed for winding coals, &c., from mines, and other similar purposes, and is designed more especially for the purpose of compensating, in a higher

degree than has been usual hitherto with round ropes, for the extreme weight of the rope or ropes, thereby diminishing the extreme load or pressure upon the engine, or otherwise enabling the same engine to do more duty with the same pressure or other equivalents. This improvement consists in arranging the sides or planes of winding drums, sheaves, or pulleys parallel, as near as may be, to each other, leaving a width or space between the insides of the planes of each drum, sheave, or pulley equal to, or only a little in excess of, the diameter of the rope to be used, so that, when the rope is attached to the drum, and the drum is caused to rotate, each consecutive coil will be laid or wound upon the preceding coil, and so on in succession, instead of, as is usual, coiling upon a drum side by side, or to the extent of a few laps only in depth.

3030. J. LEACH, *East-street, Walworth, London*, "*Preparing matters to be used in the manufacture of candles.*"—*Dated 3rd December*, 1861.

This invention consists in producing or manufacturing a substance suitable for the manufacture of candles, by subjecting dead or heavy oil to the action of chlorine gas, distillations, and carbonic acid gas.

3031. G. T. BOUSFIELD, *Loughborough Park, Brixton, Surrey*, "*Stoppers for bottles, &c.*"—*A communication.*—*Dated 3rd December*, 1861.

This invention consists in the manufacture of a hollow stopper of elastic gum, having shoulders adapted to corresponding shoulders on the neck of the bottle.

3032. J. L. FIELD, *Upper Marsh, Lambeth*, "*Mould candles.*"—*Dated 3rd December*, 1861.

For the purposes of this invention, in order that mould candles may be made suitable for fitting various sizes of sockets of candlesticks without cutting, as has been commonly the practice, the lower end of each candle is moulded with a tapering end of such a length as may be desired, so that the lower end may diminish in size more and more as it comes more and more to the end which enters the socket of a candlestick, the upper end of each candle being moulded of the ordinary forms heretofore employed. The tapering of the lower end may be in the form of a truncated cone, or be made with several sides or surfaces decreasing in horizontal section as the tapered end comes nearer and nearer to the lower end of the candle.

3033. W. DUCHEMIN, *Prince Edward's Island*, "*Blocks for hoisting.*"—*Dated 3rd December*, 1861.

This invention relates to improvements in that class of hoisting blocks in which friction rolls are introduced, and consists, First, in a block having a ring or central bearing of considerable diameter cast on to or otherwise suitably attached to the shell of the block, and surrounded by a loose metal ring (which serves the purpose of the sheave of an ordinary block), and between which and the central bearing is interposed a series of friction rolls on which the loose ring turns. Secondly, in improvements in metal bushings for sheaves of blocks, the same consisting of a loose ring or sleeve surrounding the axle on which the sheave runs, a series of friction rolls, and a box for containing the same.

3034. W. E. NEWTON, *Chancery-lane, London*, "*Artificial teeth.*"—*A communication.*—*Dated 3rd December*, 1861.

The patentee claims the manufacture of mineral teeth with pins, having heads at their outer ends, as, and for the purposes, set forth.

3035. W. E. GEDGE, *Wellington-street, Strand, London*, "*Nosebags.*"—*A communication.*—*Dated 4th December*, 1861.

This invention relates to the manufacture of canvas or other description of tissue suitable for the manufacture therefrom of horses' nose bags, or other similar articles presenting one or more open worked or trellis parts, obtained by the insertion in the tissue by and during the weaving of the same, of a suitable number of strings, twine, or other thread of a much coarser description than those of the remainder, back, or ground of the tissue, the said strings, twine, or coarse threads forming by their mutual interweaving a coarse open worked part or trellis.

3038. C. CRABTREE, *Bingley*, "*Paper tubes.*"—*Dated 4th December*, 1861.

This invention relates to paper tubes now employed in worsted spinning to contain the yarn, and which are made or formed by rolling up suitable sized sheets of paper, and pasting the laps or layers together. In the unwinding of the yarn from such tubes in the process of weaving it is found that the outer corners of the laps are sometimes not properly pasted or securely fastened down, but project out and catch on the yarn or weft, which is thereby broken. To remedy this the inventor cuts off those corners of the paper before rolling it into tubes; and the means or apparatus which he adopts consists of a table with adjustable guides or fences for setting or guiding a number or quantity of the sheets of paper into proper position, so that a knife or knives or cutting instruments of suitable shape, mounted in slide frames, and to which reciprocating motion is given or communicated by hand or power, will cut off the said corners to the precise form and size required with great facility.—*Not proceeded with.*

3041. W. E. NEWTON, *Chancery-lane, London*, "*Pumps.*"—*A communication.*—*Dated 4th December*, 1861.

This invention cannot be described without reference to the drawings.

3042. R. KENNEDY *and* J. ARMSTRONG, *Lisburn, Ireland*, "*Driving gear.*"—*Dated 4th December*, 1861.

The object of this improved arrangement of driving gear is to prevent what is known to engineers as back lash, which is a movement creating great wear and tear in bevel and spur gearing. To remedy this inconvenience the patentees apply to the spindles of the bevel or spur gearing fast pulleys, around which run driving straps which pass from one pulley to another. By this means a series of spindles and gearing may be bound together, and effectually prevented from overrunning, which is the principal cause of back lash.

3044. R. A. BROOMAN, *Fleet-street London*, "*Improvements in albums or books for containing and showing photographic and other pictures, and in slides for the same.*"—*A communication.*—*Dated 4th December*, 1861.

The patentee, in carrying out this invention, takes two of such sheets of paper, with apertures in the centre, as are generally used in albums for showing photographic pictures, and unites them at three sides, after having interposed a strip or strips of thick paper, cardboard or the like, equal, or nearly so, to the thickness of two or three pictures to be contained and shown. Thus the sheets will be united at their edges on three sides to interpose filling pieces, and one side will be left open for the insertion of the slide hereafter described. The slides consists of a frame of cardboard or thick paper equal in thickness to the interposed filling pieces. To one edge of the frame on both sides a sheet of gelatine, talc, or other transparent material is attached; the space in the frame is calculated to receive two pictures back to back. After being inserted in the space in the frame each picture is entirely covered by the gelatine or talc. The slide is formed with angle pieces, and, when inserted between the sheets of paper, the outer edge of the slide fills up the space between the inclined edges of the two sheets.

3048. J. KNOWELDEN, *Southwark*, "*Pumps.*"—*Dated 5th December*, 1861.

The First part of this invention is for an improvement upon an invention for which letters patent were granted to the present patentee in conjunction with Downes Edwards, 7th July, 1859 (No. 1613), and refers to the valve chamber and valves. The present improvement consists in forming the chamber circular, and in fitting the valves to feathers on a circular plug. The patentee connects a handle to the outside of the plug, whereby the same may be withdrawn in case of need, and whereby the action of the pump in connection with the valves may be reversed, that is, the pipe which acted as a suction pipe may be made to act as a force or delivery pipe, and that which acted as a force may be converted into a suction pipe.

3049. G. W. ROBERTSON, *Cannon-street, London*, "*Machinery for cleaning rice, &c.*"—*Dated 5th December* 1861.

This invention consists in forming a conical basin of stone, and in fitting, so as to revolve between the sides of them, a conical drum of such size as to allow of space between the basin and drum all round. The inventor covers this drum with sheep skin, felt, or other like yielding and soft material. He forms apertures in the sides of the basin, and inserts wire gauze for the purpose of admitting air, and to allow of the *debris* and dirt from the grain passing through the same. Rotary motion is imparted to the drum, the grain is fed in between the drum and the basin, and the grain passing through the machine becomes cleansed.—*Not proceeded with.*

3050. J. WILSON, *Glasgow*, "*Frames used for displaying trade show cards, pictures, &c.*"—*Dated 5th December*, 1861.

In carrying out this invention, in order to identify each frame with the house of business from which it is issued, it is preferred to attach the trade mark or device to the frame in such manner as to render it useless for any other purpose. Under one modification of carrying out this improvement the trade mark, device, monogram, or other design is formed of wood modelled in composition, or made of other suitable material, and gilded or otherwise decorated. This device is made with a stud or other projection at the back, which part is sunk into a corresponding recess or hole made in the frame itself, and fixed by means of glue, or in any other equivalent manner.—*Not proceeded with.*

3051. W. DICKS, *Floore, Northampton*, "*Pumps.*"—*Dated 5th December*, 1861.

This invention relates to certain peculiar constructions and arrangements of combined lift and force pumps, whereby the first cost is considerably reduced, the working parts being greatly simplified. According to one arrangement of pump the inventor proposes to enclose the barrel inside an air-tight box or chamber, to the upper end of which box or chamber is connected the rising main, whilst the suction pipe is bolted to a flanged pipe on the bottom of the box. This arrangement affords facility for using a large barrel with a small rising main, and enables the bucket to be readily detached from the bucket rod and removed from the barrel when requisite for repairs or cleaning, it being simply necessary for such purpose to remove the front of the box which encloses the barrel. The bucket rod passes down the interior of the rising main, being guided so as to work centrally therein by suitable radial guide arms fixed to the rod at proper intervals. The upper end of the rising main has a five-way fitting screw thereto, and the bucket rod passes out through a stuffing-box screwed into the central vertical nozzle of such fitting, and carries at its upper end a suitable crosshead or guide which slides vertically between the two vertical arms of a syphon air vessel, the lower ends of which arms are connected to the two lateral branches of the five-way fitting above mentioned. The sweep or lever handle for working the pump passes through a slotted eye or fork cast in one piece with the crosshead on the bucket rod, a slot in the sweep receiving an anti-friction roller or pin carried by the slotted eye or fork. The spout of the pump is connected with the lateral branch which forms the fifth opening of the five-way fitting, and is formed at its nozzle with an external screw thread to receive the union of a hose pipe, which is intended to be used when the pump is required as a force pump. In this case a cock, which is fitted on to the top bend of the syphon air vessel, is to be closed, so as to confine the air, but when the pump is used as an ordinary lift pump only then the cock may be opened to allow the air to escape.—*Not proceeded with.*

3052. J. COCHRANE, *Harburn, Midlothian*, "*Wet gas meters.*"—*Dated 5th December*, 1861.

This invention relates to a peculiar arrangement of wet gas meters, whereby the ordinary existing meters, as well as the new meters constructed according to this invention, are made to comply with the requirements of the Sale of Gas Act. According to this invention it is proposed to surround the present float of the gas inlet valve by a box or partition, so as to separate it from the ordinary water chamber of the meter, and to insert the lower end of the water supply pipe into this box or float chamber, in lieu of into the main water chamber, as heretofore. By this means the smallest quantity of water which may be fraudulently extracted, by a syphon or otherwise, through the water supply pipe will instantly affect the position of the float, and cause the gas to be shut off without affecting the proper water level in the chamber.

3054. C. DAVIS, *Mile End, London*, "*An improved composition for coating metal and wood to preserve them from decay.*"—*Dated 5th December*, 1861.

This invention consists in making an improved composition by mixing or compounding together the following ingredients, matters, or substances, viz., coarse brown soap, pitch, spirits of turpentine, and elastic glue—such as is now used for waterproofing materials—in the proportions of about one quarter of a pound of soap to six pounds of potash, one pint of spirits of turpentine, and one quarter of a pound of elastic glue, as aforesaid. These ingredients the inventor places in a suitable vessel, and subjects them to heat sufficient to dissolve them, stirring them together so as to thoroughly mix and incorporate them; and while hot he applies the same with a trowel to the part that is intended to be coated or covered therewith, the composition setting when cold, and hardening when it is immersed in water.—*Not proceeded with.*

3058. J. *and* W. H. BAILEY, *Salford*, "*Apparatus for indicating the pressure of steam and gases, the amount of vacuum, the flow of fluids, the weight of materials, and the speed of bodies, &c.*"—*Dated 6th December*, 1861.

In one of these improved arrangements of steam pressure and weight gauges the patentees employ a knife-edged crank or pivot attached to a weight or its equivalent, so as to act as a lever. They employ the ordinary india-rubber or metallic diaphragm acting against a piston in the usual manner. The piston and weight are connected together by a link, having at the bottom a semicircular bearing, upon which the knife-edged pivot rests, so that, when the piston rises and falls, the pivot will have a delicate motion on the bearing of the link, and thereby cause but little friction. The Second part of the invention relates to spring gauges, and consists in causing a regulating arm or quadrant to act upon one end of a large spring fixed to the casing. The Third part of the invention consists in the employment of a lever in heat gauges and steam and water traps. The end of the said lever is in contact with the flange of a short copper, aluminium, or other metal tube, through which the steam or water passes. The contraction or expansion of the tube operates upon the lever, and in heat gauges it indicates, by means of a wheel and pinion with index hand, the heat or temperature, and in steam or water traps the lever shuts and opens a valve which lets off the steam or water according to its heat or temperature. The Fourth part of the invention consists in indicating the speed of any revolving or traversing body by means of a pair of ordinary governor balls, put in motion by the shaft or body required to be indicated. To the sliding piece of the governor they attach a rod, and when the sliding piece rises, by the action of the governor balls, the rod presses against a lever attached to a wheel gearing into a pinion and finger, thereby indicating the exact speed. Or they apply to the shaft of the ordinary registering apparatus a ball or universal joint to enable the indicator to be actuated either by a vibrating or revolving motion. The Fifth part of the invention consists in the employment, for the apparatus hereinbefore described, of *papier maché* in the manufacture of dials and cases; and also of aluminium or its compounds or alloy for diaphragms, screws, or other parts, that metal being superior to most others in preventing oxidation.

3059. C. CRADDOCK, *Orchard-terrace, Kensington*, "*Method of cutting out ladies' dresses.*"—*Dated 6th December*, 1861.

This system or method is intended to facilitate the cutting out of the bodies of ladies' dresses, so as to ensure a perfect fit to the figure, without the necessity for taking more than three dimensions or measures, viz., first, the size round the chest and shoulders, taken under the arm and over the bust; secondly, the measure round the waist; and, thirdly, the length of the side seam taken from close under the arm down to the natural waist of the figure. In applying this system to the cutting out of the body of a ladies' dress certain forms or diagrams are made use of which are so arranged as to be adapted to any form or size of figure, the forms or diagrams being made of cardboard or other suitable material, and certain marks or graduations being made upon the edges of the said forms or diagrams corresponding with the inches of the measure taken.—*Not proceeded with.*

3060. J. D. NAPIER, *Glasgow*, "*Brakes.*"—*A communication.*—*Dated 6th December*, 1861.

The patentee claims the jointing of the ends of a friction brake strap upon the actuating lever at different distances from the centre of motion of the lever, and so that the turning of the lever causes both ends of the strap to move in the same direction, or in an equivalent manner, and the using of such arrangement as a self acting appliance for preventing backward motion.

3066. J. J. RUSSELL *and* B. BROWN, *Wednesbury*, "*Apparatus used in the manufacture of paper tubes.*"—*Dated 6th December*, 1861.

For the purposes of this invention the dies used when drawing tubes are so constructed and worked that the diameter of the dies is constantly varying as a tube is drawn through them. The dies may either consist of two grooved rollers, or two grooved sections of rollers, the grooves being made wider at one end than the other, and gradually diminishing from the widest end to the narrowest end. These dies are made to move progressively, so as continually to present a different section of opening, whilst the tube is drawn through such varying opening at a speed greater than the surface speed which is given to the rollers or to the section of rollers in which the grooves are made. The rollers or sections of rollers are geared together or worked in such manner that the groove of the one is kept correctly to correspond with the groove in the other. The arrangement of draw bench or machinery used for drawing the tubes through the dies may be varied, and the means of giving motion to the dies may also be varied.

3067. T. LAWES, *City-road, London*, "*Quilts and coverlets.*"—*Dated 7th December*, 1861.

An extension of time for filing the final specification of this invention having been petitioned for, the documents relating to the invention cannot at present be seen.

3069. R. JOLLEY, *Smithfield, London*, "*Apparatus for heating, cooling, or drying, infusing, extracting, or absorbing vapours or gases for manufacturing, medical, or domestic purposes, and for preserving liquids and solids.*"—*Dated 7th December*, 1861.

This apparatus or enclosure is made with double or single doors, lids, and covers to shut air tight, and is wholly constructed upon air tight and non-conducting principles, with valves to let air in or out. It may be made of any shape or size, as a box, closet, larder, or receptacle of any kind, and any number together, and is hereafter in this specification called a safe. It may be made to stand or be fixed where required, or be movable for transit by railways, steam and sailing vessels, or any other motive power whatever. In its construction the patentee uses a new combination of fibres, pulpy, and waterproof materials, natural, artificial, or manufactured, for the purpose of preventing the transmission of heat, cold, air, or moisture, so as to keep whatever is placed within this safe in a quiescent state, or at any required uniform temperature. He makes this safe as a double case, or one case within another, and the space between is stuffed with charcoal, soot, hemp, flax, tan, bark, sawdust, hair, or any non conducting materials, fibrous or otherwise, mixed or separate, and either or both of these cases he forms of wood boarding double, and so placed that the joints of one layer of boarding is covered by the other boarding over either transversely, horizontally, diagonally, or otherwise to keep out air, and for keeping out moisture. He covers the outside or places between these layers of boards asphalt, felt, cotton, or wood fabric, cocoa-nut, or any fibrous or pulpy or waterproof material or liquid, resinous, vitreous, or otherwise, but to prevent the transmission of heat or cold these fibrous materials need not be waterproof; or he constructs this safe partly of boarding as described, and partly of compressed fibrous pulp, or any fibrous material, waterproof, vitreous, or not. For the purpose of heating he lays on gas to burn inside or outside, with a metal covering to prevent injury to whatever may be placed within this safe; or he uses steam, hot air, or water, lime, or any liquid or solid mixed or otherwise, which will produce heat, by which means anything may be made or kept hot or dried, or the taste or smell of one liquid or solid may be infused into another. For the purpose of cooling and extracting he places within this safe about the upper part a vessel, vessels or cistern, metallic or otherwise, corrugated, ribbed, angulated, or not, with curved, elliptical, circular, angular, or flat sides, ends, or bottom or all and of such a form as will cause the adhesion of vapours during the process of extraction, which vapours and water are conducted by pipes, drains, and traps for quickly carrying off or collecting whatever is distilled or extracted or required.

3070. G. T. BLADON, *Camberwell*, "*Chimney tops.*"—*Dated 7th December*, 1861.

The inventor constructs these chimney tops of a rectangular form, by preference, and covers in the upper part. In each side he forms a long opening of, say, half the breadth of the sides, and extending throughout the greater part of the height; on these openings he applies external flaps, which are hinged at top, and hang so as entirely to close the openings if pressed close to the sides. He connects the opposite flaps in pairs by a connecting rod, the length of which is such that each flap is pressed outwards and held at bottom about three inches from the side of the chimney top, if uninfluenced by any pressure; but if any pressure of wind takes place on the one flap it is pressed closer, at the same time thrusting the opposite flap further off, and making a larger egress for the smoke thereat; very slight pressure of the wind closes the one entirely. In this way the wind pressing against one or two sides of the chimney closes them, and prevents ingress of air or escape of smoke at those sides, but providing for its free escape at the opposite side or sides where the wind has no tendency to enter, and, therefore, providing for the free escape of the smoke and preventing down draughts.—*Not proceeded with.*

3071. D. MAY, *Wood-street, London*, "*Securing scarfs and similar articles to the neck.*"—*Dated 7th December*, 1861.

This invention consists in attaching a rigid material, such as card or millboard, to a part of the scarf or tie, the said board being shaped at top to fit the throat, and in sewing or fastening to the said board, or material covering it, a piece of elastic web, terminating at top in a loop. This loop is to be passed over the shirt or collar button, when the card or millboard, with the material covering it, will be held up against the throat of the wearer, and the scarf thus secured. No part of the scarf or tie extends round the neck. For washing materials the card or millboard is capable of being removed.—*Not proceeded with.*

3079. M. A. F. MENNONS, *Paris*, "*Natatory apparatus.*"—*A communication.*—*Dated 9th December*, 1861.

This invention cannot be described without reference to the drawings.

THE breach in the Underground Railway has been nearly repaired.

THERE is a talk of altering all the Armstrong 110-pounders to muzzle loaders.

THE jurors' awards at the Exhibition will be made public on Friday the 11th July.

MR. WHITWORTH'S 12-pounder gun is said to have lately attained an initial velocity of 2,200ft. per second.

THE case of Hills *v.* the Liverpool United Gaslight Company again came on on Wednesday, before the Lord Chancellor. We need hardly add that it was not concluded.

ABOUT one hundred of the workmen at Messrs. Simpson's, at Pimlico, lately presented Mr. Hulmes, their foreman (who was about to leave the works), with a purse containing ten sovereigns.

THE traffic receipts of railways in the United Kingdom amounted for the week ending the 14th of June, on 10,246 miles, to £576,377, and for the corresponding week of last year, on 9,951 miles, to £549,245, showing an increase of 295 miles, and of £27,132 in the receipts.

THE MIDDLE LEVEL.—The dam which has at last been successfully constructed is found to work efficiently, the flow of the tidal waters into the drain having been completely checked. Every day this week the work has been further strengthened, so as to enable it to resist the pressure of the high tides which will again prevail tomorrow and Saturday. The drainage of the flooded country and the relief of the drain itself is to be effected by 12 great syphons, each of 3ft. diameter; and it is expected that in a few days the "Middle Level Inundation," which has become almost as familiar in men's mouths as "household words," will be merely a matter of local history. If report, however, speaks truly, something more will be heard on the subject in the courts of law, as the sufferers from the calamity intend to obtain some compensation, if possible, from the Middle Level Commissioners.

THE following appointments of naval engineers have been made since our last:—G. Tucker and A. H. Miller, chief engineers, to the Black Prince; Edwin Pearce, W. Burgess, and Henry F. Saunders, engineers, to the Black Prince; J. C. Williams and J. Jessop, first-class assistant-engineers, to the Black Prince; J. E. Turner and G. W. Hancock, second-class assistant engineers, to the Black Prince; J. R. R. Potam and W. R. Macavoy, acting second-class assistant-engineers, to the Black Prince; Richard Oliver, in the Devastation, John Brown (a), and Henry Hollingsworth, in the Trafalgar, promoted to the rank of first-class assistant-engineers; A. G. A. Billowes, in the Clio, Thomas Haywood, in the Melpomene, John B. Stevens, in the Liffey, Thomas Clark, in the Cumberland, William Inglis (b), in the Mersey, and Thomas Summers, in the Melpomene, promoted to the rank of acting first-class assistant-engineers; G. E. M. Keeg and S. Chantler, in the Euryalus, confirmed as second-class assistant-engineers.

THE GREAT MONT CENIS TUNNEL.—By the terms of a convention just concluded the expense of the great tunnel through Mont Cenis is to be defrayed proportionately by the French and Italian Governments and the Victor Emmanuel Railway Company. The French Government is to contribute a sum not exceeding £760,000, and the Victor Emmanuel a sum of £800,000, interest being guaranteed on the latter at the rate of 4½ per cent. The Italian Government is to undertake the execution of the works and find the remainder of the requisite capital. If the works are concluded in less than 15 years from January last the French Government is to give an additional subvention of £24,000 upon every year saved out of the 15. The works are to be measured up periodically, and interest at the rate of 5 per cent. paid by the French Government to the Italian Government on the expenditure incurred so far.

THE 10½IN. GUN.—The Government having ordered twenty more smooth bore 156-pounders, Mr. B. Osborne said, the other night, in the House of Commons:—"What, however, does the House think of the fact—and I should like to be satisfied on this point by some right hon. gentleman—that, in the face of all this 20 more of these Armstrong guns (156-pounders), and one 600-pounder have been ordered, and that this does not receive the approval of the Select Committee on Ordnance? I do not know what the cost of these Armstrong guns is, but I am told that it is something enormous. I have told you what was the impression made by the 12-ton smooth-bore gun, and it is necessary that the House should also know what was the effect upon the gun itself of firing these enormous charges of powder, because not a word has been said about that. The present condition of the 300-pounder is as follows:—There is a fracture of the outer coil 4ft. long, extending under what is called the trunnion ring and the rear reinforcing ring. To test this a knife was put down the crack for 5in. on the bottom side of the gun. Be it remembered that not 50 rounds, I suppose not more than 25 rounds, have been fired from this gun, and yet such was the effect of these heavy charges that it has become unserviceable, and is now being doctored in Woolwich Arsenal. I challenge contradiction upon that point."

PERMANENT EXHIBITION IN PARIS.—The project for a permanent Exhibition in Paris, where specimens of the manufactures and products of every country will be collected in one spacious building, in order that dealers and consumers from all parts of the world may see them, has met with the entire approval of the Emperor Napoleon III. The Ministers of Finance and of Commerce and Agriculture have issued the necessary authority for carrying out the undertaking. A special license has been granted by the above Ministers for the admission of all foreign products free of duty, with liberty to re-export them without payment of duties; or to sell them on the spot on paying the duties imposed by the new international tariff. The whole of the capital, amounting to £600,000, has been subscribed in France. The palace, which is in course of construction near the railway station at Auteuil, in Paris, will be opened for the purposes of the Exhibition early in the summer of 1863. It is stated that the building will surpass in size the present International Exhibition. The amount of space allotted to France and several other continental countries has already been taken up. It is proposed that all products and manufactures of the same nature shall be classified and placed in juxtaposition, so that those of different countries may be compared by intending purchasers. The British agency is at Messrs. J. Studdy, Leigh, and Co.'s, 27, Leadenhall-street, E.C.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

PRELIMINARY MEETING YESTERDAY: *Prices Confirmed*—THE WEEK'S DEMAND FOR FINISHED IRON: *Effects of the Weather*—PIG IRON: *Slight Lull: Few Sales*—APPREHENSIONS OF TROUBLES WITH AMERICA—COAL TRADE: *Demand for Durham and Derbyshire Coal and Coke*—GENERAL MANUFACTURING TRADES: *Unfavourable Reports: Decrease of Pauperism*—A NOVELTY IN DOOR LOCKS: *Pottery Knobs*—THE FEARFUL EXPLOSION IN BIRMINGHAM: *Nine Lives Lost: Important Presentment by the Grand Jury.*

THE Stewpony attracted the usual number of ironmasters yesterday (Thursday) assembled in Preliminary Meeting. As we last week remarked would probably be the case, the proceedings passed off without the expression of much difference of opinion in respect of the chief subject of deliberation, namely, the scale of prices to rule the transactions of the ensuing quarter. The rates of the past three months, it was resolved, should be those of the association up to Michaelmas; subject, however, to the confirmation of the quarterly meetings. At the same time that some masters complained of very low rates being accepted by certain masters, it seemed to be the opinion of the meeting generally that such proceedings were not more numerous than is usually the case at a time of depressed trade; and that in the past few weeks they had been somewhat on the decrease. The meeting were unanimous in the conclusion that, during the latter half of the quarter, there has been a marked improvement in the demand; and there were few who did not rejoice that the improvement was most visible in the inquiries for the better descriptions. From the nature of the prevailing demand there was, it was conceded, reason to conclude that the activity now experienced would continue far into the ensuing quarter. Our own inquiries satisfy us that, as compared with last week, the demand in the past seven days has slightly fallen off, and that in the trade generally there is a slight lull. Farmers' reports are slightly checking business. They are to the effect that the cold weather has so greatly checked the development of the ears of the wheat that the crops will be less by some two bags an acre than they would have been if warm, genial weather had prevailed in the past fortnight.

The lull is equally perceptible in the pig iron trade. On account of the numerous sales in the past fortnight not many negotiations were opened yesterday. The finished ironmakers who occupy a first-class position assert that they have bought most of their quarter's supply at the rates of three months back. Vendors of pig iron, on the contrary, maintain that the majority of their transactions have been at an advance, and the producers of first-class iron are certainly firm at the recently-quoted advance in the open market.

Determining from the class of Preliminary Meeting that we have just had there is not ground for concluding that the Quarterly Meetings will be other than quiet. A steady demand may, however, be looked for by all the houses from the leading consumers of finished iron. At the same time the demand will be greatly influenced by the political news that will come to hand in the meantime from those distant parts of the world to which all eyes are now directed with not a little anxiety. Ironmasters view with interest every project calculated in any way to lessen our dependence upon North America for any supplies of raw material, or for orders for manufactured goods, inasmuch as they cannot resist the conclusion that the Northern States will not rest till they have tried their strength with this country; and the letter of the Secretary of the Navy, suggesting the erection of a navy yard in the valley of the Mississippi for manufacturing iron-plated ships, has not, of course, tended to weaken the conviction to which they have come.

The coal trade continues without much alteration. Lumps and slack continue in good demand at the various works in the district; but there is less large coal being moved by rail for domestic use. The foreign coal and coke now most in favour here is that from Durham and Derbyshire, to the slackening of the demand for the produce of the Welsh pits and ovens.

The general manufacturing trades are in the condition in which few are able to report favourably of the demand either on foreign or on home account. A few manufacturers have been busy finishing up orders before the end of the quarter; but the greater number have suffered from the quarter having terminated in the week, only few fresh orders having been received since our last, and such as they were being for small lots, and for delivery next month. Such orders neither manufacturers nor factors put in hand till the last moment. Both in Birmingham, in Wolverhampton, and in the populous surrounding districts, there is decidedly less being done by the numerous hardware manufacturers than was the case a fortnight and three weeks ago. The fancy trades of Birmingham are, perhaps, suffering the most. It is, nevertheless, a most gratifying circumstance that both in Birmingham and also Wolverhampton pauperism is decreasing. This is traceable in some degree to the improved demand for labour at the ironworks, and, next, to the necessities of the agriculturists being such as to demand an increase of hands in the completing of the hay harvest.

A novelty, so far as it relates to British manufacture, has just been produced by the leading firm at Willenhall. For some time past certain American firms have produced the knobs of door locks not of brass, as almost universally adopted for small dwelling houses, but of the common pottery glazed, and the clays so mixed as to have the appearance of brown marble. The shoulder of the knobs, however, are made of iron fixed in the knob with lead solder. This shoulder being very much longer than that of the brass knob, the connection between the knob and the spindle is much firmer than is possible with the brass knobs, the bite of which upon the spindle is small, and its liability to become loose proportionately great. Hitherto the English makers have been unable to compete with the American makers in this article. Now, however, Messrs. Harper and Tildesley have, with the help of a pottery firm, succeeded in producing it in its entirety. On Wednesday last it was being shown in Wolverhampton, and it was receiving much attention from the factors, who can obtain it at from 10 to 15 per cent. below the price of brass knobs, while they can offer it as a larger knob, firmer on the spindle, and without liability to tarnish. The rose is of iron, varnished to the colour of the knob; and the pottery is said to be proof against any ordinary amount of rough usage.

A painful calamity has befallen us in Birmingham. On Saturday an explosion of another percussion cap manufactory happened, occasioning the instant death of nine persons and serious injuries to some thirty others; while, as may be expected, the destruction of property was considerable. The explosion happened on the premises of Messrs. Walker and Sons, of Graham-street. The entire premises of Messrs. Walker were completely destroyed, the whole of the front portion being thrown into the street, and the adjoining properties of Messrs. Heeley and Sons, steel toy manufacturers, and Messrs. Neale and Warwick, lamp manufacturers, were considerably damaged. Two of Walker's sons are of the dead, and two of their daughters are among the injured. As to the cause of the accident, there appears to be every probability that it was caused in the process of "mixing," for which, by the way, the premises were not licensed. For some time before the occurrence of the accident Messrs. Walker had been executing a large Government order for caps, and the fulminate of mercury was mixed on premises adjoining the house of Mr. Walker—the actual proprietor of the manufactory—on the Nechell's Park Road. These premises were duly licensed; but a few days ago Mr. Walker removed to Summer-hill, and in the meantime the fulminate was taken to the premises in Graham-street. It may be stated that this process of mixing is the most dangerous of all the processes in the manufacture of percussion caps—more dangerous, indeed, than priming—and it being no doubt so thought, that at least was required by the Act to be removed from the manufactory. The process consists in this—a certain portion of pure fulminate of mercury, properly damped, is strewn over half the surface of a sheet of perfectly clean paper. The least particle of grit would cause an explosion. On the other half of the paper is strewn the proportion of chemicals necessary to form the particular quality of detonating powder, for there are several qualities which it is intended to make. The paper is then lifted carefully and gently undulated until the ingredients are thoroughly mixed. The greatest care is required. The pressure of the thumb nail, even the accidental folding of the paper has been known to cause an explosion. And, if we recollect rightly, an explosion arising from the latter cause occurred in past years at this very manufactory, on which occasion the mixer was blown to pieces. Whether this process of "mixing" was going on on Saturday does not seem to be known. This, however, appears pretty certain, that a few minutes before the occurrence of the explosion Mr. Thomas and Mr. Richard Walker, with the man John Buckley, went down into the cellar and inquired for the keys of the safe, where the fulminate was kept. A few hours earlier some of the fulminate had arrived on the premises, and before entering the cellar Mr. Richard Walker was supplied with two sheets of white paper. The inference therefore is, that he and his brother and Buckley were either in the act of "mixing" or placing the fulminate in the safe when it exploded. The Recorder of Birmingham, in his charge to the grand jury at the sessions, opened on Monday, showed the necessity for further legislation to prevent the continuance of such manufactories in the heart of the town, and the grand jury on Tuesday made the following presentment:—"The grand jury cannot separate without thanking you, sir, for having called their attention to the frightful explosion which has so recently struck with terror the inhabitants of this borough, and they respectfully present that the time has arrived when the carrying on of the manufacture of explosive compounds within the limits of a populous town should be made a criminal offence, punishable by imprisonment; and they request that you, sir, will take the necessary steps for bringing this subject to the notice of the Home Secretary. They also wish to state that it is within the knowledge of some of their number that there are hundreds of places within this borough where quantities of gunpowder, far beyond the amount which the Act of Parliament allows, are kept at defiance of the law, and they are of opinion that far more stringent laws, and a more stringent carrying out of the laws which already exist, are absolutely necessary for the protection of the lives and limbs of her Majesty's subjects." The Recorder: "This is a most important presentment, gentlemen, and I shall lose no time in forwarding it to the Secretary of State, and I have no doubt but that it will receive proper attention. I am obliged to you, and the town also must be obliged to you, for calling attention to a practice which is so dangerous to the inhabitants generally." The local newspapers and private correspondents are also calling upon the Town Council to interfere.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

NORTHERN MATTERS: *The Iron Trade: The Low Lights Dock: A 15-Ton Steam Hammer*—STATE OF TRADE: *Newcastle: Sheffield: Manchester*—THE BANKRUPTCY OF MESSRS. G. J. CALVERT AND CO.—NEW IRON PIER AT BLACKPOOL—LIVERPOOL: *Mersey Docks and Harbour Board: The Stock of Cotton.*

WE commence with the north, where the general depression in the commercial affairs of the empire finds only a too faithful reflection. The iron trade of the district is flat.—The Redesdale Ironworks are announced for sale next week; the establishment formerly produced excellent iron, and the Border Counties and Wansbeck Valley railways would give greater facilities than formerly for a ready delivery of raw material and products. In prosperous times the undertaking would probably readily find a purchaser, but it is doubtful how matters may go now.—A conference has taken place between the Newcastle and North Shields Chambers of Commerce in reference to the Low Lights Dock, the construction of which has so long been delayed. The deputation from Tynemouth was accompanied by the president, Mr. Richard Hodgson, M.P., who fully and lucidly explained the views of the chamber of that borough; and, as a result of the interview, a resolution, urging on the Tyne Commissioners the propriety of proceeding as speedily as possible to provide the necessary deep-water dock accommodation at the mouth of the river, in accordance with their Act of last session, was unanimously adopted. A deputation, embracing representatives from both the Chambers of Commerce, was also appointed to wait on the commissioners.—The *Newcastle Chronicle* gives some particulars of a 15-ton steam-hammer recently constructed and brought into operation at Messrs. Morrison and Co.'s works, the Ouseburn, Newcastle. The hammer, which has been for some time at work, is constructed upon Mr. R. Morrison's first patent; is single-acting, and worked by hand. The cylinder is 46in. diameter, the hammer bar is forged of the best scrap iron in one solid piece with the piston and dovetail end for receiving the face, and finished to 18in. diameter, and the total length of it is 27ft. 6in. The cylinder, with its covers and glands, weighs 32 tons; the hammer bar, 15 tons; the two frames, 34 tons; the anvil block, bedplate, and sockets for crane posts and bottom foundation plates, 120 tons; making in all 210 tons. The cylinder is strongly flanged and ribbed, and securely bolted between the frames by 48 bolts, 2¼in. diameter each, turned and fitted tight to holes previously rymed, thus securing the cylinder and frames together in one solid mass, perfectly rigid, and the whole is held down by eight foundation bolts, each 4in. square, passing through strong cast iron plates 14ft. below the surface. The foundation for carrying the whole is composed of concrete, timber, and stonework, and is 44ft. one way, 26ft. the other way, and 14ft. deep, as above stated. The frames are cast hollow, measuring 4ft. one way, and 3ft. 6in. the other, and 2½in. thick; one of those frames contains the valve and gear for working the hammer as well as the steam and exhaust pipes, so that there is nothing projecting on the outside to interfere with the workmen or the cranes. The cylinder is 46in. diameter, with a clear fall or stroke of 8½ft. The space round the hammer is such that workmen can go about their work with facilty, the height from the surface of the ground to the underside of the frames being 11ft. 3in., so that the largest piece of work which can be got under the hammer can be turned round in every way without being taken from underneath it, and the moving mass of the hammer itself being of malleable iron, and in one solid piece, there is no possibility of breaking. The length of the cylinder over the top and bottom covers which form the guides is 14ft., so that whatever may be the size of the forging under the hammer the bar is always guided for the length of 14ft.

As regards the state of employment in Newcastle, many workmen have already been discharged from the Elswick Works, and it is hinted that others are likely to follow. The works of Messrs. R. Stephenson and Co., and Messrs R. and W. Hawthorne continue pretty well employed for the present. At Sheffield there is still a good deal of general depression. The steel trade, however, is tolerably brisk, the chief demand being for crinoline steel, for which orders come freely from both home and foreign markets. The file trade is not very active, the orders from Lancashire being much below the average. The state of employment at Manchester is increasingly unfavourable, but Captain Palin's returns show that matters might be a very great deal worse than they are at present. Captain Palin returns the position of the machinists and foundries as follows:—Machinists—On full time with all hands, 11; on full time with a portion of their hands, 22; on short time, 13; stopped altogether, 1. Foundries—On full time with all hands, 7; on full time with a portion of their hands, 13; on short time, 4.

Some interesting evidence has been given in the Leeds Bankruptcy Court in reference to the affairs of Messrs. G. J. Calvert and Co., of York, further proceedings in respect to which stand adjourned to Tuesday, July 29. Mr. G. J. Calvert stated that the firm were introduced, early in 1860, to Mr. Bateman, ironfounder and commission agent, of London, having built a small bridge for him. Mr. Calvert added: "We were introduced to Messrs. Brassey and Co. in July, 1860, by Mr. Bateman respecting the erection of the West London Extension Bridge. Bateman was to have three per cent. for his commission. I applied to Bateman for assistance in July, 1861. It is quite possible that in February, 1861, there was a written instruction to Brassey and Co. to hand over our acceptances to Bateman. The foundry at Clementhorpe was given up to Bateman at the latter end of December, 1861, for we then owed him a great deal of money for wages. In January Bateman wanted about £13,500 of us, and we assigned certain deeds to him. We determined to call our creditors together on the 17th January. After Bateman got the assignments he also obtained a quantity of iron from our place, amounting to about £3,000. We obtained £250 worth of iron from the South Durham Iron Company in January. We sent 560 tons of iron to Bateman in January; but I believe the whole of that sent by the South Durham Company in January is now lying at the railway station. Altogether we received 1,258 tons from the South Durham Campany from 1st October until the time of our failure. We got £790 worth of iron from Messrs. Bell Brothers, and some 230 tons went to Bateman as we got it." Mr. Bond applied for an adjournment to examine the books, and also to consult a higher authority with respect to the steps to be taken by the assignees with regard to Mr. Bateman. There were creditors, he added, representing £50,000, who would be exceedingly lucky, according to the present complexion of affairs, if they got a shilling in the pound.

A large iron pier is about to be erected at Blackpool by a joint stock company. The first pile will be driven in a few days by Mr. Clifton, the Lord of the Manor. The pier will extend seawards about 1,350ft., and it is expected to be finished in about twelve months.

At the last meeting of the Mersey Docks and Harbour Board it was agreed to accept the tender of Messrs. Holme and Nicol to construct a roof and slide doors for the shed on the south quay of Coburg Dock for the sum of £1,210. It was resolved not to allow petroleum or rock oil to remain upon the quays beyond the 48 hours allowed by law, even at the quay rent on the reduced scale like other goods, except a written statement were handed in to the traffic manager that the oil so allowed to remain was intended for re-shipment, in which case it would be allowed to remain a day or two at the usual quay rent. The terrible strain on the cotton stock is every day growing in intensity. At present the quantity on hand is little more than one-fifth the stock held two years since, and, as regards American, the last return showed that only 82,550 bales remained at Liverpool, as compared with 843,930 bales in the corresponding week of 1861! Was there ever such an enormous variation in the ordinary course of the colossal commerce of these present times?

PRICES CURRENT OF METALS.

British Metals are quoted Free on Board; Foreign in bond.—Extra sizes charged for at the rates agreed by the trade. Brokerage is not charged for buying except on Foreign Tin.

		£	s.	d.	Dis. p. ct.
IRON, English Bar and Bolt:—					
in London	pr tn	5	15	0	2
in Wales	„	5	0	0	„
in Liverpool	„	5	10	0	„
Staffordshire Bars (Deliv. into boats at wrks; Nom. rates last qr. day for favourite brands)	„	7	0	0	1
Sheet, Sngl.	„	8	10	0	„
Dbl.	„	10	0	0	„
Hoop	„	8	0	0	„
Rod, round	„	7	0	0	„
Nail Rod, sq	„	7	5	0	„
SHIPPING IRON, Staffordsh. Bars (Delivered in Liverpool 10s. per ton less)	„	7	0	0	2
Sheet, Single	„	8	15	0	„
Double	„	10	5	0	„
Hoop	„	8	5	0	„
Rod. Round	„	7	0	0	„
Nail Rod. Square	„	7	5	0	„
IRON, Rails, in Wales, cash	„	5	10	0	nett
„ „ 6 months	„	5	7	6	„
Old, to cut up	„	0	0	0	„
Railway Chairs, in Wales	„	4	0	0	„
„ in Clyde	„	3	15	0	„
Pig No. 1, in Clyde	„	2	11	9	„
3-5ths No. 1 & 2-5ths No. 3		2	12	3	„
No. 1, in Wales	„	3	10	0	„
No. 1, in Tyne and Tees	„	2	12	0	„
Ditto, Forge	„		9	0	„
Staffordshire Forge Pig (all Mine), at the Works, L. W., nom.	„	3	10	0	„
Welsh Forge Pig (all Mine), at the Port	„	3	5	0	„
Acadian Pig, Charcoal	„	7	10	0	„
Scotch Pig, No. 1, in London	„	0	0	0	„

		£	s.	d.	Dis. p. ct.
IRON, Swedish, Indian assortments	pr tn	11	5	0	2
Russian C C N D to arrive	„	16	0	0	„
STEEL, Swedish Keg, ham.	„	15	10	0	2½
Ditto, rolled	„	18	0	0	„
Fagot		17	0	0	„
SPELTER, on the spot	„	17	10	0	net
To arrive	„	18	0	0	„
Hard, remelted	„	17	0	0	„
ZINC, in sheets	„	24	0	0	„
COPPER, Tile, 14 to 28 lb.	„	93	0	0	2
Tough Cake	„	93	0	0	„
Sheathing and Bolts	pr lb.	0	0	10½	„
Sheet	„	0	0	10½	„
Bottoms	„	0	0	11	„
Old	„	0	0	9	„
Yellow Metal	„	0	0	9	„
Burra	„	96	0	0	„
Russian do.	„	0	0	0	„
LEAD, British Pig	„	21	5	0	„
Spanish	„	20	0	0	„
W. B.	„	21	10	0	„
Sheet	„	21	10	0	„
TIN, English Block, nom.	„	114	0	0	„
Bar „	„	115	0	0	„
Refined „	„	119	0	0	„
Foreign Banca	„	118	0	0	„
Straits	„	114	0	0	„
TIN PLATES, Charcoal, IC	pr bx	1	9	0	„
Ditto IX	„	1	15	0	„
Coke, IC	„	1	3	6	„
Ditto IX	„	1	3	6	„
Do. at Newport, 1s pr bx less		—			„
Do. at L'pool, 6d. „		—			
CANADA, Plates	pr tn	12	0		„
QUICKSILVER	pr bt				

RAILS.—The market is not quite so firm as last week, but prices remain as last quoted.

SCOTCH PIG IRON receded to 52s. during the week, but a slight improvement has now taken place, and the market closes firm at 52s. 3d. and 52s. 6d. for Warrants.

SPELTER may be had for £17 10s. on the spot. Market dull.

LEAD firm at quotations.

COPPER dull of sale.

TIN.—At the annual Dutch sale yesterday the whole quantity of Banca offered, consisting of about 5,173 tons, was sold at 67¾ guilders, which is equal to £116 10s. laid down here. To-day, of course, the price of Banca is quite nominal—somewhere about £118, and Straits £114.

June 26th, 1862. MOATE AND Co., 65, Old Broad-street, E.C.

PRICES CURRENT OF TIMBER.

Per load—	1861 £	s.	£	s.	1862 £	s.	£	s.
Teak	14	0	15	0	15	0	16	0
Quebec, red pine	3	10	4	10	3	5	4	0
yellow pine	3	0	4	0	3	0	3	15
St. John, N.B., yel.	5	0	5	10	5	0	5	10
Quebec, oak, white	5	10	6	10	5	0	5	10
birch	3	10	4	0	4	0	0	0
Memel	0	0	0	0	0	0	0	0
elm	3	10	5	10	3	10	4	15
Dantzic, oak	3	10	6	10	3	10	6	0
fir	2	15	3	10	3	0	4	0
Memel, fir	3	0	3	10	3	10	4	0
Riga	3	0	3	10	3	10	3	15
Swedish	2	15	3	0	2	15	3	0
Masts, Queb. rd pine	5	0	6	0	5	0	6	0
yl. pine	5	0	6	0	5	0	6	0
rd pine	0	0	0	0	0	0	0	0
Lathwood, Dantz, fm	5	0	6	10	6	0	7	0
St. Peters.	8	0	8	10	9	0	9	10
Deals, per C., 12 ft. by 3 by 9 in.								
Quebec, wht. spruce	13	0	18	0	15	0	19	0
St. John, wht. spruce	13	0	16	0	15	0	17	10

Per load—	1861 £	s.	£	s.	1862 £	s.	£	s.
Yel. pine, per reduced C.								
Canada. 1st quality	17	0	18	10	17	10	19	0
2nd do	12	0	12	10	12	0	13	0
Archangel, yellow	13	0	13	10	14	0	15	0
St. Petersbg. yel.	12	0	12	10	12	10	13	10
Finland	9	0	10	0	9	10	10	10
Memel	10	0	15	0	10	0	15	0
Gothenburg, yel.	10	0	11	10	10	0	12	10
white	9	10	10	0	9	10	11	0
Gefle, yellow	10	0	11	0	11	0	12	10
Soderhamn	10	0	10	10	11	0	12	10
Christiania, per C 12 ft by 3 by 9 in. yellow	22	0	25	0	22	0	24	0
Deck plank, Dntz per 40 ft. 3 in.	0	14	1	4	0	14	1	4
Staves, per standard M								
Quebec, pipe	70	0	75	0	80	0	85	0
puncheon	16	0	18	0	16	0	18	0
Baltic, crown pipe	150	0	160	0	170	0	180	0

SCOTCH PIG IRON REPORT.

	s.	d.	
No. 1 Gartsherrie	56	0	f.o.b Glasgow.
„ 1 Coltness	55	0	do.
„ 1 Calder	53	0	do
„ 1 G.M.B.	52	0	do.
„ 3 Do.	50	9	do.
M. Nos. Do.	51	6	do.

WARRANTS.

3-5ths No. 1 and 2-5ths „ 3 .. G.M.B.	s.	d.	
Cash prompt	52	3	per ton.
1 mo. open	52	6	do.
2 mos. „	52	9	do.
3 „ „	53	0	do.

MANUFACTURED IRON.

	£	s.	d.	
Bars, Govan	7	0	0	
„ Common	6	10	0	
Drumpeller, Common	6	10	0	
Do. Best	7	10	0	
Cramond Scrap Bars Delivered in London	10	5	0	less 5 per cent.
Plates and Sheets	9	0	0	to £9 10s.
Rails	6	5	0	
Pipes	4	17	6	
Chairs	3	12	6	

GLASGOW, 25th June, 1862.

There has been a good amount of business done (particularly for speculation) in our market during the past week. The quiet drooping state of the trade has induced considerable sales, which, however, have been readily met by buyers, and the price has given way very little. Makers find the demand still very slack.

Exports last week were only 13,224 tons, against 12,736 tons in the corresponding week of last year.

SHAW, THOMSON, AND MOORE, Metal Brokers.